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COBALT LAKE

The Cobalt Lake Mining Company, whose property is described in this issue, is confronted with an engineering problem which is neither so complex nor so hopeless as is generally supposed. The ore lying under the lake bottom is to be won. Shafts are being sunk within a few feet of the east shore of the lake, and when these have attained a suitable depth, drifts will be started from them under the lake. Contrary to the expectations of many critics, no difficulty has been experienced with water. The shafts make only a few gallons per day. Surface prospecting has been proceeded with, but more attention has been paid to shaft sinking, and we have no doubt that encouraging results will reward underground development. Briefly, if the Cobalt Lake Mining Company were capitalized at a reasonable figure there would be very little cause to hold anything but a very cheerful view of its prospects. Unfortunately, it was thought necessary, in organizing the company after the purchase of the lake, to set its capital at $5,000,000. Of the stock issued a large amount went in commissions and brokerage. Large blocks were assigned to certain persons for no apparent consideration whatever. Had the capitalization included merely the purchase price and the amount actually necessary to develope the mine, Cobalt Lake would have been a most desirable proposition. As it stands to-day it is problematical, though by no means hopeless. Fortunately, a vigorous and comprehensive policy has been adopted in developing the property. No shipments have been made, because it was frankly recognized that regular shipments cannot be counted upon until a relatively large amount of preparatory work has been performed. Any other policy would spell ruin.

So far as the peculiar difficulties of mining are concerned they have been carefully studied, and, we believe, successfully attacked. But considerable as these difficulties are, they do not handicap the enterprise to the same extent as does its egregious capitalization.

Incidentally, the Ontario Government has been criticized for its share in the original sale. No doubt the Government has erred on several occasions in affairs pertaining to Cobalt. Under the circumstances it is surprising that more mistakes were not made. But we consider the Government perfectly justifiable in this transaction. It advertised Cobalt Lake as for sale to the highest bidder. To the highest bidder, complying with necessary conditions, Cobalt Lake was sold. The purchase price was not excessive, when the tremendous contemporaneous inflation of values is considered. Nor would the first cost of the property militate against its successful working had not subsequent manipulation

raised the capitalization far beyond the safe or necessary limit.

If Cobalt Lake succeeds, it will succeed in spite of the unwisdom of its promoters. If it fails the blame cannot be laid upon the Provincial Government, nor upon its sane and efficient executive.

DISSIPATION OF ENERGY

Although in the ordinary iron blast furnace we have one of the most economical forms of the utilization of the energy stored up in coal, still even in its operation there are many very serious losses of energy. No scheme has yet been devised whereby the heat contained in the molten slag can be utilized. Sporadic attempts have been made to this end, but no method has been evolved whose application is of general value. Similarly in the quenching of the pig iron after it has been moulded, a considerable loss of heat energy occurs. But in the production of coke for use in the furnace the loss of energy is most marked. In the case of bee hive ovens the whole of the volatile hydrocarbons are entirely lost. The incandescent coke is quenched in the oven, and again energy is dissipated to the winds. With the by-product ovens, the most serious loss occurs in this quenching. The red hot coke is pushed out of the rectangular ovens and is quenched on a platform with a stream of water. In view of the efficiency of all the other operations of these ovens, this wasteful method is anomalous. It is surprising, indeed, that it has not been superseded long ago. That the utilization of this hitherto wasted heat energy is practicable is demonstrated by Mr. Charles E. Arnold in an article on "Quenching of Coke," in the May number of *The Chemical Engineer.*

In principle his plan is simplicity itself: "The hot coke is pushed from the oven directly into the cooling apparatus, which communicates directly with any oven which is ready to be 'pushed.' The coke having been received into the compartment, the doors are closed and the outside air entirely excluded. The small amount of air in the compartment is soon deoxygenized, and the hot gases (nitrogen, carbon monoxide and carbon dioxide) are drawn away from the coke, blown through a cooling compartment and again in contact with the coke. This circulation is kept up for a short time, when the coke can be discharged into the air without danger of combustion.

"The heat from the coke has been carried by inert gases to the iron coil, which conduct it to the water or other cooling medium circulating within said coils, thus making every unit of heat given up by the coke available for regeneration for a multitude of purposes." The still unremedied leakages of energy might very profitably become subjects of attention from the various Technical Colleges.

PROPHETS WITHOUT HONOR

The conferring of honorary degrees is a pleasant and profitable function. It is expected of our larger universities that they will see to it that those on whom they bestow recognition shall not only be in themselves worthy and distinguished men, but that they shall have been directly or indirectly of signal service to the community or to the country at large. Thus it is appropriate that the professional man whose work, whether literary or scientific, or specifically technical, has actually benefited his fellows or has ameliorated the hardships incidental to any class or classes of society or, in fine, has tended in any way to improve the conditions of life, should receive official recognition from the universities. But our universities are educational institutions supptored by the people, for the people. Doubtless the larger foundations serve a dignified and useful purpose in conserving the ideals and maintaining the best traditions of the Canadian people. But their first duty is to fit our young men to earn a livelihood and to recognize and encourage men, Canadians primarily, who are doing and have done something to advance the material welfare of their native land. In glancing over the names of those upon whom in late years the University of Toronto has conferred honorary degrees, we find men of letters, politicians, doctors and lawyers. Many of these are distinguished foreigners, whose relation to Ontario's welfare it is hard to guess. We do not question their worthiness. But we wish to suggest, not without humility, that the Province of Ontario and, indeed, the Dominion of Canada, owes far more to the geologist, to the mining engineer, to the civil engineer, and to the technical man generally, than to any of the classes that Ontario's largest University has chosen to honor. We would further suggest that the University of Toronto need not look far afield to find creditable recipients for the honors of which she has the bestowal. The world is moving.

LABOUR

It would be well for the Federal authorities to take prompt measures to relieve the dearth of labor in the West. In British Columbia and the new Provinces the the production of coal could be greatly increased were there a sufficiency of labor. The operators of metalliferous mines in British Columbia have been forced to grant substantial increases of wages to their employes to prevent them from leaving for other parts. These distressing conditions will, in the case of the coal mines, contribute towards another fuel famine next winter. Metalliferous mining in British Columbia is but now recovering from a long period of depression. It is essential that these industries be watched and guarded. The Federal Government employs emigration agents in Europe, and it has ample sources of information. The streams of immigration are, to a certain extent, dirigible.

It should be quite feasible not only to select the proper class of workers across the ocean, but to place them exactly where they are needed.

THE PAYNE MINE

The once famous Payne Mine was sold at public auction in Montreal to Senator Forget for $60,000. The bidding started at $800. In its time the Payne paid over $1,000,000 in dividends. The property consists of four small claims on Payne Mountain on the slope toward Carpenter Creek. The Payne was stupidly and grossly mismanaged. It is safe to predict that in due course it will once more become a producer.

The original company was organized in 1891, and was capitalized at $2,500,00 in $1 shares. From 1899 the shares fell steadily until a few years later they dropped to 10 cents. They then disappeared from the market.

PROGRESS

The large amount of mining machinery under order or being installed in the Cobalt camp is an encouraging symptom. In itself it is indicative of progress and may be taken as tangible evidence that the mine owners in general have faith in their properties. The needs of the camp have created a temporary famine in ore mining machinery. Air compressors and other machinery ordered six months ago from the manufacturers are still undelivered. These delays are especially costly to mines groaning under heavy share capital. Every effort is being put forth to catch up with the unexpected volume of business. It is quite apparent, however, that the manufacturers have been caught unprepared.

EDITORIAL NOTES

The new mining law in Germany has passed its third reading and been referred to the Upper House. The most important provision reserves the right of exploration in certain areas to the State, with the power to transfer the working rights to others against indemnity and with a temporary title.

Of recent years (one might almost say of recent months) gas producers and gas engines have been improved so markedly and their application widened to such an extent, that the cost of power has been cut in two. Peat and lignite are now possible and profitable sources of commercialy saleable energy. A peat bog may now become a rival of Niagara. There is already a growing tendency to develop power at the coal mines and transmit it electrically. The effects of this movement wil be entirely beneficial. The enormous waste, which is the usual concomitant of the usual methods of raising steam, will be obviated and a much higher efficiency in developing power will indirectly conserve our coal resources.

In our respected contemporary, *The Mining and Scientific Press*, there appeared recently an article entitled "On Technical Writing." Many of the pet phrases current among mining men were heartlessly impaled as specimens of "bad" English or as inaccuracies. While we concur entirely with the spirit of the article referred to, we may be allowed to remark that in another respect the composition of many technical men is faulty. To ourselves the laws of punctuation have always appeared to be a blot upon our civilization. The writer who seeks to punctuate by rules need have no other ambition in life. However, the remedy is at hand. A Toronto writer, Dr. J. D. Logan, in a quietly revolutionary little book, "Quantitative Punctuation," has breathed upon the hitherto sacred "laws" and they are not. We seriously recommend "Quantitative Punctuation" to all young technical writers.

It is now generally admitted by the best authorities that the spontaneous ignition of coal is attributable to the action of the occuded oxygen in the coal. Freshly-mined coal absorbs oxygen freely. Since the coal in some degree retains is original porous structure, these pores are filled with methane and carbon dioxide, gases associated with its origin. Freshly-mined coal, on exposure to the atmosphere gives up these gases and absorbs oxygen. In large pieces of coal this action is superficial; but it is tremendously increased as new surfaces are exposed by breakage. This phenomenon in itself can not bring about ignition. There must be at some point an extrinsic factor which causes a local rise in temperature.

Moisture is a very potent factor in promoting the chemical action of the occluded oxygen. Iron sulphide, despite the popular idea that it is the principal agent in causing spontaneous ignition, plays but a subsidiary part

We referred in a previous issue to the mischief wrought by unqualified or spurious assayers. A mining boom always brings with it a swarm of pseudo-assayers, imitation mining engineers and professional crooks. Cobalt has been afflicted with all three varieties. But as she takes her place as a steadily productive camp, she will give a more and more attentive ear to the reputable, honorable men of experience. To-day the better and cleaner element is in the ascendency. When Cobalt has attained her majority she will look with disgust upon the frisky fakirs of to-day, and a full page advertisement will cause her pain.

British Columbia Copper Company's Mother Lode Mine, Boundary District of British Columbia.

By E. Jacobs.*

Copper mining in British Columbia has steadily advanced in importance during recent years, and this to such an extent that the value of the copper produced was considerably in excess of that of any other mineral included in the Province's total production of nearly $25,000,000. While not the largest producer in the Province, the British Columbia Copper Company ranks second only to the Granby Consolidated Mining, Smelting and Power Company as regards total production of copper to date. It is therefore fairly entitled to rank as representative of the copper mining industry of the Canadian West, hence the choice of its largest mine—the Mother Lode—as the subject for an article illustrative of that industry.

Before giving information concerning the Mother Lode mine a digression will be made for the purpose of showing the relative positions of British Columbia generally and the Boundary district of that Province particularly as producers of copper in comparison with that of all the remaining parts of the Dominion combined. Incidentally, the proportion of copper in last year's total mineral production in Canada will be shown as under:

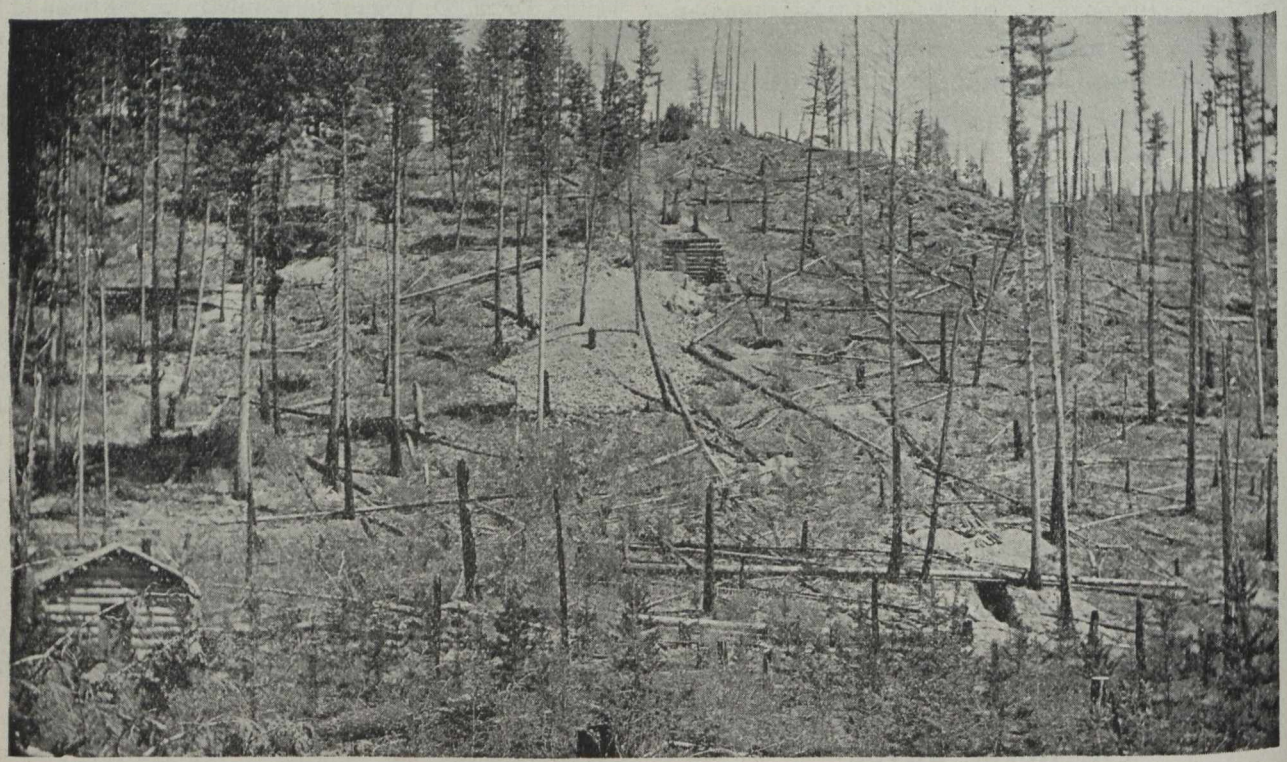
Important Position Occupied by Copper.

Next to gold among the metallic minerals produced in Canada is copper, the production of which in 1906 was, according to the preliminary estimate of mineral production made public last March by the Mines Section of the Geological Survey of Canada, in value more than one-fourth of the total of metalliferous minerals produced, and more than one-eighth of the total mineral production—metallic and non-metallic—of the Dominion for the year. The respective totals were given as under:

	Value, 1906.
Copper	$10,994,095
All metallic minerals	42,979,629
Total mineral production	80,000,048

Ten years ago the position stood thus:

	Value, 1896.
Copper	$ 1,021,960
All metallic minerals	8,030,633
Total mineral production	22,474,256



MOTHER LODE HILL IN FALL OF 1896.

These figures show that the production of copper has increased in much greater proportion than other minerals, in what ratio is easily calculated from the foregoing figures.

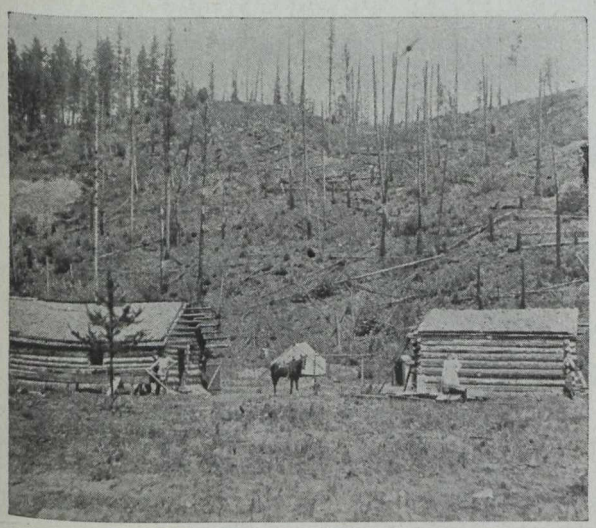
Another comparison shows that by far the greater part of the increase in the production of copper has been made in the Province of British Columbia. The figures for that Province and the remainder of the Dominion, respectively, are as follows:

Production of	Value in 1896.	(1906. (Unrevised.)
British Columbia	$ 190,926	$ 8,675,100
Remainder of Dominion	831,034	2,318,995
Total	$1,021,960	$10,994,095

These figures indicate most unmistakably that, in regard to the production of copper, British Columbia occupies a place of pride in the Dominion.

*Editor *British Columbia Mining Record.*

Prior to 1894 there was no copper produced in British Columbia, or if there was the quantity was so small as not to have found place in the official records of mineral production. A comencement was made in 1894, when copper to the value of $16,234 was produced, partly by Nelson and partly by Rossland mines. Thereafter these mines continued to be the only producers of copper in the Province until, in 1900, mines in the Boundary section of Yale district commenced producing and quickly became important producers. By this time Nelson's production had decreased considerably. The



First Cabins on Mother Lode Claim, built by Boundary Mines Syndicate in 1896.

leading position since taken by Boundary copper mines over those of other copper-producing sections of the Province is exemplified in the following table, showing the total production of copper ore in British Columbia in all years to 1906, inclusive:

District.	Lb. of Copper.
Nelson	12,300,00
Rossland	63,825,000
Boundary	135,500,000
Coast	30,000,000
Other parts of Province	1,790,000
Total	243,415,000

During seven years (to end of 1906) Boundary mines produced 4,609 tons of ores, practically all of it copper ore of a low grade. The proportions of this total contributed by the several mines of the four copper mining companies operating in the district are as under:

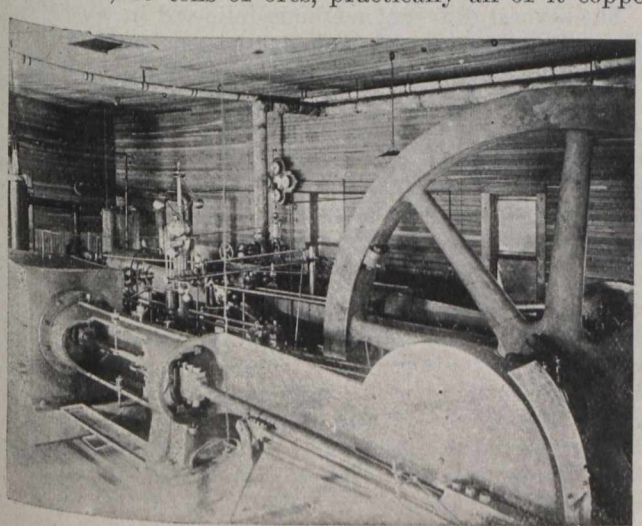
Company.	Tons.
Granby	3,005,000
British Columbia Copper	1,073,000
Dominion	390,000
Consolidated M. & S. of Canada	102,000

The remainder of the production of this district was chiefly from small silver-gold mines.

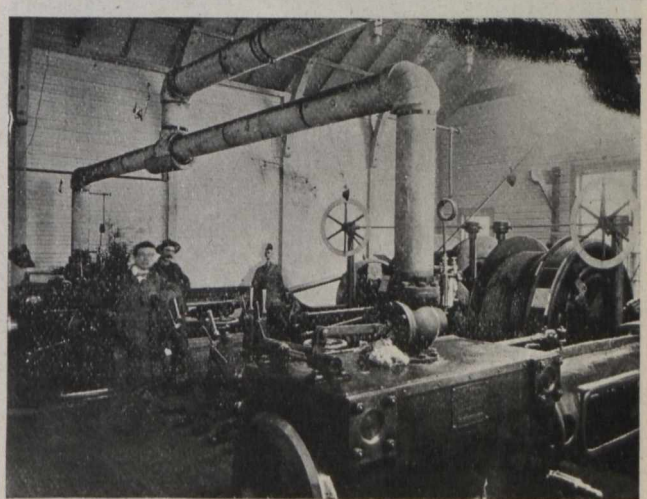
The British Columbia Copper Company, Limited, with head office in New York City, is working six mines in the Boundary district, four of which are in British Columbia and two in the adjoining State of Washington, just south of the international boundary line. Of these the Mother Lode is the largest. It is typical of the big copper mines of the district and, though not so extensive as the combined mines of the Granby Consolidated Company in Phoenix camp, distant about seven miles from the Mother Lode, is a decidedly important and valuable mine, having a producing capacity, as now opened and equipped, of about 1,000 tons of ore per diem, and with further development in progress in preparation for a still larger output

The Mother Lode is situated in Deadwood camp, about three miles west of the Town of Greenwood. The mineral was located on May 28th, 1891. The surrounding hills were but thinly timbered, and the big copper-stained bluff or "blowout," then a prominent feature, could be seen from such a distance that the prospectors had no difficulty in finding "mineral in place" to warrant their making the location. The accompanying view of the Mother Lode hill, reproduced from a photograph taken by Mr. Keffer in 1896, gives a fair idea of the surface appearance the claim presented shortly after the work of prospecting the big showing of mineralized rock occurring on it had been fairly commenced.

