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CONTENTS.



## MINING IN ONTARIO

Ontario is an important producer of minerals. The silver mines at Cobalt, the nickel-copper mines at Sudbury, the gold mines at Porcupine and many other mines and quarries throughout the province are pouring out a steady stream of wealth.

The industry is flourishing and the producing mines are making good records at a time when money is at a premium. The present condition of the money market is of course affecting exploration work; but the mining industry is making an excellent showing as a producer of wealth, while many other industries are in very unsatisfactory condition.

In our issue of December 1 will be found much interesting information on mining in Ontario. Official statements of production of the numerous metals and non-metals, statements of dividends paid by the several mining companies and descriptions of visits to some of the mining districts will be given. Numerous photographs will be used in illustrating the articles.

## ONTARIO BUREAU OF MINES REPORT FOR 1912

Part one of the twenty-second annual report of the Ontario Bureau of Mines has just been issued. This volume contains the Statistical Review of mining in the Province for the year 1912, which has been prepared by the Deputy Minister of Mines, Mr. Thos. W. Gibson.

Mr. E. T. Corkill, formerly chief inspector of mines for Ontario, reports on Mining Accidents in the province in 1912, and on work done during the year at the various mines.

Prof. A. P. Coleman contributes reports on the Whiskey Lake Area north of Lake Huron, the Massey Copper Mine Area, and on Glacial Phenomena of Toronto and Vicinity.

Mr. J. B. Tyrrell reports on the Hudson Bay Exploring Expedition, which was undertaken for the purpose of selecting lands, waterfront and easements to which the Province of Ontario is entitled under an agreement with the Province of Manitoba. Mr. Tyrrell's return trip was made through the District of Patricia, that part of the District of Keewatin which has been recently added to the Province of Ontario.

Mr. Arthur L. Parsons reports on geological work done in the vicinity of the Lake of the Woods.

Mr. Robert B. Stewart reports on the West Shining Tree Gold Area.

The report of Mr. Stewart appears elsewhere in this issue.

Mr. Frank B. Taylor describes moraines north of Toronto.

In our next issue, which will be a special issue devoted to mining in Ontario, we will publish extracts from several of the other reports.

## WEST SHINING TREE

During the past few years a number of gold-bearing quartz veins have been discovered in the vicinity of West Shining Tree Lake, north of Sudbury. Several parties have done some development work on the claims staked; but there has been little yet done on most of the claims. It is known that there are a number of gold-bearing veins in the area, and the district seems worthy of more attention than it has received.

In 1912, Mr. Robert B. Stewart examined the deposits for the Ontario Bureau of Mines. His report has just been published, and is reprinted in this issue of the Journal. It will be seen from Mr. Stewart's descriptions that coarse gold can be seen in several places in fractured quartz and that fine gold, as determined by assays, is present in a large number of veins. Many of the rich shoots are narrow and not deep, and so far no large body of high grade ore has been developed. Exceedingly rich specimens have been taken from several veins; but they must be regarded as specimens rather than as samples.

Enough has been proven, however, to show that some of the properties are well worthy of systematic exploration.

## PRESENTATION TO DR. W. G. MILLER

On Saturday evening, November 1, a number of mining men met in Toronto at a banquet in honor of Dr. Miller, Provincial Geologist of Ontario.

Some time ago Dr. Miller was asked that the mining men be allowed to present him with a portrait to be painted by Mr. J. W. L. Forster. A committee composed of Messrs. D. A. Dunlap, R. H. Flaherty, H. E. T. Haultain, G. G. S. Lindsey, J. C. Murray, W. E. Segsworth and C. E. Smith called on mining men for subscriptions and made arrangements for the presentation.

The dinner was followed by a number of speeches, the tenor of which was the same—all the speakers showing that both for his services to the mining industry and on account of his splendid qualities as a man among men, Dr. Miller has won the admiration of those who know him and his work.

## THE CALGARY OIL STRIKE

From the article in our last issue, furnished by the Director of the Geological Survey, concerning the recent discovery of oil near Calgary, Alberta, it is evident that while the prospects are distinctly encouraging there is no justification for wild excitement or high prices for oil leases, for nothing is as yet proven. The existence of a commercial oil pool has to be established and something demonstrated as to its shape, extent and depth from the surface before the lands in this vicinity will have much real value as oil lands. What is certain at the moment is that there is a good prospect and that prospecting will cost a lot of money.

On the present showing, intelligently-directed capital will be willing to thoroughly test the prospects, provided it does not have to pay too dearly for the privilege of risking a heavy expenditure. The discovery of a commercial oil field would create business and industry in this section as nothing else could, so that everyone in the west is directly interested in having the oil prospects properly tested, and it would be a calamity if those who would be willing to spend their money in thoroughly and scientifically determining the possibilities of this district were prevented by the designs of mere speculators and, as a result, this opportunity should be lost.

## THE CHISANA (SHUSHANNA) GOLD DISCOVERIES

Canadians, and particularly those interested in the Yukon, were pleased to learn this summer that rich placer gold had been found in the Chisana district, Alaska, a few miles from the Alaska-Yukon boundary.

The section of the Yukon territory immediately adjoining is one which the Geological Survey of Canada considered to be of exceptional promise, and for some years it has had the investigation of the region in contemplation. Circumstances prevented this until the present year when the Canadian Geological Survey despatched two parties into the district, a topographical party under Mr. W. E. Lawson and a geological party under Dr. D. D. Cairnes. These parties were at work in the district when the stampede to the Alaskan placer field commenced, and to correlate the geology of the Chisana with that on the Yukon side of the line, and also to determine whether the gold-bearing gravels are likely to extend into Canadian territory, Dr. Cairnes visited the discoveries in August.

Dr. Cairnes states that rich gold-bearing gravels have been found in an area not exceeding ten or twelve miles in extent. He regards the conditions favourable for the occurrence of similar deposits some distance eastward in Canadian territory.

The original discovery in Chisana district, generally known as the James discovery, is located 30 miles west of the international boundary line, at about latitude 62° 10′ N. and longitude 141° 55′ W. The gold-bearing belt lies along the southern edge of the Nutzotin mountains, and within 25 miles of the northern slopes of the snow and ice-capped Wrangell mountains which include several peaks exceeding 12,000 feet above sea-level, the highest of which—Mount Sanford—rises to a height of 16,200 feet above the sea. The Chisana gold deposits, situated as they are near the headwaters of the White and Tanana rivers, are in a district which is very difficult to reach and may be considered one of the least accessible portions of Alaska.

Five main routes to Chisana are available, two of which may be considered as Alaskan, and the remaining three as Yukon routes. The two Alaskan routes are respectively by way of the Copper River and Northwestern Railway, and the Tanana river.

All three of the Canadian routes proceed from tidewater at Skagway, over the White Pass and Yukon Railway to Whitehorse, a distance of 110 miles. From Whitehorse, the routes diverge and may be named the Kluane, Coffee Creek, and White River routes, respectively.

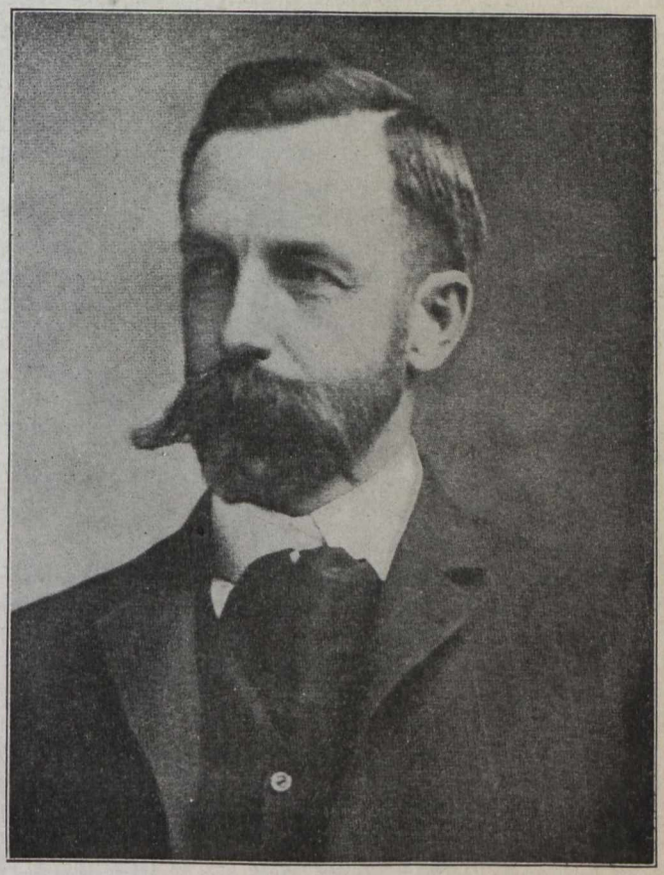
# WILLET G. MILLER

Provincial Geologist, Ontario.

