

THE COBALT MINING DISTRICT

COBALT, ONTARIO, CANADA

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In 1903, workers on the Temiskaming and Northern Ontario Railway noticed unusual mineralization along the right of way. The drab minerals turned out to be the first indications of one of the richest silver-mineralized areas in the world: Cobalt. Since that time over 600 million ounces of silver have been recovered from the silver-cobalt-nickel-arsenide veins, along with nine minerals new to science. Great specimens, particularly of silver, can still be collected from old waste rock dumps around Cobalt.

INTRODUCTION

There have been many great silver-producing mining camps over the centuries. One of the greatest is the Cobalt mining “camp” located in the area just east of Lake Temiskaming in Ontario, Canada. For the purposes of this article, even though the bulk of the silver deposits occurred in the vicinity of the town of Cobalt itself, “Cobalt” refers to all of the silver deposits located in the small geographical area including Cobalt, South Lorrain Township, Gowganda, Elk Lake and Casey Township. The cobalt-nickel-silver-arsenide veins were discovered and mined out during about 80 years of the 20th century, and during that time Cobalt produced a staggering 600 million troy ounces of silver (Miller, 1905; Petruk *et al.*, 1971c).

The purpose of this article is to relate the interesting early history of the “birthplace of Canadian hardrock mining,” to describe the various minerals that occur in the area, to pinpoint the locations of various specimen-producing mines, and to present to the world some seldom-seen, unusual mineral specimens from Cobalt, in particular those housed in the collection of the Royal Ontario Museum.

HISTORY

Silver from the vicinity of present-day Cobalt has been known for centuries. The French explorer Jacques Cartier (1491–1557) referred to stories, related to him by indigenous peoples during his second voyage (1535–1536), of silver occurrences somewhere up the Ottawa River in the “Kingdom of the Saguenay.” It had long

been thought that indigenous people did not know of or exploit the silver at Cobalt. However, relatively recent analyses of silver artifacts utilizing trace element signatures (Spence and Fryer, 1990) indicate that, in fact, indigenous people *did* know about silver from the vicinity of Cobalt and did recover some native silver from which they made buttons, pan-pipes and jewelry. Analyses of silver artifacts in indigenous burial mounds and graves show that small amounts of native silver were transported by trade from the Cobalt area to other places ranging from southern Ontario to sites in the states of Illinois, Georgia and Mississippi. We have no evidence of indigenous “mine” workings on the veins at Cobalt, but it is possible that they were not recognized by the modern miners at Cobalt and were inadvertently destroyed. It is also possible that indigenous people located silver in glacial float or stream gravels and never encountered the *in situ* veins where the silver originated. If the indigenous peoples had any detailed knowledge of the silver localities of the area, they did not pass it on to later generations.

In 1686, French Army Captain Pierre de Troyes, while on his way to Hudson’s Bay with soldiers to disrupt the British fur trade, was directed by local indigenous people to an argentiferous galena vein on the eastern shore of Lake Temiskaming (Smith, 1986). That vein is only 6.8 miles southeast of the Cobalt silver mining camp and is not related genetically to the larger deposit. The vein was eventually worked for lead in 1850; this operation was known as the Wright mine, and only a few tons of ore were mined. Apparently, knowledge of the vein’s presence did not lead to any serious exploration of the area.

For centuries, many explorers, traders and settlers traveled along the Ottawa River and Lake Temiskaming, within a kilometer of silver veins, so it is somewhat surprising that none of them stumbled across a vein *in situ* before the modern discovery of silver at Cobalt in 1903.

That discovery took place near Long Lake (later renamed Cobalt Lake) during construction of the Temiskaming and Northern Ontario (T. & N.O.) Railway, now the Ontario Northland Railway. The government was building the first 114-mile stretch of railway from North Bay to New Liskeard between 1901 and 1904, to service the growing farming area at the north end of Lake Temiskaming and thus to help open up the north. Before the railway existed, the only routes into the area were by water, but when the lake froze for six or seven months of the year, all access to places farther north was cut off.

A railroad blacksmith by the name of Fred La Rose is credited with the discovery of the first silver vein. As legend has it, La Rose was working at his forge and was perturbed by a pesky fox that was skulking nearby. He threw a hammer at the fox, but the fox dodged and the hammer glanced off a rock outcrop. Fred inspected the place where the hammer had struck and noted that it was different from the other rocks in the area and contained metallic minerals. The story is amusing but is considered apocryphal. In whatever manner he did it, though, La Rose in fact found some interesting mineralization which he mistook for copper; possibly he erred in this because the samples contained coppery-colored nickeline and breithauptite, plus green annabergite (“nickel bloom”) which could easily be misidentified as malachite. He gave a chunk of the peculiar rock to Arthur Ferland, the proprietor of the Matabanick Hotel at Haileybury, a few miles to the north, who in turn showed it to Thomas W. Gibson, Director of the Ontario Bureau of Mines, who happened to be in the area on business. Gibson, recognizing that the sample contained nickel mineralization, sent it to provincial geologist Willet G. Miller. In an accompanying letter, Gibson asked Miller to visit this new and interesting area (Miller, 1913):

I am enclosing herewith a fragment of a larger sample of what I take to be kupfer-nickel found along the line of the

Temiskaming and Northern Ontario Railway. The locality of the deposit is in the unsurveyed territory immediately south of the Township of Bucke. I have not learned anything as to the extent of the discovery, but if the deposit is of any considerable size, it will be a valuable one on account of the high percentage of nickel which this mineral contains. I think it will almost be worth your while to pay a visit to the locality of the discovery before navigation closes. I am under the impression that the find was made while making the cutting for the railway. Mr. Ferland, of Haileybury, showed me a sample of the mineral when I was there, but he did not appear to recognize it or know its value, deeming it to be a compound of copper. It would be remarkable should our nickel deposits turn out to have a wider range than [has] hitherto been supposed and especially if the new outcrop should be a large one containing ore of so high a grade.

Gibson was theorizing that “our nickel deposits,” the nickel deposits of the Sudbury area, also stretched to the vicinity of these newly discovered veins.

Further analysis of Ferland’s sample revealed that it was not only nickel-rich but was also laced with native silver. This prompted Miller to visit the area late that fall, before the snow arrived. He arrived in November and determined that four veins had been located, three of them very rich in native silver. Miller returned to Toronto with rich samples of nickel and silver mineralization.

The first mining claim was filed on August 13, 1903 by James H. McKinley and Ernest F. Darragh, contractors who supplied railway ties for the railroad construction and who had first noted some peculiar minerals while cruising for timber. On a beach on Long Lake they found some unusual specimens which were heavy and appeared to be ductile. They applied the “teeth test” and, in fact, it was easy to leave teeth marks in some of the samples! Analyses of the specimens that they sent to the assayer in Ottawa showed only bismuth and arsenic, no precious metals. McKinley and Darragh were disappointed but did not drop their investigation. They had some other samples analyzed at McGill University at Montreal, and the assays showed that *those* samples contained over 4000 ounces of silver per ton (Smith, 1986).

Willet G. Miller, in his landmark 1904 Ontario Bureau of Mines report, described one of the veins that McKinley and Darragh had discovered and staked (Miller, 1904):

Vein No. 4, although having the smallest width of the four is, in many respects, the most interesting of the group. Here a perpendicular bare cliff of rock 60 or 70 feet high faces west. The vein whose width averages not more than 8 inches, cuts this face at right angles, and has an almost vertical dip. The vein is weathered away leaving a crack in the face of the cliff 2 feet, in some places 4 or 5 feet in depth. When I saw it first, it had not been disturbed. Thin leaves of silver up to 2 inches in diameter, were lying on the ledges, and the decomposed vein matter was cemented together by the metal, like fungus in rotten wood. It was a vein such as one reads about in textbooks, but which is rarely seen, being so clearly defined and so rich in contents. It was found impossible to get a fresh sample of the ore with the prospecting pick, the vein being so much decomposed.

It must be every prospector’s dream to locate a vein such as that!

Meanwhile, when Arthur Ferland learned that his sample contained silver, not copper, he convinced several railway construction engineers to form a syndicate to purchase the claim containing a vein found by a lumberjack named Tom Hebert. Ferland did not participate in the La Rose find but wasted no time in becoming

involved with Hebert's ground. He convinced a number of investors to join him and they formed the "Ferland Syndicate." They staked four claims on what turned out to be some of the richest ground in the area, then sold the claims for the princely sum of \$250,000 (Smith, 1986). Those four claims eventually produced over 90 million troy ounces of silver.

Fred La Rose sold his claim to two pairs of brothers, Noah and Henry Timmins and John and Duncan McMartin; then he purchased a house and retired. John McMartin had been La Rose's boss on the railroad and the Timmins brothers were general store merchants from Mattawa, Ontario. The total value of the sale was a mere \$30,000: a tidy sum in those days, but in the end a small fraction of the value of the mineralization that lay in the veins. Noah Timmins went on to develop one of the first mines in the new Cobalt mining camp. A few years later, he purchased a fabulous gold deposit, discovered by Benny Hollinger, in another new mining camp which eventually was named Timmins in his honor. Noah Timmins built one of Canada's mining empires, Hollinger Mining, starting with the earnings that he made from the claim he bought at Cobalt.

A Cornish prospector, William G. Trethewey (1865–1926), who had experience in the silver fields of southeastern British Columbia, journeyed to the Long Lake area, having heard about the silver find from the assayer in Montreal who had assayed the McKinley-Darragh samples. This excerpt from a dissertation by Trethewey (quoted in Davis, 1910) shows clearly what life was like at that time at the site of the silver discoveries:

While metallic silver had never amounted to much in Ontario, I was determined to visit Cobalt as soon as the snow was out. I came to Toronto, saw the department, got my license and equipped myself for prospecting. I left Toronto on May 6, 1904. At that time, one had to go to North Bay by the Grand Trunk, then on the CPR [Canadian Pacific Railway] to Mattawa and by the short line to Temiskaming. From Temiskaming one had to get to Haileybury by Lumsden steamers. From Haileybury we had to walk over a muddy trail about five miles to the new camp. No one at that time appeared to be very much impressed. Even the fellows who made the discoveries not being at all excited, although the silver was looking them in the face. My idea was to buy something in the camp but I discovered that no one was prepared to sell. I went back to Haileybury and hired a man there and came right back, pitched camp on what is now the O'Brien property and started to prospect. Alec Longwell, who was up there for Mr. Leonard, shared my tent with me. I was prospecting just two days. On the second day I went to Pickerel Lake, where Longwell thought there was something good, but found nothing, and came back to camp at 1 o'clock. About 4 o'clock I thought I would finish up the day, and I struck out in a northerly direction, to a section to which no one had paid any attention at all. The impression at that time was that the valley along which the T. and N.O. ran, divided the mineral area from that which contained no silver, as all the discoveries so far had been made on the east side of the divide.

I walked almost straight to the old Trethewey mine. I passed over several ridges until I struck one where the rock looked good and I followed it south. As I walked along it I could see where the other fellows had torn away the moss. I came to a bluff where the point ran down into a swamp. I had to wade into the water to get round its western face. I could not see the face of the cliff until I had got out about twenty feet, when I saw a black streak on its face and I knew it was a silver vein. My first anxiety was to see if anyone had been there before me, but after a careful examination I concluded that it was a

virgin discovery. I had no axe with me, and there were fellows down at camp who would have made a wild rush up there if they had known, and I might have lost my mine. So I hid it as well as I could by throwing sticks and moss over the rock where I had chipped it, and came down to my tent and quietly had my tea. I did not know how to get away from the camp without the others following me, so I said to my man, "Give me my axe, I am going to chop a tree down."

