DEPARTMENT OF MINES, OTTAWA, CANADA

Mines Branch Investigations

Memorandum Series | February 1925 | No. 20

THE GOLDFIELDS OF NORTHWESTERN QUEBEC

by

W. B. Timm (1) and A. H. A. Robinson (2)

Introductory

To the newcomer the most striking fea tures of the goldfields of northwestern Quebec are; the great extent of territory (a zone nearly 100 miles in length) within which finds have been made; the number of finds within the territory; the absence of the customary signs of a mining boom; and the interest in the district being displayed by mining companies (Canadian, British, and American) that have been successful in other mining fields.

Excepting on a few properties such as the Horne in Rouyn township; the Stabell in Dubuisson township at the eastern end of the gold belt; and the Lake Fortune in Boischatel township near the Ontario boundary, the amount of intensive development is rather disappointing, no doubt largely due to the dispersion of effort brought about by the extent of the gold bearing areas and the constant new finds being made; the comparative

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(1) Review of ore occurrences and metallurgical treatment by W. B. Timm, Chief, Division of Ore Dressing & Metallurgy

(2) Introductory by A. H. A. Robinson, Mineral Technologist, Division of Mineral Resources.

Information obtained from personal observations in the field by the writers during the fall of 1924.

recentness of many of the new discoveries and in the western part of the field, the difficulty and expense of getting in supplies over the summer routes - a drawback that was intensified by a wet season in 1924. At the time of writing (Jan.1925) the transportation situation has been relieved by the opening of two good winter roads to Rouyn, one from Larder Lake on the T.& N.O.Ry., the other from Makamik on the C.N.Ry. It is expected that the Makamik road will later be made a summer road suitable for motor trucks.

The activity of old established mining companies in this new field (their scouts are ubiquitous) means that the district will be thoroughly and systematically explored and promises well for the future. They already hold very large tracts under option and there is a very real competition for promising discoveries.

Character of the ores

From a metallurgical viewpoint, the gold ores of northwestern Quebec, as far as we know them at present, will require in many cases a different treatment from that of the gold ores of the Porcupine and Kirkland Lake districts situated on the westerly extension of the gold belts in northern Ontario. As a general rule the Quebec ores have in association certain sulphides and arsenides which make them complex in character, and not so readily amenable to treatment by the cyanide process, which is the practice with the Ontario ores.

For want of better classification the Quebec ores may be divided into the following types, according to the predominating sulphide minerals present; namely, ores in which chalcopyrite and pyrrhotite are the predominating sulphides; ores in which iron pyrite is predominant; and ores in which arsenopyrite and pyrite predomina te.

The Horne ores of Rouyn township, of which several varieties have been exposed by exploratory and development work, may be cited as a sample of the first type. The ore from No. 1 shaft is heavy chalcopyrite with bands of pyrrhotite carrying gold values considerably above the average for copper ores. On the other hand, the ore from the No. 2 shaft shows the pyrrhotite predominating over the chalcopyrite. The ore in some cases is practically pure pyrrhotite, and in others the chalcopyrite and pyrrhotite are disseminated throughout the rhyolite gangue. Ore has been found on this property almost free from sulphides: a deposit of sphalerite was cut by diamond drilling, and deposits of white iron pyrite carrying little or no values in gold have been uncovered. The ores of the Horne present a metallurgical problem that will require much study and research to determine the most economical method of treatment. Deposits showing ore of a similar character are reported to have been uncovered around Lake Dufault to the north of the Horne.

The ore of the Stabell mine in Dubuisson township is another example of the first type, namely those in which chalcopyrite is the predominating sulphide mineral. The ore differs from the Horne ores in that it occurs in a well-defined quartz vein. Pyrrhotite is present, but not to the same extent as in the Horne mine.

The Arntfield and Lake Fortune ores may be taken as an example of the second type in which iron pyrite is the chief sulphide mineral. This type of ore should present very little difficulty in its metallurgical treatment. The Arntfield ore possesses very similar characteristics to that of the Crown Reserve and Associated Goldfields at Larder Lake, Ont., and the Lake Fortune ore is very similar to the Kirkland Lake ores.

Examples of the third type, in which arsenopyrite and iron pyrite are the chief sulphides, are the ore of the Edna Bathurst claim, situated south of Pelletier Lake in Rouyn township, and optioned to the McIntyre interests, and the ore of the O'Brien claims, south of Lake Preissac in Cadillac township. The presence of arsenopyrite makes these ores more difficult to treat than the majority of northern Ontario gold ores.