By H. Mortimer-Lamb.

Were I invited to name a man to worthily exemplify a Canadian of the highest type, I should have no hesitation in indicating the Provincial Geologist of Ontario. In point of lineage, Dr. Willet G. Miller is a more representative Canadian than many of us, for both his father and his father's father were native born; and relatively few in this Dominion can lay claim to this distinctiveness. In him too the influences of descent and environment are markedly manifested, for one instinctively associates Miller with Canada. He is not only essentially a product of the country, but he typifies it. He is a big man physically and intellectually; and his heart, though he carefully guards the secret, is as big as his body. His manner is reserved and even shy, and he is a thinker rather than a talker; yet when occasion demands he can speak with fluency and to the point. He has a well-developed sense of humour, and there are not many better judges of human nature. His sterling uprightness of character, his absolute integrity, his generosity and his disregard for money, are among the qualities that have won him respect and esteem. Few men have fewer enemies; few can boast a greater number of loyal friends. It is impossible to know him or to work with or for him, without giving him one's regard. He is a man who inspires confidence and affection. His scholastic career at the University of Toronto, and at the Universities of Chicago, Harvard and Heidelburg, was distinguished and brilliant. Later as a professor of geology in Queen's University he demonstrated for nearly ten years, his ability as a teacher; and he was beloved by his students. Between the years 1897 and 1901, he was in charge of field work in Eastern Ontario for the Provincial Government, and his report on the corundum occurrences led to the development of the area and the establishment of the industry. In 1902, resigning his professional duties, he accepted the office of Provincial Geologist and Inspector of Mines. It was work for which he was peculiarly adapted both by natural inclination and training. He had specialized in economic geology, and his whole energy was directed to turning his knowledge to account in the interests of the mining industry. What he has accomplished is on record. The achievement is a notable one. Incidentally it may be mentioned that in 1902 the value of the mineral industry of Ontario was $13,391,634 (in 1912 it was $53,127,489. At least some of the credit for this prodigious progress redounds to the Provincial Geologist.

Dr. Miller was the first to recognize the importance of the silver discoveries in Cobalt. It was by following his advice that more than one man became a millionaire. Dr. Miller might also have become rich. He received numerous tempting offers to resign his post and accept in exchange interests in properties and handsome retaining fees from mine owners who competed for his services; but it was all to no purpose. He is indifferent to money making; his heart is in his work. His classification, by-the-way, made in 1904, of the Cobalt rocks stands to-day with but minor modifications. From the first he expressed a preference for veins in the conglomerate as distinguished from those in the Keewatin and diabase as sources of silver production, and expressed the opinion that in passing from the conglomerate to the Keewatin the silver values would tend to diminish. These views have since been substantiated. His maps of the area, in the compilation of which, however, his assistant, Mr. Knight, materially helped, have proved of the greatest value in the development of the district. In 1908 he was elected President of the Canadian Mining Institute, an office he held for two years. These were the two most active years in the Institute's history. He was the ideal president—tactful, resourceful, progressive, energetic. Other honours nave been showered on him. He was made an honorary member of the Institute of Mining and Metallurgy, a Doctor of Laws of Queen's University, a Fellow of the Royal Society of Canada, and still more recently an LL.D. of the University of Toronto. The mining men of Canada have subscribed that his portrait may be painted and hung permanently in the halls of the Legislature Building of Ontario.



But these things count for relatively little. Honours as great have been bestowed on smaller men. The reward of such as Dr. Miller is the consciousness of work well done and of friendships well earned.

Since writing these few lines of appreciative testimony, I have received a letter from one high in authority who has been associated officially with Dr. Miller for many years. I quote a paragraph from this letter as an appropriate corollary. My correspondent writes: "In describing Professor Miller's work I would say generally that his mind is conservative in its tendencies and he is not inclined to be sanguine or optimistic, but in interpreting the difficult and confusing pre-Cambrian geology of Ontario, in working out the relationships of ore deposits to the enclosing rocks, and in deductions from field and petrographic evidence, no more brilliant record has been achieved by any geologist in America. Mining men in Ontario have come to regard Miller as practically an oracle on Ontario geology, and his opinion once expressed is regarded as second to none in authority.

# WEST SHINING TREE GOLD AREA*

By R. B. Stewart.

Late in May, 1912, the writer was instructed by the Provincial Geologist of Ontario to proceed to West Shining Tree and continue the examination of that area made during September, 1911. Mr. Dowler Freeman served as assistant.

Transportation facilities have improved during the year. The regular train service on the Canadian Northern railway has been extended to Ruel, sixty-six miles from Sudbury. Two dams were built in the fall of 1911 on the Opickinimika river in order to deepen its shallow portions. This enables small gasoline boats or pointers to run from Ruel to the north end of Allin lake, which is 1½ miles from West Shining Tree lake. Mr. Thomas Clemow, of Ruel, had two boats on the route during the season, giving a tri-weekly service to West Shining Tree lake.

A wagon road will be built during the coming season into the area from mileage 80 on the Canadian Northern railway.

Mr. John Moore, of Sudbury, has established a general store and accommodation for travellers on the south side of West Shining Tree lake. In September, a post office (Tungsten) was established at the store with Mr. Moore as postmaster.

During the year considerable development work has been done. Assessment work was performed on a large number of claims, and a number of the most promising properties and adjacent holdings have been surveyed. In several places, shafts 20 to 50 feet deep have been sunk, and in other places open cuts have been made, chiefly on properties under option.

**Geology of the Area.**—The rocks of the area are chiefly of Keewatin age. They consist of ellipsoidal basalts, altered diabases, ampibolite and hornblende schist. The ellipsoidal rocks predominate. Small areas of quartz porphyry, syenitic porphyry and felsite resembling rhyolite are also present.

A schistose structure exists in most of the Keewatin, but is most pronounced in narrow shear zones that have a general east-west trend, and the developed schists dip nearly vertical. Ferruginous calcium and magnesium carbonates are present in much of the schist.

A lamprophyre dike cutting the older Keewatin rocks was observed on the boundary between Churchill and McMurchy, about 20 chains from the southwest corner of the latter township.

Numerous dikes and small areas of fresh quartz and olivine diabase are found in the area. The diabase dikes intrude all other rocks, and also cut the gold-bearing veins.

**Auriferous Quartz Veins.**—A large number of quartz veins occur in the Keewatin rocks and many of them contain visible gold. Most of the veins are in the ellipsoidal basalt, but two gold-bearing veins have been found in the hornblende schist.

The veins vary in width from 15 feet to a few inches, but most of them are less than 4 to 6 feet across in the widest parts. They present little uniformity in width. They pinch out or narrow to mere stringers in a few yards, then widen again or break up into stringers. The dip of the veins is usually nearly vertical, but several dip at much lower angles—45 degrees or less.

Considerable variation is presented in the strike of the veins. Many veins occur in the east-west shear zones and conform in a general way to the strike and dip of the enclosing schists. Others having an approximate north-south strike occur in the more massive rocks.

Several irregular masses of quartz or quartz and schist occur. The largest one that has been found, so far, is on W.D. 1157. It is roughly 160 feet long and 60 feet wide.

The veins and adjacent country rock are usually well mineralized with iron pyrites. Specular hematite and barite are sometimes present. Much rusty decomposed material resulting from the oxidation of the pyrites and the decomposition of the ferruginous carbonates is almost invariably associated with the veins.

Several small areas of felsite and porphyritic syenite are found in the vicinity of the veins just east of West Shining Tree lake. The latter rock occasionally contains many stringers of quartz cutting it in a very irregular manner and sometimes veins of quartz 3 to 4 feet wide.