I started out with my axe on my shoulder slowly enough until I got out of sight of the camp, and then I only hit the ground at the high places, I squared a post, put the number of my license and my name on it and planted it firmly over the discovery. And I made a witness tree. Then I started along the bluff a little farther and discovered the Coniagas mine. I knew by the indications that there was a vein but it was dark and I was afraid of getting caught in the woods. I saw Professor Miller that night and told him that I had made a find and asked him to say nothing. He and his assistant, Cyril Knight, visited the property with me next morning and we examined it carefully to see if there were any signs of prior discovery. But there was nothing.

At that time the area was known as the Long Lake Construction Camp, but Miller felt that the place should have a more distinctive name. In May 1904, at the place on the railway where the trains stopped, and where the railway station was to be built, Miller put up a sign that read "Cobalt Station, T. and N.O. Railway." The name became popular, and Cobalt became the name of the town that was to spring from the wilderness at that place.

One of the remarkable things about the Cobalt mining camp is that the mineral wealth was so easily accessible. Veins consisting largely of native silver, acanthite ("argentite") and other silver minerals were mineable right at the surface. Although the country rock is very hard, the veins were soft and weathered; a man needed nothing more than a pick and shovel to get started. A hard-working miner could generate considerable wealth very quickly if he was lucky enough to find a vein. Mining down to a depth of 50 feet or so by open cut required no more than drill steel, dynamite, a wheelbarrow, shovels, and a good measure of muscle. By these means Trethewey took \$250,000 (in 1904 dollars!) of silver out of a cut 50 feet long and 25 feet deep (Smith, 1986). The vein that he mined was eight inches across at its widest point.

Such a vein could yield unbelievable returns on investment. One company, the Temiskaming and Hudson Bay Mining Company, was started with a capitalization of \$25,000. The company picked up some ground at Cobalt and developed what became the Hudson Bay and the Silver Queen mines. By the time the mines were finished, the return on the original investment after dividends and sales of stocks was 39,000% (Smith, 1986)!

Mining in Cobalt started off slowly, with only 158 tons of ore being shipped in 1904. In 1905, however, 2,144 tons of hand-picked ore were shipped, containing 2,451,356 ounces of silver. The grade averaged over 1,143 troy ounces of silver per ton (Miller, 1913).

Over the years, more than a hundred separate mines and prospects were active in the Cobalt area. These mines spawned the miners, mine managers and prospectors who moved to other mining camps, discovered later, throughout northern Canada. This is why Cobalt is called "The birthplace of Canadian hardrock mining."

Of course, such a sudden discovery of wealth cannot take place without a "boom town" springing up. At one stage, Cobalt had a population of 12,000, and there were a dozen hotels, a hospital, four banks, nine restaurants, a National Hockey Association team (forerunner of the National Hockey League), and even an opera house (Smith, 1986), as well as a mill and shaft within the town

limits. Just a few years before, the area had been a relatively remote wilderness marked by just a few prospectors' tents.

Exploration spread out in all directions from Cobalt, and similar, significant silver discoveries were made in subsequent years in other areas close by, including Gowganda Lake, Casey Township, Elk Lake and South Lorraine Township.

The wealth and excitement generated by the Cobalt discoveries fed the enthusiasm and wallets of mining companies and prospectors, enabling them, as they spread north from Cobalt, to discover a number of other areas which could be mined, chiefly for gold. Other mining camps which were directly related to the flow of prospectors passing through, and to the money generated in Cobalt, were Larder Lake (1906), the Timmins area (1909), Kirkland Lake (1911), Matachewan (1916) and Noranda (1920).

Cobalt prospered in the first couple of decades after the initial discoveries; the highest production year for silver was 1911, when 29,981,423 troy ounces of silver were recovered (Murphy, 1977). In 1929, low prices for silver ended Cobalt's heyday, although some mines continued to operate. In the early 1950s, demand for cobalt metal led to the reopening of some mines, and subsequent exploration revealed new veins. Again in the 1960s, increases in the price of silver led to discoveries of more veins. Mining operations have been limited since the late 1970s, and the last mine shut down during the 1980s. It certainly is possible that new veins will yet be found and the remains of old veins and dumps reworked, but the chances of major new discoveries in the area are slim.

GEOLOGY

General Geology

The silver deposits of the Cobalt-Gowganda area occur along the northern and eastern margins of Ontario's Southern Province, in an area referred to as the Cobalt Embayment. The term Embayment derives from the overall "bay-like" shape of this large (approximately 11,580 square miles) area, which is bounded on the north and east by Archean basement rocks and on the southeast by the Grenville Front. A small outlier of Paleozoic strata is preserved at the northern end of Lake Timiskaming.

The Cobalt Embayment is underlain by Early Proterozoic rocks of the Huronian Supergroup which rest unconformably on Archean granitic, metavolcanic and metasedimentary rocks of the Superior Province. The Huronian Supergroup consists of an assemblage of sedimentary and minor volcanic rocks deposited between 2,500 and 2,220 million years ago; it is subdivided into four stratigraphic groups. In ascending stratigraphic order these are the Elliot Lake, Hough Lake, Quirke Lake and Cobalt Groups.

In the Cobalt-Gowganda area the Huronian sequence consists of a variety of essentially flat-lying, coarse to fine-grained clastic sedimentary rocks of the Cobalt Group which have been subdivided into the Gowganda, Lorrain and Gordon Lake Formations. The Gowganda Formation is subdivided into the Firstbrook and Coleman Members. The Coleman Member, consisting predominantly of conglomerate, laminated siltstone and sandstone, is the most important sedimentary host to the silver vein deposits. Archean basement rocks are exposed within the Cobalt Embayment as isolated inliers, and both the sediments and basement rocks have been intruded by sills and dikes of a rock known as the Nipissing diabase. Corfu and Andrews (1986) report a U-Pb baddeleyite age of 2219.4 ± 4 million years for Nipissing diabase near Gowganda, but because of the widespread occurrence of these intrusions throughout the Huronian Supergroup it is not known whether they occurred as a single event or in stages over a considerable period of time. Compositionally an olivine tholeiite, the Nipissing diabase occurs as a suite of gabbroic sills and steeply dipping dikes and plugs. The

sills, more accurately described as undulating sheets, maintain a relatively uniform thickness of 980–1,100 feet.

Faults

Three major regional-scale fault trends occur within the area. They cut all the rocks in the Cobalt Embayment and extend for hundreds of miles afield from it, cross-cutting the Grenville Front to the south and the Archean basement to the north. Although mineralized veins do occur in these faults, they are also found to crosscut them, and most of the regional-scale faults are barren of mineralization. No clear relationship has been established between the veins and these regional-scale faults (Jambor, 1971a).

Metamorphism

The oldest Archean rocks consist mainly of intermediate to mafic, massive and pillowed volcanics and minor pyroclastic and interflow sediments. These rocks were intruded by Archean granites followed by minor mafic, ultramafic and lamprophyric dikes and sills. The metavolcanic-metasedimentary rocks subsequently underwent a regional greenschist-facies metamorphic event and were isoclinally folded. The Huronian strata are mainly flat-lying and very well preserved, exhibiting only a sub-greenschist-facies assemblage.

Associated with the Nipissing diabase, and interpreted as resulting from contact metamorphism, is an alteration phenomenon commonly called “chlorite spots” or “chlorite spotting.” Developed mainly in Huronian sedimentary rocks, it also occurs in Archean mafic metavolcanics and mafic plutonic rocks. The alteration appears as dark green, spherical aggregates, between 0.04 and 0.20 inches in diameter, mainly composed of chlorite. Confined to the northeastern portion of the Cobalt Embayment and extensively developed in the Cobalt-Gowganda area, the alteration is highly erratic in its occurrence but is regularly found within 490 feet of Nipissing diabase contacts. Although there appears to be a spatial relationship between “chlorite spotting” and ore veins, in particular in that ore veins cut through rocks exhibiting chlorite spots, they are considered to have resulted from two separate events (Jambor, 1971c; Andrews *et al.*, 1986).

Character and Distribution of Ore Veins

The veins occur in a variety of rock types, including Huronian sedimentary rocks (mainly of the Coleman Member), Nipissing diabase, and Archean metavolcanics and metasediments. Ore veins have also been found in Archean granites and late lamprophyre dikes. The ore veins vary from a few inches to over 12 inches wide, with an average width of less than 2 inches. The veins may be over 1,000 feet long and 300 feet deep and can swell and vary in width over their length. Mineralization is typically discontinuous along any given vein. The veins occur along faults, in local shear zones and along zones of dilation, mainly as discrete and narrow fissure fillings and rarely as networks of multiple veins which can branch and converge both along their length and at depth.

The mineralogies and textures of the silver-arsenide veins are notably consistent throughout the Cobalt-Gowganda area and do not vary with the type of host rock. Veins are predominantly composed of carbonates (calcite and dolomite) with arsenides and sulfarsenides of Co, Ni and Fe, and with native silver and native bismuth. The veins are typically zoned: the carbonates make up the central and major parts of the veins while silicates occur as thin layers, typically less than 0.5 inches thick, immediately adjacent to the vein walls. The silver-bearing assemblages, when present, occur at or near the interfaces between silicates and carbonates.

Origin and Processes of Mineralization

The origin of the silver-bearing veins and the sources of their metals have been hotly debated questions since the discovery of the

veins in 1903. In spite of the work done—much of it recorded in an entire volume of the *Canadian Mineralogist* (“The Silver-Arsenide Deposits of the Cobalt-Gowganda Region, Ontario”) and in papers in the *Canadian Journal of Earth Sciences* (vol. 23, no. 10, 1988, “Silver Vein Deposits”)—the source, timing and mechanisms of the silver-arsenide vein mineralization remain unresolved.

Many of the various models of the origin of the silver veins are based on the veins’ occurrence and distribution. All of the deposits occur at or near the Archean-Huronian unconformity. They are spatially associated with Nipissing diabase, lying either within it or within 600 feet of its upper and lower contacts. Many of the mineralized veins occur on the upward projection of Archean supracrustal rocks, and many are found near volcanogenic base-metal sulfide deposits in the Archean basement (Andrews *et al.*, 1986).

In light of these observations, virtually every rock type that occurs in the area has been proposed as a possible source of the metals and gangue vein material. These candidates include

(1) **Archean metasedimentary beds**, with minor contributions from metavolcanics (Boyle and Dass, 1971; Smyk and Watkinson, 1990).

(2) **Archean carbonaceous and pyritic tuffs** (Watkinson, 1986).

(3) **Base-metal sulfide mounds** in the Archean metavolcanics (Goodz *et al.*, 1986).

(4) **Huronian sedimentary rocks** (Kerrick *et al.*, 1986), including those of the Cobalt Group, and in particular of the Coleman Member (Appleyard, 1980; Innes and Colvine, 1979).

(5) **Nipissing diabase** (Jambor, 1971d).