Extent of the ore bodies

Little is known at the present time regarding the extent of the ore bodies. In the main, mining operations have been chiefly confined to exploratory work such as geological mapping of rock exposures, prospecting, trenching, and in the case of the larger veins and deposits, diamond drilling. This exploratory work has exposed veins, vein systems, and deposits very promising as to surface extent, and the logs of diamond drilling operations show continuity at depth. Underground development work, such as shaft sinking, crosscutting, and lateral drifitng, has not been sufficient to block out any extensive tonnages of ore reserves.

The property on which the most extensive exploratory and development programme has been carried on is the E. J. Miller claim on the west side of Osisko Lake, Rouyn township, known as the Horne mine, optioned to the Noranda Mines, Ltd. A much oxidized capping extending over a considerable area has been exposed by numerous trenches. For the last two years intensive exploratory work has been carried on by diamond drilling. Up to the end of 1924, using two and at times three machines, some 14,000 ft. had been drilled. The continuity of the deposits, as determined by a series of holes, has been proven to a depth of 250 ft., and one hole down over 450 ft. still showed heavy mineralization. The reported figures for ore reserves, based on drilling only, assuming $6.50 per ton a s ore, run into the tens of millions of dollars. Two development shafts were started during last year. Shaft No. 1, near the south boundary of the claim was sunk to a depth of 120 ft., for the most part in practically solid sulphides. The ore from this shaft is stated to have averaged over 15% copper and $6.50 in gold. Lateral work was started on the 110 ft. level, to connect up with No.2 shaft, 1100 ft. to the northwest. The ore of No.2 shaft, which was started last October, contains more pyrrhotite and less chalcopyrite than the ore of No.1 shaft. This shaft will probably have reached the 110 ft. level and lateral drifiting started to connect up with No.1 shaft. The ore bodies are of such extent and of such value that the company officials are considering the erection of a smelter. With an intensive development programme by Noranda Mines Ltd. and the possibility of other large deposits of copper ores being developed, it is probable that Rouyn will be the centre of an active smelting industry, or at least supply the ore for such an industry, in the near future.

One of the oldest properties in northwestern Quebec is the Stabell mine, in Dubuisson township, now owned by the Stabell Gold Mines Ltd. The property was first drilled to establish the continuity of the vein at depth. This information having been acquired, a vertical shaft, the deepest in the district, was sunk to a depth of over 600 ft. Stations were cut at 150, 300, 450, and 600 feet. At the 300-ft. level the vein was explored for a total distance of 650 feet by lateral drifting on both sides of the shaft. The drifts followed a quartz vein mineralized with chalcopyrite and pyrrhotite carrying sufficient gold values to warrant sinking to the 600-ft. level and developing laterally on this level. The vein, which has a dip of approximately 75° follows closely a porphyry dyke about 8 ft. wide. The country rock is Keewatin basalt.

In Boischatel township considerable exploratory and development work has been done on the Lake Fortune, the Arntfield, and Howard claims. On the Lake Fortune claims a quartz vein carrying free gold and tellurides was uncovered along the shore of the lake. A shaft was sunk to a depth of 135 ft. and a cross-cut driven north 240 ft. on the 125-ft. level, cutting near its northern extremity a promising shear zone. Lateral drifting is being done on this shear zone and also from a break encountered in the cross-cut, to pick up the vein exposed along the lake shore.

On the Arntfield claims considerable trenching has been done, exposing a mineralized shear zone with an average width of 150 ft. for a considerable distance along the strike. Portions of this shear zone show fair assay values. Over 3,000 ft. of drilling was done on the eastern portion of the Arntfield claim a nd showed the persistency of the mineralization in depth.

Further east, close to the boundary between Boischatel and Rouyn townships, the Huronian Belt Co. Ltd. are exploring a group of claims, and have uncovered, by trenching at intervals for a distance of several hundred feet, a promising shear zone in carbonated schist, showing good mineralization and reported to carry good gold values. The Rouyn Gold Mines Ltd. has trenched the extension of this zone on the adjoining property.

A considerable amount of exploratory and development work has been done on the Chadbourne claim by the Noranda Mines Ltd. A large outcrop of brecciated rhyolite was trenched at intervals of 100 ft. and a vertical shaft sunk for 150 ft. The ore is auriferous iron pyrite disseminated throughout the rhyolite. The company suspended operations on this claim to concentrate their efforts on the more promising chalcopyrite-pyrrhotite deposits of the Horne mine, to the east.