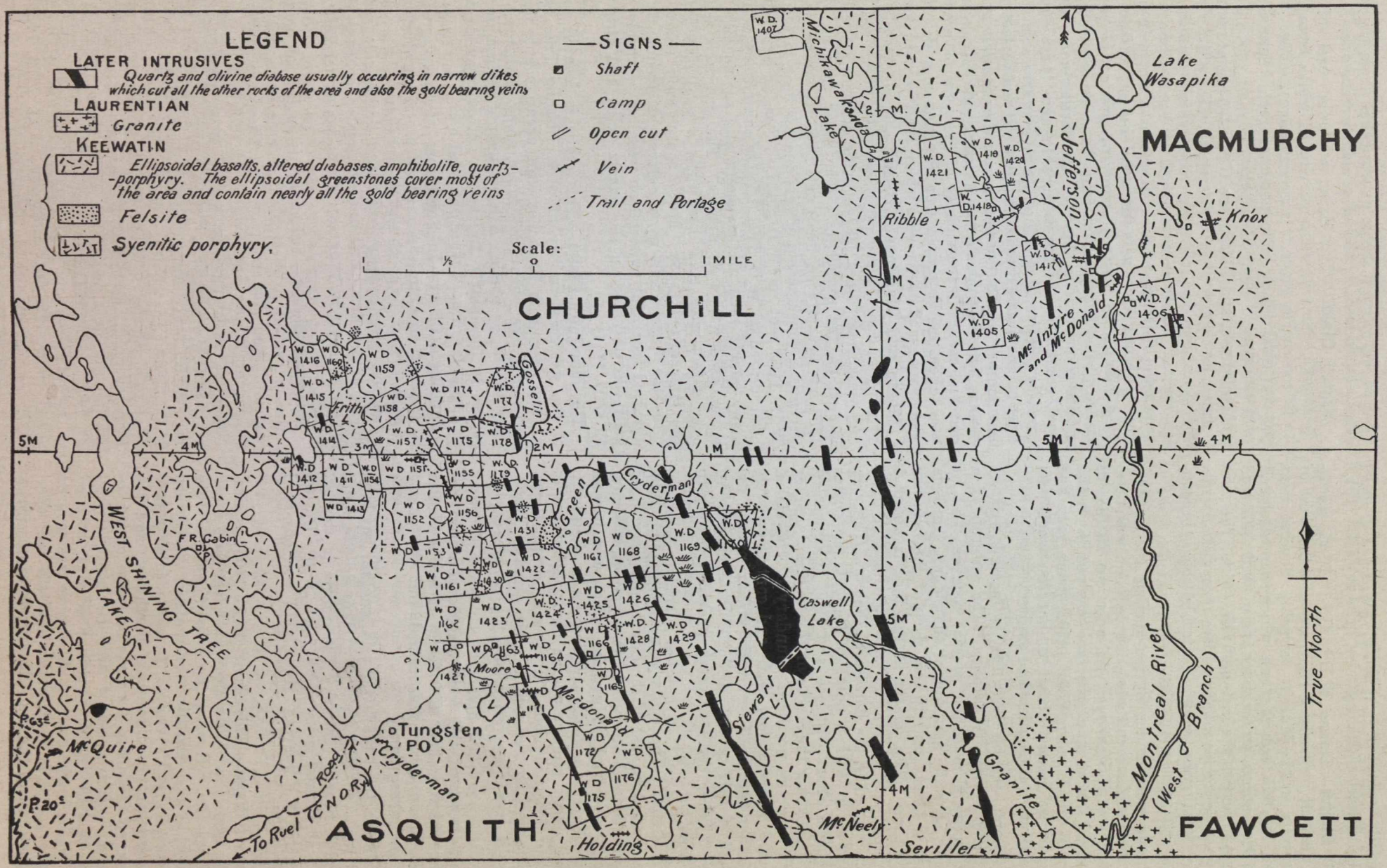
Gold occurs in many of the quartz veins and to a small extent in the enclosing schists. Much of the gold in the quartz is in a fine state of division, but nuggets several grains in weight are frequently found. Examination of several specimens showed that a large amount of the gold has been deposited along fracture lines in the quartz. The schist immediately adjacent to the veins appears to be impregnated with quartz to a certain extent, and contains some gold, but assays of several samples of schist taken in the vicinity of the veins do not indicate that the amount of gold in the schist is of importance.

### Gold Claims.

**Gosselin.**—The mining locations, W.D. 1151-52 and W.D. 1155-56-57-58 and 59, are commonly known as the Gosselin claims. The first discovery of gold in the area was made on these claims. A mass of quartz about 160 feet in length and 60 feet wide occurs on W.D. 1157. Gold has been found in this outcrop. Just east of this quartz body is a vein 3 or 4 feet wide, striking about north and uncovered for about 100 feet. About three chains to the north of this vein is a mass of quartz 50 feet long and about 15 feet wide that contains some visible gold, and immediately east of here on W.D. 1175 is a mass of quartz extending 70 feet in a northeasterly direction and about 15 feet wide. Near the northern boundary of W.D. 1151 is a vein 1½ to 2½ feet wide, having an east-west strike and dipping to the north at about 45 degrees. Gold was observed in this vein. Another vein has been located southeast of this claim and extends into W.D. 1156. It has been traced for 8 or 9 chains. The vein strikes a little west of north and varies in width from a few inches to 15 feet. Gold was seen in several places. This is a promising looking vein.

A Duluth company had an option on the properti early in the year. Surface work was carried on to d termine the extent of the quartz bodies and these were

*From 22nd annual report Bureau of Mines, Ontario.




**Geological Sketch Map of West Shining Tree Gold District. Prepared by R. B. Stewart, for Ontario Bureau of Mines, 1913**

systematically sampled. A shaft was put down 50 feet on the incline on the east-west vein on W.D. 1151.

**Caswell Claims**—Claims W.D. 1418-19-20-21 constitute the Caswell property. They are situated west of lake Wasapika, in MacMurchy township. Several veins have been located, but the one which has attracted most attention occurs on the south end of W.D. 1410 and appears again across the lake on W.D. 1418. The vein is of the east-west type and is seldom over a foot wide. The rusty weathering schist alongside the vein contains many stringers of quartz.

The claims were under option during the winter. Most of the development work carried out was done on the vein described above. An open cut 25 feet in length and 12 feet deep at the face was put in on the east shore of the lake on W.D. 1420. Some very fine specimens of gold were obtained, but the work was discontinued when the option had expired.

**Seville Claim.**—Claim W.D. 1417 is located west of the south end of lake Wasapika. The outcrop of a vein that appears to strike several degrees west of north occurs near the east side of the claim. An open cut 30 feet in length and 16 feet deep at the face has been made here. The quartz at the face is about 6 feet wide and well mineralized with pyrites. A little gold was observed in the bottom of the cut. The vein pinches out about 30 feet north of the cut, but comes in again for a short distance and then is concealed by the drift. Along the strike of this outcrop another one occurs near the northern boundary of the claim. The quartz is about a foot wide and contains visible gold. Another outcrop 3 feet wide and uncovered for a chain and a half occurs at the south boundary of W.D. 1418. These three outcrops probably belong to the same vein.

**Jefferson Claim.**—The claim is not surveyed. It is situated immediately east of the Seville property. Gold was first found on this property in a vein that occurs on the west side of lake Wasapika. This vein has an east and west strike and dips 60 degrees to the north. It has been uncovered for over a chain. The quartz is about four feet wide, but pinches out several times. Considerable iron pyrites occurs in the quartz. Finely divided gold was observed about the centre of the outcrop.

Six chains west of this vein, another outcrop has been uncovered for about 200 feet. It has a similar strike and dip to the one described, but the quartz is narrow and irregular.

Two chains north of the latter vein, another has been uncovered for about 200 feet. It strikes a little south of east and is nearly vertical. The quartz is about 2 feet wide and maintains its width fairly well. Pyrites is abundant in the quartz. Much gold was observed in many places in this vein.

**The Bennett Claim.**—This claim (W.D. 1406) is situated on the east side of the Montreal river just south of lake Wasapika. During the fall of 1911, a vein carrying visible gold was discovered along the eastern side of the claim and running into the adjoining property. It appears to strike about northwest, and has been uncovered for about four chains. The quartz in the vein is seldom over a foot wide, but many stringers occur in the vicinity of the vein. Gold was observed in several places in the quartz. An option was secured on the property to the east, and a shaft 34 feet deep was sunk just east of the line. Encouraging quantities of gold were found in the quartz taken from the shaft. This vein occurs in the ellipsoidal greenstone.

**Knox's Claim.**—This claim is located east of lake Wasapika. Several veins varying in width from three to fifteen inches occur in a greenish-gray schist. Their general strike is a little north of east. Coarse gold was observed in one of the veins.