(6) The **same magma chamber** as that from which the Nipissing diabase emanated (Sampson and Hriskevich, 1957).

(7) A **separate, deep-seated, parental magma source** (Miller, 1913; Bastin, 1939; Moore, 1955).

It is beyond the scope of this paper to present all of the models that have been proposed, but interested readers should refer to the references for further details. One of the earliest, most persistent and simplest models is that related to the intrusions of Nipissing diabase. In this model, the diabase acted as a heat source which initiated a long-term hydrothermal convection system that leached metals from the host rocks and deposited them in favorable faults, shear zones and zones of dilatancy. One of several pieces of observational evidence that would seem to challenge this model is that veins can cut completely across intrusions of diabase, including the contact-metamorphic “chlorite spots” (Andrews *et al.*, 1986). Also, Nipissing diabase intrusions are widely distributed throughout the Southern Province, but the veins are restricted to the northern and eastern boundaries of the Cobalt Embayment. And finally, the silver-arsenide veins at Cobalt are not unique; they are similar to other epigenetic, hydrothermal five-element (Co-Ni-As-Ag-Bi) vein assemblages found in a number of localities, and the spatial association with diabase evident at Cobalt is not typical (Bastin, 1939).

MINERALOGY

The mineralogy and the textures of the ore veins at Cobalt are fascinating. The elemental composition of the mineralizing agents, together with the complex processes of their deposition, have resulted in a unique and beautiful assemblage made up primarily of “silver-colored” sulfides, arsenides and antimonides such as skutterudite, safflorite, gersdorffite, cobaltite, rammelsbergite, parammelsbergite and allargentum, together with native elements such as bismuth and silver. Since these minerals have similar coloration and occur in intimate association, visual identification of individual minerals in a sample is usually very difficult; sophisticated diagnostic equipment is nearly always required to distinguish the species.

In addition to the arsenides and sulfides mentioned above, some

species, such as acanthite (paramorphic after argentite), proustite, stephanite and silver, are found in magnificent specimens.

Within the Cobalt-Gowganda area are the type localities for nine minerals: allargentum, burgessite, chapmanite, clinosafflorite, ferri-symplesite, langisite, larosite, mckinstryite and pararammelsbergite.

The minerals crystallized in the veins from solutions rich in Co, Ni, Fe, Ag, Sb, As and S, with the chemical make-up of the solutions varying somewhat with each depositional phase, probably as a result of sequential depletions of elements in a cooling system. Generally, the silver precipitated first and the arsenides and sulfides later, but silver (with significant antimony content) continued to precipitate throughout the depositional period. It appears that some silver and antimony were remobilized during the latter phase of the deposition and re-precipitated as pure silver plus silver antimonides. Gangue minerals, mostly carbonates, chlorite and quartz, appear to have been deposited contemporaneously with the ore minerals, with quartz and chlorite always precipitating earlier. Oxidation of vein materials occurred in the upper portions of the orebodies, but significant secondary enrichment was not common.

The complex emplacement of the ore minerals resulted in a highly layered texture in the ore. The various minerals were deposited as botryoidal layers and as dendritic and branching crystal aggregates which, in cross-section, appear as multilayered "rosettes" with earlier minerals at the center and later minerals in the outer layers. The highest-grade ores have silver at the cores of the rosettes and the arsenide suite of minerals in outer zones (Petruk, 1971). Commonly the cores are empty, the silver having migrated to fractures in the veins and wall rock. Pseudomorphs of arsenide minerals after silver crystals are common. The combinations are very interesting and attractive, and mineralogists have been drawn to examine their make-up since their initial discovery.

The ore veins occur in "groups," with basically the same composition and textural characteristics prevailing within each group. The chemistry varies to some degree from group to group, but the general characteristics of the veins remain similar.

The following is a listing and discussion of the minerals occurring in the Cobalt-Gowganda ores, with emphasis on the species that occur in significant well-crystallized specimens. Species first described from the Cobalt-Gowganda district are indicated by an asterisk (*).

Acanthite Ag_2S

Acanthite, the most common silver sulfide at Cobalt, formed at a high temperature, during vein emplacement, as isometric crystals of argentite. As these crystals cooled, their atomic arrangement inverted to the monoclinic form of silver sulfide known as acanthite; such a change in crystal unit cells takes place at the atomic level and the outward shapes of the crystals maintain their isometric symmetry. Many collectors still refer to this material as argentite, but all specimens of it should be regarded as paramorphs of acanthite after argentite. In the following description we refer to the outward isometric forms of the crystals.

Acanthite (called argentite when mining was active) was one of the first minerals found at Cobalt. Chunks of the black silver sulfide were found admixed with silver in the upper levels of silver veins and on the surface around the vein outcrops.

The crystals of acanthite are cubes, octahedrons, and cuboctahedrons; complex combinations of these and other forms are not uncommon, and some specimens show penetration-twinning cubes. Although a few crystals are sharp and lustrous, most are dull and rather crude. Exceptionally large masses of crystals have been recorded and some very large individual crystals are known. There are superb octahedrons up to 0.5 inches on an edge in pink calcite from South Lorrain, and on one specimen from this local-

ity, 0.2-inch cubic crystals have tiny radiating groups of acicular acanthite crystals perched along their edges. It is almost certain that these are secondary growths that formed in the storage cabinet and thus took the form of primary low-temperature acanthite. On some acanthite crystals from Cobalt, the cube faces show striations parallel to the edges, perhaps marking tetrahedral growth; on others, the cubic crystals display hopping. Acanthite also occurs as solid vein-like masses, in some cases fibrous across the vein, from 0.2 to 1 inch thick.

On acanthite specimen M16330 in the Royal Ontario Museum collection, penetration-twinned cubic crystals of acanthite are associated with well-formed stephanite crystals. Wire silver is frequently seen on the faces of acanthite crystals. Although acanthite is known to occur at many of the mines, the best crystal specimens that have survived are from the Castle-Trethewey, Cobalt Lake, O'Brien, Keeley-Frontier, Langis, Silver Miller, Silver Cliff, and Silver Queen mines.

Aikinite PbCuBiS_3

Aikinite occurs as solid veinlets to 0.3 inches thick in the Cobalt area. Crystals have not been noted.

Allargentum* $\text{Ag}_{1-x}\text{Sb}_x$

Masses of allargentum found at Cobalt have often been erroneously determined to be dyscrasite (Petruk *et al.*, 1971b), because of their composition. It is difficult to differentiate allargentum from silver in Cobalt ores: both occur as veins and veinlets cutting other minerals, and allargentum occurs also as lamellae in silver which can only be seen by slicing, polishing, and etching the polished surfaces with acid (Reiner Mielke, personal communication, 2009). The mineral is named from the combination of the Greek term "allos" for another and the Latin term argentum, silver.

Alloclasite $(\text{Co,Fe})\text{AsS}$

Alloclasite has only been found at Cobalt as microscopic phases with glaucodot and as small masses with safflorite (Petruk *et al.*, 1971d).

Annabergite $\text{Ni}_3(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$

Annabergite is a common mineral at Cobalt, found where nickel-rich veins have cropped out at or close to the surface. It occurs as powdery coatings or botryoidal crusts in seams near or on nickel arsenide mineralization. Occurrences of annabergite on nickel-rich fragments of vein material in mine dumps may represent post-mining alteration of nickel arsenides.

Aragonite CaCO_3

Aragonite has been found as tiny white crystals in near-surface mineralization.

Arsenopyrite FeAsS

Arsenopyrite is a very common constituent of Cobalt-area ores, occurring most commonly as millimeter-size crystals and as druses of crystals with individuals in the 0.04 to 0.1-inch size range, although individual crystals to 0.4 inches across have been noted. Arsenopyrite is associated with all of the common ore minerals at Cobalt.

Axinite-(Fe) $\text{Ca}_2\text{Fe}^{2+}\text{Al}_2\text{BO}(\text{OH})(\text{Si}_2\text{O}_7)_2$

Axinite-(Fe) occurs on one specimen at the Royal Ontario Museum—specimen M29427—as coarse 0.4-inch crystals.

Bismuth Bi

Native bismuth does not occur as crystals in Cobalt-area ores but does commonly occur as rich, coarsely crystallized, late-stage vein fillings. Specimens from Cobalt are usually vein sections consisting

of pure, brilliant cleavable masses with individual cleavages and vein sections up to 2.5 inches across.

Bismuthinite Bi_2S_3

Bismuthinite is relatively rare in the ores of Cobalt. There is one specimen in the Royal Ontario Museum collection that has 0.15 to 0.2-inch vugs in the ore containing acicular crystals of bismuthinite. In the D. K. Joyce collection and the Geological Survey of Canada National Mineral Collection there are also specimens showing felted masses of bismuthinite crystals in calcite vugs.

Bornite Cu_5FeS_4

Bornite is always massive in Cobalt-area ores, and although not particularly common it occurs in many of the mines in small amounts. It is often associated with leafy silver.

Breithauptite NiSb

Breithauptite is relatively common in the veins at Cobalt and was one of the first minerals noted during the initial discovery. At that time it was mistaken for a copper mineral, probably because of its peculiar pink-red metallic color. Breithauptite occurs in the veins at Cobalt as masses, sometimes filling the entire vein or replacing other arsenides/sulfides and silver. It has also been found in microscopic crystals.

Burgessite* $\text{Co}_2(\text{HAsO}_4)_2 \cdot 5\text{H}_2\text{O}$

Burgessite is a new mineral from Cobalt, recently described from a single specimen in a New Jersey collection (Sejkora *et al.*, 2009). It looks very similar to erythrite, and some of what has previously been identified as erythrite may be burgessite. The mineral is named for David Burgess (b. 1951) of Newington, Connecticut, a prolific mineral species collector who brought a sample of the species to the attention of the mineral community.

Calcite CaCO_3

Calcite is one of the main constituents of the ore veins and sub-veins in the country rock. Small crystals lining cavities in the veins are common, but good, larger calcite crystals are not common. Very nice lavender-colored calcite crystals to 2 inches were recovered from the Cross Lake mine.

Chabazite $\text{Ca}_2(\text{Al}_4\text{Si}_8\text{O}_{24}) \cdot 13\text{H}_2\text{O}$

Chabazite has been seen on only one specimen (Royal Ontario Museum collection M14544), as colorless, rhombohedral crystals to 0.1 inches associated with colorless stilbite. The location is given as the western side of Cross Lake.

Chalcopyrite CuFeS_2

Chalcopyrite occurs in the ores of the Cobalt/Gowganda area as massive patches and vein fillings, but not as crystals. It commonly occurs with bornite and carbonates.

Chapmanite* $\text{SbFe}_2^+\text{Si}_2\text{O}_8(\text{OH})$

The Keeley mine in the South Lorraine area near Cobalt is the type locality for chapmanite, and most of the specimens known to the authors are from that mine. It was named for Professor Edward J. Chapman (1821–1904) of the University of Toronto. This unusual mineral occurs as earthy to porcelaneous vein fillings to several inches across, commonly laced heavily with native silver. No crystals have been observed.

Chlorargyrite AgCl

Chlorargyrite is rarely seen in the Cobalt Mining Camp, but it has been noted from the Nipissing mine as small patches in gossan (Royal Ontario Museum samples M18902 and M18898).