The first gold occurrence to be developed in Rouyn was the Powell vein, traced for 3,600 ft. along the strike. The vein was stripped and trenched, and a shaft sunk for 225 ft. The vein filling was mainly quartz sparsely mineralized with auriferous iron pyrite and a little chalcopyrite.

Other promising claims on which considerable exploratory work, such as trenching and diamond drilling, has been done and on which development by shaft sinking is progressing, are the Bronwell and Lowry group in Joanne township; the Pellerin group

in Cleriey township; the Gouldie claim in Fourniere township; the Union Mining Co's and Siscoe Island claims in Dubuisson township, and the Clarke claims in Bourlamaque township. In all the above claims the iron pyrite is the predominating sulphide in the ore.

Among the promising occurrences of ore in which arsenopyrite is the chief sulphide mineral may be mentioned the McIntyre option south of Pelletier Lake in Rouyn township, and the Dumond and Thompson groups south of Lake Preissac in Cadillac township. The latter groups are being explored by O'Brien Mines Ltd. and the Victoria Syndicate, respectively. The exploratory work on these claims consisting of stripping, trenching, etc. has exposed quartz veins of considerable length mineralized with arsenopyrite and iron pyrite, and carrying visible free gold. The country rock is conglomerate intruded by masses of porphyry.

Although it is true that small tonnages of ore reserves have been actually blocked out by underground development, the surface indications are such as to promise the development of a number of operating mines in the near future. Sufficient information has been disclosed by diamond drilling and development at the Horne to assure that this property will develop into a mine of considerable size. Intensive development work during the next year or two will determine whether sufficient ore will be blocked out to warrant large scale smelting operations. With the exception of the Horne, Stabell, and Lake Fortune, and Powell, active underground operations are only starting. Although exploratory work has proven gold to occur throughout an area extending from the Provincial boundary eastward to the Harricanaw river, and for a strip of undetermined width south of the Transcontinental railway, and veins and deposits carrying gold values have been found, trenched, and explored by diamond drilling, the development of these into producing mines is still a question of the future.

Possible methods of ore treatment

Considering the mineralogical classification of the ores mentioned above, a brief survey of the possible methods of treatment may be in order. The three types of ores already described will be discussed separately;

Ores in which chalcopyrite and pyrrhotite are the predominating sulphide minerals: Certain varieties of the Horne ores, such as the ore from No.1 shaft, and the heavy pyrrhotite ore from No. 2 shaft, and other sections of the deposits cut by diamond drilling, would be amenable to pyritic or semi-pyritic smelting. The disseminated ore of this property will require concentration to eliminate the siliceous gangue rock for this class of smelting operations. The highly siliceous gold ore could be used as converter flux. By these methods the various Horne ores could be treated. Limestone and coke would have to be brought in, and the blister copper either refined a t the point of smelting operations or shipped out for refining, depending on the cost of electric power. Highly siliceous ores like those of the Stabell, containing copper and gold values, make a desirable flux for smelting operations. The economic use of such ores for this purpose depends on transportation charges to the smelter. The treatment of these ores at the mine will depend to a large extent on the distribution of the

gold values, that is, whether the gold is associated with the chalcopyrite or with the pyrrhotite, pyrite, or quartz gangue, or with all the sulphide minerals. If the gold is associated with the chalcopyrite, concentration of this mineral from the iron sulphides and gangue will produce a copper concentrate that might stand shipment to the smelter. If the gold values are contained in the iron sulphides and gangue as well as in the chalcopyrite, concentration will need to be supplemented by cyanidation. Cyanidation of gold ores containing appreciable amounts of copper has not yet been proven to be an economic operation.

Ores in which iron pyrite is the predominating sulphide mineral: The general class of ores of this type found throughout the gold belts of northern Ontario and Quebec are those in which the sulphides are disseminated in the vein matrix and not as massive sulphides. Where the sulphides are massive they, as a general rule, carry little or no gold values. The disseminated type of ore presents no difficult metallurgical problem. The cyanide process has been successful in recovering the gold values. However, the indications are that such ores in Quebec, in a number of cases at least, will contain small amounts of chalcopyrite which will make their treatment more difficult. Unless the chalcopyrite is removed by concentration, the consumption of cyanide is prohibitive. If the chalcopyrite is concentrated from them it will generally carry a portion of the gold values. The successful treatment of such ores depends on the proximity of smelting works, where the concentrate can be sold at a profit, unless the ores are high enough in gold values to stand the excessive cyanide consumption, or to permit of the stacking of the concentrate until it can be sold or otherwise profitably treated..