Prior to 1896 there had been no work done on the Mother Lode other than the very limited amount necessary to fulfil the annual assessment requirements. In that year the claim was bonded by Col. John Weir, representing himself and Messrs. F. L. Underwood and Jas. F. Tichenor, all of New York City. Mr. Frederic Keffer, now president of the Canadian Mining Institute, was placed in charge of the property immediately after the bond was obtained and thereafter he developed it for the Boundary Mines Syndicate, formed by the three gentlemen first above named. When Mr. Keffer commenced work there was not a tunnel nor a shaft 25



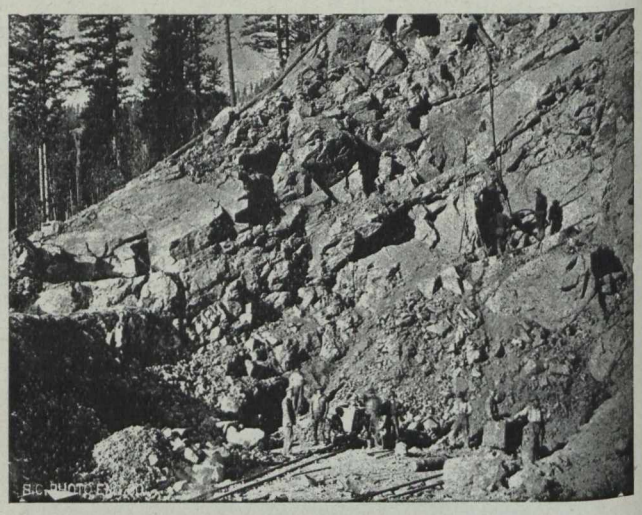
40-Drill Air Compressor. Installed in 1902.



Canadian Rand Hoisting Engine. Installed in 1902.

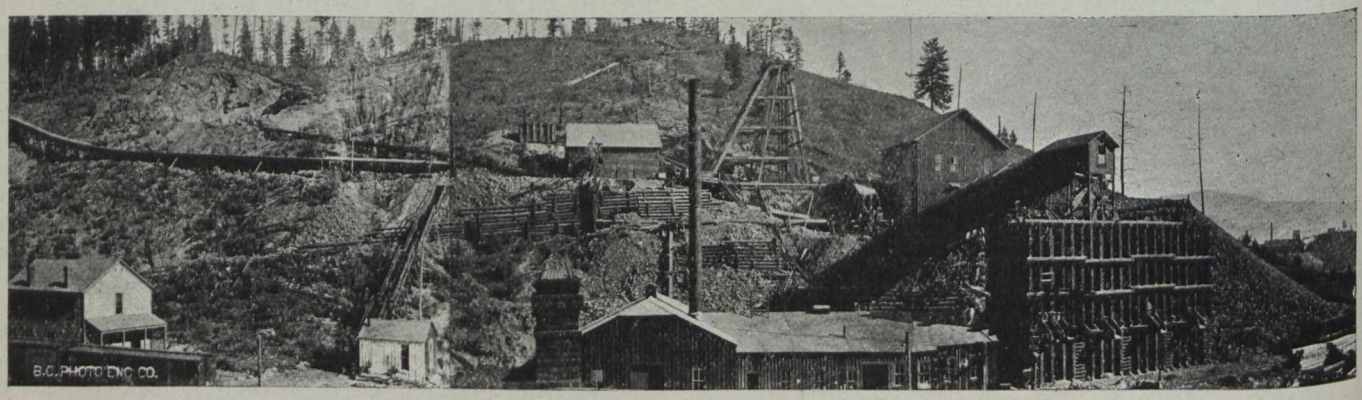
feet in length or depth on the claim; to-day he is still in charge and during the intervening periods of between ten and eleven years there has been done under his direction development work that in sinking and raising, drifting and cross-cuting, has aggregated fully 21,000 lineal feet (about four miles), leaving out of account much other work done in underground stoping and surface quarrying in the big ore bodies opened up here

In March, 1897, prospecting operations having meanwhile proved the occurrence on the Mother Lode and adjoining mineral claims of unusually large bodies of ore, the British Columbia Copper Company, Limited, was organized in New York, to acquire and work the Mother Lode group, consisting of the Mother Lode and five adjoining fractional claims previously purchased, the whole giving an area of about 80 acres. A power plant was installed and the systematic development of the mine undertaken. The plant consisted of two 60 horse-power steam boilers, 10-drill Ingersoll-Sergeant air compressor with complement of drills, station sinking pumps, Ligderwood hoisting engine with 30 inch drum, and all else requisite to make a complete plant. The weight of this machinery, etc., was about 85 tons, and it was no light undertaking to haul it in wagons from the railway at Marcus, Washington (at that time the



Open Quarry as it appeared in 1902.

steam from two 100 horse-power boilers; a Canadian Rand double cylinder hoisting engine, with cylinders 22 x 42 inches and drums of 6 feet diameter, with two 80 horse-power boilers to furnish steam for operating; two large rock crushers, and much other machinery, were



GENERAL VIEW OF MOTHER LODE MINE IN 1902.

nearest railway station), to the mine, a distance by road of 65 miles. A two-compartment shaft was sunk and levels opened at 200 and 300 feet depth.

Three years later it became necessary to provide a much larger power plant, so an air compressor having a capacity of 30 to 40 machine drills, and supplied with

Open Quarry as it appeared in 1902.

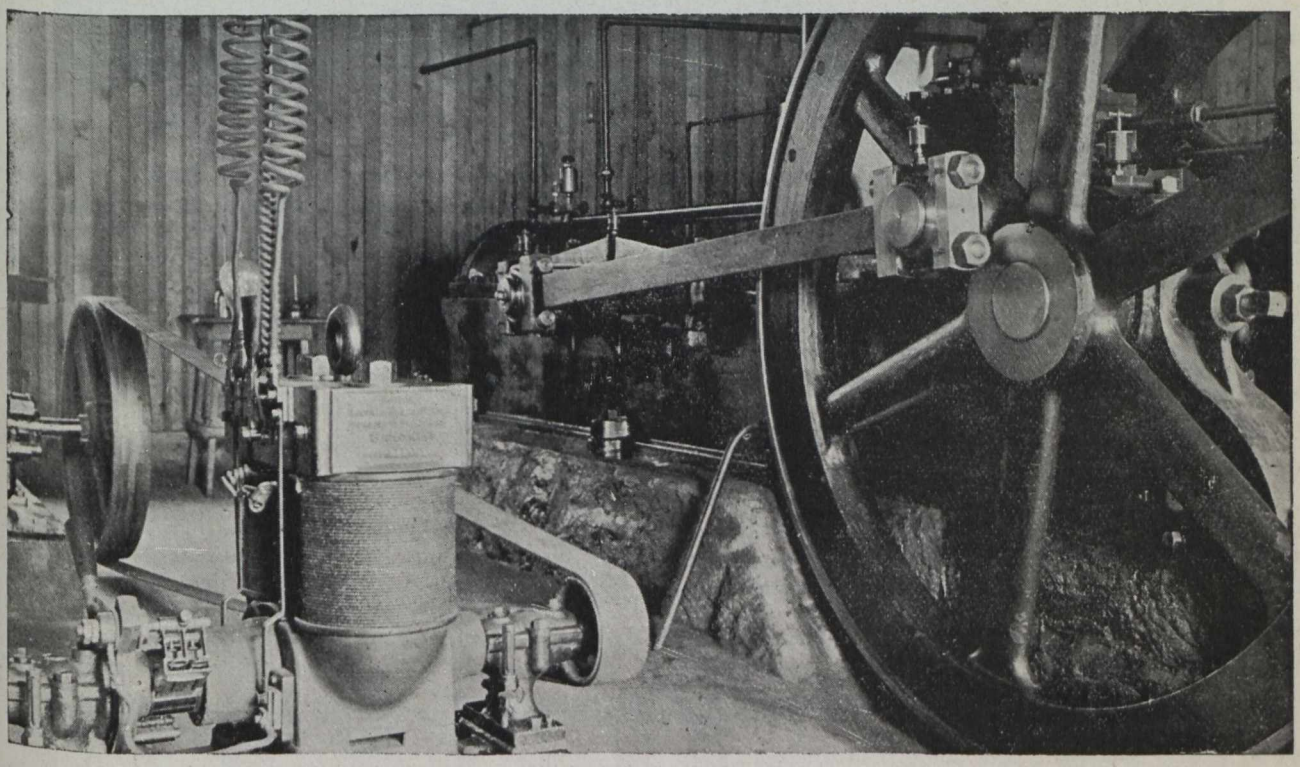
installed. Ore bins having a holding capacity of about 3,000 tons were erected, and bunk and boarding house accommodation was provided for more than 100 men, beside cottages for married employes. Recently electricity was substituted for steam to drive the heavier machinery.

The several different methods followed in working the mine, after the company had erected smelting works and it became necessary to regularly maintain a comparatively large output of ore, were dealt with in two papers contributed by Mr. Keffer to the "Journal of the Canadian Mining Institute" in 1902 (p. 213, and 1904, p. 42), respectively. One plan, known as the "pillar and stope" method, which continues to be of interest to mining men, was thus described by Mr. Keffer:

"The ore body was divided into stopes 30 to 40 feet wide, the length of the stope being the distance across the ore body. The cross-cuts already existing were used, and others cut where needed under the centre of each stope. From these cross-cuts upraises were made 30 feet apart. These were made 10 to 12 feet high, and were then connected by second and parallel cross-cuts. From these latter the stopes were opened out the intended width, and then carried vertically upward, the short upraises being cribbed and fitted with gates for loading. Between the stopes, pillars 20 to 25 feet in thickness

were left, these being frequently pierced to allow intercommunication and ventilation." The accompanying plan and section illustrate the general arrangement of the workings.

Afterwards the quarrying system, briefly noted by Mr. Keffer in his first paper, was so greatly extended as to admit of the hoisting of ore from the underground workings of the mine being discontinued for two or three years. Last year, however, in preparation for the considerably larger output that would be required to provide for the much-increased treatment capacity of the company's smelting works consequent upon the installation of three 600 to 700 ton blast furnaces, underground development was resumed in the mine. The main shaft was enlarged to a four-compartment shaft and deepened to 475 feet; a level was opened at 400 feet depth, and a second connection between the 300 and 400 foot levels was made by means of a winze. Much exploratory work was done by diamond drill with gratifying results, new



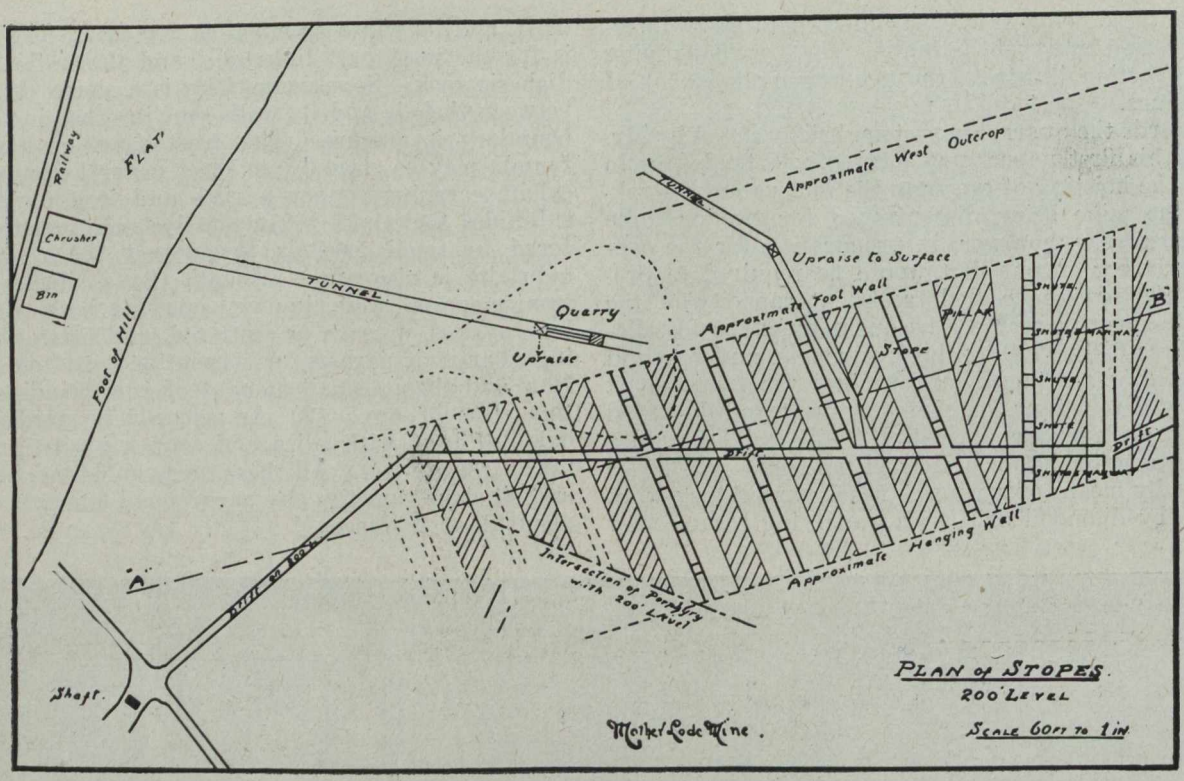
TEN-DRILL AIR COMPRESSOR. INSTALLED IN 1898.

bodies of ore of a shipping grade having been located. Beside preparing for stoping ore on all three levels—200, 300 and 400 feet—much work was done on an intermediate level opened at about 100 feet below the surface in a big body of sulphide ore. As a result of these developments underground, and of further additions to plant and machinery, the daily shipping capacity of the mine has been increased to about 1,000 tons of ore, crushed to a size suitable for charging into the blast furnaces at the smelter without further preparation.

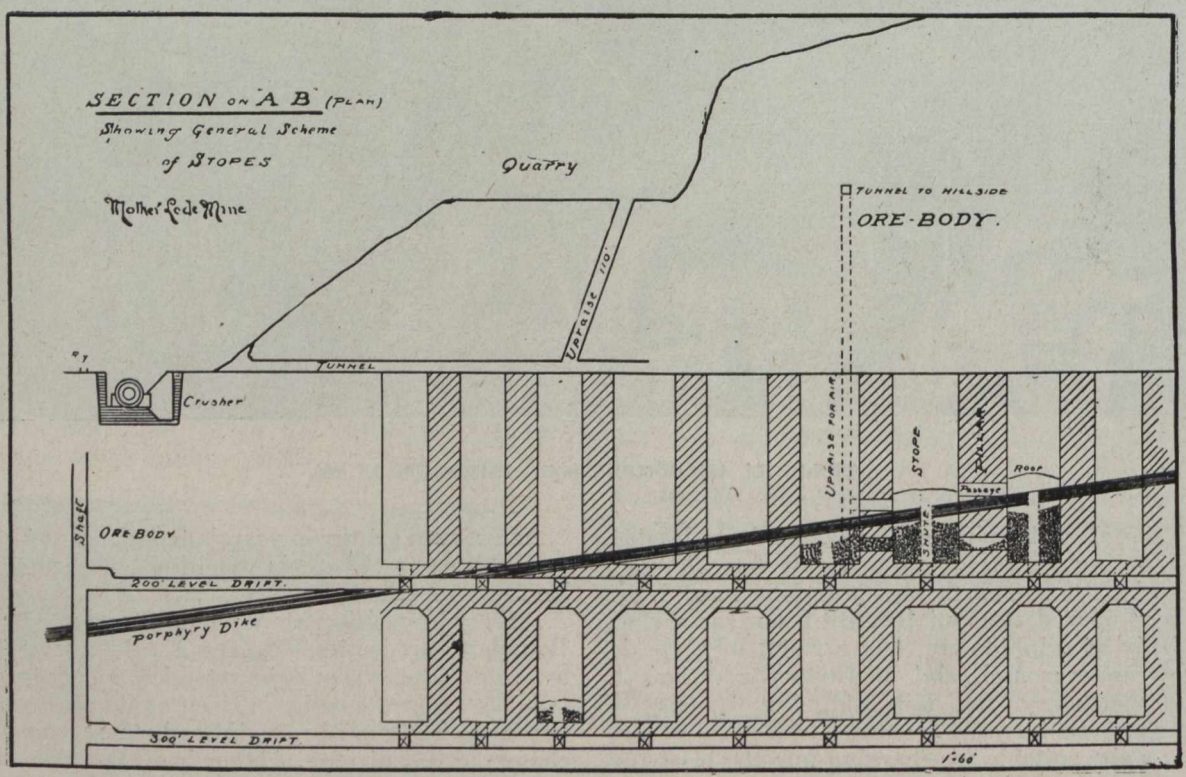
Concerning the character and extent of the Mother Lode ore bodies, Mr. Keffer, in his first above mentioned paper, said: "The croppings are in places soft oxides of iron from decomposition of ore-bearing rock, and in others unaltered magnetic iron oxides very solid and compact, carrying copper pyrites, iron pyrites, more or less quartzose material, and also carrying gold. The extent of the lode is surprisingly great, its length being some 1,100 feet to where it disappears under the heavy drift, and its width as much as 200 feet. The foot wall is for the most part limestone, and the wall an altered diabasic rock. Sometimes there is a sharp demarcation between thelode and its walls, but in other instances the boundary is obscure. The ores themselves (so far as found) may be classed into three general groups: (1) A calcite carrying copper pyrites and iron pyrites, these sulphides sometimes being massive and sometimes scattered in small crystals throughout the rock. Some quartzite is also often present; (2) a silicate of lime, iron, magnesia and alumina, carrying both copper and iron pyrites, massive or scattered, and often also carrying quartz, or garnets, or serpentine, or often all three. Now and then a small amount of zinc blende occurs in this class of ore. (3) An excessively hard magnetic oxide of iron, with silica and copper pyrites; not often much iron pyrites. All these carry gold, and the calcitic and silicious varieties also carry small amounts of silver, about 1 or 2 ounces."

After two or three years' experience of these ores had demonstrated their smelting characteristics, Mr. Keffer wrote:

"From a smelting standpoint, the ores of the larger Boundary properties have, as a rule, grown less basic as the workings have been extended and deepened. That is to say, the proportion of iron oxide ores to the whole ore body has sensibly diminished, there being no great change in the amount of other base. Whether or not this reduced proportion of base to acid ore is to be permanent, it is (at any rate in the case of the Mother Lode mine) impossible to predict. Long experience in mining these deposits has shown that it is not possible to make safe predictions as to occurrence of zones of mineralization, new ore bodies frequently having been found in unexpected places. On the 200 foot level of this mine there has been found considerably less oxide of iron ore than in either the quarries or the 300 foot level. The iron oxides of this latter level are uniformly of higher



PLAN OF STOPES, MOTHER LODE MINE, 1902.

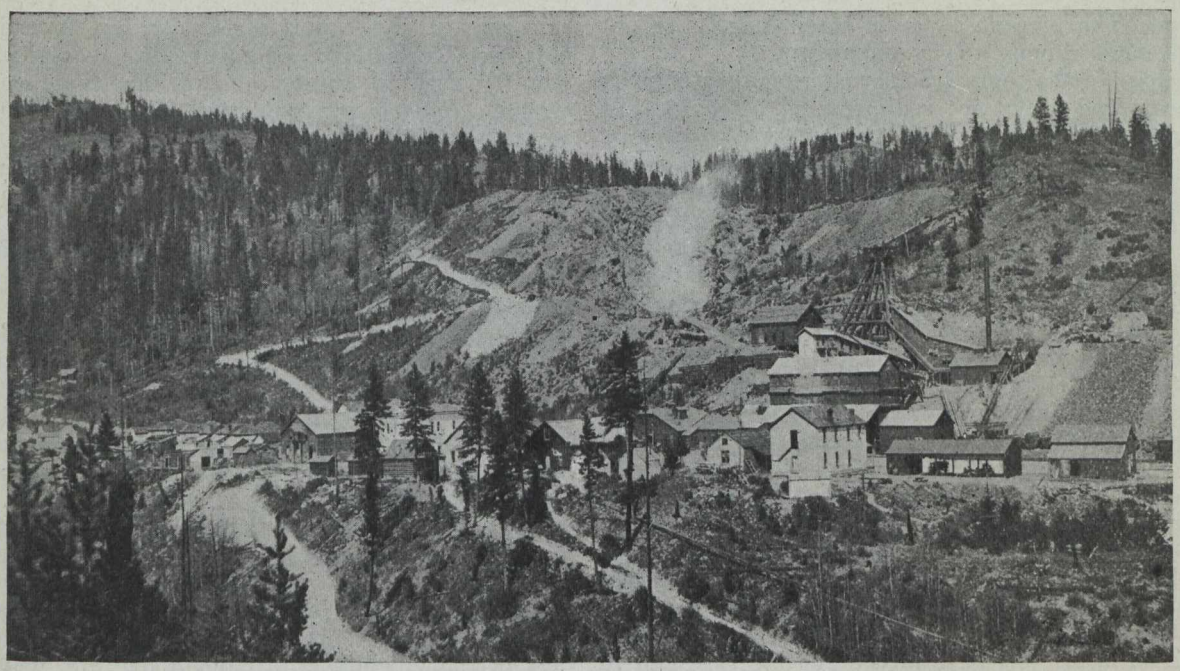


SECTION OF STOPES, MOTHER LODE MINE, 1902.

grade than those of the quarries carrying more copper and gold, and they do not appear to be directly connected with the upper deposits, although this is not absolutely proven . . .