Clinosafflorite* $(\text{Co,Fe,Ni})\text{As}_2$

The Cobalt area is the type locality for clinosafflorite, the monoclinic polymorph of safflorite (Radcliffe and Berry, 1971). It occurs finely intermixed with safflorite and has been noted only in polished section.

Cobaltite CoAsS

Good crystals of cobaltite to more than 0.3 inches exist, but are rare, in Cobalt-area ores. A number of specimens in the Royal Ontario Museum collection from the Columbus mine, most notably M8681, have very sharp, silvery, cuboctahedral cobaltite crystals to 0.3 inches across.

Cosalite $\text{Pb}_2\text{Bi}_2\text{S}_5$

Cosalite occurs as masses of tightly packed acicular crystals to 0.2 inches at the Columbus mine; an example is Royal Ontario Museum sample M9700.

Dolomite $\text{CaMg}(\text{CO}_3)_2$

Dolomite is a common vein constituent at various stages of vein development. Only small crystals have been noted.

Dyscrasite Ag_3Sb

Although originally reported as common, dyscrasite is actually rare in the Cobalt/Gowganda ores. Most specimens originally thought to be dyscrasite turned out to be mixtures of allargentum and silver (Petruk *et al.*, 1970).

Erythrite $\text{Co}_3(\text{AsO}_4)_2$

Erythrite is present in all areas of the camp that contained cobalt-bearing minerals and that have undergone oxidation, both in the veins and in the country rock surrounding the veins. In fact, "Cobalt bloom" was the most common indicator that prospectors used to detect the presence of cobalt and, possibly, of silver-bearing veins. Erythrite can be seen on most of the old workings in the Cobalt camp, even today. While most of it is powdery and commonly mixed with other oxidation minerals, some attractive botryoidal coatings and hemispherical aggregates composed of acicular crystals less than 0.04 inches long are encountered.

Ferrisymplectite* $\text{Fe}_3^{3+}(\text{AsO}_4)_2(\text{OH})_3 \cdot 5\text{H}_2\text{O}$

The Hudson Bay mine is the type locality for ferrisymplectite. Specimens from that mine and from the O'Brien and Cobalt Lode mines are preserved in the Royal Ontario Museum collection. The mineral occurs as amber-brown, resinous particles and botryoidal masses with erythrite or other oxidized minerals.

Fluorapatite $\text{Ca}_5(\text{PO}_4)_3\text{F}$

Fluorapatite as pale pink, columnar crystals to 0.2 inches long by 0.1 inches in diameter associated with cobaltite crystals from the Columbus mine have been noted on at least one Royal Ontario Museum specimen, M53923.

Freieslebenite PbAgSbS_3

Freieslebenite was found in Royal Ontario Museum specimen M21270 as a minute veinlet in a skutterudite grain (Petruk *et al.*, 1971d). It is very rare at Cobalt.

Galena PbS

Galena is not common but is found at some localities in the Cobalt-Gowganda area. Most specimens consist of massive or disseminated galena with calcite, silver, tetrahedrite and other ore minerals. A vein of solid galena was found in Gillies Township, just south of Cobalt, but it is not known if it was related to the Cobalt silver veins.

Gersdorffite NiAsS

Although gersdorffite is represented in the Royal Ontario Museum collection by only two specimens, as crystals to 0.3 inches embedded in other arsenides, it could be much more widespread than that implies, occurring as a phase in layered cobalt-nickel arsenides.

Glaucodot (Co,Fe)AsS

There is only one specimen of glaucodot known from Cobalt, and it is in the collection of the Royal Ontario Museum. It is a vein section consisting largely of 0.3-inch coarse crystals embedded in other arsenides.

Langisite* CoAs

The Langis mine is the type locality and eponym for langisite. It occurs in safflorite as veinlets, grains and lamellae with native bismuth and cobalt sulfides (Petruk *et al.*, 1971a). There are two specimens (holotype) in the Royal Ontario Museum collection: M28883 and M28884.

Larosite* (Cu,Ag)₂₁(Pb,Bi)₂S₁₃

Larosite was found in a sample at the Geological Survey of Canada, with acicular larosite crystals cutting across stromeyerite, chalcocite and polybasite. The type locality of this mineral is the Foster mine. The mineral was named for Frederick Alfred LaRose who supposedly discovered the silver ores of Cobalt.

Laumontite Ca₄[Al₈Si₁₆O₄₈]·18H₂O

Only one specimen of laumontite from the Cobalt-Gowganda area, M19992, is in the Royal Ontario Museum collection. It shows 0.08 to 0.11-inch crystals in oxidized ore from Coleman Township.

Löllingite FeAs₂

Löllingite occurs in many mines of the area as feathery and colloform masses comprising entire veinlets. Dendritic growths composed of löllingite crystals have been encountered at the Rustex (Hudbay) mine; typically they have been etched out of calcite, as for Royal Ontario Museum specimen M53907.

Matildite AgBiS₂

Matildite occurs as microscopic lamellae and irregular grains in galena in several specimens from the Foster and O'Brien mines. No discrete crystals have been found.

Maucherite Ni₁₁As₈

It is interesting to note that maucherite was described as "temiskamite" from the Moose Horn mine by Walker in 1914, but soon thereafter was found to be the same mineral as Grunling had described one year earlier as maucherite, and so the name maucherite took precedence. The more interesting specimens consist of rounded, pea-size, nodular aggregates from the Moose Horn mine, but it also has been reported from the Langis and Colroy mines. It occurs commonly with nickeline and other Co-Ni arsenides (Petruk *et al.*, 1971a).

Mckinstryite* (Ag,Cu)₂S

The Foster mine is the type locality for mckinstryite. It was found in a sample with chalcopyrite, stromeyerite, silver and arsenopyrite (Skinner *et al.*, 1966). The mineral was named to honor Hugh Exton McKinstry (1896–1961), Professor of Geology at Harvard University.

Millerite NiS

Millerite is a rare mineral in the Cobalt-Gowganda area. It occurs in a sample from the Miller Lake O'Brien mine as 0.15 to 0.20-inch crystals embedded in massive arsenides (Royal Ontario Museum specimen M47001).

Mimetite $\text{Pb}_5(\text{AsO}_4)_3\text{Cl}$

Mimetite occurs in one specimen in the Royal Ontario Museum collection, as a coating on corroded galena.

Nickeline NiAs

Nickeline is very common in the Cobalt-Gowganda area and was one of the chief nickel ore minerals in the concentrates; crystals of nickeline, however, are not common. It is most frequently found as massive vein sections to 9 inches and as globular aggregates, often with rich native silver and with many of the other cobalt-nickel arsenides. Some very sharp hexagonal-prismatic crystals have been found, but they seem to be pseudomorphs of various other arsenides after nickeline.

Nickelskutterudite $(\text{Ni},\text{Co},\text{Fe})\text{As}_{2-3}$

Nickelskutterudite occurs most commonly as small disseminated crystals in arsenides. It has been reported from the Hudson Bay mine (Rustex mine) near Gowganda, where it purportedly occurred as superb crystals to 0.5 inches. However, analyses of these crystals showed the mineral to be skutterudite.

Pararammelsbergite* NiAs_2

The Moose Horn, Hudson Bay and Keeley mines are listed as type localities for pararammelsbergite, a fairly common mineral from the Cobalt-Gowganda ores. It is most commonly found as a constituent of the so-called arsenide “rosettes” and is difficult to distinguish from other silvery arsenides.

Pearceite $[(\text{Ag}_8\text{CuS}_4)][(\text{AgCu})_6(\text{As},\text{Sb})_2\text{S}_7]$

Pearceite occurs as microscopic crystals in a cavity in ore on Royal Ontario Museum specimen M29542 from the Silver Miller mine.

Polybasite $[(\text{Ag}_8\text{CuS}_4)][(\text{AgCu})_6(\text{Sb},\text{As})_2\text{S}_7]$

Polybasite is often found in the oxidized portions of Cobalt- area veins, in small crystals. However, one notable specimen from the Keeley mine has crystals to 0.4 inch across.

Proustite Ag_3AsS_3

Proustite is the most common “ruby silver” mineral in the Cobalt mining camp. It forms excellent scalenohedral crystals to 0.8 inch in oxidized portions of the silver veins, in association with various arsenides, calcite and xanthoconite. The best examples occurred at the Keeley mine and are preserved as beautiful specimens at the Royal Ontario Museum. Well crystallized specimens also occurred at the O’Brien, Nipissing and Christopher mines. It is also found in veinlets and blebs in ores.

Pyrargyrite Ag_3SbS_3

Pyrargyrite crystals are not common in the Cobalt-Gowganda deposits; the mineral occurs most commonly as massive veinlets and patches in ore replacing silver and allargentum (Petruk *et al.*, 1971d), or derived from silver. It is associated with acanthite, silver and tetrahedrite.

Pyrite FeS_2

Pyrite is commonly seen in the ores in small amounts, rarely as small crystals. Royal Ontario Museum specimen M37813 consists of a botryoidal crust of pyrite covered with acanthite and wire silver.

Pyrrhotite Fe_{1-x}S

Pyrrhotite occurs fairly commonly in the veins, usually outside the areas mineralized with arsenides (Petruk *et al.*, 1971d). It is found as minute (to 0.10-inch), platy, hexagonal crystals in cavities and embedded in many other minerals.

Quartz SiO_2

Quartz usually occurs as rounded prismatic crystals embedded in carbonate gangue and arsenides, not as good crystal specimens.

Rammelsbergite NiAs_2

Rammelsbergite is fairly common in the Cobalt-Gowganda ores. It occurs as massive sections in veins and bulbous (as seen in cross-section) aggregates in carbonate veins. It is found intergrown with other arsenides and as a component of arsenide “rosettes” (Petruk *et al.*, 1971a).

Safflorite CoAs_2

Safflorite occurs in most of the veins throughout the district, and is the Cobalt camp’s most common arsenide (Petruk *et al.*, 1971a). It is a common constituent of the arsenide “rosettes” and is difficult to distinguish visually from the other white arsenides. It can be found as irregular grains in arsenide masses and as lath-like crystals arranged radially around cores of the “rosettes”. Many fine specimens have been recovered by removing carbonates from vein sections to reveal botryoidal safflorite in handsome specimens.

Silver Ag

Native silver is by far the most important silver mineral present in the ores of the Cobalt-Gowganda area. Petruk (1971) has recorded three distinctly different types that can be distinguished on the basis of chemistry and crystal structure. “Silver 1” is the main type, containing some antimony and mercury in solid solution; “silver 2” contains large amounts of antimony and mercury, whereas normal native silver, without appreciable amounts of antimony or mercury, forms at a late stage in the ore genesis as wires, veinlets, and disseminated grains. Allargentum is a distinct mineral species occurring as discrete grains with silver 1 and as exsolution lamellae in silver 2. Silver 1 and silver 2 cannot be distinguished visually from “normal” silver unless the latter occurs as wires.

The Cobalt camp produced some 600,000,000 ounces of silver, and huge masses of the mineral were encountered and recorded during mining. The “Silver Sidewalk” was a descriptive name given to a vein near Kerr Lake, conveying an idea of the huge size of some of the silver masses.

Unfortunately, large, spectacular wire silver specimens similar to those from Kongsberg, Norway were never found in the Cobalt area. However, smaller wires have been preserved in various collections, and many are very attractive. Large silver plates weighing up to hundreds of pounds are known.