Ores in which arsenopyrite is the predominating sulphide mineral: The economic treatment of ores of this type depends largely on the sale of an arsenical gold concentrate to a smelter equipped for the recovery of the arsenic as well as the gold values, as is the case in the treatment of the arsenical ores of the Nickel Plate Mine, Hedley, B.C. Arsenical-gold ores are being concentrated in Nova Scotia and the concentrates shipped to Belgium. Shipments of arsenical gold concentrate from northern Quebec would be prohibitive on account of excessive transportation charges. However, an arsenic refinery could be installed on a comparatively small scale and need not involve an excessive expenditure. Arsenic commands a favourable price in the world's markets, and indications are that the price will be well maintained. Ores of this type will, therefore, present no insurmountable difficulties if sufficient is developed to warrant the erection of small arsenic refineries, or a central one for the district. The process would be one of concentration, cyanidation, and refining of the arsenical concentrates. Should it be found uneconomical to recover the arsenic content of such ores, cyanidation without excessive consumption of cyanide is possible. It is also possible to make good recoveries of the gold values by cyanidation and concentration, or vice versa, and subject this concentrate to a supplementary treatment of roasting and amalgamation in a grinding pan.

Mines Branch investigations: Although the treatment of the gold

ores of northwestern Quebec presents difficult metallurgical problems, the history of the metallurgy of complex ores indicates that an economic treatment will be found, provided that sufficient ore reserves are available. The Mines Branch, Department of Mines Ottawa, realizing the complex character of the ores as compared with the ores of northern Ontario, is experimenting in a small way on possible methods of treatment other than those of established practice. Research is being conducted along the following lines:

1. The smelting of the heavy chalcopyrite-pyrrhotite ores and concentrates in a non-oxidizing atmosphere, using an alkali flux to slag off impurities, and producing a low-grade matte containing all the metals, such as copper, iron, and precious metals, and also the sulphur content of the ores; the roasting and chloridizing of the matte; the leaching of the chloridized matte in weak acid solution, leaving an iron oxide residue for conversion into iron and steel products; the electrolysis of the leached solutions for the recovery of the copper and precious metal values.

Such a method applied to the Horne ores would permit of smelting operations at the mine without any serious damage to vegetation in the immediate vicinity as all the sulphur content of the ores goes into the matte. As the property is situated in the clay belt, in a good agricultural district, at present covered with uncut pulpwood, smelting operations in which the sulphur is allowed to escape into the atmosphere would be the cause of considerable damage to the surrounding country, and worry to any operating company. The low-grade matte could be shipped to a point where little vegetation exists and where cheap electric power could be made available, with the possibility of utilizing at least some of the sulphur content for industrial purposes. The iron content and also the copper and precious metal values could be recovered. It is upon processes of this nature that the greatest economical development of our mineral resources will ultimately depend.

2. An investigation is being made of the cyanidation of cupriferous gold ores, in which the copper content will not permit of the economic recovery of the copper values. Research is being conducted on such ores carrying copper values up to 2% copper, by cyaniding the ores in the regular manner, precipitation of the dissolved gold and copper values, with the regeneration of the cyanide. If a process of this nature could be worked out and demonstrated to be commercially feasible, it would have a wide application in the treatment of cupriferous gold ores, including many of the ores of north-western Quebec.

3. The concentration and cyanidation of cupriferous gold ores: Experimental work is being conducted on the concentration by selective flotation of the chalcopyrite and the cyanidation of the flotation tailing. This process depends on the establishment of a smelting industry in the district where the copper concentrate could be sold at a profit.

Other mineral occurrences

Gold, chalcopyrite, and arsenopyrite are not the only economic minerals of the district. Molybdenite was mined during the war years, and for some years previous. The chief occurrences

of the mineral are in the district south of Amos on Indian Peninsula in Preissac township and east of Lake Malartic in La Corne and Malartic townships. They are easily reached by water route up the Harricanaw river from Amos. The molybdenite occurs in a network of pegmatitic quartz-feldspar veins, many of which show the mineral in what would appear to be economic quantities. Indications are that this mineral will be found over a much wider area. The market for molybdenite, which declined at the close of the war to such an extent that all production ceased, is gradually gaining in strength with the consumption of war stocks, and the discovery of new uses for the metal. It is possible that mining operations will be renewed in the very near future.