"The change in the basic character of the ore is illustrated by the following average slag analyses, taken over corresponding periods of 1901, 1902 and 1903. The small tonnage of foreign ores treated affects the assays somewhat, but not materially:

Year.	Silica.	Per cent. Iron.	Lime.	Total.
1901	33.2	28.5	20.6	82.3
1902	40.5	22.2	20.2	82 0
1903	42.7	20.4	20.2	83.3



GENERAL VIEW OF MOTHER LODE MINE IN 1907.

"With slags runnings in silica from 40 to 43 per cent. and matte at 40 to 45 per cent. copper, it is found that the furnaces can be maintained in good running condition, and slag losses kept within proper limits. To guard against possible scarcity of iron fluxes it has, therefore, become the general practice to conserve the iron ores of the mines, using only sufficient to keep slags within bounds above indicated."

The Geology and Ore Deposits of Franklin Camp, B.C.

By R. W. Brock, Ottawa, Ont.

(Toronto Meeting, 1907.)

The steady increase in the mineral production of British Columbia, which, last year, is estimated to have exceeded $26,000,000, the dividends now being paid, not by one concern, but by a considerable percentage of the operating mines, the continued increase in the demand for copper and the corresponding great advance in its price, the opening up of new territory by railway construction, the general prosperity throughout the commercial world, have all contributed to a revival of outside interest in mining in this Province, and to restore that confidence which, since the collapse of the '97 boom had been withdrawn. This renewal of interest will find expression in the reopening of properties now lying dormant in the older districts and in the birth of new camps. Portents of this are not lacking. One of the first districts to benefit by this improvement in conditions is what may be termed the hinterland of Grand Forks.

The Town of Grand Forks is situated in Yale district, at the Forks of the Kettle River, the eastern entrance into the Boundary Creek District. Its chief industry is the large smelting works of the Granby Company, which treats all the ores from their Phoenix mines, located on the mountains a few miles to the west of the town.

A short distance up the north fork of Kettle are several small mineralized areas that were partially developed some years ago, but which have been neglected the last few years. Farther up stream, on the east branch of the north fork, forty-three miles from Grand Forks, is Franklin Camp. It was located by Franklin MacFarlane, for many years a trapper on this stream. His discoveries and those of some friends attracted prospectors, and in 1900 a little colony of them were busy in this camp. During the same summer a reconnaissance survey, which included Franklin Camp, was made on behalf of the Geological Survey by the writer and Mr. W. W. Leach. The results of this survey were embodied in the West Kootenay map sheets, published by the Department.

But the camp had come into notice too late to be benefited by the boom. Moreover, it was three days' journey by pack train from Grand Forks; there was no immediate prospect of transportation facilities, and none was prepared under these conditions to buy surface showings at boom prices. During the last two seasons, however, some attention has been paid to the district north of Grand Forks. Last summer a wagon road was constructed to the camp, bringing it within eight hours' stage journey from the railway, and work was begun on a branch railway from Grand Forks up the North Fork to Franklin. Several townsites had been platted, and hotel and store accommodation provided.

Some of the salient points in the geology and tography are shown on the map, taken from the West Kootenay sheet of the Geological Survey. Many of the geological boundaries represented are only approximate, as when the reconnaissance was made the country was to a large extent timbered. Since that time the district has been burnt over and the rocks and ledges are now much better exposed; but as my visit last summer was restricted to one day, nothing could be done toward revising the

boundaries. The present paper is based largely on observations made during the reconnaissance.

The geology of the camp is somewhat complicated. The oldest recognized rocks are sedimentary, often greatly metamorphosed. Among these the most conspicuous, when not too highly altered, is limestone. It is metamorphosed to crystalline limestone and lime silicate hornfelds. The latter is sometimes a green and sometimes a compact, broken-up, light-colored, porcelain-like material, resembling a baked argillite. When alteration to silicates has been uneven and incomplete, a breccia-like or conglomerate-like rock results, with the green silicates sometimes as the matrix, with limestone rests and sometimes as the nodules, with an unaltered limestone matrix. The limestone and its alteration products occupy a larger area than represented by the limestone coloring on the map. Some argillites occur in this series, and closely associated are some greenstones. Large masses of gray Nelson granodiorite is intrusive in these basal rocks. Both these formations are intruded by small masses of a gabbro-like rock and a porphyritic syenite distinguished by its long reddish feldspar crystals. Towards the west, forming the West Branch divide, is a light acid granite (Valhalla Granite) intrusive in the above series, and to the east a pink, alkali-syenite, also later than and intrusive in the above formations. Numerous porphyry dykes from these intrusives traverse the older rocks.

At many points overlying the previous formations is a series of Tertiary rocks. These consist of quartzite-like, gritty tuffs with coarse conglomerate bands, conglomerates and ash beds, and overlying these again, lava flows with some inter-leaved ash rocks. The conglomerates hold pebbles and boulders of the older rocks, particularly of the granodiorite, limestone, greenstone and an older, finer-grained conglomerate These range in size from a half inch to two feet in diameter. The conglomerate appears to cover a greater area than represented on the map, reaching in places to the North Fork bottom. It is cut by dikes from the alkali syenite and from the volcanic rocks.

The lava beds, which occupy the higher levels, show in places basaltic jointing. Some beds are rich in gas pores, the latter often containing agate, calcite or zeolites. The intrusive rocks have profoundly altered the older formations over considerable areas, and incidentally ore deposits have been developed in the latter.

The deposits so far uncovered present several more or less distinct types.

1. Those in which the gangue consists of country rock altered to green lime-silicates, such as hornblende, epidote, garnet (generally reddish), with quartz and calcite. Such deposits, since they are especially apt to occur in the (altered) limestone may be, for convenience, called the limestone type.

Deposits of this class differ in the relative amounts of their metallic minerals, and, using this as a basis, may be sub-divided into—

(a) Pyritic Type—The metallic minerals consist predominantly of pyrite and chalcopyrite.

(b) Magnetitic Type—The metallic minerals consist predominantly of magnetite, with some copper and iron sulphides.

(c) Galena Type—The metallic minerals consist of galena, blende and chalcopyrite—this type occurs on the McKinley near type a and b; the silicate minerals are not prominent in the exposures on this lead, the crystalline limestone often abutting against the sulphides.

2. Chalcopyrite, or pyrite deposits with molybdenite, calcite and quartz in crushed zones, fractures, fissures or near contacts. Replacements or substitution of the minerals of the country rock by ore is usually conspicuous. Granodiorite or porphyritic syenite formed the country rock in all deposits of this type seen by the writer. For convenience, then, these may be referred to as the granite type.

3. Quartz veins, in which quartz is the dominant mineral accompanied by galena, blende, pyrite, chalcopyrite, molybdenite, arsenopyrite, etc.

The most extensively developed claim is the McKinley, on which approximately $30,000 has been expended in surface improvements, trenching, tunnelling and diamond drilling. On the north slope of McKinley Mountain in a band of crystalline limestone, running north across Franklin Creek to Franklin Mountain, four leads have been discovered. The strike of the leads has not been definitely determined, but they appear to be lying transversely to the direction of the limestone band—here about 300 feet wide. Along these leads the limestone is more or less changed to epidote, hornblende and garnet. The lowest lead, exposed by an open cut, shows a heavy development of magnetite, with some pyrite and chalcopyrite. The latter, while somewhat disseminated in small specks, show a tendency to accumulate in veinlets in the magnetite. Diamond drilling, which was in progress on this showing, was said to be demonstrating a fair sized body of ore.

The second ledge outcrops for a width of about 30 feet, but the dip is at a low angle southwest. It shows a heavy development of galena and blende as well as chalcopyrite. The lime silicates are only sparingly developed here, the crystalline limestone being often in direct contact with the galena. Only open cuts have been made in this lead. The grade of ore is stated to be high, particularly in silver. The third ledge, in which the chief work has been done, holds iron and copper pyrites, with a considerable amount of the gangue minerals. It is supposed to be about 40 feet wide, dips 45 degrees south, and has been traced for 300 feet.

The main working is a tunnel. About 100 feet in, a cross-cut has been run westward 104 feet, the last 80 feet of which is in ore. Two hundred and fourteen feet in the tunnel 15 feet of ore is encountered (No. 4 lead). This ore is like that of No. 3, except that it contains less pyrite and more chalcopyrite.

Average assays of the largest ledge are said to run about 2.5 per cent. copper and about $2.00 in gold and silver.

The McKinley Company are also testing the Banner claim on Franklin Mountain by diamond drilling. This claim has not been seen by the writer since 1900. At that time a strong, very wide lead of quartz, mineralized with galena blende and chalcopyrite were exposed.

On the Maple Leaf claim, on the northeast slope of Franklin Mountain, copper ore occurs in the reddish porphyrite syenite near and along its contact with the basal formation. The mineralization is confined almost exclusively to the intrusive rock. Fractures in this syenite are filled with seams of chalcopyrite and pyrite, or with green malachite resulting from the alteration of the copper ore by atmospheric weathering or surface water, and in addition there is marked selective replacement of the minerals of the syenite by the sulphides. The colored constituents are more readily replaced, so that where the action has not been excessive the prominent feldspar crystals may be found lying in a sulphide base. Where the replacement has been more extensive, the feldspars are attacked, and finally the whole mass of rock becomes sulphides. At several points along the contact, which is generally covered with wash, wide stretches of the more or less mineralized syenite have

been uncovered. About 400 fet back from the contact, an open cut has exposed a lode 4 feet wide of fairly well mineralized rock.

The Gloucester group, now being worked under bond by the Dominion Copper Company, was not visited. On the G. H. claim of this group is a ledge of magnetite, with a little pyrite and chalcopyrite. In places it is at least forty feet wide, and it has been traced several hundred feet. It seems to lie wholly in the grey granodiorite. On the Gloucester was a good showing of copper ore, with pyrite, molybdenite, calcite, and quartz, with grey granodiorite on one side at least, but the country rock is badly altered. Development here is made more difficult by some faults which have been encountered.

On the south slope of Tenderloin Mountain, several copper lodes were seen during the survey of the district. They occurred in the grey granodiorite, in fractures, or crushed zones. In the latter, the rock is sometimes crushed to a sort of nodular structure, the more highly triturated material of the rock wrapping round the ball-like rests of unbroken material. In these crushed zones, particularly along well-marked fracture planes, the mineralization by copper and iron sulphides is quite heavy.

In addition to the claims mentioned, a large number are held, on which deposits of one or more of the types mentioned, have been discovered. Most of the claims spoken of lie within an area 3 x 1 1-2 miles, and an area 8 miles long by 1 to 4 miles wide—covering both sides of the river, would embrace most of the discoveries so far made. There are possibilities, however, in this camp over a somewhat longer and a much broader area—all that ground lying within the encircling, recent acid or alkali eruption rocks, for all the older rocks of the camp, the altered basal rocks, the granodiorite, gabbro and porphyritic syenite are mineralized and lode-bearing. Lodes of the first type are likely to occur in the continuation of the limestone band northward from the McKinley, and in other limestone or altered limestone areas. Contacts seem promising points for prospecting, and in addition to the contacts, shear or crush zones in the massive rocks. From what has been seen of the acid granite, and the pink alkali syenite (Rossland alkali syenite) and the Tertiary lavas, both here and elsewhere in this Province, it is altogether unlikely that workable deposits, at all events of the described types, will be found in these rocks, but the older formations along their contacts, and along dykes from them is good ground to prospect.

In its geology and the nature of its ore deposits it bears a strong resemblance to the Boundary Creek district. The main rock formations are common to both, as are deposits of types 1a and b, and 3, the main difference being that in the Boundary sulphur is less plentiful, so that pyrrhotite is found in place of pyrite, and iron oxides are more prominent.

Deposits of Type 1 are connected with contact metamorphism by intrusive rocks—and are to be explained by the influence of heat, together with mineral-charged water or vapors given off by the cooling intrusive magma upon the country rocks. Such emanations ascend as best they are able by all sorts of channels, among which fissures and fracture planes are likely to be important. The rock along these channels usually exhibits characteristic alteration, produced by these mineralizers, and is often replaced by the mineral matter carried by them for some distance on either side of the channel—especially when complex fractures enable the solutions to wander into the rock and expose a great number of surfaces of attack. It will be evident that contact metamorphic action will not be confined to the immediate contact of the intrusive rock (indeed may be absent there) but may be irregularly distributed, according to the physical and chemical characters of the neighboring country rock, the distance below the surface, temperature and other precipitating conditions. There may be expected to be transitions between contact metamorphic deposits and ordinary lodes or veins, and such have been found in a number of places. Deposits of Type 2 are probably to be regarded as such—as are also the deposits of the Rossland Camp, now being mined. Deposits of the contact metamorphic type seem to be widespread in Southern British Columbia, not only in Boundary and Franklin, but in other districts as well, and will, no doubt, be recorded from a great many localities.

From descriptions of copper and magnetite deposits in the Similkameen, Kamloops and the coast, it would appear to the writer that examples occur in these localities. On the outskirts of the Rossland Camp the same type occurs, and transitional types to ordinary lodes and veins are widely distributed.

It has not been absolutely determined for Franklin Camp what intrusive rock has been responsible for the metamorphism and mineralization. The possibilities are the granodiorite, the alkali syenite, and the undiscovered or unrecognized plugs or dykes which gave vent to the lavas. The first is in closer proximity to the deposits in large exposed areas, but the second is well represented by large dykes; of the third, as no information is at hand, nothing may be said. The granodiorite is itself deformed and mineralized; the alkali syenite at certain points in this section is responsible for mineralization and seems to have been injected just prior to the great period of ore formation. Both these rocks are present in the districts of Southern British Columbia visited by the writer, which are characterized by this class of deposits. At present, the balance of the evidence seems to be rather in favor of the alkali syenite as the metamorphosing rock. In the Boundary district the large syenite porphyry dykes seem to have been furnished by the mineralizers. (1) In a recent monograph (2) Lindgren ascribes the origin of the Clifton-Morenci contact deposits to porphyry dykes.

The contact metamorphic deposits, while distinguished by Von Goddick in 1879, have only in recent years been recognized as an important type, found in a large number of copper-gold districts, but an extensive literature on the subject is now being rapidly accumulated.(3)

Of the more important deposits of this class may be mentioned some of the Clifton-Morenci copper deposits, Arizona (4), the copper deposits of Cananea, Mexico (5), and the gold-copper deposits of many other parts of Mexico. In Eastern Ontario, the writer has recognized examples of this type.

Since limestone has been found to be the country rock of most of the contact metamorphic deposits hitherto described and consequently seems to be the rock most susceptible to this mode of alteration, and since in its impurities it contains many of the elements necessary to form with the lime the observed gangue minerals, the inference has been widely drawn that such deposits are peculiar to limestone contacts. This fact has been included in various definitions of this type of deposit. Many authorities (Rosenbusch, Barrell, Zirkel Klockmann) hold that the results are due to the alteration of impure limestones through heat alone, and that there has been no addition of material, by waters and vapors, at all events none to go towards the formation of the typical gangue minerals. Others, as Michel Levy, Vogt, Lindgren, Kemp and Blake, bring forward facts to show that some of the material of these minerals has been in-

troduced by emanations from the intrusive lava. In the Boundary Creek District the evidence is wholly in support of the latter view, (6) and the same seems to be true in Franklin Camp.

In many places the limestone is altered to marble, except in the mineral-bearing zones. These mineralized zones have not the accordance in strike, nor the regularity in distribution that impure bands in a limestone would possess. The ores must certainly have been introduced, and there is good reason for believing that the iron and silica of the silicates have been as well. Moreover, these deposits are not confined in these districts to limestone as a country rock.(7) In the Boundary Creek district the writer has shown that even the granodiorite is mineralized to some extent in this way, and that in it garnet zones are developed. A full description of this formation of garnet in granodiorite will be given in a paper shortly to be published. Kemp, in a recent paper (8), describes the formation of a similar mineral-bearing garnet zone in granite porphyry at White Knok, Idaho. In Franklin Camp, the magnetite ore of the Gloucester group, according to notes taken in 1900, occurs in the granodiorite, and some of the copper ores of the camp also have this as their country rock.

The development work already done in Franklin Camp is limited and shallow, so that it is not known how the values, particularly the copper values, will hold out in depth, nor is it yet demonstrated that a large tonnage of low grade ore can be maintained. To prove these points requires extensive development and time. While good values have been found on some of the lodes, it will probably be on low grade ore that the success of the Camp must depend. The results on the McKinley, so far, seem to be encouraging.

While nothing can yet be said of the extent and value of the mineralization, while it is yet too early to state that any one of the prospects is going to be a good mine, it may be said that the camp posesses many of the earmarks of a mineral-bearing district and that in kind, whether or not in degree, in the nature of its ores whether or not in extent, it takes its places in a goodly company of mining camps, among which its neighbor, the Boundary Creek district, is not the least important.

The expensive development work required in this camp will be greatly facilitated by the railway, and when this reaches the camp, its possibilities will no doubt be tested as they deserve to be.

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(1) Preliminary Report on the Boundary Creek Mining Dist. Summary Report G. S. C., 1902, p. 90-136.

(2) Prof. Paper, 43, U. S. G. S.

(3) As examples the following may be cited. The Character and Genesis of Certain Contact Deposits. W. Lindgren. Genesis of Ore Deposits, A.I.M.E., p. 716, T.A.I.M.E., Vol. XXXI.

Copper Ores and Garnet in Association, W. P. Blake, T. A. I. M. E., XXXIV,, p. 886.

Limstone Granite Contact Deposits of Washington Camp, Arizona, W. O. Crosby, T. A. I. M. E., XXXVI, p. 626.

Ore Deposits at the Contacts of Igneous Rocks and Limestones, and their Significance as Regards the General Formation of Veins. J. F. Kemp, Economic Geologist, Vol. II, p. 1.

Die Kieslagerstatten Roros Sulitelma und Rammelsberg. J. H. L. Vogt, also Genesis of Ore Deposits, A. I. M. E., 1902, p. 648. Zeilschiep for Prak. Geologie, 1894, p. 177, 464, and 1895, p. 154.

(4) Lindgren, U. S. G. S., pp. 43; and T. A. I. M. E., Vol. XXXV, p. 511.

(5) Ore Deposits near Igneous Contacts, Weed, T. A. I. M. E., Vol. XXXII, p. 715.

(6) Preliminary Report on the Boundary Creek District, R. W. Brock, Summary Report, G. S. C., 1902, p. 90?136.

(7) Op. Cit., page 107, also Journal Can. Min. Inst., 1902, p. 369.

(8) Economic Geol., Vol. II, p. 1.

THE BRITISH IRON AND STEEL INSTITUTE.

PRESIDENTIAL ADDRESS.

By Sir Hugh Bell, Bart.

A little more than a hundred years ago, when the nineteenth century was still in its salad days, my grandfather, the son of a Cumberland yeoman, came to the Tyne to enter the service of a well-known firm of Newcastle merchants, into which he was shortly afterwards admitted as a partner. He was born in Cumberland, near Woodside, the seat of the Losh family, and no doubt Mr. Losh, the senior partner, was instrumental in bringing the young man to "The Quayside," a term which indicated the business quarter of the cannie town as clearly as "the City" does that of the English metropolis.

That I, the grandson, occupy by your kindness the distinguished position of your president, and, in that capacity, am called upon to deliver an address this morning, makes it not inappropriate that I should choose as my subject a review of the position of the great trade in which we are engaged as it was then and as it is today, a century after the occurrence which identified the fortunes of my family with the maunfacture of iron.

I am only too sensible that it is because of my parentage that the choice of the Council has fallen on me, and that it is as the son of Sir Lowthian Bell that I have been selected to follow a most distinguished series of men who have adorned the chair I now unworthily fill. This affords an additional reason why I should choose for the subject of my address a sketch of the iron trade in the last hundred years, for his life, begun in 1816 and ended nearly ninety years later, almost covers the period I propose to pass briefly in review; to do so exhaustively would mean a great and profoundly interesting volume.

Let me then ask you to recall the position of the world in 1807, when the young Thomas Bell entered the firm of Losh & Company, so that we may understand from what platform we started.

The eighteenth century had closed on a world under arms. The titanic struggle which we identify with the name of Napoleon was at its height, and the new century opened amidst the din of battle. The power of the Colossus who was attempting to overstride Europe was undimmed, and rumors of invasion of "the little isle set in the silver sea," which strove to withstand the overwhelming onslaught of his armies were everywhere current.

The men of that day might well contemplate the future with anxiety bordering on terror. But before the first decade had closed an event occurred which, to those who had eyes to see, put a term to the dreams of universal dominion, which had dazzled the imagination of the great Corsican. In October, 1805, Trafalgar Bay had witnessed a sight which virtually ended the conflict, though nearly ten years elapsed before the war of the giants ended and Europe was left free to effect the great commercial development which, in one of its aspects, I propose to lay before you.

For while Europe was one vast battle-field, and men's

energies were being devoted to arms and their capital to armaments, the fertile brains of inventors were busy. Great discoveries were being made, or, what is more important for our purpose, were being turned to useful ends.