**MacDonald and MacIntyre Claim.**—This property is located just south of lake Wasapika. Very little work has been done on it during the year. Outcrops of quartz and small areas exposed by surface work extending a distance of 8 to 10 chains seem to indicate the existence of a vein running southwest from the west side of the Montreal river and gradually bending to the west. The quartz is four feet wide in places. No gold was observed in this vein, but farther north a vein has been uncovered for a short distance that contains considerable free gold. The latter veins seems to strike west of north and dips to the east. It is two feet wide in some parts. The formation is rather massive greenstones, but some schistosity is developed. Much rusty material occurs in the vicinity of the veins. An option was taken on the property in September, and a shaft was commenced on the vein where the free gold occurs.

**Moore and MacDonald Claims.**—These claims are situated in the vicinity of Moore lake. Several east and west shear zones, 60 feet wide or more, have been located on the properties. The shear zone on W.D. 1164 has been traced for 9 or 10 chains. What is apparently a continuation of this one has been located on W.D. 1163 and on W.D. 1427. Similar areas have been located on W.D. 1171. These shear zones contain many quartz veins and stringers, and are usually well mineralized with iron pyrites. The quartz is seldom over a foot wide, and constitutes a small fraction of the mineralized areas. Much rusty, leafy schist adjoins the quartz and good colors can frequently be obtained from this material on panning. Considerable gold was observed in the quartz veins and stringers on W.D. 1171.

**The MacQuire Claim.**—This claim is located south of the southwestern bay of West Shining Tree Lake. Several veins 8 to 10 inches wide occur in hornblende schist and are uncovered for a short distance. The veins dip to the north. A large amount of iron pyrites occurs in the quartz and schist. It is reported that rich samples of gold were obtained here.

**Holding's Claim.**—In September of this year, Mr. R. Holding, of Chapleau, made a promising discovery of gold west of the south end of MacDonald Lake. The formation here is amphibolite and hornblende schist. Gold occurs in the quartz and decomposed schists. Surface work was in progress when the writer left the field.

**Surveyed Claims.**—Following is a list of mining claims surveyed at West Shining Tree Lake, with the names of their stakers or owners. These are shown on the accompanying map:

Bennett, W.D. 1405-6-7; Beilby, W.D. 1172-74; Caswell, W.D. 1418-19-20-21; Clark, W.D. 1169-70; Coleman, W.D. 1411-12-13; Coombs, W.D. 1175; Coulson, W.D. 1166-67-68; Frith, W.D. 1157-58-59; Fulton, W.D. 1162; Gosselin, W.D. 1151-52; Hanch, W.D. 1430; Johnston, W.D. 1426, 1428-29; Lennon, W.D. 1415-16; MacDonald, W.D. 1163, 1164, 1172; Moore, W.D. 1177-78, 1431, 1165, 1171; Odlum, W.D. 1154; Pendleton, W.D. 1161; Peterson, W.D. 1422-23; Seville, W.D. 1417; Speed, W.D. 1155-56; Thompson, W.D. 1176, 1424-25, 1427.

# PRINCIPLES AND PRACTICE IN TECHNICAL EDUCATION*

By Dr. James Douglas.

My first visit to Colorado was made in 1872. My mission was to report on the California mine in Gilpin County, which had been sold to a Scotch company, and was being restored to the original owners by other methods than those of bargain and sale. As a mine expert I got a lesson in how not to conduct legitimate mining. On the other hand I saw the first successful Western attempt at smelting argentiferous and auriferous copper ores at the old Black Hawk works of Senator Hill; and I made the acquaintance of a brilliant young man, Richard Pearce, in charge of the Swansea Works, at the bend of Clear Creek, below Georgetown. This was only forty years ago, but the changes which have been made in metallurgy since then, suggest many reflections on methods of scientific education, and on the equally important habits in self-training we should cultivate and practise on ourselves.

### Development of Reverberatory Furnace.

Let us glance at these changes. The Boston and Colorado Smelter, under the management of Prof. Hill, who had been a professor at Brown University, started their smelting works in 1867 with two hearth roasting furnaces and two reverberatories of 15 by 9 feet, heated by wood as fuel at $5.00 per cord. The lump sulphides were calcined in heaps. Each reverberatory received its charge of two tons of roasted ore and roasted concentrates, which constituted a self-smelting mixture and yielded a matte of about 40 per cent. in copper. This was shipped to England for refining and separation.

It is Mr. Pearce to whom the credit is due for taking the lead in enlarging the reverberatories, increasing their capacity and reducing the fuel consumption.

Startling as was the progress for that day and generation, it was slow in comparison with the service which of late years has been extracted from the reverberatory, not so much by increasing its size as by improving its operation.

Mr. E. P. Mathewson, in his paper before the recent Eighth International Congress of Applied Chemistry, on the Development of the Reverberatory, says:

"The next step in development was made in Butte, Montana, by the Colorado Smelting Company—this plant being at that time, affiliated with the Argo Works—so that Mr. Pearce's influence was apparent. The step referred to, was the lengthening of the hearth to 50 feet, with consequent increase in capacity to 105 tons in 24 hours."

The first furnace of this size—built from the Colorado Smelting Company's plans—was constructed at the Butte and Boston plant in Butte, in the year 1900.

### Oil as Fuel.

At Cananea, under Dr. Ricketts, the use of oil as fuel and the recovery of waste heat were studied with care. But the highest results seem to have been attained at the plant of the Steptoe Company at McGill, Nevada, with California oil as fuel.

Mathewson says: "A record performance at McGill, communicated by Superintendent Sorensen on December 17th, 1911, No. 1 furnace smelting 660 tons of total charge on an oil consumption of five-eighths of a barrel of oil per ton of charge is as follows:

| | |
|---|---|
| Total charge per furnace day, tons | 666 |
| Oil fired per furnace day, bbl. | 421 .. |
| Coal equivalent of oil fired, tons | 124.0 |
| Total charge per bbl. of oil, tons | 1.58 |
| Oil, bbl. per ton of total charge | .63 |
| Equivalent gross coal, as % of total charge | 18.60 |

The substitution of oil for coal has, from the point of view of cheaper operation and the control of the heat, taken place wherever the difference in the cost of the unit of heat value does not forbid it. The low cost of smelting now attained in the reverberatory is attributable also to the conversion of the waste heat, as it escapes from the throat of the furnace, into steam. This loss has always been recognized, though with the old type of boilers, it was never found practicable to remedy it; but in this as in most other metallurgical processes, the mechanic has co-operated with the metallurgist to consummate what each alone would have failed to accomplish. From forty-five to fifty-five per cent. of the heat generated by the fuel is recovered as steam. The combination of the reverberatory with the blast furnace, instead of the often unreasonable, exclusive preference for the one over the other, is now finding many advocates. At the Copper Queen works at Douglas we use both, and there we have imitated Cananea in fettling our furnaces by pouring i ore of suitable fusibility along the wall of the furnaces through openings in the roof.

But the development of the reverberatory would not have revolutionized the smelting and refining of auriferous and argentiferous copper ores had not two other great inventions intervened during the short period of time under our review. I refer to the introduction of the pneumatic method, through the Bessemer converter, and the refining of copper by electrolysis.

### The Bessemer Converter in Copper Smelting.

It was about 1882 that the news of M. Manhes' successful application of the converter to the concentration of copper induced Mr. Franklin Farrel to introduce the pneumatic method into his Parrot works in Butte. Difficulties, of course, beset him, but they were so slight that by 1885 he had six stands in successful operation. Since then the principle and main features of practice being accepted, the progress in both concentrating to bullion and incidentally in learning how to smelt crude ore in the converter, has been such that the converter has become more essential to the copper metallurgist than to the steel worker. It has grown in size from 4½ feet in diameter to 20 feet, and from a capacity of one and a half tons of matte per charge to thirty-three tons. Instead of an acid lining requiring frequent replacement, the shell is now lined with basic bricks, so refractory that, under proper precautions, from a single lining 15,000 tons of copper are poured, this first lining being still in use. And, owing to the acid ingredients of the charge, a much wider latitude of ores can be allowed for the acid ingredients of the charge, necessary to eliminate the iron from the matte, than when special clays and quartz had to be selected on account of their plastic or other qualities. The converter has thus become a smelting furnace as well as an appliance to eliminate the older methods of concentration by repeated roastings and smeltings, which involved so much fuel and time and labour. And almost simultaneously with the practical introduction of the converter improvements in the generator to produce electric current in large quantities and cheaply, made the electro-