Despite the fact that millions of ounces of silver have been encountered at Cobalt, distinct crystals of silver are rarely found. Arborescent growths are common, however, and beautiful, branching aggregates of silver are often found, almost all of these showing coatings of nickel or cobalt arsenides that can either be thin or so thick as to form the majority of the vein. Such specimens of dendritic silver are found at many mines in the Cobalt-Gowganda mining camp.

“Herringbone” silver is also frequently encountered. This style of arborescent growth differs from the previously described arborescent growths in that the silver crystals are straight and have formed in delicate comb-like aggregates resembling the ribs of herring. These delicate aggregates of branching, twinned crystals are almost always coated with cobalt-nickel arsenides and encased in calcite. Collectors are fascinated by the patterns exhibited when such high-grade samples are cut with a diamond saw. Slabs of this type of high-grade ore also find use as a lapidary material. “Herringbone” silver can be found at many of the mines of the Gowganda area.

Attractive pseudomorphs of cobalt-nickel arsenides after dendritic silver are commonly found in the Cobalt-Gowganda mining camp.

It often appears that the silver has been re-mobilized out of the cobalt-nickel arsenide coatings to leave epimorphs; often, in these cases, the silver has been re-deposited as solid veinlets in calcite veins near the epimorphs.

Skutterudite CoAs_3

Skutterudite occurs as small euhedral crystals in many mines of the Cobalt-Gowganda area, and in excellent larger crystals in some of the mines. Sharp 0.4-inch crystals have been found in the Temiskaming and Keeley mines. The best skutterudite crystals have been collected at the Hudson Bay (Rustex) mine, near Gowganda.

Sphalerite ZnS

Sphalerite is not common in the veins at Cobalt, although it occurs in significant quantities in the Keewatin interflow volcanics, some of which host silver veins. Royal Ontario Museum specimen M13276, from the La Rose mine, shows lustrous sphalerite microcrystals.

Stephanite Ag_5SbS_4

Stephanite is relatively common in small crystals and in massive form in Cobalt-area ores. Most stephanite crystals are 0.2 inches or less in longest dimension; however, one specimen from the Keeley mine, M47444 in the Royal Ontario Museum collection, displays a prominent 1.1-inch crystal. Stephanite specimens are often found partially coated with paramorphs of acanthite after argentite crystals.

Stromeyerite AgCuS

Stromeyerite is not known to occur in crystals at Cobalt. It occurs at several mines as veinlets and blebs in rock and carbonate/quartz veins (Petruk *et al.*, 1971a).

Tetrahedrite $\text{Cu}_6\text{Cu}_4(\text{Fe,Zn})_2(\text{Sb,As})_4\text{S}_{13}$

Massive tetrahedrite (crystals are very rare) is associated with native silver and most of the arsenide minerals, both in the veins and in wall rocks near them. Locally it forms masses up to several inches across.

Ullmannite NiSbS

Ullmannite is not a common mineral in the Cobalt-Gowganda silver veins. There is one specimen in the Royal Ontario Museum collection, M25565, from the Silver Bar mine, which shows 0.2-inch crystals embedded in nickeline.

Xanthoconite Ag_3AsS_3

Xanthoconite is found in proustite-rich areas of the veins in yellow-orange platy crystals less than 0.05 inches. Occasionally xanthoconite has been found in mammillary aggregates of bladed crystals associated with proustite crystals.

Other Minerals

A number of other minerals have been noted in various studies and examinations of specimens, but not in significant quantities or quality. They include anatase, arsenic, arsenolite, azurite, chalcocite, covellite, galenobismutite, garnierite, gold, magnetite, marcasite, molybdenite, parkerite, pavonite, pentlandite (cobaltian), siegenite, sphaerocobaltite, smythite, violarite and wittichenite.

COLLECTING LOCALES

Mine Dumps

Each mine in the Cobalt camp had its own dump where barren rock from the workings was discarded. Luckily for mineral collectors, the miners sometimes missed chunks of high-grade ore, and pieces of rock or vein containing varying amounts of silver ended up being mixed in with the "waste." To this day, it is possible to comb through old waste dumps and find spectacular silver and arsenide specimens, although it is not as easy now as it once was.

Mineral collectors have been picking over the dumps for many years, and any silver that had been lying on the tops of the dumps was found long ago. However, the old dumps occasionally are disturbed when volumes of broken rock are taken for road fill or for other uses. When this happens, fresh rock is exposed from deep within the dumps, and pieces showing interesting mineralization may be turned up after being hidden for many decades.

The use of metal detectors has helped collectors probe more deeply into waste piles to detect pieces of rock or vein material containing silver. By now, most old mine dumps have been probed with metal detectors to depths of at least two or three feet. Again, if the dumps are excavated to obtain rock fill or for other reasons, then fresh rock may be exposed which will enable the collector with a metal detector to find some nice specimens of silver and associated minerals. It is amazing how frequently people return to "picked over" dumps and somehow find nice specimens of high-grade ore, even though many hundreds of collectors have probably been there before them!

It is relatively easy to find chunks of high-grade ore consisting of silver associated with arsenides and sulfides; it is more difficult to find leaf and plate silver. Wire silver was never very common at Cobalt, and only on very rare occasions has it been discovered in waste dumps.

The unusual minerals such as proustite, stephanite, xanthocobaltite, etc. were really only found *in situ* in the early workings. It is extremely rare to find well-formed crystals of these minerals in waste dumps. Nearly all good crystal specimens of these minerals came many years ago from blasted rock fresh from underground workings.

Glacial Float

During the last ice age, before 10,000 or so years ago, giant ice sheets and glaciers covered all of northern Ontario. These moving ice sheets scoured the rock surfaces and tore out chunks of silver and arsenides from the Cobalt-area veins, along with much rock; such torn-out, glacially transported debris is known as glacial "drift" or "float." As the glaciers moved, they transported the chunks of rock, including ores from the veins, "down-drift" from the places where they had originated. When the glaciers melted, the pieces of silver vein were dropped and buried, along with boulders and pulverized rock. Some spectacularly large pieces of glacial "float" silver have been found on the surface of the ground in the Cobalt area. In 1923, a glacial boulder weighing 1,424 pounds and containing an estimated 11,000 troy ounces of native silver was found in Gillies Township (Smith, 1986). Many other pieces of silver-rich float have been found over the years. Recently, determined collectors with metal detectors have found some fantastic native silver glacial float; in most such specimens the carbonates and arsenides have been completely or partially leached from around the silver by circulating groundwater. Such collecting is difficult in the dense bush that exists down-drift from the silver veins.

In Situ

In Cobalt today it is virtually impossible to collect silver or other interesting minerals *in situ*. Any surface veins with any valuable minerals have been excavated at some time in the past. It is still possible to trace extensions of veins along strike and see erythrite or annabergite stains in the rock. Most underground workings are below the water table and are flooded. Very few are accessible, and those that are accessible are not maintained and must be considered very dangerous.

Old collections

On occasion, old collections become available that include nice specimens of silver or associated minerals from the “heydays” of mining at Cobalt.

ACCESS

Ease of access to old mine operations and dumps is varied. Some landowners and claimholders do not want trespassers under any circumstances, while others don't mind at all when collectors visit. There are many old mine dumps, and ownerships are constantly changing. It is best to seek permission to collect at Cobalt.

Appendix I. Mines of the Cobalt district.

The bulk of mining in the Cobalt camp was accomplished prior to 1968. During those times, claims and mines were bought and sold, ores were hauled from one mine to another's concentrator, mines were interconnected and ores from several were hoisted from a common shaft, etc.—and so it was always problematical to try to identify the historical claim or mine from which a given specimen had come.

The longitudes, latitudes and production figures for the following mines are taken from the Miscellaneous Data Inventory (MDI) site compiled by the Ontario Geological Survey. The site can be found on the web page: <http://www.geologyontario.mndmf.gov.on.ca/>.

Cobalt Area Coleman Township

Alexandra Silver Mining Company

Production: 3,612,195 oz. Ag; 116,845 lbs. Co

Location: Lat. 47° 22' 28" Long. 79° 40' 32"

The Alexandra Silver mine was started in 1906 and became the Canadian Gold and Silver Mining Company in 1913. After two years of operation it was leased to various individuals, and in 1962 the Silverfields Mining Corporation began to work it.

During the 1970s and 1980s, the Teck Corporation purchased the Alexandra property and operated it as the Silverfields mine. Teck mined and milled ore from other claims in the Cobalt camp as well, operating them all as the Silverfields mine. The main Silverfields mine shaft and mill were near Cart Lake, the mine serving as a main source of mill feed. The Silverfields mill, however, also processed ore from dumps, small underground operations and pillar-mining operations, and served as a custom milling operation, until 1983.

Beaver Consolidated Mines Limited

Production: 7,127,858 oz. Ag; 139,868 lbs. Co

Location: Lat. 47° 21' 44" Long. 79° 38' 26"

The Beaver has long been a source of excellent high-grade silver/cobalt specimens as well as leaf silver. In the late 1990s, cobalt ore was recovered both from the old Beaver and Timiskaming mines and simultaneously from a shaft on the Beaver mine property, and so the newer dumps on the property are composed of a mix of material from both claims. Collectors may thus encounter specimens from the Beaver-Timiskaming mine in these dumps.

Brady Lake Property

Production: 2,250,136 oz. Ag; 190,812 lbs. Co

Location: Lat. 47° 21' 32" Long. 79° 38' 54"

The Brady Lake Property is actually composed of three original claims: Lumsden, Rochester and Pan Silver. They were operated as separate properties until amalgamated under “Brady Lake Property” in 1947.

Buffalo Mines Limited

Production: 14,154,558 oz. Ag; 152,406 lbs. Co

Location: Lat. 47° 23' 36" Long. 79° 41' 28"

The Buffalo Mines Limited were operated by a number of mining companies and leases over the years before being acquired by Agnico Mines in 1957.

Chambers Ferland Mining Company Limited**Claim RL401,PCL3&4**

Production: 2,297,000 oz. Ag; 25,415 lbs. Co

Location: Lat. 47° 24' 13" Long. 79° 40' 41"

Claim RL402W, RL400E ½

Production: 2,000,000 oz. Ag; 2,057,142 lbs. Co

Location: Lat. 47° 23' 53" Long. 79° 40' 36"

These claims were owned or leased by many companies but half of the production was accomplished by Silver Miller Mines Limited between 1954 and 1958.

Christopher Silver Mines Limited

Production: 4,100,000 oz. Ag; 2,143 lbs. Co

Location: Lat. 47° 21' 22" Long. 79° 38' 55"

Also known as Columbus Cobalt Silver Company, and Cobalt Consolidated; it was finally acquired by Agnico Mines Limited.

City of Cobalt Mining Company Limited

Production: 14,000,000 oz. Ag; 25,022 lbs. Co

Location: Lat. 47° 23' 35" Long. 79° 41' 25"

This mine operated directly under much of the central part of the town of Cobalt. The old headframe is still standing and currently houses a café. Also it was operated by Mining Corporation, Cobalt Properties Limited and eventually by Agnico Mines Limited.