Two centuries earlier men had become aware that a great instrument stood ready for those who knew how to use it, but the common opinion which gives to James Watt (1736-1819) the credit of the steam engine, and forgets Giovanni Branca (1601), Solomon de Caus (1615), the Marquis of Worcester (1663), Denis Papin (1690), and even Thomas Savery (1698), is doing that rough substantial justice which the popular view rarely fails to distribute. Though the great Scotchman was unquestionably aware of the importance of his improvements, which, in fact, made steam the powerful agent we know, even he would be surprised could he see how far his successors have surpassed him in its economical use, and what purposes they have made it serve. For Watt died in 1819, when the steamboat was in its earliest infancy and steam traction on land was hardly begun.

The propulsion of ships by steam dates from the end of the eighteenth century, but John Fitch's invention brought him nothing but misery, and led to his suicide in 1798. The Iron and Steel Institute is of so cosmopolitan a character that it would be unseemly to assert for Great Britain claims which may be contested. I will, therefore, not seek to award the merit of the practical employment of steam in ships as between my namesake Henry Bell (1767-1830) and Robert Fulton (1765-1815), though I might claim the credit for "Britain" in either case, since the American was born at "Little Britain," in Pennsylvania, while Bell hailed from Torphichen Mill, in Great Britain. The two purposes to which I have referred give us the reason why the nineteenth century should have witnessed the great industrial developments, to a rapid sketch of which my address is devoted.

While men were dependent on such puny instruments as those which had served their purposes since civilization dawned on the world, we may rather be surprised at the wonderful ingenuity which enabled them to accomplish so much than at the the slow progress which had been made. I have within the last few months visited the Valley of the Nile and seen with amazement the great works accomplished by a people who, as far as we know, possessed no other contrivances than the lever, the wheel, and the inclined plane, and those primitive instruments which our remote ancestors devised when they emerged from the rest of the animal creation and stood forth as men. The magnificent monuments of that wonderful land bear comparison for stupendousness with the great works which the engineers of the nineteenth century have constructed for the benefit of the country and the world at large, while in beauty they vastly surpass them. But without such assistance as we can now call to our aid, it is impossible to conceive the industry of the world on its present scale conducted under the conditions which produced the marvels we admire in Egypt.

Now, of all the aids we have at our disposal to-day, none is more important than the facility of transport. It has been said that no real improvement in this respect was made from the time when the Romans began to build roads till steam took the place of vital power as a propelling force, and that the Emperors Caracalla and Geta, hurrying from York to claim the Imperial purple in the third century, were no longer in reaching Rome than was Sir Robert Peel in returning from Rome to London to become the Prime Minister of Great Britain in the nineteenth. Yet till the power of bringing together in great masses the mineral resources of the world was attained the output of iron was limited to those districts where the ore and the fuel chanced to lie in juxta-position. The great developments of recent times depend entirely on the improvements in transport. What would the founder of the ironworks at Dowlais have said had he been told that their prosperity would come to depend not so much on the fact that the iron ore and the coal could be extracted from the same pit as on the accessibility of Cardiff to the Basque Provinces of Spain? And the two things react on one another—without steam transport a highly developed iron trade is impossible; without abundant and cheap iron steam traction is inconceivable. It is for these reasons that the history of railways is so intimately connected with that of the iron trade.

As is well known, the idea of a fixed and rigid path along which the wheels of a wagon should travel is a very old one, but until the end of the eighteenth century it had been but little utilized. It remained for George Stephenson (1781-1848) to show tthat it was essential to the construction of a road on which the means of traction should be that new power which the genius of Watt and his collaborators had placed at man's disposal. Here, again, the common opinion which connects the name of Stephenson with this great invention and disregards, or at least places in subordinate positions, Murdock, or Trevithick, or Blenkinsopp, or Hedley, does no more than substantial justice. The first quarter of the nineteenth century witnessed the trials and failures which were to end in revolutionizing carriage by land. In 1822 the first railway, in the modern sense of the word, was opened for mineral traffic, while three years later (in September, 1825) the first passenger line, the forerunner of the vast network which now overspreads the civilized world, began operations between Darlington and Stockton.

But to render this possible much more was needed than to invent the locomotive engine or the fixed path. Here, again, we find many names claiming to be inscribed on the roll of fame as entitled to the honor of inventor of the process which was destined to bear its part in the coming revolution. To Henry Cort (1740-1800) we must, in any case, assign a prominent place on the roll, for though we may deny him the title of "father of the iron trade," or even that of the "inventor of puddling," there can be no question that to his ingenuity the industry owes a deep debt—a debt only indifferently discharged by grants from the Government of the day, the last of which was made, at the instance of Dr. Percy, one of my predecessors in the chair, by Lord Palmerston, to Cort's only surviving son, in 1856. If to him we add John Wilkinson (1728-1808), and the veritable dynasty of Abraham Darbys, of whom the grandfather was born in 1677 and the grandson died in 1791, we have noted the chief of those whose endeavors towards the improvement of processes connected with the iron trade rendered it possible for the inventors of the railroad to make the fixed path of malleable iron produced in great quantities and at reasonable cost. It is not unnatural that the bulk of the names mentioned have been citizens of Great Britain. This country, from its physical configuration, its geological peculiarities and its limited size, presented the most favorable laboratory in which to try experiments. To these circumstances is due the fact that, at the beginning of the last century, one-third of the world's production of pig iron came from these islands, though the total production of the world did not exceed three-quarters of a million tons.

In every case it will be found that the production of iron depended on the proximity of fuel and ore. The iron trade of Sussex died when the exhaustion of the forests removed the fuel. Staffordshire, Scotland, South Wales, indeed every ancient seat of the iron trade in Great Britain, tell the same story, which is true of Sweden, of Russia, and of every country whence, before we entered on the new phase, we drew supplies. For it is interesting to observe that, in the past, England was an importer rather than an exporter of iron. From Sweden, which in 1780 was the chief producer, and from Russia she brought the metal which her smiths were to fashion into those goods for which she was early to become renowned. But though Sheffield holds and has long held the highest reputation for the excellence of her wares, it is significant that from Spain we derive bilbo as a name for our sword, and from Syria the word damascening to describe the pattern with which it is adorned.

But neither Bilboa nor Damascus bears any part in the history of the iron trade a hundred years ago. We must look to Germany, to France, to Belgium, and to Austria if we would see how the continent of Europe stood at the date we are considering. It will be noted that I do not repeat the names of the two northern countries from which, in earlier days, Great Britain drew her supplies. Sweden and Russia barely count in the developments we are considering. From producing something like one-seventh part of the output of the world in 1830, they have fallen to producing but about one-eighteenth in 1905, though their total outputs have risen from about a quarter of a million tons at the earlier date to over three million tons at the later date.

The great ironmaking districts of Germany which lie in proximity to the Rhine owe their importance to the facilities of transport afforded by the river and by the railways which line its bank.

The works at Essen date from about the time at which my review opens, for the firm of F. Krupp was founded in 1810, but it is not till 1850 that Westphalia begins to play an important part in the history of the trade. By that time, already, it had become possible to transport the ores of the Seig and the Lahn to the coal districts. The discovery of the Bessemer process marks another step in advance. Bessemer compels Westphalia to bring ore from Spain, Gilchrist and Thomas restore to the native ores their importance. The basic process marks a great stride, and in 1879 the astonishing development of the German iron trade begins, the production of basic pig iron rising to 8,039,808 tons out of the German pig iron production of 12,293,825 tons in 1906, whilst the output of Bessemer pig iron was only 491,086 tons. Again, it is the possibility of bringing ore from distant countries to the fuel needed to smelt it that this region owes its present position. It may be permitted to a subject of King Edward to point out that here too a citizen of these islands appears as taking a prominent part, and to recall the fact that one of the chief collieries in Westphalia is called "Hibernia," in honor of the nationality of the man to whom the initiation of the enterprise is due.

With the help of Mr. Brough I am able to append to my address a chronological table of great interest. In it, under the year 1811, will be found the following entry: "Moyeuvre was purchased by François de Wendel from the French Government." I may be allowed to pause to welcome as a member of the Institute the great-grandson of that François de Wendel (himself a François), to express our grief at the loss we have sustained by the death of his father, who was a Bessemer gold medallist, and our satisfaction at enrolling the honored name once more on our lists, which have been adorned by those of his father and his uncle, Robert de Wendel. I restrain myself from telling the story, full of romance, related to me by the second François de Wendel, which is covered by the words in tthe Appendix: The spoliation by the revolutionary government in 1794, the years of suffering and of preparation under a foreign sky, the painful return and recovery of the family properties in 1803, and the building up of a great family industry—a monument of perseverance continued over four generations and through political changes to which I must do no more than allude.

Among the other great works in France to which I should like to refer are those of Le Creusot, which have a special interest to Englishmen, as they were partly owned at one time—in 1823—by an English company, Manby-Wilson & Company, who purchased an interest in them from a French company. They date from a somewhat earlier period than that with which I am dealing, but it was not till 1836 that they passed into the hands of Messrs. Schneider, by whom they were rapidly developed, till they became the important establishment to which we were welcomed in 1899. We are proud to have counted among our honorary members one of the founders of the Schneider dynasty, to have had his son as member and Bessemer medallist, and now to be honored by the presence of his grandson on our Council. Terre Noire is of about the same date, having been founded in 1819.

In Belgium the great establishments at Seraing call for mention. They interest us in this country since the founder was John Cockerill, a Lancashire man, who settled in Belgium early in the century to join his father in the management of a factory for the construction of spinning and weaving machinery, and in 1817 founded the works now under the management of our colleague on the Council, Mr. Greiner.

Our approaching visit to Vienna would make me wish specially to refer to the part borne by Austria in the wonderful story I am attempting to tell. The Austro-Hungarian Monarchy is also an example of the same process of development. The manufacture of iron dates from the remotest antiquity, but does not begin to attain to important figures till the introduction of improved methods of transport. In 1830 the output is said to have amounted to 80,000 tons. Fifty years ago this quantity had grown to just under a quarter of a million tons, while to-day Austria-Hungary contributes over one and a half million to the world's output.

The American continent presents the matter in yet clearer terms. I am glad that the limits I have laid down for myself do not call for any account of the position of the trade in that vast country before 1776. The selfish and short-sighted policy which marked our legislation as to our colonial trade makes unpleasant reading for us to-day. I may pass to 1810, when the make of iron was under 54,000 tons, which compares with 243,851 tons made in Great Britain. In 1840 this had grown to 286,903 tons against Great Britain's 1,396,400 tons. This slow growth continues, the United States not reaching the 1,000,000 tons, to which Great Britain had attained in 1836, till 1864, nor the second million till 1872. By this time, however, the means of transport were improving with extraordinary rapidity. The production pauses between the second and third million for seven years, the reaction of 1876 sending it below 2 millions (1,868,961 tons), jumps from 2 3-4 millions in 1879 to 3,835,191 tons in 1880, stays for five years between 4 and 5 millions, rushes to 5,683,329 in 1886, and so

onwards till in 1905 it has attained 23,360,258 tons, out of the world's total of 54,610,269, to which Germany contributes 10,875,061, and Great Britain 9,608,086 tons.

Steam transport by sea and land, steam and electric-driven instruments for dealing with the ship's contents when they arrive at the discharging quay, have alone rendered these extraordinary results possible. The vast distances which so lately as 1890 made a judge as competent as my father doubt the possibility of utilizing the great deposits in the West have been reduced to insignificance, and the coal fields of Pennsylvania placed, commercially speaking. alongside the iron deposits of Lake Superior, from which they are separated by 800 miles of land and water.

But precisely because the distances in Great Britain were small, it was here that the first attempts to annihilate them by mechanical means were made. To this cause we must attribute the growth of the iron trade having in the earlier period been so much more rapid than elsewhere. When the century opened the production of Great Britain did not exceed one-quarter million tons. Even thirty years later it was considerably under three-quarter million tons, and about half the total production of the world.

By 1830 the improved means of support had begun to tell, and the progress in the mechanical arts to place better implements in the hands of the ironmasters. A glance at the chronological table shows what was taking place and absolves me from a catalogue of events. The next twenty years raised the British output to two and one-quarter million tons, out of four and one-quarter million tons for the world. In the following twenty years Britain more than doubled her output, which in 1870 reached five and one-quarter million tons out of ten and one-half for the world. By this time the means of transport first adopted in Great Britain had spread to other countries. The distances separating ore and fuel in America, in Germany, and in France were becoming of less and less importance, and by 1870 the total production of these countries was only about a million tons less than that of Great Britain. Ten years later, the three countries together produced as much as Great Britain. In 1890 she was called upon to yield the premier place to America. In 1903 Germany overtook her, and now, for the year 1905, which is the latest date to which we have complete statistics, the pig iron output of the world stands as follows:—

Country.	Tons.	Percentage of Total.
United States	23,360,258	42.7
Germany & Luxemburg	10,875,061	20.0
United Kingdom	9,608,086	17.6
France	3,076,550	5.5
Russia	2,715,063	5.0
Austria-Hungary	1,540,896	2.8
Belgium	1,310,290	2.4
Sweden	539,437	1.0
Canada	403,449	0.8
Spain	383,100	0.7
Italy	143,079	0.3
Other countries	655,000	1.2
Total	54,610,269	100.0

This enormous quantity may well fill us with surprise. Some fifteen or twenty years ago my father expressed to me alarm at the rapidly increasing output of iron, and doubted whether the powers of consumption of the world were equal to disposing of the huge mass of metal. In this he followed Scrivenor, who, in the preface to the 1854 edition of his "History of the Iron Trade," remarks on the increase from 1,300,000 tons in 1840 to 2,700,000 tons in 1852, and proceeds:—

"This did certainly appear a matter of sufficient importance to justify an inquiry—especially considering the striking events of the period which had elapsed—as to the causes by which this enormous increase had been encouraged, whether to the advantage of individuals as well as of the country, and whether the supply is likely to be supported, or, on the contrary, whether reckless make has not brought us to a position from which—unless mineral fields, at present unknown, come into operation, with similar advantages to the blackband ironstone of Scotland—we must retrograde . . . and reduce the manufacture to somewhat more moderate limits."

That these fears were in both cases unfounded the sequel proved. In 1854 Cleveland was just about to enter on the scene with a production which, in 1855, was under 100,000 tons, by the end of the decade was 248,655 tons, in 1864 was 409,106 tons, rose to 1,158,471 tons in 1874, and continued to grow till it reached 2,213,584 tons in 1900, and now (1906) stands at the estimated amount of 3,600,000 tons. Within the last twelve months we have seen the world short of iron and clamouring for more, the clamour taking a form which the manufacturers regarded with much complacency, for it resulted in a large increase in price.

And when we ask how the world, which a hundred years ago was content with considerably under a million tons of iron, to-day calls for more when we try to satisfy it with upwards of fifty million tons, the answer is not far to seek. The ingenuity of man was not exhausted when our grandfathers invented railways and steamships. Iron gives place to steel. The puddling furnace having served its purpose, is tossed aside for the Bessemer converter. An instrument with which the arduous labor of several men produced in twenty-four hours about two and one-half tons of malleable iron, is rejected for one in which the forces of nature, guided by human skill, gives us thirty tons of steel in twenty minutes. Iron, but sparingly used when the century opened, is demanded in continually increasing quantities to-day. The iron trade, responding to the call of the world, seeks new methods for producing still better results, and would seem to be about to reject the Bessemer converter for the open-hearth furnace. The remarkable invention of the regenerative furnac made fifty years ago is being continually perfected. Even now the great improvement of a continuous instead of an intermittent process is touched.

If we ask whence come these manifold perfectionments, we are led to look to another aspect of the question. Those to whom were due the great improvements which one hundred years ago were beginning to be effected were, on the whole, men who owed little to schools or colleges. "Self-made," as the expressive phrase goes, it was to their indomitable courage and energy that they owed success; to these and to that inborn perception of the possibilities presented to them which school or college seems to do nothing to create and little to strengthen. But the first barriers broken down, and the pioneers having shown the way, the carefully trained mind is needed to make straight the path. It must be admitted that we in this country have been disposed to neglect that careful training of the mind, and to rely on the native powers of insight more than on the trained intelligence. The workshop rather than the college was the technical school in Great Britain.

It is significant that in the chronological table we find a German Technical High School at Prague mentioned as being founded in 1806, that the Chausthal School of Mines comes next in 1810. Long before the century opened the School of Mines of Freiberg in Saxony was in existence, having been founded in 1765. In 1816 France appears on the scene with a School of Mines at St. Etienne. Belgium in 1836 contributes the School of Mines at Liége, and in the same year Spain that of Madrid, and Austria that of Leoben in 1840, while we have to wait till 1851 before the Royal School of Mines in London appears. Since then we have indeed given much more attention to this matter, and the air is filled with projects for supplying those educational facilities which our fellow-workers abroad possess in such abundant measure.

For as the tools in our possession become more complicated, we must be better trained in their use. The empiric skill of the native genius, where imagination stands instead of knowledge, gives place to the learning acquired by the patient student at the technical school, and science supplants art at furnace and in workshop. If we in this kingdom are to keep our place in the world of industry, we must be ready to make use of the changed methods as our grandfathers were ready in their day to avail themselves of the forces newly placed at their disposal. For we, as they, look out on a world of perpertual change.

The men who stood on the threshold of the nineteenth century would have been filled with astonishment could they have foreseen the changes it was to bring, giving us a world in which time and space are all but excluded from our calculations. A telegram with which we greet a distant friend in America reaches his hand hours before the sun has travelled westwards to mark there the same time as it marked here when our message was despatched. Jules Verne, by the exercise of his imaginative art, told us how with great good fortune his hero encircled the world in eighty days. With no trouble to ourselves beyond taking a ticket from a tourist agency, we could travel westwards from London till we reached this city again from East in a day or two more than half that time.

But let me picture to you one who, one hundred years ago, should have said to the most skilled and far-sighted man of that day, "Within a century from now corn grown on the western slopes of the Rocky Mountains will be conveyed by steam along an iron road to the sea coast, borne over the sea in a ship made of iron and propelled by steam, and sold in the London market cheaper than it can be grown in Essex." Not one of his anticipations would have been thought within the range of the barest possibility.

Beyond doubt we, who stand on the threshold of the twentieth century, may look forward to changes as great and far-reaching before the next hundred years are run out. New forces are again being placed within our reach. The ultimate possibilities of the electric current are not yet within sight, though, with the eyes of faith, we may guess at them. It may well be that the steam engine will be as obsolete as the horse gin before the twentieth gives place to the twenty-first century, and that the new machine will be in truth the heat engine towards which the first experimenters worked. Our views of the constitution of matter are in a state of flux, and though the highly abstruse questions involved in this may seem far removed from these technical questions which chiefly occupy us, they are no more remote than may have seemed the discovery by Oersted of the deflection of the magnetic needle by an electric current. Yet that discovery contained the germ of the electric telegraph.

And if I to-day look forward, as I picture that other man to have done a century since, what form might my guess of the future take? How in a hundred years will the great swiftly-gliding ship of those days be propelled? With little, or mayhap with no machinery on board, with barely any crew she speeds on her way drawn by the electric force generated at Niagara, and transmitted over the Atlantic by wireless telegraphy. She crosses to New York, takes her cargo, and returns as she came.

Strange as my forecast may seem, it is no more incredible than what has happened since 1807. The things which to us are commonplace would have been deemed impossibilities by our forefathers.

The world moves on in a succession of dreams and their fulfilment. The wild imaginings of one age become the splendid realities of the next, for

". . . all experience is an arch wherethro'
Gleams that untravell'd world whose margin fades
For ever and for ever when I move."

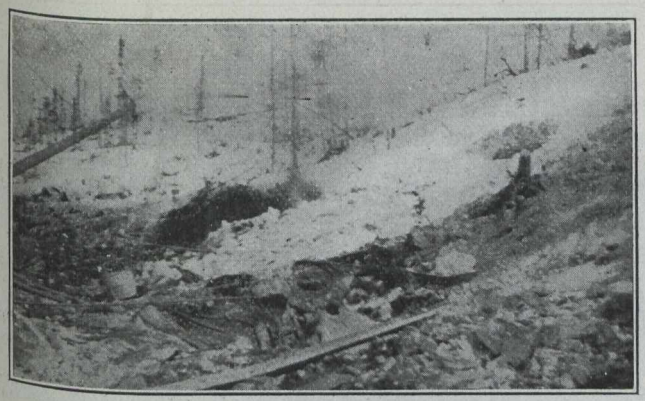
COBALT LAKE.

Cobalt Lake occupies an area of 51 acres in the heart of the Cobalt mining camp. The McKinley-Darragh location covers 3 1-2 acres of the southern end, and the remaining 47 1-2 acres are the property of the Cobalt Lake Mining Company, Limited. The company also owns a strip of 33 feet of land, half the road allowance, along the eastern side of the lake.

Early in the autumn of 1906 the Ontario Government announced its intention of selling to the highest bidder the mineral rights of Cobalt Lake. On November 22nd of the same year official announcement was made of the conditions of sale, and December 20th was set as the last day on which tenders would be received. The successful tender set the purchase price at $1,085,000. Of this amount about three-quarters was subscribed by an Ottawa syndicate, the remainder by Toronto and American capitalists. The whole amount was subscribed by about 670 persons. A marked cheque for $108,500 (10 per cent. of the purchase price) accompanied the tender.