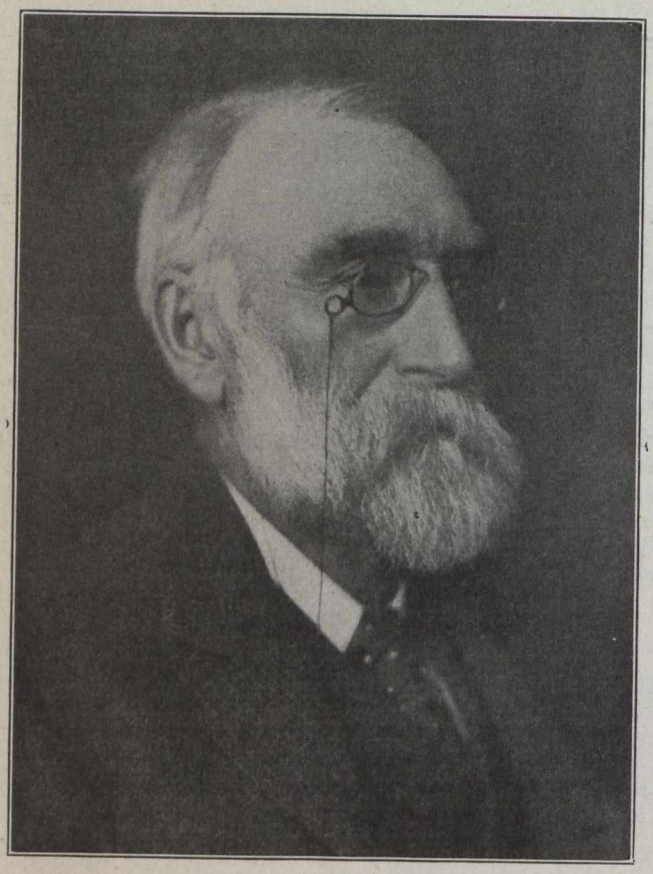
*Extracts from Commencement Address, Colorado School of Mines, July, 1913.

lytic refining of copper and the separation of all impurities, including gold and silver, possible.

**Refining of Copper by Electrolysis.**

When I was superintendent of the Chemical Copper Co.'s works at Phoenixville, in 1878, Mr. Franklin Farrel, to whom the copper industry owes more than perhaps to any one man of the vanishing generation, induced me to make an experiment in the electrolysis of copper, at first on a small scale, with battery current, and then on a working scale, with generators, and in vats arranged in series and in multiple arc.

Our ignorance was replaced by the knowledge and gracious assistance of Mr. Edward Weston, of Newark, who loaned me three of his nickel-plating dynamos, and, better still, came to Phoenixville more than once to advise



**James Douglas, LL.D.**

and help me out of difficulties. I suppose I may claim the merits of making, in this country, the first electrolytic copper by the ton, but the merit is really due him, who in this and innumerable other instances has concealed his disinterested work for his favourite science and pursuits under a thick veil of modesty and generosity.

My idea at first was that the cathode might be rolled into coherent sheets. I soon found out my mistake, but the copper was all bought at high figures by the Shaker community, who found that the cathodes yielded an extraordinarily good quality of metal for anodes in their depositing vats. The Chemical Copper Co. was always in difficulty. It started with a shortage of capital, and never covered the shortage. The works came to an ignominious close. The company was not prosperous. The price of copper in 1878 and 1879 was at a low ebb, but took a sudden jump to twenty-five cents before the close of 1879. I had a nice stock of copper on hand and in the vats, and was doing well; but the temptation to realize on such a soaring market was irresistible, and I was ordered to refine everything I could find, at the sacrifice of even the precious metal contents. Excuse this personal digression. It was one of the blind steps in the progress of events which had a momentous influence on your immediate neighbourhood; for the rapidity of the pneumatic process and the perfection of the electrolytic process has inevitably supplanted the more intricate, the more interesting process, from a metallurgical standpoint, of Pearce's modification of the Ziervogel method, as practised first at Black Hawk and then at Argo.

Up to date of Mr. Pearce's alliance with Senator Hill the mattes, as I have said, were shipped to England. And the prices paid for ore and concentrates were low. Fortunately, as a compensation, the value of silver was high. Mr. Pearce, in his Presidential address to the American Institute of Mining Engineers in 1889, gives the proportion of values paid the miners in those early days. He says:

**Proportion of Values.**

"The following table, which I have prepared from data collected by a friend, will show the commercial advantages which the miner has experienced by the progressive development of the smelting industry. For the sake of comparison, I have selected ores which have no special value as fluxes, or as aids to smelting, and will consider them merely in relation to their intrinsic value, and endeavour to show the returns which the miner gets now, as compared with the figures of eighteen years ago. In other words, the net percentage value of an ore to the miner to-day is compared with the value for successive periods from 1871. The value of the silver has been figured from $1.29 per ounce in 1871, down to 93 cents in 1899, and, for the years prior to the resumption of specie payment, the premium on gold is taken into consideration. The slight falling off in 1874 and 1875 was due to the depression following the financial panic in the fall of 1873. For a time, silver-ores were rather a drug on the market and prices consequently fell off.

**Table Showing Percentage of the Total Value of Ores Paid to Miners Each Year During a Period of Eighteen Years.**

| Place. | Year. | Contents in Silver per ton. | Percentage of total value paid to the miner. |
|---|---|---|---|
| | 1871 | 100 oz. | 65. |
| | 1872 | " | 65. |
| | 1873 | " | 65.5 |
| Black | 1874 | " | 53.6 |
| Hawk | 1875 | " | 60. |
| | 1876 | " | 67.2 |
| | 1877 | " | 64.3 |
| | 1878 | " | 65. |
| | 1879 | " | 70. |
| | 1880 | " | 74. |
| | 1881 | " | 74. |
| | 1882 | " | 76. |
| Argo | 1883 | " | 76.5 |
| | 1884 | " | 81. |
| | 1885 | " | 77. |
| | 1886 | " | 80. |
| | 1887 | " | 80. |
| | 1888 | " | 82. |
| | 1889 | " | 84. |

"The difference between the maximum and minimum is 30.4 per cent.

"I have avoided making any figures to show the changes in value of gold-ores from year to year, but, without going

into details, I may state that a Gilpin County gold-ore which would net the miner 53 per cent. of its value in 1870, would now yield him 80 per cent., a difference of 27 per cent. and, on a somewhat lower grade of ore, the difference is 33 per cent."

Since then the gold would yield the miner 90 per cent.

Comparing the prices paid for tailings in 1874 and 1889 he quotes 24 per cent. of the value as that of 1874 and 78 per cent. as that in 1889.

Prof. Hill in 1872 defended himself in the Central City Register against the accusation of extortionate charges based upon unjust comparison of his furnace treatment with California milling practice. The Professor says:

"The Boston and Colorado Smelting Company are treating ores, of which the gross value of the gold and silver estimated in currency, is $50, $100, and $150, at a cost to the miner of $35, $40, and $45 respectively, that is, for ores which contain $50 per ton, currency value, all over $35.00 is paid to the seller, and for ores containin $100 per ton, also all over $40 is paid to the seller, and so on. For intermediate grades a pro rata charge is made.

"This company also pays for the copper $1.50 for each per cent. on the dry Cornish assay, which is the assay on which all copper ores are sold.

"No one who is acquainted with the facts will deny that the ores of Colorado are the most complex which are worked on this continent, containing, as they do, mixed with the sulphurets of copper and iron, large quantities of the sulphurets of antimony, arsenic, zinc and lead, and a refractory gangue. Neither can any one deny that the actual costs of all the principal elements employed in smelting, viz., fuel, labour, fire bricks, and iron, are more than double here what they are east of the Mississippi River, and much higher than they are in California.

"Dr. Raymond, in his report as Commissioner, for 1870, gives the following as the scale of prices paid at the Hill works:

| For ore containing per ton | Is paid of the value. |
|---|---|
| 2 ounces gold | 20 per cent. |
| 3 ounces gold | 30 per cent. |
| 4 ounces gold | 40 per cent. |
| 5 ounces gold | 45 per cent. |
| 6 ounces gold | 50 per cent. |

"For silver, seventy-five cents per ounce is paid, after deducting as many ounces of silver as there are per cent. of copper in the ore. For copper $2 for each per cent., deducting one-half per cent. from the amount indicated by wet assay. No account is taken of quantities less than one ounce of silver, one per cent. of copper, or one-quarter ounce of gold. The above rates are in coin."