Cobalt Badger Mining Limited

Production: 3,475 oz. Ag; 112 lbs. Co

Location: Lat. 47° 21' 52" Long. 79° 38' 58"

Cobalt Lake Mining Company Limited

Production: 6,900,486 oz. Ag; 146,204 lbs. Co

Location: Lat. 47° 23' 29" Long. 79° 41' 09"

This property was made up of all of the land under Cobalt Lake and was operated by a number of companies over the years.

Cobalt Lode Silver mines

Production: 4,493,725 oz. Ag; 2,547,404 lbs. Co

Location: Lat. 47° 21' 24" Long. 79° 38' 39"

Cobalt Silver Queen Limited

Production: 1,406,214 oz. Ag; 168,462 lbs. Co

Location: Lat. 47° 23' 19" Long. 79° 41' 52"

Cobalt Townsite Mining Limited

Production: 32,150,746 oz. Ag; 4,120 lbs. Co

Location: Lat. 47° 23' 29" Long. 79° 41' 27"

Cochrane Cobalt Mining Limited

Production: 33,280 oz. Ag; 2,705 lbs. Co

Location: Lat. 47° 21' 27" Long. 79° 38' 24"

Colonial Mining Company Limited

Production: 1,211,956 oz. Ag; 3,675 lbs. Co

Location: Lat. 47° 23' 43" Long. 79° 39' 41"

Coniagas Mines Limited

Production: 33,963,067 oz. Ag; 310,557 lbs. Co

Location: Lat. 47° 23' 51" Long. 79° 41' 22"

When one of us (DKJ) attended the Haileybury School of Mines, I visited the underground workings of the Coniagas (Cobalt-Nickel-

Silver-Arsenic) mine a couple of times to learn how to do geological mapping underground. The mine manager showed us big chunks of high-grade silver ore consisting of masses of black, heavy silver arsenide and sulfide mineralization that was being recovered from "pillar-robbing" extraction work.

This claim was operated by W. Trethewey for two years before it was acquired by Coniagas Mines Limited. It was bought and sold by a number of companies over the years.

Conisil Mines Limited

Production: 100,000 oz. Ag

Location: Lat. 47° 22' 12" Long. 79° 39' 40"

Consolidated Silver Banner Property

Production: 41,701 oz. Ag

Location: Lat. 47° 21' 04" Long. 79° 38' 39"

Cross Lake O'Brien Property

Production: 2,846,103 oz. Ag; 97,211 lbs. Co

Location: Lat. 47° 23' 29" Long. 79° 38' 44"

This property was operated for many years by M. J. O'Brien Limited and then by Deer Horn Mines Limited. Some specimens from it are attributed to the Deer Horn mine.

Crown Reserve Mining Limited

Production: 20,325,302 oz. Ag; 33,713 lbs. Co

Location: Lat. 47° 22' 33" Long. 79° 39' 33"

This claim consisted of all of the land under Kerr Lake.

Drummond Mines Limited

Production: 3,887,585 oz. Ag; 246,029 lbs. Co

Location: Lat. 47° 22' 36" Long. 79° 39' 11"

The Drummond mine was owned by Henry Drummond, a famous Canadian poet who immigrated from Ireland, attended McGill University and became a medical doctor. He became famous by writing poems about the French Canadian Habitants, the rural people of Quebec. He learned about the silver strikes at Long Lake from an assayer at McGill University and headed to Cobalt, then staked a claim just north of Kerr Lake, operating and managing the Drummond mine until his death in April 1907. The Drummond Cairn was originally the chimney from his home at the mine. Drummond's home was designated a historical place in the 1930s, and more recently the Cairn was moved into Cobalt from the mine site.

Farah Mining Company Limited

Production: 8,952 oz. Ag

Location: Lat. 47° 23' 06" Long. 79° 39' 20"

Foster Cobalt Mining Company Limited

Production: 1,159,390 oz. Ag; 457,574 lbs. Co

Location: Lat. 47° 22' 22" Long. 79° 39' 57"

Hargrave Silver mines

Production: 506,927 oz. Ag; 6,424 lbs. Co

Location: Lat. 47° 22' 18" Long. 79° 39' 14"

Hiho mine (See Kerr Lake Mining Company)

Hudson Bay mine

Production: 6,452,266 oz. Ag; 185,739 lbs. Co

Location: Lat. 47° 24' 15" Long. 79° 41' 12"

Juno Metals Corp.

Production: 46,391 oz. Ag

Location: Lat. 47° 22' 59" Long. 79° 39' 40"

Kerr Lake Mining Company

Production: 28,502,037 oz. Ag; 650,679 lbs. Co

Location: Lat. 47° 22' 31" Long. 79° 39' 29"

This property was worked by a number of companies over the years but famously by Hiho Silver Mines Limited. Specimens may be referred to as coming from the Hiho mine.

King Edward Mining Company

Production: 1,294,233 oz. Ag; 3,470 lbs. Co

Location: Lat. 47° 23' 33" Long. 79° 38' 20"

This operation was also referred to as the Watts mine in the earliest days of Cobalt.

La Rose Mines Limited

Production: 26,283,372 oz. Ag; 1,010,720 lbs. Co

Location: Lat. 47° 24' 00" Long. 79° 40' 33"

La Rose Mines Limited was named for the railroad blacksmith Fred La Rose, who is credited with finding the first silver at Cobalt. Fred's original blacksmith shop still stands near the mine site. Since the veins were exposed on the cliff faces at the northern end of Cobalt, they are prominent to this day.

Lawson mine

Production: 4,213,513 oz. Ag

Location: Lat. 47° 22' 26" Long. 79° 39' 41"

One of the veins mined on this property was the famous "Silver Sidewalk," called so because the surface expression of the vein was almost 1,000 feet long and its width of 6 to 8 inches appeared to consist of largely solid silver.

Little Nipissing claim JB2

Production: 82,000 oz. Ag

Location: Lat. 47° 23' 08" Long. 79° 41' 44"

Lumsden claim (See Brady Lake Property)

M. J. O'Brien mine

Production: 43,739,820 oz. Ag; 3,124,504 lbs. Co

Location: Lat. 47° 23' 57" Long. 79° 40' 06"

The O'Brien mine yielded some amazing high-grade ore in its heyday. Some of this material escaped the miners and can still be found to this day on mine dumps. Also, the O'Brien had surface zones that produced good crystals of acanthite (paramorphs after argentite), proustite and other secondary silver minerals. If collectors encounter well crystallized specimens of such minerals from this (or any other) mine, they are no doubt very old specimens from the days of active mining.

Mayfair Mines Limited

Production: 26,240 oz. Ag

Location: Lat. 47° 20' 44" Long. 79° 38' 36"

McKinley-Darragh-Savage mines

Production: 17,300,000 oz. Ag; 465,582 lbs. Co

Location: Lat. 47° 23' 19" Long. 79° 41' 28"

These mines, more usually called the McKinley-Darragh mine, were named for the two men who staked the first claim in the Cobalt mining camp.

Mensilvo Mines Limited

Production: 374,824 oz. Ag; 149,643 lbs. Co

Location: Lat. 47° 22' 29" Long. 79° 40' 55"

Nancy-Helen Mines Limited

Production: 91,770 oz. Ag

Location: Lat. 47° 23' 40" Long. 79° 41' 26"

Nerlip Mines Limited

Production: 911 oz. Ag; 2,949 lbs. Co

Location: Lat. 47° 23' 56" Long. 79° 39' 09"

New Bailey Mines Limited

Production: 3,131,352 oz. Ag; 76,849 lbs. Co

Location: Lat. 47° 22' 20" Long. 79° 40' 14"

This property is popularly known today as the Glen Lake mine. Excellent high-grade silver/cobalt ore can still be found in the old dumps.

Nipissing Mines Limited

Claim 404

Production: 91,796,735 oz. Ag; 5,641,757 lbs. Co

Location: Lat. 47° 23' 33" Long. 79° 40' 53"

Claim 406

Production: 1,236,879 oz. Ag; 74,036 lbs. Co

Location: Lat. 47° 22' 49" Long. 79° 41' 17"

Claim 407

Production: 1,843,633 oz. Ag; 157,738 lbs. Co

Location: Lat. 47° 22' 51" Long. 79° 40' 28"

For the most part, each mine of the Cobalt area was located on a single claim or portion of a claim. The Nipissing mine property, however, was originally staked as several claims, on some of the richest ground in the Cobalt camp. This explains the extensive workings and large mill site of "the Big Nip." The many mine dumps have been the source of some good high-grade silver, including leaf silver, over the years. These claims were eventually all acquired by Agnico Mines Ltd. and operated from the 1960s until the 1980s.

Nova Scotia Silver Mining Company

Production: 1,082,774 oz. Ag; 114,301 lbs. Co

Location: Lat. 47° 23' 14" Long. 79° 39' 44"

Pan Silver claim (see Brady Lake Property)

Penn Canadian Mines Limited

Production: 4,418,802 oz. Ag; 190,821 lbs. Co

Location: Lat. 47° 22' 32" Long. 79° 40' 16"

Peterson Lake Silver-Cobalt Mining Company Limited

(Peterson Lake)

Production: 918,076 oz. Ag; 27,328 lbs. Co

Location: Lat. 47° 23' 16" Long. 79° 40' 33"

Peterson Lake Silver-Cobalt Mining Company Limited

(Cart Lake)

Production: 5,711,490 oz. Ag; 7,787 lbs. Co

Location: Lat. 47° 22' 52" Long. 79° 41' 02"

Princess claim

Production: 3,713,806 oz. Ag

Location: Lat. 47° 23' 16" Long. 79° 41' 44"

Red Jacket Property

Production: 3 oz. Ag; 355 lbs. Co

Location: Lat. 47° 22' 36" Long. 79° 42' 20"

Reinhardt Cross Lake Group

Production: 278,631 oz. Ag; 2,535 lbs. Co

Location: Lat. 47° 23' 26" Long. 79° 38' 44"

Right of Way Mines Limited

Production: 2,969,195 oz. Ag; 41,811 lbs. Co

North mine

Location: Lat. 47° 23' 52" Long. 79° 40' 43"

South mine

Location: Lat. 47° 23' 22" Long. 79° 41' 35"

The Right of Way mine was one of the most prominent mines in

Cobalt, since it lay in the middle of town, right beside the railway. The headframe of the North mine still stands today.

Rochester Claim (see Brady Lake Property)

Savage mine (McKinley-Darragh)

Production: 4,500,000 oz. Ag; 465,582 lbs. Co

Location: Lat. 47° 23' 19" Long. 79° 41' 28"

This mine and the McKinley-Darragh mine were both operated by the same company, McKinley-Darragh-Savage Mines Limited, during the heyday of Cobalt from 1903 onwards.

Silver Cliff Mining Company Limited

Production: 535,246 oz. Ag; 9,323 lbs. Co

Location: Lat. 47° 23' 40" Long. 79° 39' 20"

Silver Cross Cobalt Mining Company Limited

Production: 3,091 lbs. Co

Location: Lat. 47° 22' 54" Long. 79° 38' 45"

Silver Leaf Mining Company Limited

Production: 495,443 oz. Ag; 1,208 lbs. Co

Location: Lat. 47° 22' 33" Long. 79° 39' 38"

Silver Miller Mines Limited

Production: 2,030,000 oz. Ag

Location: Lat. 47° 23' 53" Long. 79° 40' 36"

This company operated the Brady Lake Property for a number of years. Some specimens from the Property may be attributed to the Silver Miller mine.