A company was very rapidly organized, with an authorized capital of $5,000,000. Of this $4,000,000 was issued at once. Each subscribed to the purchase price received three shares of a par value of one dollar each, for each dollar of cash paid by him. This $3,255,000 allotment was made to the original subscribers. Brokerage and organization expenses amounted to $240,000. To provide for immediate development, $300,000 of treasury stock was issued. A considerable portion of this was taken up at 85 cents by members of the original syndicate.

During the latter part of the month of January, 1907, about one-quarter of the shore line was stripped. This work was necessarily unsatisfactory, on account of snow, ice and severe weather. In February, Mr. E. L. Fraleck

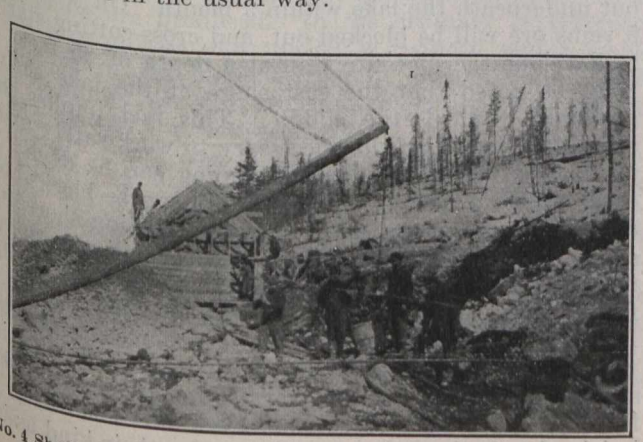


No. 4 Shaft Cobalt Lake, Beginning Sinking.

was placed in charge of the mining operations. Under his direction a force of 60 men continued trenching the frozen ground during the remainder of the month. Two veins were disclosed. North of the central part of the lake shore a smaltite vein two and one-half inches wide was disocvered, and a very high grade silver vein, about the centre of the shore line. The severity of the weather made continuous work impossible, but the results obtained by intermittent efforts were, at least, encouraging.

At present the entire shore line of the company's property has been partially stripped. On No. 1 vein a shaft has been sunk to a depth of 20 feet. On No. 2 vein, which consists of solid smaltite, varying from 2 to 6 inches in width, a prospect shaft has been sunk 40 feet. About 100 feet to the south of No. 2 an 18 foot shaft has been sunk of a 2 1-2 inch vein of niccolite, smaltite and calcite; and on No. 3 vein an 18 foot shaft has been put down. This vein is composed of solid niccolite and attains a maximum width of 18 inches. On No. 4 vein a shaft has been sunk to the depth of 80 feet. No. 4 carries good silver values and is composed principally of smaltite, niccolite and calcite, though considerable argentite, wire silver and occasional specimens of ruby silver have been encountered. On No. 5 vein a shaft has been sunk 80 feet. The vein varies from three to five inches and is composed of smaltite and native silver. No. 6, which is on the McKinleyDarragh line, has been sunk to a depth of 35 feet. It will thus be seen that a total of 291 feet of sinking has been performed, mostly by hand.

The shafts have a cross section of seven feet by ten in the clear, and are collared with a block skin to skin crib of hewn timber, affording a hoisting compartment five feet by five and a pipe and ladderway three feet by five. Below the collar the shafts are timbered with square setts in the usual way.



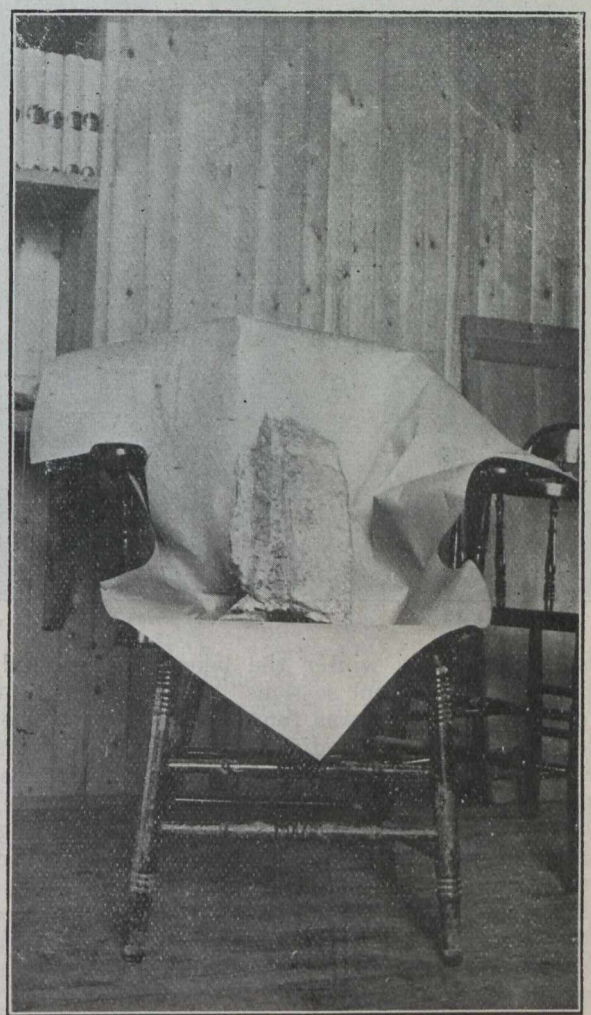
No. 4 Shaft Cobalt Lake, last week of February, 1997—Beginning Sinking.

In addition to these mining operations, the company has put up the following buildings:—

One cobbing house.
Two blacksmith shops.
One machine shop.
One oil house.
Compressor and boiler building.
Office building.
Eating and cook house.
Bunk house and stables.

All of these buildings are on the east shore of Cobalt Lake.

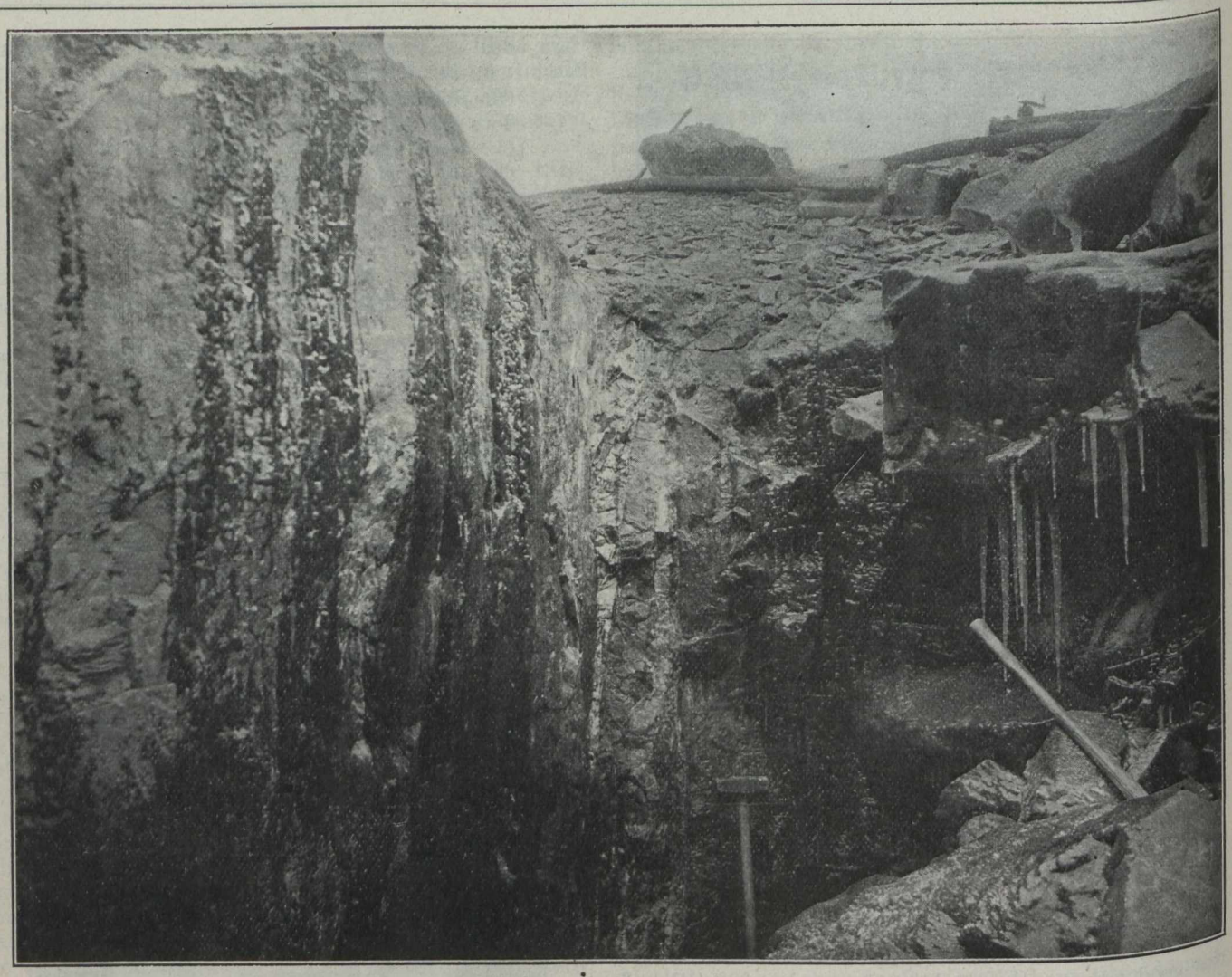
Two tubular boilers of one hundred horse-power each have been installed, and a fifteen drill cross compound air compressor will be in operation early in July.



Specimen of Niccolite Ore, Cobalt Lake, Showing Width of Vein.

Notwithstanding the depths attained in No. 4 and No. 5 shafts and their nearness to the lake shore, 23 feet in one instance and 15 feet in the other, it has not yet been found necessary to make any installation for pumping. No. 4 shaft, although it is over 70 feet below the water level of the lake, only makes about two barrels of water in a half-shift, and No. 5 about three barrels in the same period. These facts satisfactorily dispose of the apprehensions that water from the lake might be encountered in the early workings.

It is now the intention of the management to sink three main working shafts, one in the centre of the shore line, and one at each end. From these, when a suitable depth has been attained, the ground underneath the lake will be thoroughly prospected by means of drifts and cross-



No. 4 VEIN COBALT LAKE.

cuts. During the winter the lake was surveyed and laid out in in 66 foot sections. Soundings were taken at every 66 feet. It was found that the bottom of the lake is covered with a stiff clay, which will average a greater depth over the bottom of the lake than the actual depth of the water. This blue clay, it is supposed, will afford an impervious blanket, effectually preventing percolation, or seepage, from the lake into the underground workings.

The Cobalt Lake Mining Company has uncovered the continuation of the Nipising Cobalt vein, the largest cobalt vein in the camp. It has also struck the largest niccolite vein yet discovered. In addition to these, their three veins, Nos. 4, 5 and 6, are rich in native silver. Moreover, a continuation of the McKinley-Darragh veins

No. 5 Shaft Cobalt Lake, Middle of March.

into the lake may be counted upon. And all these do not exhaust the possibilities of the property. Most assuredly the property is well situated. It would be hard to pick out 47 acres in any other part of the camp, restrict the prospecting to a 33 foot strip and attain such results within a few months.

At present the company has on hand 20 tons of niccolite, which averages 25 per cent. nickle and 5 per cent. cobalt; 12 tons of smaltite, averaging 15 per cent. cobalt. There are also 9 tons of first grade silver ore and a considerable quantity of second grade ore sacked and ready for shipment. This ore has been obtained from prospecting and development only. Drifts will be started out underneath the lake within a month. On Nos. 4 and 5 veins ore will be blocked out, and cross-cutting started to develope the niccolite vein at a depth of 85 feet. It is to be noted that the east shore of the lake shelves gradually towards the middle. This fact implies that at a depth less than that necessary to work safely under the lake, a certain amount of stoping can be done. In other words, a limited amount of ore can be blocked out and won between the shafts and the shelving shore at a depth of, say, 100 feet; while in all probability work cannot be commenced directly under the lake until the 150 foot level is reached.

Mr. D. B. Rochester, of Ottawa, is managing director, with office at the mine. Mr. E. L. Fraleck is the mine superintendent, and all the work so far accomplished has been arranged and caried out by him. The writer is indebted to both of these gentlemen for their kind assistance and hospitality.

THE MacMURTRY-ROGERS PROCESS

Continued from May 15th Issue.

Moreover, it seems probable that the small amount of water present near the zone of combusion aids materially in the desulphurization, acting in some way as a carrier of oxygen from hot material to the cooler material near the hot material; the effect being to slightly increase the quantity of oxygen present and so cause more rapid combustion, with consequent increase of temperature. To take the simplest case first:—

In the desulphurization of regule, if attempting to desulphurize this when dry and in a converter, very little action takes place; if water is added, metallic copper is readily produced. It was proved, in 1904, that this reaction takes place readily at a temperature just below the melting point of copper, as is evident from the porous structure of the product, which cannot have been completely fused.

Gautier* has recently observed this reduction of copper from cuprous sulphide by water vapor, but at a *white* heat; he formulates the reaction as:—

$$Cu_2S + 2\,H_2O = 2\,Cu + SO_2 + 2\,H_2.$$

This may possibly be the only reaction when only water vapour is present. When air is also blown in, sulphate of copper and oxides of copper can be shown to be formed in large quantities; these react with unaltered sulphide in the well-known manner. It seems also possible that some hydrogen peroxide may be formed thus:—

$$Cu_2S + 2O_2 + H_2O = Cu_2O + SO_2 + H_2O_2.$$

This hydrogen peroxide may quickly decompose at a lower temperature and give rise to a rapid evolution of heat at the point where it decomposes; owing first to the increase in the percentage of oxygen in the gas mixture at that point; and second, to the heat given out in the decomposition of the hydrogen peroxide. Any hydrogen formed by Gautier's reaction will burn higher up the charge and so transfer heat from the zone of combustion; some hydrogen appears to burn at the surface of the charge fairly long, and hot flames are seen above the hottest points on the surface.

The above conclusions have not, so far, been definitely proved, but have served very well as a working hypothesis. One can, however, be quite sure, from the nature of the product, that the ordinary reactions between oxides and sulphides and sulphate of copper can be carried out without melting these substances or the copper produced.

If the cuprous sulphide contains nickel sulphide, very little nickel is reduced, although both nickel oxide and sulphate are produced. In the ordinary reverberatory roasting process some nickel is reduced and a smaller amount in the bessemerizing of molten copper matte containing nickel. It seems to follow that the maximum temperature for the reactions—

$$2\,NiO + NiS = 3\,Ni + SO_2 \text{ and}$$
$$Ni\,SO_4 + NiS = 2\,Ni + 2SO_2.$$

is well above the melting point of copper; whereas the equivalent reactions with the copper compounds readily take place at slightly below this temperature. Steinhart has pointed out that it is not possible to reduce molten nickel sulphide by blowing air through it, as nickel silicate is produced.* In this process the nickel oxide and sulphate produced in the blowing operation readily form silicate when the product is melted down on a sand bottom, and give a slag with considerably more nickel in proportion to copper than is the case with the regule under treatment.

When a mixture of sulphides of copper and iron is treated, desulphurization proceeds rapidly if both water and silica are added, but not at all if either of these constituents is absent. Gautier states (*loc. cit.*):—

$$3\,FeS + 4\,H_2O = Fe_3O_4 + 3\,H_2S + H_2.$$

and also that

$$2\,Fe_2O_3 + 7\,H_2S = 4\,FeS + 3SO_2 + 7\,H_2.$$

when air is used in addition it is obvious that this hydrogen will burn, as also will the H_2S. It seems as if Fe_2O_3 is only a product of the reaction where the temperature is low. In a well-burnt charge of matte or ore, in this process. Fe_2O_3 is only seen at the side and top of the cake, that is where it has been cooled by radiation. If Fe_3O_4 is formed, one can understand that it readily parts with 1 atom of O, giving FeO—thus:—

$$Fe_3O_4 = 3\,FeO + O.$$

This atom of oxygen would help in the oxidation of FeS, and

$$FeS + O + O_2 = FeO + SO_2$$

The latter reaction would be very intense and may be a factor in heating up the particles to the point at which FeO and SiO_2 combine. This reaction is very important, and gives rise to a further evolution of heat, and any small portions of ferrous silicate formed will, in consequence, enhance the action in the neighborhood. In practical work, this formation of ferrous silicate and consequent sintering, can be seen extending outwards from the centres where the silicate formation first takes place. In this connection it is quite possible that water also acts as a carrier of oxygen by the alternate formation and decomposition of hydrogen peroxide, thus:—

$$FeS + H_2O + 2O_2 = FeO + SO_2 + H_2O_2$$
$$FeS + H_2O_2 + O_2 = FeO + SO_2 + H_2O.$$

and it seems possible that wherever oxidation takes place at a high temperature in the presence of air *and* water vapor, when the reaction requires an odd number of atoms of oxygen the other atom of oxygen from the molecule or molecules of oxygen will combine with water to form H_2O_2. This view has been brought forward by Armstrong and others in connection with the oxidation of carbon and carbonic oxide.

In the treatment of ore by this process the reactions involved are very similar to those occurring with matte, except that the passage of the zone of combustion upwards is preceded by the distillation of sulphur from pyrite and chalcopyrite. This sulphur must be allowed to escape to some extent, otherwise it interferes with the progress of the reaction by forming a viscous layer of ore and molten sulphur. With both ore and matte charges the time factor is very important.

The reaction must proceed so rapidly that, at the zone of reaction, a sufficiently high temperature is kept up for the formation of ferrous silicate; otherwise ferric oxide is formed and decreases the amount of active oxygen in its neighborhood, when a diminution of temperature takes place, and causes a patch of unsintered material to be formed. If much Fe_2O_3 is formed at any point it does not appear possible to reduce it. The formation of ferrous silicate aids very materially in getting a product low in sulphur, as well as in sintering the material; for it probably acts as a carrier of oxygen to any particles of ferrous sulphide that may be originally included in it.

*Abstracts Jour. Chem. Soc., 1906, p. 548.

*Trans. Vol. XV., p. 233.

THE VALUE OF A MINE.

By J. B. Tyrrell, Mining Engineer, Toronto, Ontario.

What is the value of a mine? Probably most people to whom this question would be put would simply answer: "Just what can be got out of it."

But let us suppose that the purchaser is guided by rational business principles, and that he is buying a mine, or stock in a company owning a mine, as a good permanent investment.

In deference to prevailing conditions it will be assumed that the mine under consideration is owned by a joint stock company, and that the shares in this company can be purchased freely on the stock market.

The first point to consider, then, is how much money will the mine yield in dividends; and this is dependent on a number of conditions, such as:

1. How much marketable ore does it contain, or can be extracted from it? 2. How much will it cost to extract this ore? 3. What is its value at the mouth of the shaft? 4. What is the value of the plant and property, after all the ore has been extracted?

These are questions that the mining engineer must answer to the best of his ability. But after they have been answered as well as possible under all the known conditions, the further question remains to be answered: What is the present value of the property when a rational estimate has been obtained as to what dividends may be expected from it? It is to this latter question that some attempt will here be made to offer an answer.

It is probable that the majority of men who purchase shares in mining companies regard them in very much the same light as shares in other companies, with the added attraction of unknown possibilities in the form of new but usually very improbable discoveries of pockets of rich ore. The fact that investments in these two forms of companies are inherently different is generally disregarded.

Stock in transportation companies, banks, loan companies and industrial enterprises, if the companies are properly managed, may be expected to increase in value from year to year with the natural and regular growth of business. Thus, a company whose stock was worth par ten years ago may easily be worth 2 to-day, and ten years hence, with the natural enlargement of its business, it may be worth 4. For instance, stock in the Canadian Pacific Railway is worth four times what it was twenty years ago, even though additional stock has been issued to the shareholders on favorable terms in the meantime, and with the natural growth of the country the traffic and general business of this railway must still vastly increase, and the stock will become of still greater value.

Industrial enterprises might be cited to the same effect. The manufacture of agricultural implements has greatly increased in the past twenty years, and stocks in the manufacturing companies have correspondingly increased in value. There is no reason to suppose that the limit of this increase has been reached or approached. In fact there is every reason to believe that the value of these stocks will continue to increase with the continued increase in the volume of business.

But mining investments to be successful must be made on a different basis. Instead of increasing the mine is decreasing in value with every ton of ore taken from it, and the company owning it is living or deriving its profits in the using up of its capital.

When a man invests in railway or industrial stocks he feels that in the ordinary course of events and with the normal growth of business the value of his stock is sure to increase, so that when he wishes to sell he can get a little more than his original capital back again, and he consequently feels satisfied with a rather low rate of interest. He also feels that both his capital and interest are reasonably secure. There is no thought taken or no provision made for getting the capital back in a certain number of years, for the enterprise is intended to be carried on indefinitely.