In 1875 Prof. Egleston published a paper in the Transactions of the American Institute of Mining Engineers on the Boston and Colorado Smelting Works, after Mr. Pearce had joined Prof. Hill and was separating the precious metal. His description is significant of the small scale on which work was still conducted, and the high terms on which ore was bought. He says:

"The works are thus located in the very centre of the gold and silver producing regions of Colorado, and are also most favourably situated with regard to transportation. They treated in 1874, 30 tons of ore and tailings in 24 hours, and produced 700,000 ounces of silver, 12,000 ounces to 15,000 ounces of gold, and 225 tons of copper. With matte from Alma their production in 1875 will be 110,000 ounces of silver, 25,000 ounces of gold, and 250 tons of copper.

"The gold ores are divided into three classes. The first class consists of auriferous copper pyrites containing from 2 to 10 per cent. of copper, 2 ounces to 10 ounces of gold, and 2 ounces to 10 ounces of silver. These ores average 4 per cent. of copper, 3½ ounces of gold, and 6 ounces of silver. The second class are tailings from the gold mills, consisting of pyrites with about 1½ per cent. of copper, 1¼ ounces of gold, and 4 ounces of silver. The third class consists of tellurium ores, which have a very silicious gangue, and contain 100 ounces to 200 ounces of gold, and 6 ounces to 10 ounces of silver. These ores come mostly from Boulder County, and are often worth $10,000 to $15,000 to the ton.

"The silver ores of the first class consist of surface ores, mostly free from sulphur, containing 70 per cent. of silica. They contain 100 ounces of silver and 5 to 6 per cent. of lead, and no gold. Those of the second class are sulphurets, rich in blende and poor in galena and pyrites; they contain 150 ounces of silver, 15 per cent. of zinc and lead, and no gold."

The next contribution to the literature of our subject was the Presidential address from which I have quoted.

By that time the smelting industry of Colorado had expanded from about 20,000 tons per year in 1877 to 596,594 tons in 1888, and Argo was treating some 200 tons of copper bearing material from all sections of the Rocky Mountains, including the matte from the company's famous branch works in Butte, operated under the superintendence of Mr. Williams. When Mr. Pearce had introduced the Ziervogel method of separating copper and silver, substantially as practised in Germany and England, and his own modification of parting the gold, the heavier expense of shipping the matte to England or Germany was avoided, and, as the above table showed, the miners shared in the saving. But the method was delicate, and costly, involving not only skill, but many operations. And consequently it has not been able to compete with matte concentration in the converter, and the perfect separation of the precious from the baser metal in the electrolytic vat. The requiem of this famous enterprise was thus pronounced in "Mineral Resources" for 1910. Part 1, page 196.

"The year witnessed the dismantling of the plant of the Boston and Colorado Smelting Co. and the passing of this pioneer in the copper smelting industry of the West. Although this company had been successful in its long period of operations, the management did not consider it wise to rebuild the plant, which was becoming out of date. This pioneer plant has had a long and successful career, but copper smelting plants constructed in the State in recent years have been far less successful and have been able to operate but intermittently."

The moral in its effect on us as students is to regard methods, even the most ingenious and scientifically perfect, as merely stepping stones across the river of industrial life, the further side of which is still far away.

### Study of Principles Should Occupy a More Prominent Place Than the Study of Practice.

Looking back, therefore, on the changes in these two branches of mining and metallurgy, namely, in the improvements and changes of methods and the higher values which the miner receives to-day for the products of his industry, we are forced to recognize how, in our system of education, the study of principles should occupy a more prominent place than the study of practice. Even our acceptance of principles, outside of mathematics, should be held as open to modification, but in the main the fundamental laws of physics and chemistry may be accepted as we interpret them, to be correct and our only safe guides. Every improvement made in your own region has been through a better understanding of these laws, and carrying them into operation.

For instance, the effect of the injection of air into molten metal was perfectly understood before Bessemer brought mechanical ingenuity as well as chemical science to bear upon the solution of the pneumatic method. The practicability of extracting the carbon to the exact point at which pig iron is converted into steel proved to be so difficult that the Bessemer process would probably have had a limited range of usefulness had not the suggestion of another chemist been adopted, to oxidize all the carbon, then re-add to the charge the specific amount of carbide of manganese with a known quantity of carbon to re-carbonize the iron, while the manganese absorbed any dissolved oxide of iron. The whole success of this momentous improvement, which was no discovery at all, depended upon the application of known facts to meet certain practical conditions.

Following along the line of steel manufacture, the adoption of the basic lining in the converter, following the Thomas Gilchrist proposal to line the open hearth furnace with a basic material to eliminate phosphorus was a simple application of known chemical facts.

Turning from the pneumatic method as applied to iron to similar methods as applied to copper, we see Holloway carrying his smelting of ore and concentration of matte up to the point where metallic copper began to form, then the occlusion of the tuyeres in the bottom of the steel converter by the chilled copper; and the loss of years, in the adaption of this simple method to the concentration of copper, till Mons. Manhes, adopting a type of converter with elevated tuyeres, which Mr. Bessemer had himself patented, brought the tuyeres within reach of a punching bar, and thus substantially revolutionized the metallurgy of sulphides of copper.

The wonderful progress in the study of the generation of electricity, its transmission, its conversion into power, and its electrical action, has been made within the short period we have been reviewing. It is a special branch of study and research, the intricacies of which the average student cannot thoroughly master, but with the general laws of which he should be familiar. The carrying out of any mining scheme which utilizes electricity involves the employment of an expert in the person of an electrical engineer, but if you are to be an efficient manager of a mine, mill or furnace plant you must personally know what can be done with this mighty but mysterious force, though you may have to leave the handling of it to your electrician.

Another element which of late we have called to our uses for service at a distance from the point of its generation, is compressed air. To determine whether in each particular case, transmission by electricity or by compressed air or by a combination of both should be adopted involves on the part of the manager a fair acquaintance with the fundamental laws of electricity and pneumatics, if he is to be the controlling factor in the administration, instead of a puppet in the hands of his subordinate officers. He may not be familiar with all the practical appliances or the latest improvements for applying these principles, but he must be sufficiently master of the subject to be the master of his staff.

There is another field which the mining and metallurgical engineer of the future will have to cultivate, and that is industrial chemistry. It is of course a branch of industry in which co-operation between the chemical manufacturer and the miner and metallurgist must be closer and keener than it is at present. In fact, our metallurgical activity has been greater than the chemical, partly due to the fact that the market for chemical products has been widely distant from the possible sources of some of the more necessary chemical ingredients, which are essential to all large chemical operations.

We are living at the close of a period of almost unnatural activity and prosperity. We have had half the new world to exploit, and, with steam and electricity as our aids, in little more than a generation we have depleted the fertility of the soil and emptied our mines of their richest ore, taking from each the stores nature had accumulated nearest the surface. The harvest has been abundant and cheaply garnered; but a future generation cannot reap crops without planting, and in our case, if mining prosperity is to be maintained, it must be by saving every product and by-product, and widening, therefore, the field of our operations and consequently of our studies.

The experience here of the past generation demonstrates how rapidly practices have changed under the application of scientific principles. The conclusion, therefore, is that, as a fundamental maxim of education, our studies should aim at a better understanding of the deep and broad laws which underlie all practice rather than the ephemeral methods of the day; and thus train our minds in habits of original research rather than obediently and servilely following the practice of the past or even of the present. The study of methods, however, cannot be neglected, but, if familiar with the principles, you are better able to use your principles in assisting you to devise methods for carrying them into practice.

The danger of too much knowledge of principles is that the scholar becomes so conscious of his shortcomings in practice and sees so keenly the possible perfection of practice ahead that he does not devote himself with sufficient energy to working out and practising the imperfect, practicable methods and using tools he has to his hand to work with. Some of the cleverest men I have had to do with have developed this fault. It should be your endeavour to familiarize yourselves with the scientific basis of the subjects you have to deal with without destroying your practical ingenuity and being depressed by the evident shortcoming of your best efforts to carry principles into action.

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## ANALYSES OF COALS.

Government purchasing agents, designing and operating engineers, and the fuel departments of industrial concerns, large dealers in coal, and persons interested in the distribution and character of the different coals in the United States, will find valuable information in a report just issued by the United States Bureau of Mines as Bulletin 22, entitled, "Analyses of coals in the United States, with descriptions of mine and field samples collected between July 1, 1904, and June 30, 1910." This report contains the analyses of 5,000 samples of coal taken from 1,500 coal mines and prospects situated in the various coal fields of the United States. Not only all of the important fields are represented, but practically all of the more important mining districts.