Smith Cobalt Mines Limited

Production: 456 lbs. Co

Location: Lat. 47° 23' 26" Long. 79° 38' 19"

Timiskaming Mining Company Limited

Production: 12,118,796 oz. Ag; 202,869 lbs. Co

Location: Lat. 47° 21' 40" Long. 79° 38' 27"

Over the years this mine has yielded much high-grade silver to collectors using metal detectors. (See Beaver Consolidated Mines Limited entry for additional information.)

Trethewey Silver Cobalt Mines Limited

Production: 7,256,470 oz. Ag; 216,392 lbs. Co

Location: Lat. 47° 24' 01" Long. 79° 41' 09"

University Mines Limited

Production: 790,000 oz. Ag; 82,681 lbs. Co

Location: Lat. 47° 22' 12" Long. 79° 40' 15"

Violet Mining Company Limited

Production: 897,291 oz. Ag

Location: Lat. 47° 23' 52" Long. 79° 39' 42"

Gillies Limit Township

Cleopatra Mining Company Limited

Production: 2,160,356 oz. Ag; 136,069 lbs. Co

Location: Lat. 47° 22' 10" Long. 79° 40' 29"

Good high-grade ore has been found in recent years in waste dumps around this old mine.

Provincial mine

Production: 286,897 oz. Ag; 54,522 lbs. Co

Location: Lat. 47° 22' 36" Long. 79° 41' 11"

Interestingly, this claim was put aside by the government of Ontario to be mined by a government-controlled company "for the people"—something unusual for the time. The mine was opened

but operated for only a short time before the ore ran out. It was a money-losing venture. The government turned it over to a private company which also failed to make it profitable.

Waldman Silver Mines Limited

Production: 33,525 oz. Ag; 2,068 lbs. Co
Location: Lat. 47° 22' 17" Long. 79° 41' 08"

Wyandoh Silver Mines Limited

Production: 33,699 oz. Ag; 1,235 lbs. Co
Location: Lat. 47° 22' 16" Long. 79° 41' 03"

Bucke Township

Agaunico and Reuthel mine

Production: 980,000 oz. Ag; 4,353,909 lbs. Co
Location: Lat. 47° 25' 08" Long. 79° 36' 17"

The "Agaunico" in this mine's name is derived from Ag (silver), Au (gold), Ni (nickel) and Co (cobalt). The gold may have been wishful thinking, although, purportedly, some gold was found in the mine.

Cobalt Contact mine

Production: 26,000 oz. Ag; 31,028 lbs. Co
Location: Lat. 47° 24' 55" Long. 79° 36' 59"

Dotsee mine

Production: 125 oz. Ag; 8,007 lbs. Co
Location: Lat. 47° 25' 41" Long. 79° 45' 16"

Genesee Mining Company

Production: 69,404 oz. Ag; 12,079 lbs. Co
Location: Lat. 47° 24' 30" Long. 79° 40' 21"

Green-Meehan and Red Rock mine

Production: 498,000 oz. Ag; 27,024 lbs. Co
Location: Lat. 47° 24' 54" Long. 79° 37' 10"

Harrison-Hibbert and Ruby mine

Production: 876,500 oz. Ag; 214,792 lbs. Co
Location: Lat. 47° 24' 53" Long. 79° 37' 32"

North Cobalt and Hunter mine

Production: 1,453 oz. Ag
Location: Lat. 47° 25' 16" Long. 79° 37' 30"

Casey Township

Casey Cobalt-Silver Mines Limited

Production: 10,094,801 oz. Ag; 384,157 lbs. Co
Location: Lat. 47° 34' 53" Long. 79° 34' 48"

Also popularly referred to as the Langis mine, after the Langis Silver and Cobalt Mining Company, a company which operated it for a while during the 1960s, the Casey has been the source of some of the best dendritic silver and high-grade ore. Specimens commonly consist of chunks of ore, sawn to reveal intricate "herringbone" patterns of silver crystals, usually coated with arsenide minerals, in carbonate vein material. Sometimes the carbonates can be leached away with acid to reveal excellent herringbone crystal structures. The Langis mine is located on an isolated patch of sedimentary rocks and Nipissing diabase about 12 miles north of Cobalt, at the north end of Lake Temiskaming, near New Liskeard.

Harris Township

Harmak Mining Company

Production: 4,625 oz. Ag; 12,937 lbs. Co
Location: Lat. 47° 34' 34" Long. 79° 35' 01"

Lorrain Township

Lang Caswell mine

Production: 1,503 oz. Ag; 4,932 lbs. Co

Location: Lat. 47° 34' 34" Long. 79° 35' 01"

*Elk Lake Area
Farr Township*

Roy Silver Mines Limited

Production: 1,888 oz. Ag

Location: Lat. 47° 46' 59" Long. 80° 27' 46"

James Township

Ethel Copper Mines Limited

Production: 6,061 oz. Ag

Location: Lat. 47° 44' 53" Long. 80° 16' 29"

Moose Horn Mines Limited

Production: (?)

Location: Lat. 47° 44' 17" Long. 80° 18' 46"

The Moose Horn mine was not a prolific silver producer. Only a few tons of silver ore rich in nickeline were ever shipped. However, the Moose Horn mine was the source of temiskamite, $\text{Ni}_{11}\text{As}_8$, which was proposed as a new mineral—and was so, in fact. Unfortunately, German scientists had characterized maucherite just prior to the characterization of temiskamite, and thus the name maucherite took priority, temiskamite being discredited.

Mother-Lode Mining Company Limited

Production: 1,581 oz. Ag

Location: Lat. 47° 44' 39" Long. 80° 21' 29"

Mickle Township

Mapes-Johnston Mining Company Limited

Production: 1,000 oz. Ag; 870 lbs. Co

Location: Lat. 47° 44' 16" Long. 80° 26' 19"

Otisse Mining Company

Production: 2,380 oz. Ag; 26 lbs. Co

Location: Lat. 47° 43' 16" Long. 80° 26' 32"

Shane-Darragh Claim W.D. 904

Production: 63,417 oz. Ag; 1,214 lbs. Co

Location: Lat. 47° 43' 15" Long. 80° 25' 20"

Willet Township

Lucky Godfrey Silver mines

Production: 9,835 oz. Ag; 593 lbs. Co

Location: Lat. 47° 39' 46" Long. 80° 16' 54"

Cane Township

Cane Silver Mines Limited

Production: 3,100 oz. Ag

Location: Lat. 47° 36' 11" Long. 80° 01' 29"

Whitson Township

White Reserve Mines Limited

Production: 19,775 oz. Ag; 452 lbs. Co

Location: Lat. 47° 26' 22" Long. 80° 16' 47"

Gowganda Area

Corkill Township

Kell Silver mines

Production: 1,621 oz. Ag; 180 lbs. Co

Location: Lat. 47° 30' 19" Long. 80° 38' 50"

Haultain Township

Bonsall mine

Production: 141,856 oz. Ag

Location: Lat. 47° 40' 23" Long. 80° 44' 56"

Capitol mine

Production: 10,837,181 oz. Ag; 209,662 lbs. Co

Location: Lat. 47° 40' 16" Long. 80° 43' 49"

The Capitol mine has been a favorite collecting locality for collectors with metal detectors, and has produced many fine specimens of dendritic silver ore over the years.

Castle-Trethewey mine

Production: 9,410,095 oz. Ag; 376,392 lbs. Co

Location: Lat. 47° 40' 45" Long. 80° 44' 27"

The "Castle mine," as it is usually known, still yields nice high-grade ore and crystallized silver specimens today.

Miller Lake Everett mine

Production: 3,461 oz. Ag

Location: Lat. 47° 40' 41" Long. 80° 44' 38"

Millerett mine

Production: 611,822 oz. Ag; 5,004 lbs. Co

Location: Lat. 47° 40' 16" Long. 80° 44' 34"

Lawson Township

Bishop, Caleta & Keora mine

Production: 42,400 oz. Ag

Location: Lat. 47° 39' 22" Long. 80° 39' 28"

Leith Township

Hudson Bay Silver Mines Limited

Production: 80,186 oz. Ag; 567 lbs. Co

Location: Lat. 47° 30' 47" Long. 80° 48' 17"

This mine, also known as the Rustex mine and Rusty Lake mine, has produced superb specimens of skutterudite. The skutterudite occurs as crystals in calcite veins, with other arsenides and with silver. The calcite can be removed with acid to reveal clusters of sharp, lustrous skutterudite crystals to 0.5 inch.

Milner Township

Bartlett mine

Production: 20,219 oz. Ag; 18 lbs. Co

Location: Lat. 47° 35' 49" Long. 80° 48' 46"

Mann/Boyd Gordon mine

Production: 123,620 oz. Ag;

Location: Lat. 47° 37' 16" Long. 80° 48' 57"

Specimens of branching silver crystals in oxidized arsenides have been found over the years at this mine. These specimens are usually said to be from the Manridge mine, after Manridge Mines Limited, a company that operated it as well as the Bartlett, Boyd Gordon, Reeve-Dobie, South Bay and Welch mines.

Reeve-Dobie mine

Production: 88,584 oz. Ag

Location: Lat. 47° 36' 11" Long. 80° 48' 50"

South Bay mine

Production: 1,500 oz. Ag;

Location: Lat. 47° 35' 31" Long. 80° 48' 10"

Welch mine

Production: 1,000 oz. Ag

Location: Lat. 47° 35' 57" Long. 80° 48' 57"

Nicol Township

Miller Lake O'Brien mine

Production: 43,181,431 oz. Ag; 787,350 lbs. Co

Location: Lat. 47° 39' 58" Long. 80° 44' 01"

This mine has been a source of rich high-grade ore, found with metal detectors.

Morrison mine

Production: 719,522 oz. Ag; 22,064 lbs. Co

Location: Lat. 47° 39' 10" Long. 80° 42' 54"

Walsh mine

Production: 453,424 oz. Ag; 3,563 lbs. Co

Location: Lat. 47° 39' 30" Long. 80° 43' 39"

South Lorrain Township

Bellellen mine

Production: 38,027 oz. Ag; 28,506 lbs. Co

Location: Lat. 47° 12' 15" Long. 79° 30' 07"

Canadian Lorraine mine

Production: 276,825 oz. Ag; 16,693 lbs. Co

Location: Lat. 47° 12' 51" Long. 79° 27' 46"

Curry mine

Production: 49,821 oz. Ag; 7,698 lbs. Co

Location: Lat. 47° 11' 24" Long. 79° 30' 07"

Gilgreer mine

Production: 446 oz. Ag; 1,733 lbs. Co

Location: Lat. 47° 12' 51" Long. 79° 27' 57"

Harris Mines Limited

Production: 13,659 oz. Ag; 26,310 lbs. Co

Location: Lat. 47° 12' 00" Long. 79° 29' 59"

Keeley and Frontier Mines Limited

Production: 19,197,413 oz. Ag; 3,310,556 lbs. Co

Location: Lat. 47° 11' 42" Long. 79° 30' 14"

The "Woods Vein" of this rich silver producer was also a prolific specimen producer. Most of the mines in the Cobalt area did not contain many open vugs where proustite, wire silver and other rare silver minerals could form. According to Sergiades (1968), "Preglacial weathering on part of the Woods vein extends to 480' depth; ore deposition in consequence is partly secondary and the vein vuggy." The collection of the Royal Ontario Museum has excellent specimens of wire silver from the Keeley and Frontier mine as well as superb proustite specimens with well formed crystals to 0.75 inches.