A mine, on the contrary, not only decreases in value year after year as the ore is extracted from it, but production will cease altogether after a certain number of years, for the life of a mine is usually short. Dividends will then be things of the past. The investor in mining stock is therefore confronted with this condition, that he must look for the return of his capital along with proper interest on it within a limited number of years. Any investment in mining stock which does not provide for such repayment of capital is certain to be disastrous to the investor in the end. The dividends must include a sinking fund to replace the capital and interest at a rate commensurate with the risk incurred.

When this principle is thoroughly understood that dividends of mining companies must provide for the redemption of capital, as well as for payment of interest, the next questions that present themselves and the demand answer are: How many years should be allowed for the repayment of the capital, and therefore what percentage of it should be repaid each year in the dividend? And in addition to this, considering the possibilities of failure of the enterprise altogether, what interest should be looked for on the investment?

(To be Continued.)

NOTES ON THE MINERAL FUEL SUPPLY OF CANADA

By R. W. Ells, LL.D.

(Abstract of paper read before the Royal Society of Canada.)

(Continued from Page 212.)

The carefully detailed work of Mr. Hugh Fletcher has revealed the existence of a possibly important coal basin southwest of Springhill, along the north flank of the Cobequids. A coal seam was struck by boring, at the depth of 2,000 feet.

Small seams, such as those at Debert, outcrop on the south side of the Cobequids in formations other than the productive coal measures.

The Province of Prince Edward Island does not show the presence of any coal seams. Since all the rocks of the island are Upper Carboniferous or Permian, coal if existing at all, must be sought for at a great depth. There are, however, several peat bogs of excellent quality.

In New Brunswick the Carboniferous rocks have a very wide distribution and comprise an area of more than 10,000 square miles. At many points throughout this area thin seams outcrop, and near the upper end of

Grand Lake, where the coal appears to have the greatest thickness, it has been mined for nearly a century. The main seam is 20 inches thick; but in places where two seams unite a thickness of two and one-half feet is observed. The annual output amounts to about 40,000 tons. Boring operations have been carried on throughout the coal basin for over sixty years without finding any seam better than this.

At various points in New Brunswick, outside the limits of the principal coal basin, small seams of coal are found, some of which belong to a different horizon. Among other sources of fuel supply in this Province must be mentioned the Albert shales and the associated mineral, Albertite. Rich beds of oil shale, styled Cannelite, also occur as interstratified beds in the mass of this shale. The Albert shale formation has a thickness of over 1,000 feet. The strata are usually highly inclined, and there are numerous faults and occasional overturns. The Albertite occurred in the mass of this shale near the axis of the anticline, as the filling of a true fissure having a width varying from a few inches at the ends to about seventeen feet in the centre, decreasing in depth to the bottom of the deposit about 1,500 feet from the surface. The vein showed several faults, the mineral being thrown from side to side. It was mined to a depth of over 1,200 feet, when it assumed a brecciated structure, fragments of shale being cemented by the Albertite. These shales are regarded as of Devonian age.

Massive bands of grey and black oil shale from three to twenty feet thick, interstratified with the bituminous shale, yield from thirty to eighty gallons of oil per ton. They are readily inflammable, and though the ash is very high (45 to 60 per cent.) they evolve a great heat. In ease of extraction and in percentage of oil contained, these shales are superior to those mined in Scotland. The main vein was worked for twenty years. It yielded 204,000 tons before exhausted.

Comparing the beds of Cannelite with true cannel coals, it may be remarked that with the exception of the large amount of ash in the former there are strong points of resemblance. The associated Albertite is a highly altered petroleum, analysis showing the merest trace of ash.

Coal does not occur in Quebec in commercial quantities, but the development of the peat industry in this Province. as well as in Ontario, bids fair to furnish for certain purposes a fuel which will to some extent supply the absence of beds of true coal. The development of the peat bogs in the country between St. Johns and Farnham, and also near Bulstrode, Arthabaska County, was begun about forty years ago. Being uncompressed, the peat was not suitable for railway work. But now peat, after extraction of the contained moisture down to 12 or 15 per cent., is compressed into small cylindrical blocks having almost the hardness and consistency of coal. Peat bogs are extensively developed in many portions of the Province, and the manufacture of the compressed fuel has reached the stage where the demand exceeds the supply, and it readily sells at a good profit on the cost of manufacture.

In Ontario true coals are nowhere found; but deposits of anthraxolite and lignite occur, the latter in large quantities in the area south of James Bay. This lignite of the Moose River basin is found in Post Tertiary deposits of sand gravel and boulder clay, instead of in solid rock formation, as is the case with the lignites of the west. The seams are of considerable thickness and the lignite when dry burns readily. It is of brownish-black color, and burns freely in an open fire. It cannot, however, compare with the Tertiary lignites of the west. The lignite and peat deposits have not as yet affected the importation of coal.

Petroleum was first discovered in Ontario in 1860. The subsequent finding of immense quantities of natural gas added largely to the light and fuel resources of the Province. The original field from which Ontario petroleum was first obtained is still a producer, though the supply in recent years has materially decreased. The discovery of natural gas about fifteen years ago in the place where petroleum was first known, and later in the Niagara Peninsula, has largely affected the coal consumption in some districts. Not only have local requirements been met, but immense quantities of gas have been piped to Buffalo and Detroit, on the American side.

In the western half of the Canadian section, beginning with the great plain of Manitoba and extending across to the shores of the Pacific ocean, many of the rocks over large areas comprise Cretaceous and Tertiary sediments. In these the greater part of the coals of the western division are located. In Manitoba and throughout the great plains east of the Rocky Mountains, and extending northward down the valley of the Mackenzie River to the Arctic Ocean, the rocks are largely of Cretaceous age. The district is underlaid in many places by large beds of lignite. Outcrops are seen as far east as Turtle Mountain in Manitoba; and along the North Saskatchewan as far as Victoria these lignites are seen, sometimes in beds of great thickness.

Passing west into the foothills of the Rockies, as at Banff and as far south as Crow's Nest Pass, the lignites change their character and pass into lignitic coals, bituminous coals and anthracites. Of this wonderful series of coal beds, which at Crow's Nest is 200 feet in thickness, many seams are large and of superior quality.

(To be Continued.)

The Hon. the Minister of Mines has authorized the preparation of a report on the mining and metallurgical industries in Canada, embodying the following information: Name of company, date of incorporation and charter, authorized capital, value of shares, directors and officers, head office, Canadian office, number of men employed, wages, transportation facilities, market and prices. The following additional information is sought regarding the mining industry: Mining land owned and controlled, class and character of ore mined, average quality of ore(analysis, method of mining, treatment of ore, if any cost, cost of mining, drilling, explosives, hoisting, transportation, general expenses), total cost per ton of ore raised. For the metallurgical industry the following information is asked: Location of plant, ore treated, quality of product, method of treatment, description of machinery and apparatus used, source of supply of raw material, composition of raw material, cost of production. It is proposed to report only upon producing mines, mines under development and established metallurgical plants. The present rapid progress in and the changing conditions regarding such factors as labor, market and prices will necessitate supplementary annual publications to bring the information of the original report up to date until the changes and new material call for the issuance of a complete new report.

THE COBALT MINING DISTRICT.

By Dr Robert Bell, F.R.S., Ottawa, Ont.

(Toronto Meeting, 1907.)

In the present paper the writer proposes to confine his remarks mainly to some points in connection with the geology of the Cobalt district and the nature of the metalliferous deposits, the most important of which are those of silver.

The silver-bearing area is comparatively small, the most productive portion, so far as known, not exceeding about fifteen square miles, although fresh discoevries are being made, some of which tend to increase the area. The general appearance and the physical characters of this area are similar to those of the region which surrounds it for many miles. It is an undulating, rocky, forest-clad district, with numerous small lakes among the hills, which latter are not high or conspicuous, the general aspect, on the large scale, being that of a mammillated peneplane.

The centre of the productive area is about three and a half miles west of Lake Temiskaming, in latitude 47 degrees 30 minutes. The rocks within the above fifteen square miles belong to the series, all of which was formerly called Huronian.

A few words of explanation may here by advisable in reference to the history of the Huronian system, and the evolution and nomenclature of the divisions which are now more or less recognized by geologists. It is well known that some sixty year sago the whole of the upper series of the azoic or archaean was called Huronian. This was before discovery had advanced sufficiently or geologists had had time to properly classify and sub-divide the great series of crystalline rocks overlying the Laurentian, which Logan and Murray had already found in the region of Lakes Huron and Superior.

It required much time and labor to ascertain the general nature, the importance, the geographical extent and distribution, the volume and the probable natural divisions of the system. While the whole series may be described as of a pyro-clastic type, an igneous character prevails towards the base and the sedimentaries become more and more abundant and diversified towards the top. The underlying igneous type has been called the Keewatin division, while the term Huronian has always been applied to the higher portions, and this may be again separated into the lower and upper Huronian, although no continuous dividing line has been established.

One of the characteristics of the Huronian proper is the want of continuity of any particular belt or division. The lithological divisions which may exist in one district all thin out and terminate in both directions, and gradually become interlocked or dovetailed with new formations which gradually introduce themselves from both sides. In other words, a general cross section of the Huronian, covering a considerable distance, would show a series of interlocking lenses of different rocks, which are gradually replaced on the strike by other kinds. For this reason an identity or difference in any set of these rocks in widely separated localities is no criterion as to a ismilarity or a difference in age.

The recognized Keewatin rocks of the Lake of the Woods lie at a distance of seven hundred and fifty miles in a straight line from the Cobalt district, and the two formations have not yet been separated from each other in any part of the intervening distance, in the course of which the Huronian areas are broken up and separated by wide intervals of the Laurentian. Too much stress, therefore, should not be laid on differences of age which are supposed to exist among the rocks of the Cobalt district. It may be better to defer an exact separation and classification until some general work in this line has been done over this great interval and until this whole subject is better understood. It is worthy of notice that some persons who make frequent use of the word Keewatin apparently believe that it is a lithological term, like conglomerate, diorite, slate, etc., and could point out where a few yards of it might be seen. The writer should here observe that he has done no work personally in the way of mapping out and classifving the rocks of this district, and as the geologists who have been engaged upon it do not agree, it might be better for the present to confine our geology to making as correct a petrographic map as possible, which is all the prospector or the miner requires, and leaves the classification to be determined later on.

The silver-bearing rocks have so far been found to consist of massive or crystalline diabase, but more especially of a volcanic breccia or agglomerate having a bluish and grayish matrix consisting of hornblende porphyrite, while the contained fragments are mostly reddish and grayish granite, together with others of the porphyrite itself and various forms of greenstones. The fragments are generally of rather small size and mostly angular or subangular, although in some parts many of them are more or less rounded. They stand at all angles in the mass and are very irregularly distributed; sometimes well scattered throughout considerable volumes of the rock, sometimes occurring in large and small bunches or "flocks," or they may be sparingly distributed or almost entirely absent. This agglomerate has a general horizonal attitude and is the rock which is most in evidence at the surface in the more productive parts of the district. Associated with the two kinds of rocks which have been mentioned are fine-grained drab and gray slatey rocks and dark and light colored greywacke, passing into impure quartzite. These also lie horizontally or conformably with the great sheet of brecciated hornblende porphyrite.

In the Cobalt district itself, the brecciated rock extends beyond the silver-bearing area and the same breccia occurs abundantly on Lake Temagami, around Rabbit Lake, and in other parts of the region, but holding little or no silver, as far as known. The presence of the silver at Cobalt would therefore appear to depend upon an original local impregnation of the parent breccia and diabase with the metal. It would therefore appear to be a mistake to suppose that silver is to be looked for wherever the breccia is found. The occurrence of the silver in the Cobalt district appears to be regional and to be confined (with some exceptions) to a comparatively small area. This is not the only example we have of these local occurrences of a certain metal. The great abundance in this same locality of the hitherto rare and expensive metal, cobalt, affords another example of this phenomenon. The immense deposits of nickel, within a very limited area at Sudbury and in New Caledonia on the opposite side of the planet, belong to this mode of occurrence. In various parts of the world, some of the other metals, such as tin, mercury, platinum and manganese, exhibit the same tendency to regional limita-

tion. Only the other day it was announced that the hitherto rare metal tantalum had been found in great abundance at a single spot in Australia The cause of this local or circumscribed occurrence of certain metals has not yet been explained, any more than the reason why the specific gravity of the whole earth is more than twice as great as that of the average materials which form the crust. The latter fact is probably owing to the existence of various heavy metals at great depths and the former to the occasional ejection of one or more of these from great depths, especially during early periods of the earth's history.

Some of the shafts in the Cobalt district have been sunk in the agglomerate and the associated slatey ash rock and arkose, and this rock formation is supposed to have a total thickness of upwards of three hundred feet. It is traversed by two sets of vertical joint planes, recalling the jointed structure of argillites, clay slates, etc. One of these sets has an average course of northeast southwest and the other is at right angles to this. The silver-bearing part of the district is also traversed by fissures or planes of disturbance, along which, from time to time, the rocks were crushed by slight movements, under great pressure, forming spaces in which mineralizing waters could rise from considerable depths. The agglomerate and perhaps the whole of the crust of the earth to the very surface would probably have an elevated temperature at that time, while the waters from a depth would be still hotter. On approaching the surface they would be relieved of pressure and somewhat cooled.

The reason why some mining men, on visiting the district in the earlier days, did not appear to be favorably impressed, seems to have arisen from the fact that nearly all the veins were small; few of them were well marked or continuous for any considerable distance. In fact, most of them lacked the typical character of good fissure veins of the ordinary kind. When development had proceeded far enough and a sufficient number of openings had been made to enable one to properly observe the phenomena, it became evident that the supply of ore did not depend upon the individual small veins, but that there was some more general kind of mineralization. This the writer believes to be connected with the above planes of fracture or disturbance which are more continuous and deeply seated than the small individual veins on and near their course. The fisure plane may, in places, be indicated by only a small vein or a dry fault without any vein matter or gangue, but the wall rock itself along such sections of the general rent will often be found to be rich in silver for some inches or even a foot or two inward from the line of fracture. Small cracks and branch veins running out from the main fissure may carry the silver to a great distance into the country rock.

If the above view be correct, a continuous production of the silver is to be looked for by following these vertical zones of crushing and disturbance. Among these planes, the temporary formation and subsequent breaking up of veins, from time to time, was only one of the phenomena of their history. In some instances especially where the line of fracture has been nearly straight, the vein or group of veins has not been thus broken up, but has preserved its contiuity for some distance and has become enlarged or has produced new parallel veins by widening of the fissure. La Rose vein or group of veins appears to be of this character.

On the other hand, there are usually many minor irregularities in both the horizontal and vertical course of the lines of dislocation, and at any new movement of the walls there would be a fresh breaking up of the materials which had accumulated along these lines and new spaces would be found for further mineralization. This repeated brecciation has resulted in what we now see in the "mines" opened on these lines of disturbance. Both the vein matter and the wall rock are much split and broken up; dislocated fragments are cemented together along lines of small faults and there are many miniature horses surrounded with the cementing gangue. Secondary dislocations, branching from the main one, are often rich in silver, which may also penetrate into the shattered wall rock and form a body of rich ore, even if the vein matter be of inisgnificant amount or altogether wanting. The foregoing explanation of the formation of the mineralized zones and of the mode of occurrence of the silver in the Cobalt district was given in the writer's report on the district, published in the Summary Report of the Geological Survey for 1905.

The volcanic nature of the fragmental rock of the Cobalt district is manifest both in fresh fracture, and on every weathered surface. One of the localities where this is particularly convincing is the south-facing slope of the hill near opening 12, 13, 15 and 21 of the Nipissing Mines Company and not far from the power house at the shore of Peterson Lake, on lot R. L. 404. Here the rocks have been well exposed by recent hydraulic washing and show very distinctly their volcanic or plutonic character. Areas of different varieties of diabase and agglomerate are mixed together and cut by dykes which have evidently been formed before the masses which they traverse had been completely hardened by cooling. At the contact, some of the dykes became amalgamated with the rocks they penetrate and have no sharp line of division. The smaller dykes are in some instances broken and interrupted, as if by the movement or flow of the semi-fluid mass into which they had been intruded. The weathered surfaces of different adjoining small areas of the diabase present different shades of color and different degrees of texture. Some of the brecciated parts show large inclusions; some are irregularly charged with the brecciated debris, while other parts are quite free from it. A cherty rock, having lines of foliation, is associated with the foregoing. A few small veins containing smaltite and argentite traverse the diabase and the agglomerate at this locality. Lines showing limited faulting or dislocation also occur in these rocks.

Up to the present time, twelve or more different metals, either native or combined with one another or with other elements, have been found in these rocks, and this fact alone would point to an igneous rather than a sedimentary origin of the matrix.

In connection with the supposition that some of the rocks of the Cobalt district may be co-related with those which have been called Keewatin, at the Lake of the Woods, and the unfounded theory that the Keewatin rocks are not argentiferous, the fact may be mentioned that the leading feature of these Lake of the Woods rocks is the prevalence of greenstones. having a concentric spheroidal structure. On the Lawson property, which lies immediately southwest of Kerr Lake, the writer found, near the centre of the lot, an exposure of a dark greenish gray, rather fine-grained diabase, having a conspicuously concretionary structure. The sections of the spheroids are nearly circular and vary from six inches to three feet in diameter, the average being two feet. This rock is here cut by a well-defined vein of smaltite with silver, and several other silver-bearing veins occu rin the immediate vicinity.

The foregoing opinions as to the Cobalt district have

not been formed as the result of a single visit to the camp, but have been gradually matured by five different visits to the district. There is a great advantage in paying repeated visits to any locality of geological interest. In the intervals between examinations one has time to think over what he may have seen and to consider points on which he requires further evidence in order to clear up uncertainties or doubts.

EXCHANGES

The Coal Trade Journal for June 5th contains a leading editorial "The State of Trade."

The Mining Journal, June 1st, contains its usual valuable summary of the world's doings in mining.

The Maritime Mining Record, June 12th, opens with a short paper on "Coal Dust," which discusses the explosion of coal dust, in the absence of fire-damp.

The Journal of the Franklin Institute for June contains a paper on "Change of Structure in Iron and Steel," by W. Campbell, Ph.D., of Columbia University.

The Iron and Coal Trades Review, May 31st, takes up "Coalite," the new smokeless fuel. Apparently "Coalite" has failed to substantiate the claims of its promoters.

The Iron and Coal Trades Review, June 14th, devotes a page to the new fuel, "Coalite." The analysis of "Coalite" is stated to be: Carbon, 80.00 per cent. volatile matter, 12.00 per cent.; sulphur, 1.00 per cent.; ash, 7.00 per cent.

In *Fuel* for June 11th there is an article on the application of Texas lignites to the production of power by producer gas methods. It is stated that a ton of lignite will produce 90,0000 cubic feet of gas at a delivered cost of not more than 1 cent per 1,000 feet.

In *The Mining World,* June 22nd, Ralph Stoke continues his article on "The Tasmanian Tin Industry." A third paper on "British Columbia Placers," by Horace F. Evans, gives evidence of very intimate acquaintace with the alluvial gold deposits of that Province.

In the Mining Reporter, June 6th, C. C. Lane writes of "The Development of Chilian Mills." Of the Chilian mill the writer says: "When stamps reduce to one-quarter inch they can be credited with three-eighths of the duty, and the Chilian mill is entitled to a credit of five-eighths.

The Engineering and Mining Journal, June 8th, opens with a strong article on the "Metallurgy of Aluminium in 1906" The writer is Professor Joseph W. Richards. He states that the capacity of aluminium reduction plants will be enlarged very considerably during 1907 and 1908.

The Colliery Guardian, June 14th, contains another instalment of "Evidence Taken Before the Royal Commission on Mines." Watering of coal mines to obviate coal dust explosions was the subject of a great deal of the evidence taken. In a certain Welsh colliery the actual cost of watering was 1.72 penny per ton. This included the cost of all fixtures, etc., and of hauling water in tanks.

The Mining Journal, June 15th, in commenting editorially upon the Indian Geological Survey Report for 1906, notes that there is in India "a disposition to turn to the mineral occurrences promising the requisite raw material for the creation of local industries, for the success of which the great home market and abundant cheap labor afford good prospects. Such a result, while satisfactory to the country, is bound to diminish the interest felt by European mining capital in India."

The Mining and Scientific Press, June 8th, has an article on "Acid Flotation Processes at Broken Hill." The Broken Hill ore assays 16 per cent. lead, 15 per cent. zinc and 11 ounces of silver. Formerly only 65 per cent. of the lead and between 45 and 50 per cent. of the silver were saved. A recovery of 80 per cent. is now possible. The ore consists of an intimate mixture of galena, blende, rhodonite, garnet, quartz and calcite.

The Engineering and Mining Journal, June 22nd, opens with a very interesting account of the "Medical Department of the Colorado Fuel & Iron Company." This company maintains, besides the magnificent Minnequa Hospital at Pueblo, with accommodation for 210 patients, a dispensary at the Minnequa steel plant, two emergency hospitals in remote camps and dispensaries and resident surgeons at all its properties.

The Mining Journal, June 8th, in a capable editorial takes up the annual report of the Egyptian Department of Mines. An excerpt from the report speaks thus of blanketing: "The large concessions that exist in the hands of a limited unmber of people incapable of developing them still form a big obstacle to the opening up of the country. However, by the end of 1907, nearly all of them terminate, and it is anticipated that considerable local interest will then be taken."