The purpose of the bureau in compiling and publishing this information is to present reliable information regarding the chemical composition and heating value of the coals. The samples of coals were collected by experienced men according to a definite and uniform system, and were analyzed under carefully controlled conditions, so that there might be no question as to the relative merits of the different coals so far as this can be determined by chemical analyses and determination of heating values.

# ELECTROMAGNETIC ORE CONCENTRATION BY THE ULLRICH SEPARATOR

By P. Kranafeldt.

The process of concentrating ores was formerly effected almost exclusively by mechanical operations involving the aid of water and known as hydraulic sorting, in which differences in specific gravity furnished the means of separating the component materials. This method fails, however, when components require to be separated which differ but little in their density. Hence ores having components of this kind, such as spathic iron ore associated with zinc blende, spathic iron and copper pyrites and many others could only be concentrated in a very imperfect manner or could not be treated at all. Attempts were therefore made to devise methods of concentration in which other properties of minerals furnished the requisite element of dissimilarity, and machines were accordingly designed for classifying the minerals by their different behaviours with respect to magnetic attraction.

Substances are said to be more or less permeable or magnetic according to the degree in which they are influenced, i.e., attracted by, the magnetic poles. The subjoined list of coefficients may serve to convey an idea of the degree of permeability or magnetic strength of a few substances:

| | |
|---|---|
| Metallic iron | 100,000 |
| Magnetite | 40,000 |
| Spathic iron | 760 |
| Red hematite | 590 |
| Iron oxide | 280 |
| Manganite | 180 |
| Nickel oxide | 35 |

Permeabilities of a still lower degree are exhibited by the materials composing the gangue such as quartz, limestone, porphyry, etc. Magnetite is accordingly counted among the strongly magnetic ores, whilst the other metalliferous compounds named in the above list belong to the class of feebly magnetic ores. It should, however, be noted that various minerals such as spathic iron ore, red hematite, iron pyrites, etc., may by roasting be transformed into strongly magnetic compounds.

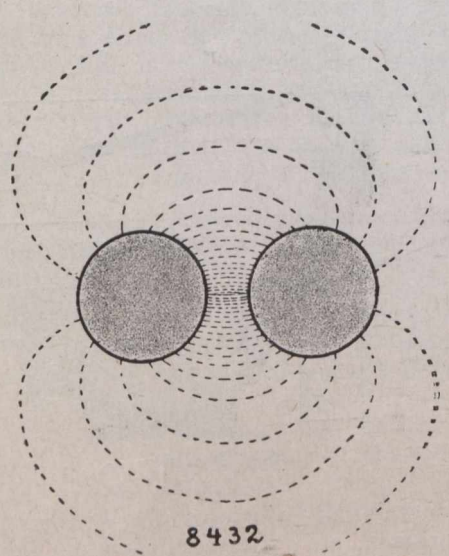



Fig. No. 1

There are two main groups of magnetic separators. In one class the electro-magnets are movable, whilst in the other they are stationary.

**Cylinder Separators.**—The principal representative of the first group is the cylinder separator, in which the poles take the form of two revolving cylinders (Fig. No. 1). The intensity of the field increases gradually until it reaches its greatest value where the two cylindrical poles are nearest to each other after which it gradually declines again. By diminishing the distance between the two poles, the intensity of the field is increased. It is greatest when the gap has been reduced to its utmost limit, which in its turn is governed by the coarseness of the material which has to be passed through the machine. Since the intensity of the field declines gradually from a greatest value it follows that the attracted particles will drop off in succession as they differ in their magnetic qualities. From the description of the process of separation it will, however, be seen that in a machine of this type there cannot be any strict sorting.

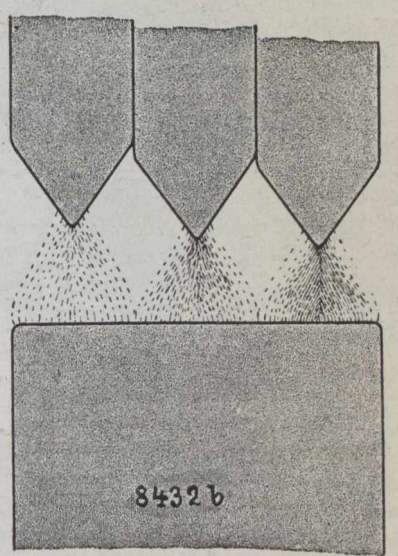



Fig. No. 2

**Stationary Poles.**—More satisfactory are ore separators with stationary poles. They are now almost exclusively fitted with poles designed in the form of V edges. Since the lines of force contract towards the edge it follows that this shape furnishes a means of producing a very intense field and that a V-shaped pole exercises a very powerful attraction. These poles are accordingly particularly well adapted for separating feebly magnetic materials. In the case where a V pole operates in conjunction with a flat pole the zone where the attractive forces due to either pole balance each other is very near to the flat pole, and hence the V-edged pole exercises an attractive force on the greatest part of the field. In separators with stationary poles

both the magnetic and non-magnetic components have to be conducted away from the magnetic field by means of belts or other conveyors. With separators of the simple type as here outlined, it is obviously not possible to separate more than two constituents. To deal with more than two components it would be necessary to set up several magnetic poles, one behind the other, so as to create as many magnetic fields. This would add much

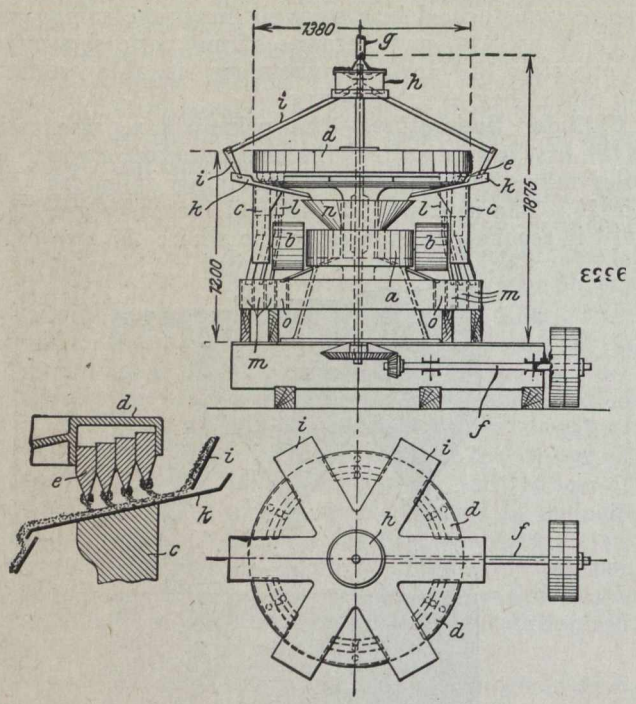



Fig. No. 3

to the cost of the machine without being attended with a satisfactory increase of the output.

It will thus be seen that whilst it is possible with the separators described so far to classify disintegrated material into more than two components, machines constructed on these lines yield either an imperfectly sorted material or their initial cost becomes excessive in proportion to the output. Both objections have been overcome by the introduction of the Ullrich Magnetic Separator.*

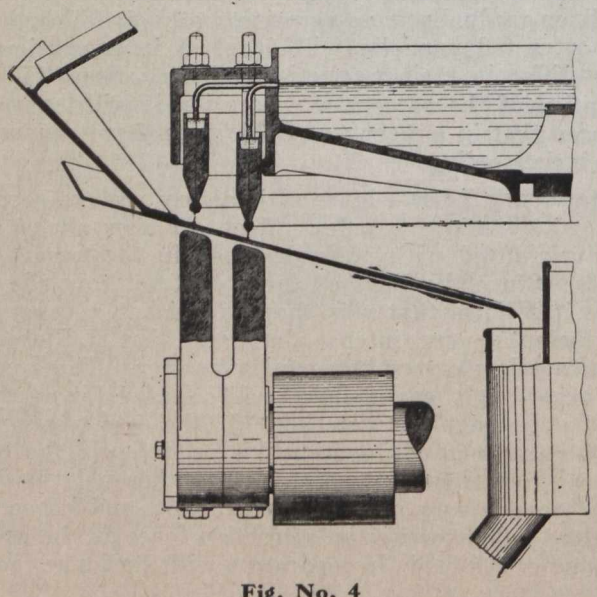


Fig. No. 4

**Ullrich Magnetic Separators.**—In these machines there are several magnetic fields, each of which is subdivided into separate zones (Fig. No. 2). These zones can be independently adjusted to a nicety, and, therefore, their intensity so regulated that an individual zone will act on one of the constituents differing but slightly from the former in its magnetic qualities. The Ullrich separator will, accordingly, in each of its magnetic fields, extract from a mixture one or more constituents differing in their degree of permeability and it will deliver these separately; and whilst it can

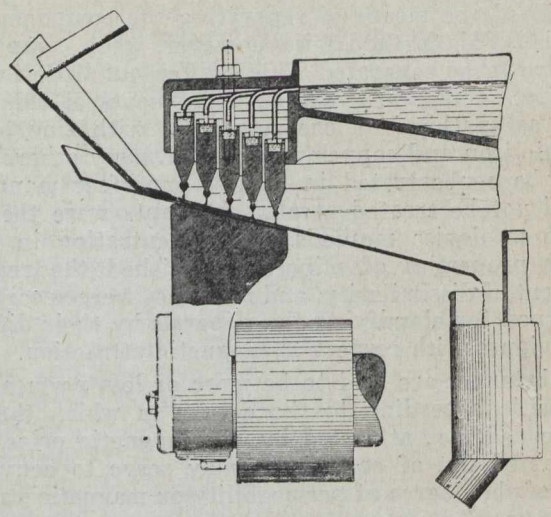


Fig. No. 5

deal with large quantities of mixed materials it delivers remarkably pure products.