Lorrain Trout Lake Mines Limited

Production: 2,876,940 oz. Ag; 315,362 lbs. Co

Location: Lat. 47° 11' 31" Long. 79° 30' 21"

Nipissing Lorraine mine

Production: 350,000 oz. Ag; 5,527 lbs. Co

Location: Lat. 47° 12' 40" Long. 79° 27' 17"

This mine is on Maidens Bay, Lake Temiskaming, and specimens from the locality, possibly along with some from the Canadian Lorraine mine, may be attributed to the Maiden's Bay mine.

Silver Eagle claim

Production: 7,989 lbs. Co

Location: Lat. 47° 11' 24" Long. 79° 29' 59"

Wettlauffer mine

Production: 2,593,041 oz. Ag; 23,931 lbs. Co

Location: Lat. 47° 11' 31" Long. 79° 29' 56"

This was a rich mine, and superb examples of high-grade ore have been found in the waste dumps with metal detectors.

Silver Center

When the South Lorrain Silver Mining area was booming starting in 1907, a town called Silver Center was established. It was a proper town, with a well laid-out town site and with great hopes for the future. Unfortunately it did not last. It is considered the area's "ghost town," and remnants of Silver Center may still be encountered in what is now wilderness. It is mentioned here since collectors may very well run into this name on labels or in writings on the Cobalt area.

SUMMARY

The Cobalt-area silver mines were a true bonanza in every sense of the word. The mineralization was extremely rich in dollar value and in mineralogical value. New mineral species were found in the veins of the Cobalt-Gowganda area. Many fortunes were made from the small but high-grade veins, and the wealth generated at Cobalt was used to stimulate developments across Canada. Even at a conservative price of \$5.00/troy oz., the total production of 600 million ounces of silver from the Cobalt camp would yield a value of three billion dollars!

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Table 1. Minerals from the Cobalt area.

Elements		Sulfosalts	
Bismuth	Bi	Aikinite	PbCuBiS ₃
Silver	Ag	Cosalite	Pb ₂ Bi ₂ S ₅
Sulfides, Arsenides, Antimonides		Freieslebenite	PbAgSbS ₃
Acanthite	Ag ₂ S	Matildite	AgBiS ₂
Allargentum	Ag _{1-x} Sb _x	Pearceite	[(Ag ₈ CuS ₄)][(AgCu) ₆ (As,Sb) ₂ S ₇]
Alloclasite	(Co,Fe)AsS	Polybasite	[(Ag ₈ CuS ₄)][(AgCu) ₆ (Sb,As) ₂ S ₇]
Arsenopyrite	FeAsS	Proustite	Ag ₃ AsS ₃
Bismuthinite	Bi ₂ S ₃	Pyrargyrite	Ag ₃ SbS ₃
Bornite	Cu ₃ FeS ₄	Stephanite	Ag ₃ SbS ₄
Breithauptite	NiSb	Tetrahedrite	Cu ₆ Cu ₄ (Fe,Zn) ₂ (Sb,As) ₄ S ₁₃
Chalcopyrite	CuFeS ₂	Xanthoconite	Ag ₃ AsS ₃
Clinosafflorite	(Co,Fe,Ni)As ₂	Halide	
Cobaltite	CoAsS	Chlorargyrite	AgCl
Dyscrasite	Ag ₃ Sb	Carbonates	
Galena	PbS	Aragonite	CaCO ₃
Gersdorffite	NiAsS	Calcite	CaCO ₃
Glaucodot	(Co,Fe)AsS	Dolomite	CaMg(CO ₃) ₂
Langisite	CoAs	Phosphates, Arsenates	
Larosite	(Cu,Ag) ₂₁ (Pb,Bi) ₂ S ₁₃	Annabergite	Ni ₃ (AsO ₄) ₂ ·8H ₂ O
Löllingite	FeAs ₂	Burgessite	Co ₂ (HAsO ₄) ₂ ·5H ₂ O
Maucherite	Ni ₁₁ As ₈	Erythrite	Co ₃ (AsO ₄) ₂
Mckinstryite	(Ag,Cu) ₂ S	Ferrisymplesite	Fe ₃ ³⁺ (AsO ₄) ₂ (OH) ₃ ·5H ₂ O
Millerite	NiS	Fluorapatite	Ca ₅ (PO ₄) ₃ F
Nickeline	NiAs	Mimetite	Pb ₅ (AsO ₄) ₃ Cl
Nickelskutterudite	(Ni,Co,Fe)As ₂₋₃	Silicates	
Pararammelsbergite	NiAs ₂	Axinite-(Fe)	Ca ₂ Fe ²⁺ Al ₂ BO(OH)(Si ₂ O ₇) ₂
Pyrite	FeS ₂	Chabazite	Ca ₂ (Al ₄ Si ₈ O ₂₄)·13H ₂ O
Pyrrhotite	Fe _{1-x} S	Chapmanite	SbFe ₂ ³⁺ Si ₂ O ₈ (OH)
Rammelsbergite	NiAs ₂	Laumontite	Ca ₄ [Al ₈ Si ₁₆ O ₄₈]·18H ₂ O
Safflorite	CoAs ₂	Quartz	SiO ₂
Skutterudite	CoAs ₃		
Sphalerite	ZnS		
Stromeyerite	AgCuS		
Ullmannite	NiSbS		

Figure 1. The location of Cobalt, Ontario, Canada near the boundary of the Southern and Grenville geological provinces.

Figure 2. Dr. Willet G. Miller, Ontario provincial geologist. Photo by C. W. Knight, 1903, courtesy of the Ontario Geological Survey.

Figure 3. Coniagas Shaft and Mill, Cobalt, September 1908. Photo courtesy of the Ontario Geological Survey.

Figure 4. Trethewey vein and Claim post, May 1904. Photo courtesy of the Ontario Geological Survey.

Figure 5. A shipment of silver bars on a baggage cart on the platform at Cobalt, waiting for the next train. Photo courtesy of the Cobalt Mining Museum.

Figure 6. Cobalt Lake and the town of Cobalt, 1911. Photo courtesy of the Ontario Geological Survey.

Figure 7. Typical prospector's camp, Cobalt, 1904. Photo courtesy of the Ontario Geological Survey.

Figure 8. The silver deposits of the Cobalt-Gowganda area occur along the northern and eastern margins of the Southern Province, in an area referred to as the Cobalt Embayment, bounded on the north and east by Archean basement rocks and on the southeast by the Grenville Front. The numbers on the map correspond to the following mines: 1. South Lorrain; 2. Cobalt; 3. Casey Township; 4. Elk Lake; 5. Gowganda.

Figure 9. Silver on acanthite, 1.25 inches, from the Keeley mine, South Lorrain Township, Ontario. Royal Ontario Museum specimen M16420c.

Figure 10. Acanthite crystal, 0.6 inch, from the Langis mine. Casey Township, Ontario. Royal Ontario Museum specimen M40941.

Figure 11. Native bismuth, 2.5 inches, from Cobalt (mine name unknown). Royal Ontario Museum specimen E1657.

Figure 12. Calcite, 2 inches, from the Cross Lake mine, Coleman Township, Ontario. Royal Ontario Museum specimen M47043.

1898

Figure 13. Chapmanite with silver, field of view 2 inches, from the Keeley mine, South Lorrain Township, Ontario. David K. Joyce specimen.

Figure 14. Cobaltite, field of view 2 inches, from the Columbus mine, Coleman Township, Ontario. Royal Ontario Museum specimen M8681.

Figure 15. Löllingite, 2.5 inches, from the Hudson Bay Silver mine (Rustex mine), Gowganda, Ontario. Royal Ontario Museum specimen M53907.

Figure 16. Maucherite nodules in calcite, 2 inches, from the Moose Horn mine, Elk Lake, Ontario. David K. Joyce specimen.

1898dfhfghxcfg1898dddWQDDQWREDqraes-rgerteqt

Figure 17. Colloform nickeline coated with löllingite, field of view 1.25 inches, from the Rusty Lake mine (Hudson Bay Silver mine, Rustex mine), Gowganda, Ontario. David K. Joyce specimen.

Figure 18. Proustite on acanthite, 0.75 inch, from the Keeley mine, South Lorrain Township, Ontario. Royal Ontario Museum specimen M26121.

Figure 19. Proustite on calcite, field of view 1.25 inches, from the Keeley mine, South Lorrain Township, Ontario. Royal Ontario Museum specimen M15621a.

Figure 20. Proustite, 1.25 inches, from the Keeley mine, South Lorrain Township, Ontario. Royal Ontario Museum specimen M15621.

Figure 21. Rammelsbergite, pararammelsbergite and nickeline, 6.25 inches, from the Temiskaming mine, Coleman Township, Ontario. Royal Ontario Museum specimen M12186.

Figure 22. Safflorite and nickeline, 2.75 inches, from the Silver Leaf mine, Coleman Township, Ontario. David K. Joyce specimen.

Figure 23. 4-cm vein section showing silver crystals coated by safflorite, with carbonates removed by acid etching, from the Castle mine, Gowganda, Ontario. [ownership not given]

Figure 24. Silver, nickeline and Ni-Co arsenides, 6 inches, from the Hudson Bay Silver (Rustex) mine, Gowganda, Ontario. Royal Ontario Museum specimen M36828.

Figure 25. The Lawson vein, also known as the “silver sidewalk,” 1904.

Figure 26. Wire silver, field of view 2.75 inches (on a 17.75-inch specimen), from the Violet mine, Coleman Township, Ontario. Royal Ontario Museum specimen M14287.

Figure 27. Wire silver, 1.5 inches, from the Keeley-Frontier mine, South Lorrain Township, Ontario. Royal Ontario Museum specimen M52073.

Figure 28. Silver, 30 inches, from the Cobalt Lode mine, Coleman Township, Ontario. Royal Ontario Museum specimen M31174.

Figure 29. Silver, 1.25 inches, from the Frontier mine, South Lorrain Township, Ontario. Royal Ontario Museum specimen M16435d.

Figure 30. Silver, field of view 2.25 inches, from the Cobalt Lode mine, Coleman Township, Ontario. Royal Ontario Museum specimen M31172.

Figure 31. Silver in calcite, field of view 2.25 inches, from the O'Brien mine, Coleman Township, Ontario. Royal Ontario Museum specimen 10145.

Figure 32. Silver, 2.5 inches, from the Mann mine, Milner Township, Ontario. Royal Ontario Museum specimen M37688.

Figure 33. Skutterudite, 2.25 inches, from the Hudson Bay Silver (Rustex) mine, Gowganda, Ontario. Royal Ontario Museum specimen M53906.

Figure 34. Skutterudite, field of view 0.75 inch (largest crystal is 0.25 inch), from the Hudson Bay Silver (Rustex) mine, Gowganda, Ontario. David K. Joyce specimen.

Figure 35. Float specimen showing highly weathered silver vein with erythrite, 6.75 inches, from near Bortha Lake, Gillies Limit Township, Ontario. Royal Ontario Museum specimen M42662.