The Mining and Scientific Press, June 15th, in a vigorous and characteristically incisive editorial on "The Trial at Boise," discusses the "orgy of brutality" which led up to the trial. "We venture to attribute it, as we attribute many other ills from which we suffer, in the very midst of a triumphant industrial progress, to the absence of a strong public opinion in support of the law." Any excerpt fails to reveal the strong, judicial spirit of this editorial. It is most worthy of careful perusal.

South African Mines, Commerce and Industries for April 6th demonstrates the advantages accruing to the users of the tube mill as an accessory to the stamp mill. The manager of the Rand Mines group reports that the 23 tube mills employed by the mines under his charge have increased the duty per stamp from 5,170 tons per day in 1905, to 5,672 tons in 1906. The extraction was increased from 89,877 per cent to 93,858 per cent. The reports of individual companies of the Eckstein group confirm these figures.

The Science and Art of Mining, June 15th, gives the first instalment of a very interesting article on "Coal Mining in the United States." The writer's point of view is British. "The only sphere in mining in which they (Americans) surpass the British is in the use of mechanical coal-cutters." Referring to haulage, the article continues to this effect: "Haulage is mostly accomplished by mules and electric and compressed (air) locomotives, very few endless ropes or main and tail rope installations being at work. Mule haulage in small mines may be cheaper, and for the time being efficient, but in a large mine mules are nothing but a costly nuisance . . . In the State of Illinoise alone, and it is typical of the Republic in this respect, 80 per cent. of the mines use all mule haulage . . . At some of the mines the treatment of the mules is cruel and inhuman."

Canada' Mineral Exhibit at the Dublin International Exhibition.

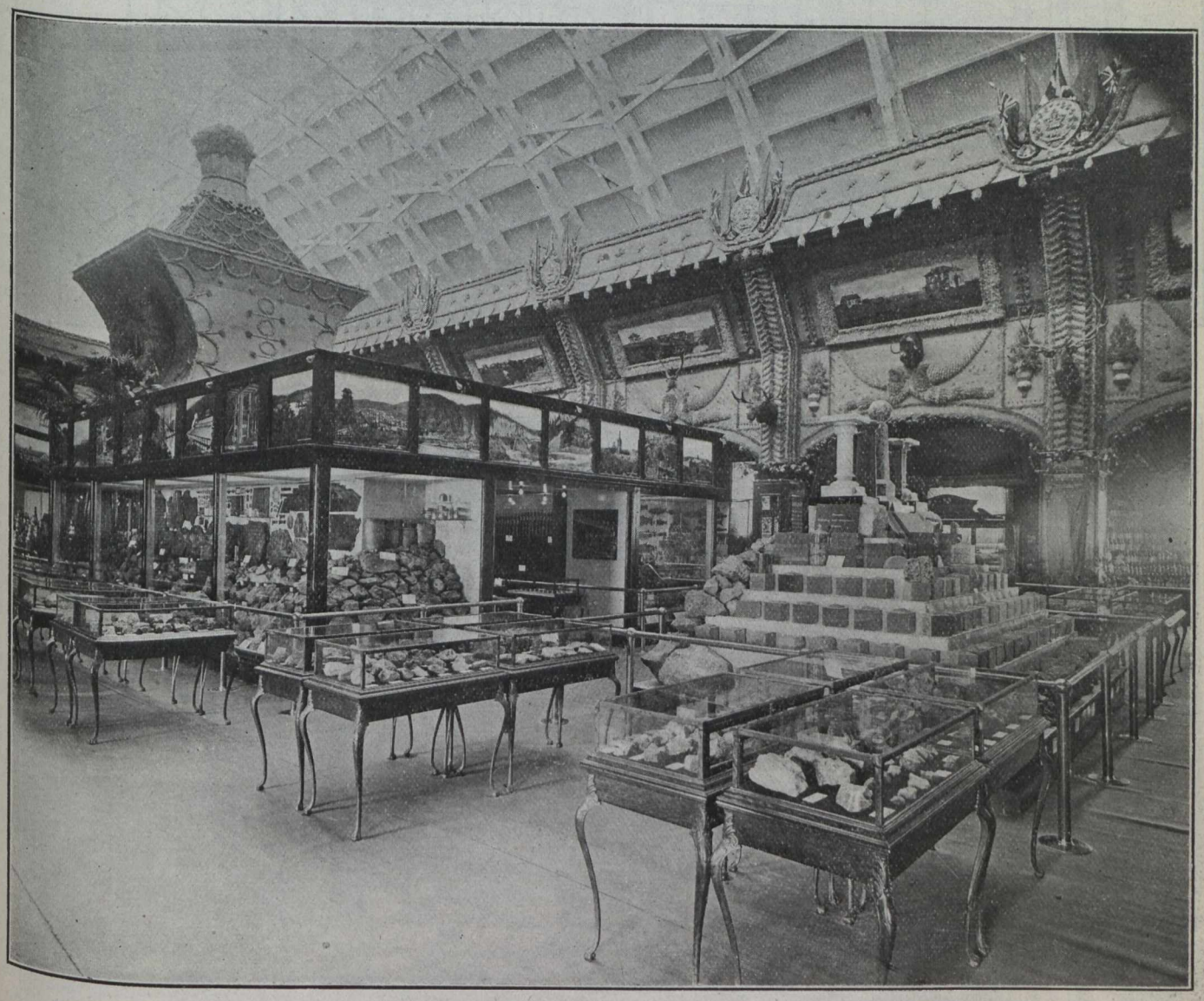
(Contributed.)

The mineral resources of Canada are graphically illustrated by the mineral exhibit in the Canadian Pavilion, in connection with the Irish International Exhibition, now being held in Dublin, and are a source of great interest to a number of European mineralogists in attendance at the big Irish Fair.

Geological and mineralogical authorities who were studying the Canadian mineral resources agree with the Canadian authorities that the mineral wealth of Canada, up to the present located, is small in proportion to the value, variety and number of deposits that remain to be discovered, and are not surprised that every year a new crop which makes individuals rich and adds to the general wealth of the nation is discovered, sufficiently important to arouse the interest of the world.

The discovery of gold in the Yukon, in 1897, the immense wealth of silver at Cobalt, in Northern Ontario, and likewise the deposits of the gold, silver, copper and immense quantities of asbestos at Chibougamoo, in the Province of Quebec, have set the European students of mineralogy thinking.

The mineral exhibit in the Canadian Pavilion at the Dublin Exhibition is quite large and comprehensive. There are 1,049 different exhibits, including a large display of cobalt, nickel, arsenides and silver ores of Ontario, together with asbestos, mica and corundum, which are the chief exhibits. There are fifteen exhibits of the manufactured products of corundum selected from the industrial centres of England, France, Germany, Belgium, Russia and the United States, that use the corundum ore, and goes to demonstrate its general use. In fact, all the Canadian ores are well represented.



CANADIAN MINERAL AND METALLURGICAL EXHIBIT—DUBLIN.

The exhibit also contains Canadian anthracite and bituminous coal. Building and ornamental stone are

very complete, with special interest taken in the display of granites. The gold exhibit in quartz and dust, from the Yukon, British Columbia, Quebec and Nova Scotia, represent 125 specimens that show the wealth of the country. An exhibit of pig iron produced by the Electro-Thermic process is very interesting to the European scientist, and shows the great possibilities in the iron ore deposits of Canada.

CANADIAN BUILDING—IRISH INTERNATIONAL EXHIBITION, DUBLIN.

CANADIAN MINERAL EXHIBIT—DUBLIN.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

Glace Bay, 10th June, 1907.

The Dominion Coal Company have just acquired a Dräger breathing apparatus, and are purchasing nineteen more, making an equipment of twenty sets, with the various oxygen cylinders, refill pumps, and the necessary accessories. Their intention is to erect a rescue station on European lines, and they will train men in the use of the apparatus. This is, we believe, the first modern apparatus of this kind that has been imported into Canada for use in mines. (A full description of the apparatus is to be found in the issue of this JOURNAL, dated 15th April.) The matter of the provision of life-saving apparatus of this kind is at present engaging the attention of a Royal Commission in England, and very recently the United States Government sent over a representative to study the German and French stations on the ground. There is without doubt a pressing need for some such provision in the mines of this continent, and the Dominion Coal Company are to be congratulated on their wise initiative. Many lives have already been saved in European mines by the use of breathing apparatus, and although at the memorable catastrophe of Courrieres the Westphalian Rescue Corps arrived too late to save any lives, yet they rendered very valuable assistance in reopening the mines and removing the dead. Since then breathing apparatus of several types havs been used in mine explosions, and one doubts whether any modern mining company can afford to be without them.

The work of reopening the Hub Mine is progressing satisfactorily, in spite of the delay which has been occasioned by the destructive nature of the mine water. The mine is being cleaned up underground, and very little damage appears to have resulted from the flooding. The fire affected mostly the upper workings, which are old and practically exhausted, and did not travel to the deep. It is hoped that hoisting will be resumed towards the end of August. The surface erections are rapidly nearing completion, and the re-screening plant for the central banking station is already in operation. Considering that the fire made a clean sweep of all the surface buildings, with the exception of the boilers, the Coal Company's officials are to be congratulated on the expeditious manner in which they have gone to work.

At Reserve Colliery also the new bankhead replacing the old structure that was burnt to the ground last October is in operation, and is a very decided improvement on its predecessor, which was one of the things that "just growed," and looked it.

The new shaft to the Emery Seam is also completed, and hoisting coal. This mine has now 500 feet of longwall face, and is putting up about 500 tons per day.

Having now got rid of the ice blockade, which so restricted operations in Cape Breton during the month of May, the Dominion Coal Company, along with all the other operators in the Island, are being hampered by the disinclination of their workmen to descend the mine after pay day. This condition of affairs appears to be getting worse, and augurs badly for the output during the "picnic season." How serious a drawback this habit is to the mining companies may be gauged from the fact that during the week preceding the pay day of the first of June the average output of the Dominion Coal Company's mines was 14,800 tons daily, whereas in the week following the pay day it dropped to 12,600 tons. This means a dead loss of tonnage to the operators of at least 20,000 tons a month, a very serious matter when the limited season of navigation is taken into consideration, together with the fact that the fixed charges of the mine and the organization necessary to produce the larger tonnage is in no way reduced to correspond with the post-pay-day yield. What the remedy is for this state of affairs is not at all clear, but that a remedy is needed is very obvious. This is further a reduction in wages that the Provincial Workingmen's Association might well take under advisement, as 20,000 tons per month additional output would mean quite a little in the pocket of the Cape Breton miner.

STELLARTON.

How easily some folk allow themselves to fall into the blues! Any temporary impediment to their progress sends them to the verge of collapse. The backward drop of the shipping season led some to give utterance to the belief that we had lost so much in coal shipments, that 1907 would show a falling off. It will need a good deal more than a week or two's lateness to supply sufficient ground for any such belief. We have been told, for instance, in the papers that the unfavorable weather conditions mean a loss in shipments to the Dominion Coal Company of some two hundred thousand tons. Nonsense. One cannot judge from the shipments of five months what the year will bring forth. Let me take a glance at the shipments of the Dominion Coal Company for the first five months of seven years, and see what they declare. The smallest shipments in five months for seven years were in 1905, when only 824,000 tons were shipped. The heaviest shipments in the first five months of any year was in 1903, when the large quantity of 1,111,700 tons were shipped. And yet what happened before 1905 was out? Though handicapped by short shipments in the first five months of nearly 300,000 tons, it beat 1903 by over 100,000 tons. The shipments for the five months of 1907, of the Dominion Coal Company, are 68,000 tons behind; but if 1905, badly behind, beat in the long run its predecessors, why not a similar thing happen again? The coal trade is a peculiar business. It is stated that some of the managers are eagerly on the lookout for new customers, while they have booked more orders than they can, to use a common phrase, "Shake a stick at." How is this, I wonder? The reason presumably is that though the managers are at times very neighborly bodies, each is careful that the other does not get ahead in any way. Our managers are good fellows; yes, and diplomats to boot. When in meeting all are chivalrous. Not for worlds, for the life of him, would one hint that some other had been poaching in his precincts. After the meeting, however, one or two, it is said, give relief to their feelings in a foreign language. This may be idle rumor only. I believe the I. C. R. contract will not be awarded, as expected, in the begininng of July. It is hinted that some of the agents of the Coal Companies have asked for delay.

Scarcity of labor is still the cry at many of the collieries, though a few immigrants are dropping in occasionally. Skilled labor is not quite so scarce as unskilled. A large proportion of the skilled labor which finds its way into Nova Scotia from Britain does not, it seems, easily adapt itself to conditions in this country. Many men after being a time in the country hie away to the United States, where they think work is easier and the conditions similar to those to which they have been accustomed. At some of the mines it takes an old countryman fully twelves months to cut as much coal and as easily as a native born. We will never have again in Nova Scotia a sufficient supply of native labor to meet the increasing requirements of our mines. Therefore we shall be forced to look abroad. From what I had read in the United States papers, I had come to the conclusion that it might be as well that the progress of the coal trade be retarded, than that it be furthered by the importation of Huns, Poles, Slavs, etc., as in the United States. I have since, however, been induced to believe that the men of Poland are not a bad lot when rightly treated. It is said they are more amenable to the discipline of the mine than natives. Their ignorance of our ways and of our language may lead them into serious faults, as was the case the other day, when two Belgians were found quietly smoking their

pipes in a mine in which safety lamps were in use, and, of course, pipes prohibited. But the poor fellows did not know they were breaking a law. Their offence was overlooked, and yet what might it not have led to? As remarked in the *Mining Record*, it may soon become necessary to print the special rules in more languages than the English. The members of the P. W. A. might prefer but one language, and that none be permitted to enter a mine who did not understand it. That desire complied with might mean the crippling seriously of some mines. I notice that hereafter the Manitoba Government will convey coal lands to no man who will not enter into bonds to give every countryman who comes with his team to the pit as much coal as he can use for a dollar and seventy-five cents per ton. That either means that the coal mine operator will work for nothing or else salt those who do not take the coal away in farm wagons. Some down here are under the impression that miners out West demand more wages than those of the East. That will not be possible with a dollar seventy-five cent coal, unless the mines in Manitoba make no water, require no timbering and have very soft coal. The wage bill alone of one of the Nova Scotia collieries was $75,000, and the coal raised was less than 35,000 tons. That gives two dollars a ton for labor, without counting material, royalty, or fixed charges. Some reformers down here hysterically call upon the Provincial Government to undertake the working of a coal mine. If the Government only would it would result, so they say, in cheaper coal and bigger wages. Just how the Government is to do this marvellous trick is not explained. It is quite possible that if the Government selected a favorable area it might for a time, and not providing for the future, or for contingencies, which in coal mining may mean the wreck of the pit by an explosion, give the people, or some of them, two dollar coal. But what would it do when the mines became deep and costly? Would it abandon deep mines and begin again, in a new place? The people would permit no such utter folly. There are in one county alone of Nova Scotia at least 24 abandoned mines. Why are they abandoned? Not because all the coal has been extracted, but because when fire or explosion took place, and there being in these days what was supposed to be a superabundance of coal, the company found it cheaper to open a new mine than go to the trouble of reopening and recovering the old. Sixty years ago the General Mining Operators abandoned a pit in Cape Breton because the coal was more expensive to work than it would be in a new mine. That old pit was reopened some time ago by the Nova Scotia Steel & Coal Company, and the coal is actually costing less to produce than at another of their mines. The Government will not again tolerate the improvidence of the old days, and surely what they will not tolerate in others they themselves will not be guilty of. One of the stock cries of those who cry for cheaper coal is that it retards industries. There is one thing these have to explain, and it is this: Coal is higher in price to-day than at any previous time within the past fifty years, and yet industries are more prosperous than ever. Between the years 1878 and 1895, coal was dirt cheap. How fared it with industrial development in these years? It was all but stagnant. The item "notive power" is no doubt an important one, but it is quite insignificant as compared with "management." We must now have the best management, irrespective of cost; it was not always so, and just because it was otherwise was there so slow progress. The *Labor Gazette* gives the average wage of Canadian miners as $513 per annum. The average number of tons raised per person employed is 300. Some of the readers of THE CANADIAN MINING JOURNAL may be able to figure out how much profit a Manitoba mine owner will have if he sells coal at a dollar seventy-five.

Notices were posted at the shaft houses of Le Roi and Le Roi No. 2 mines on June 15th, informing the employes that on July 1st the following advances in wages would take effect:—Machine men, from $3.50 to $4 per day; muckers, from $3 to $3.25; shaft men, from $4 to $4.50; timbermen, $3.50 to $4.

GENERAL MINING NEWS

ALBERTA.

As a result of the fire which destroyed the equipment of the Walters' coal mine near Strathcona, six men lost their lives and fifty men are thrown out of employment.

QUEBEC.

Discoveries of molybdenite, graphite and copper are reported from the Gatineau district near the height of land. The claims registered in Quebec are located in two islands in Lake Kabingo.

ALASKA.

Junian.—On June 4th Judge Wickersham handed down a most important mining decision, which confirmed the right to the waters of any mining stream by appropriation, as against the rights of riparian land owners. This will have the effect of protecting mining companies against extortion by jumpers. The finding was made in the suit of Thorndyke versus the Alaskan Perseverance Mining Company and, applied to ditch companies throughout Alaska, will affect investments aggregating about $8,000,000.

NOVA SCOTIA.

GLACE BAY.

Construction work is being pushed by the Dominion Coal Company at Reserve. The screening plant, which will cost about $15,000, will be run by a 75 horse-power motor taking current at 500 volts. The new bankhead is about 250 feet in length. The trestle work to the east slope is 900 feet long, to the French slope 80 feet. Coal is hoisted from the pit by endless haulage. Chain haulage conveys it to the top of the bank.

GENERAL.

The Torbrook iron mines, which were recently shut down for a short time, have resumed work. The railway extension from the Wheelock shaft to the Martin property is almost completed. Many miners have left Torbrook for Cobalt.

It is stated that Mr. Hiram Donkin, of the Dominion Coal Company, is to be appointed Deputy Commissioner of Mines and Public Works.

President Richards, of the New England Gas & Coke Company of Boston, has announced that the company intends to go into the wholesale coal business and will bring to that port about 1,500,000 tons of Nova Scotia coal per year.

ONTARIO.

COBALT.

On June 14th seven miners were overcome by dynamite gas at the Cobalt Central.

The Nancy Helen Mine has installed a 12-drill compressor, driven by a gasoline engine.

A 10-drill compound air and steam compressor has been ordered by the Nipissing Company.

From No. 6 shaft on the Cobalt Lake Company's aeras a good showing of silver leaf is being taken.

The new vein cut by the Nipissing Company is an extension of the Trethewey Company's vein and is about six inches in width.

The Coniagas Mine is still the largest shipper. When the concentrator is completed her shipments will probably be increased by fifty per cent.

The 13-drill compound air and steam compressor ordered by the Cobalt Lake Mining Company arrived at Cobalt on June 8th. It has now been installed.

Superintendent Drummond, of the Nipissing, reports that $1,058,000 worth of ore has been blocked out. The mine is shipping at the rate of $100,000 per month.

North of Latchford forest fires, commencing about June 17th, raged for several days. Many prospectors lost their camp equipments. It is reported also that several lives were lost.

During the week ending June 8th, eighteen cars of ore were shipped from Cobalt. This makes a total for the year of 4,336 tons of silver-bearing ore. Last year's total shipments amounted to only 5,666 tons. The comparison is encouraging.

A good strike is reported on the Silver Leaf close to the Lawson porperty line. The vein is eight inches wide. It shows calcite, cobalt bloom, and native silver. The strike of the vein is diagonally across the property. Only for a short distance has it been stripped.

On the Right of Way property the main shaft is down over sixty feet. At the 75-foot level a cross-cut will be driven to the vein. Four cars have been shipped already, not including the ore taken out by La Rose people and afterwards awarded to the Right of Way. Superintendent Houston is pushing construction of ore house and shaft houses as rapidly as possible.

During the week ending June 8th the following shipments were made:—Coniagas, esven cars, 441,780 pounds; O'Brien, one car, 64,520 pounds; Nipissing, three cars, 196,630 pounds; Drummond, 44,090 pounds; Kerr Lake, two cars, 94,000 pounds; Trethewey, 61,000 pounds; Silver Queen, two cars, 124,580 pounds; Foster, one car, 40,000 pounds. Total, 1,066,900 pounds, making a record for a week's shipments.

Larder Lake.

The Dr. Redick Larder Lake Gold Mining Company has purchased the stamp mill, crushers, rolls, etc., formerly used by the Ottawa Gold Milling & Mining Company at their custom reduction works at Keewatin, Ont. The plant has been idle for about six years. The machinery is now being shipped to Larder Lake.

Port Arthur.

A New York party visited and inspected the West End Silver Mine on June 20th.

The Shakespeare Gold Mine, near Webbwood, Ont., is to be operated by power developed from the Birch Creek Falls.

The Government diamond drill has been sent to Eagle Lake, west of Port Arthur, to prospect a gold property owned by J. E. Stanton.

At the old West End Silver Mine Captain Pritchard is superintending the mining. A considerable amount of ore has already been stacked.

A discovery of zinc blende is reported from the Upper Wahnapitae. It occurs in limestone and is said to carry a few ounces of silver per ton.

The shaft of the Massey Mine has been pumped out and the levels are being cleaned. Mining will be resumed under the direction of Mr. Jas. Errington.

The Beaver Mine is being unwatered, and the Rabbit Mine will also be put in commission soon. The Silver Mines Consolidated Company is the prime mover in these activities.

Surveys are being conducted for a proposed new railway to connect the Helen Mine with the C. P. R. at Thessalon. A new smetler is to be erected at Thessalon, and 400 tons of ore per day will be shipped from the Helen.

BRITISH COLUMBIA.

At the Trail and Northport smelters fuel is arriving much more freely.

Development is progressing on the 350, 400 and 450 foot levels of the Iron Mask.

At Le Roi Mine the connection between the shaft and the winze on the 1,650 foot level has been completed.

A former foreman of the Granby, Mr. J. A. Miller, has been appointed superintendent of the California-Giant properties.

On June 23rd an explosion at the Crow's Nest Pass Company's No. 6 prospect, Coal Creek, near Fernie, B.C., resulted in the death of two men.

The Canadian-American Mining Company of Bellingham, Wash., is to begin working the Lorne Creek Placers at Lorne Creek, 100 miles up the Skeena River.

The Marble Bay miners' strike has been settled. The trouble arose from a misunderstanding on both sides, and the men have returned to work at their former wages and hours.

On the west coast of Vancouver Island, at Sidney Inlet, a copper property, owned by E. Dewdney, of Victoria, is to be exploited by Eastern capital. It is well situated as regards water shipment.

The Nest Egg Mine, Rossland, has been leased by Edward Webb from the British Columbia Land & Development Agency, Limited, of London, England. The mine has not been worked since 1897. A sixty foot shaft and a few short drifts constitute the present developments.

It has been decided that in future a permanent summer mining class of the Mining Department of McGill University will be held in British Columbia. The Hon. H. E. Young, Minister of Education, is co-operating with Professor J. Bonsall Porter in making all necessary arrangements.

Thirty-five miles from Jedway, Queen Charlotte, a large deposit of copper ore is reported to have been discovered. The property is undr option at a figure of $400,000. The deposit is 100 feet wide and has been traced for 4,000 feet. It is said to carry 4 per cent. copper and some gold values. Four thousand tons of copper ore are awaiting shipment at Ikeda mine and was taken from Ikeda Mountain. The remainder came from the MacMillan mine. The ore will be shipped to the Ladysmith smelter.

The British Columbia Government has sent Mr. Herbert Carmichael, accompanied by two third-year McGill men, Messrs. Carruthers and Meyerstein, to the Alberni district on the west coast. A steam launch is to be taken up the coast, transported twelve miles by wagon road to Great Central Lake and used there during the summer. While Mr. Carmichael will perform a considerable amount of topographical work, he will also pay especial attention to the mining posibilities of the Alberni district. The Government will issue bulletins from time to time, reporting the progress of this work.

Mr. Thomas Kiddie, manager of the Brown-Alaska smelter, Hadley, Prince of Wales Island, was in Victoria early in June making arrangements to overcome the coal and coke shortage which has been handicapping the operation of his enterprise. The recent fire in the Comox coal mine caused a stoppage of shipments and had an immediate effect upon the smelter. Mr. Kiddie expressed the hope that he would be able to secure regular shipments of fuel before leaving for Hadley again. In speaking of the copper ores treated at Hadley, he said that the Maple Bay ores, which constitute their principal supply, are very silicious. To obviate the necessity of using barren fluxes, basic ores from nearby deposits are about to be secured. Mr. Kiddie has ordered the material for an installation of his hot blast system.

YUKON.

Until new discoveries shall have been made it may now be premised that the day of the individual miner in the Yukon is over, and operations in future will be confined to exploitations on a large scale by such powerful concerns as the Guggenheim Exploration Company, who last year secured the control of large areas of ground on Banaza, Hunker, Eldorado and other creeks which erstwhile yielded so fabulously. This company is meanwhile sending in large quantities of supplies and materials for the

commencement of extensive dredging and hydraulicking operations; and no less than a million feet of timber to be used for dredge construction purposes was recently purchased in British Columbia and is now being shipped to Dawson via Skagway. The pipes to be installed in connection with the company's water system are also of usual size, being 70 feet in length and 4 feet in diameter.

MINING NEWS OF THE WORLD

AUSTRALIA.

Queensland's gold yield for the first quarter of the present year represents a value of £464,960, or a slight decrease compared with last year's returns for the corresponding period.

Australia's gold output for the first four months of 1907 shows a falling off of over a hundred thousand ounces. The production, nevertheless, reached the respectable total of 1,048,647 ounces.

At Broken Hill the Zinc Corporation are experimenting with the granulation process, one unit having turned out a satisfactory concentrate on a limited scale. Six Ullrich magnetic separators have been installed and a trial run proved successful.

A report has been issued by the Commission appointed by the West Australian Government to inquire into allegations of gold stealing in that State. The report contains several pages of recommendations, including a stricter supervision of the gold-selling business, while the establishment of searching rooms at the mines is advised.

One company that has actually accomplished more than the prospectus promised is the Great Cobar, which was formed in May of last year. Since September last the mine has produced 3,217 tons of copper, 7,595 ounces of gold and 47,300 ounces of silver. As a result of development work, the ore reserves have been considerably increased, and now represent eight years' supply at the present rate of production. The company's consulting engineer is Mr. J. D. Kendall, of London, well known to many of our readers in the West.

UNITED STATES.

Applications have been made for patents covering asbestos areas in Placer County, California. On one property some development work has been prosecuted and asbestos of good quality exposed.

At Butte, the shaft on the High Ore, one of the Anaconda group, has been sunk to the great depth of 2,800 feet, where an immense station is to be cut. At the Boston and Montana production is being made at the rate of 3,300 tons a day.

The Calumet and Hecla mine, Houghton, Michigan, is being equipped with a large recrushing mill to treat the tailings from the other mills and preparation of the present stamp sands. The plant includes 48 Chilean mills and Wilfley tables.

The verdict in the case of the Stratton Independence Company vs. the Portland Gold Mining Company, in which the latter originally sued for damages on the grounds of trespass and the extraction of a large quantity of valuable ore, having gone to the dependants, the plaintiff company has given notice of appeal. The sum involved is in the neighborhood of half a million dollars.

GREAT BRITAIN.

It is proposed to establish at South Kensington an Imperial College of Science and Technology. Specialized courses in mining and metallurgy will form one of the departments of the work of the Imperial College, and provision will be made therefor in the charter.

In the course of a speech recently in the House of Commons, the Prince, referring to the regulation of the hours of labor in mines, said that the Report of the Departmental Committee on the subject showed how absolutely necessary it was for careful enquiry before introducing legislation of a radical nature. In the light of the report it was expected that a Bill would be shortly prepared, and he was not without hope that it might pass this session. A more likely contingency was that it would be introduced, criticized and made the subject of arrangement, consultation, suggestion, and perhaps compromise during the autumn, which would enable the Bill to be easily carried in the session that was to come.

SOUTH AFRICA.

The gold output of Rhodesia for April was 49,772 ounces.

The Transvaal diamond production for March aggregated 159,303.76 carats, valued at £239,610.

A tax of 7 per cent. on the profits of diamond mines exesting before the ordinance of 1904 is to be imposed in Orangia.

A general strike has been declared by the miners on the Rand, and it was considered necessary to call out cavalry to put a stop to a demonstration.

At the recent session of the Legislative Council of Rhodesia, a resolution was introduced declaring that the time ha dcome for the British South Africa Company to be relieve dof its admanistrative responsibilities, and that administration be entrusted to a representative Government. It was finally decided to approach the Imperial authorities to secure a change in this regard. There is no doubt that the mining industry of Rhodesia would be greatly benefited by the change suggested.

NEW COMPANIES

A. W. Jacobs Mines, Ottawa, $1,500,000.

Tilbury Gas Company, of Chatham, $40,000.

Cobalt & James Mines, Toronto, $1,000,000.

Canadian Bessemer Ores, Toronto, $250,000.

Lansing Cobalt Mining Company, Windsor, $400,000.

Searchlight Larder Lake Mines, New Liskeard, $3,000,000.

Coleman-Bucke Silver Mining Company, Ottawa, $1,000,000.

Prospect Developing & Mining Company, Cobalt, $1,000,000.

The Nipissing Gold Estates, Limited, Cobalt; capital, $4,000,000.

Cobalt Confederated Mines, Limited, Cobalt; capital, $3,000,000; shares, $1 each.

Buffalo Larder Gold Mines, Limited, Toronto; capital, $2,000,000; shares, $1 each.

Red Jack Mining Company, Limited, Midland, Ont.; capital, $500,000; shares, $1 each.

Montreal Gold & Silver Mining Company, Limited, Cobalt, Ont.; capital, $10,000; shares, $1 each.

New Liskeard Lands, Timber & Mines Company, a colonization and land enterprise, $300,000.

COMPANY NOTES

The annual meeting of the Dominion Iron & Steel Company has been set for July 5th. The directors passed on the report at the meeting to-day.

Under the reorganization of the Canada Corundum Company, recently completed, Mr. C. S. Wilcox becomes president, Mr. C. D. Warren chairman of the Board of Directors, and Mr. D. A. Brebner remains secretary-treasurer. Mr. H. E. T. Haultain, who has been in charge of the production end of the business for the past twenty-one months, has been appointed general manager and has moved the head office of the company from Toronto to Craigmont.

Catalogues and Other Publications Received

A special catalogue, with a strikingly beautiful cover, is issued by the Canadian Westinghouse Company, Hamilton, Ontario. Its subjects are electric fans and small power motors.

The American Spiral Pipe Works, P. O. Box 485, Chicago, Illinois, in a neat and attractive catalogue, illustrate their forged and rolled steel pipe flanges. One of their specialties is spiral riveted pipe for water supply lines.

"Mine and Quarry" for May, 1907. This very readable periodical, published by the Sullivan Machinery Company, Chicago, contains articles illustrating the use of their various drills, coal mining machines, etc. The May number gives a description of "Mineral Prospecting at Cobalt."

"Morton's Hand Book of the Cobalt District," published by Cobalt Mining Information Bureau, Limited ,1223-4 Traders Bank Building, Toronto, Canada. This convenient little hand book contains a geological sketch of Cobalt and a list of "passed" claims in Coleman, Bucke and Lorrain Townships. In addition, it gives a list of mining companies operating in Cobalt and important extracts from the Ontario Mines Act, 1906.

Under the title "Paroid Proofs," F. W. Bird & Son, makers of Paroid Roofing, issue a booklet in which are displayed photographs of buildings in various places of this continent, where "Paroid" is used. "Paroid" is a fireproof, weather-resisting roofing material. It is particularly adapted to the requirements of mine owners. The Canadian factories of F. W. Bird & Son are situated in Hamilton, Ont., and in Winnipeg, Man.

Two interesting photographs have been received from Messrs. Peacock Brothers, engineers, Canada Life Building, Montreal. The first is a group of views of the construction of the "King Edward VII." bridge, Newcastle-on-Tyne, built for the Northeastern Railway. The whole of the steel castings, including roller and fixed bearings, for the bridge are of Hadfield's best cast steel. The second photograph shows Hadfield's foundation plates with pivots and rollers. Messrs. Peacock Brothers are the Canadian agents.

A volume of superb photogravures has been received from the Brown Hoisting Machinery Company, Frick Building, Pittsburg, Pa. Many photographs of their installations of patent automatic hoisting and conveying appliances in America and Europe are reproduced. The "Brownhoist" has proved a potent factor in decreasing freight rates on the Great Lakes. A smaller volume shows the standard designs of the "Brownhoist" cranes. To these cranes is attached the "Weston Patent" safety lowering device.

STATISTICS AND RETURNS

Nelson, B.C., June 15.—The following are the ore shipments and smelter receipt sin Southeastern British Columbia districts for the past week and year to date in tons. Shipments:—

	Week.	Year.
Boundary	27,825	434,251
Rossland	5,898	119,919
East of Columbia River	2,763	56,005
Total	36,486	610,175

Smelter Recepts—

	Week.	Year.
Grand Forks	14,767	236,611
Grenwood	9,067	121,353
Boundary Falls	4,021	64,534
Trail	3,686	98,363
Nelson	353	8,551
Northport	2,846	44,255
Marysville	600	14,400
Total	35,340	588,067

British Columbia re shipments for week ending June 8th:—

Boundary Shipments—

Mine.	Week.	Year.
Granby	12,621	220,553
Mother Lode	4,400	88,617
Oro Denoro	240	1,578
Brooklyn	480	25,595
Idaho	640	1,836
Rawhide	1,280	22,036
Sunset	840	9,100
Providence	60	667
Mountain Rose	70	2,012
Other mines	.....	34,432
Total	20,631	406,426

Rossland Shipments—

Mine.	Week.	Year.
Centre Star	2,630	38,772
Le Roi	3,369	58,177
Le Roi No. 2	583	8,980
White Bear	78	1,172
White Bear, milled	350	2,550
Other mines	.....	3,370
Total	7,010	114,021

Kootenay-Slocan Shipments—

Mine.	Week.	Year.
Sullivan	600	13,800
La Plata, milled	425	9,775
Second Relief, milled	145	3,055
Queen, milled	185	4,255
Eva, milled	230	1,150
Whitewater, milled	300	1,050
Queen Victoria	136	1,994
Silver King	100	1,010
La Plata	88	1,510
St. Eugene	230	6,510
Hunter V.	109	2,188
Slocan Sovereign	47	69
Ottawa	22	125
Whitewater Deep	102	360
Other mines	.....	6,391
Total	2,719	53,242

The total shipments from the mines in the above districts for the past week were 30,360 tons, and for the year to date $573,689 tons.

The output of the Crow's Nest Pass collieries for the week ending June 21st was 19,371 tons. The daily average was 3,228 tons. For the corresponding week last year the output was 20,800 tons.

The output of the Crow's Nest Pass Coal Company's collieries for the week ending June 14th was 23,300 tons; daily average, 3,885 tons. The output for the week ending June 15th last year was 20,790 tons, a daily average of 3,465 tons.

During the month of May Le Roi Mine shipped to Northport 10,930 tons of ore, containing 2,495 ounces gold, 4,972 ounces silver, and 272,100 pounds copper. Estimated profit on this ore after all deductions, $17,500. Expended on development during the month, $13,000.

The following are the figures of German consumption of foreign copper for the months January to April, 1907:—Imports of copper, 39,059 tons; exports of copper, 2,834 tons; consumption of

copper, 36,225 tons; as against 38,804 tons during the same period in 1906.

Of this amount 31,103 tons were imported from the United States. Figures are compiled by L. Vogelstein & Company.

Cobalt ore statement for period June 16th to June 22nd, 1907:—

Trethewey Mine.—June 17th, 61,200.

Nipissing Mine.—June 17th, 60,000; June 19th, 40,160; June 21st, 59,840. Total weight, 160,000.

La ose Mine.—June 18th, 44,040; June 18th, 64,140; June 18th, 42,030; June 21st, 82,006; June 21st, 84,000. Total weight, 316,215.

Coniagas Mine.—June 17th, 67,410; June 17th, 62,000; June 18th, 62,000; June 19th, 62,000; June 20th, 62,000; June 20th, 58,450; June 21st, 62,000. Total weight, 435,860.

Buffalo Mine.—June 19th, 60,000; June 20th, 60,000; June 20th, 41,130; June 21st, 60,000. Total weight, 221,130.

Total weight for all mines, 1,194,406.

METAL, ORE AND MINERAL MARKET

Aluminium, No. 1 grade ingots—46 cents per lb.

Antimony—12 to 16 cents per lb.

Arsenic, white—7 1-2 to 7 3-4 cents per lb.

Barytes, crude—$11.25 to $14.50 per short ton.

Bismuth—$1.50 to $1.75 per lb.

Cadmium—$1.40 per lb.

Carbons, for drills—$78 to $85 per carat.

Carborundum, powdered—8 cents per lb.

Chronium, metal pure—80 cents per lb.

Cobalt, f.o.b. Cobalt, Ont., unrefined—35 to 50 cents per lb.

Corundum—7 to 7 1-2 cents per lb.

Feldspar, ground—$9.75 to $10 per short ton.

Flourspar, lump—$10 per short ton.

Graphite, domestic—$50 to $150 per short ton.

Gypsum, lump—$4.50 per long ton.

Infusorial earth, ground—$15 to $30 per ton.

Lead—5.75 cents per lb.

Manganese, pure metal—75 cents per lb.

Mica, ground—$80 per short ton.

Mica, scrap—$15 per short ton.

Molybdenum, pure—$1.70 per lb.

Molybdenite ore, 95 per cent. pure—$4.50 to $5 per unit.

Nickel—45 to 50 cents per lb.

Platinum, ordinary metal—$27 per ounce.

Platinum, scrap—$20 to $21 per ounce.

Pyrite, 38 per cent. to 45 per cent. sulphur, lump, 10 to 11 1-4 cents per unit.

Quicksilver—$41 to $42 per 75 lb. flask.

Talc—$18 to $23.50 per ton.

Tungsten, pure metal—$1.25 per lb.

Tungsten ore, 60 per cent. pure—$400 per ton.

Tin—43 1-2 cents per lb.

Zinc Sheets—$8.60 per 100 lbs.

MARKET NOTES.

Spelter.—Busines is dull and prices have declined. New York, 6.40 to 6.45 cents per lb.; London, £24 10s. per long ton.

Lead.—Quiet market. Very little business being transacted. New York, 5.75 cents per lb.; London, £20 15s. for Spanish; £21 for English.

Northern pig iron No. 1 ranges from $26.50 to $27 for delivery within thirty days. Bessemer malleable, $26 to $26.50. Bessemer ore, old range, $5. Bessemer mesabi, $4.75. Non-Besesmer, old range, $4.25.

Tin.—Although the market has been quiet, foreign manipulation has caused an advance in the price of tin. This has been felt more decidedly in London than in New York. New York, 43 1-2 cents per lb.; London, £187 10s for spot.

The copper market is stagnant, and further reduction in price is expected. Lake copper, 23 3-4 to 24 1-2 cents per lb.; electrolytic, 22 1-4 to 22 3-4 cents per lb. London quotations on long ton of 2,240 lbs. for spot standard are £99, or 21.50 cents per lb.

Silver.—There have been strong movements in silver:—June 13th, 66 7-8 cents per ounce; June 14th, 66 3-4 cents per ounce; June 15th, 67 1-4 cents per ounce; June 17th, 67 1-8 cents per ounce; June 18th, 67 1-2 cents per ounce; June 19th, 67 3-8 cents per ounce. Mexican dollars, 52 1-8 cents. British sovereigns, $4.85. Sterling exchange, $4.8735.

NEW DIVIDENDS.

The Granby Consolidated Mining, Smelting & Power Company, Limited, at the regular monthly meeting of its directors, held in New York on June 4th, declared a regular quarterly dividend of 2 per cent. and an extraordinary dividend of 1 per cent., payable June 29th out of the net earnings of the company. This is the seventh dividend of the Granby Company. It amounts to $405,000. The shares are now paying a regular 8 per cent. dividend, with extra 1 per cent. quarterly dividends bringing up payments to 12 per cent. per annum. The dividends to date are as follows:—No. 1, December, 1903, $133,630; No. 2, January, 1906, $405,000; No. 3, May, 1906, $405,000; No. 4, September, 1906, $405,000; No. 5, December, 1906, $405,000; No. 6, March, 1907, $405,000; No. 7, June, 1907, $405,000. Total, $2,563,630.

At a general meeting of the shareholders of the Richard III. Mine, held on June 7th, in Victoria, B.C., a dividend of 2 1-2 per cent. was declared, payable on and after June 15th. It was announced that after payment of this dividend a reserve of $10,000 would remain for carrying on development work. Ore from this mine is being treated at the Tyee smelter, Ladysmith.

The regular quarterly dividend of 3 per cent., or 15 cents per share, has been declared by the directors of the Nipissing Mines Company. No action was taken in regard to the erection of a smelter. No figures were given out, but it is understood that the financial report was satisfactory. The company is said to have enough cash to pay the next two quarterly dividends.

NOVA SCOTIA STEEL DIVIDENDS.

The Nova Scotia Steel & Coal Company declared dividends of 1 1-2 per cent. on common, and 2 per cent. on preferred, payable July 15th, to holders of record of June 30th.

The Coniagas Mine has declared a dividend of 2 per cent., payable on July 1st.

Crow's Nest Pass Coal has declared the regular quarterly dividend of 2 1-2 per cent., payable July 1st.

The directors of the Dominion Coal Company met in the first week of June to declare the quarterly dividend on Dominion Coal common stock. The dividend is payable in July.

At a meeting of the directors of the Kerr Lake Mining Company it was decided to pay the regular quarterly dividend, No. 7, of 2 per cent. and 1 per cent. bonus, on July 1st to all shareholders on record on June 22nd, 1907.