Before going into the constructive details of this machine attention may be drawn to a feature which distinguishes the Ullrich separator from all other types.

All electro-magnetic separators which had been designed for the treatment of feebly magnetic minerals were adapted for the handling of dry materials only. It will not be difficult to realize that this restriction introduces serious limitations in the application of the machines. We need only refer to the enormous evolution of dust which is unavoidable in machines which deal with dry and finely ground ores with its attendant

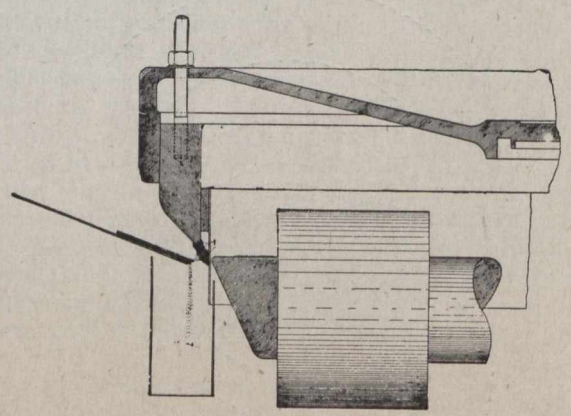


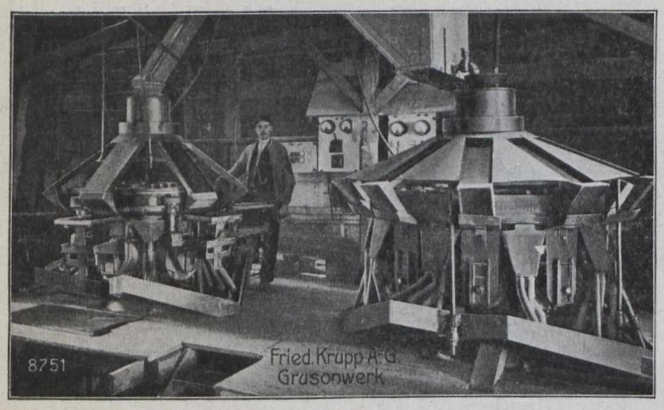
Fig. No. 6

losses of metal and injurious effects upon the health of the workmen, etc. The exclusion, as far as feebly magnetic ores are concerned, of the wet process from the scheme of magnetic separation has been all the

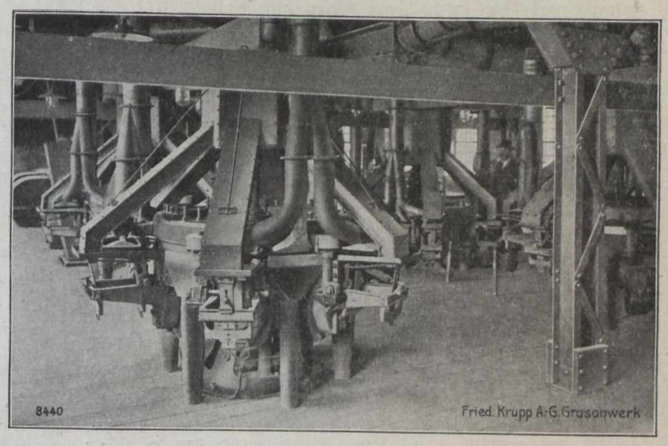
*Sole Makers: Fried. Krupp, A. G. Grusonwerk, Magdeburg, Germany; represented in Canada by Jas. W. Pyke & Co., Ltd., 232 St. James St., Montreal.

more serious since in most cases the mechanical and the magnetic processes of ore dressing cannot profitably be separated. On the other hand, ores are dressed almost exclusively by wet methods. In fact, the disadvantages inherent in the dry magnetic method of separation are notoriously such that many ores had to remain unused as it was not possible to concentrate them by any other method. Among ores of this kind are to be found hematite ores, zinc ores, etc.

The Ullrich separator was the first machine to classify feebly magnetic materials under the conditions of the wet process. But as it is available for strongly magnetic material just as well, the scope of its applicability extends to all cases in which magnetic separation may be practicable.




WET




DRY

**Ullrich Separators**

The body (a) sends out a number of radially arranged horizontal arms of soft iron surrounded by the magnet coils (b) and carrying on their extremities adjustable upright pole heads (c). The body (a) supports on ball bearings a revolving disc (d) the rim of which takes the form of a chamber for the reception of the armature rings (e). The disc is keyed upon a vertical shaft and is set in rotation by bevel gearing and a belt drive.

There are either two, four, six, eight or ten pole heads (c) arranged in a circle, providing as many separate magnetic fields. The initial material is generally conveyed to these by shaking feeders actuated by a friction roller in contact with and driven by the rim of the revolving disc (d). In the case of dry material the feeding device takes the form of a band conveyor.

The pole heads may be divided up tangentially to the armature rings into as many adjustable pole plates as there are rings (see Fig. No. 4).

The armature rings (e), of which there are one, two, three, four, five, or six, according to the number of zones required or the number of constituents to be separated, terminate below in V-edges. They rotate above the stationary poles, being suspended by screws from the top of the annular chamber at the circumference of the revolving disc and may, independently of each other, be set at any required height by means of these screws.

The wet separators have the upper portion of the rings made in the form of channels for the reception of water (Fig. No. 5) conveyed to them through small tubes from the container formed by the revolving disc (d) and its rim. The water is discharged through slots in the sides of the channels and in flowing down the sides of the rings serves to clean the products attracted to the rings.

At each magnetic field a feeder passes the material through the active space between the pole and the armature rings rotating above it. When the electromagnets are energized the space between the pole and rings becomes a magnetic field sub-divided into as many zones as there are rings. In consequence of the magnetic force of attraction in the field zones, which may be regulated by raising and lowering the rings or the pole heads, the magnetic constituents are drawn up by the Vs of the rings. In the wet separators the water which flows down the sides of the rings in opposition to the motion of the attracted particles washes down any particles of lower magnetic quality than desired for the particular ring and creates between the poles and the armature hydrostatic columns, within which the separation of the magnetic and non-magnetic constituents is effected without any difficulties being encountered on the score of surface tension.

The particles attracted by the rings are carried by the latter out of the magnetic fields and drop into separate pockets, any particles still adhering to the rings being removed by a spraying device or leather strikers.

In the case of separators provided with one ring only (Fig. No. 6) the material, instead of being passed between the pole and the ring, is merely conveyed up to the magnetic field. The magnetic constituents are then lifted out by magnetic attraction and discharged from the field through the space between the armature ring and the brass ring attached thereto. The non-magnetic constituents drop straight down from the inlet chute.

Machines designed for classifying fine slimes are fitted with stationary feeding channels (k) without shaking mechanism so that the rings can be set very accurately and therefore the components of the slimes can be separated with an exceedingly fine degree of precision.

The following minerals have successfully been concentrated with Ullrich magnetic separators:

| Minerals. | Separated Constituents. | | Remarks. |
|---|---|---|---|
| | Magnetic. | Non-magnetic. | |
| 1. Strongly Magnetic Ores. | | | Apatite, which often forms part of the gangue, is likewise separated out. |
| Magnetite. | Magnetite. | Gangue. | |
| *Magnetic Iron Pyrites.* | Magnetic Iron Pyrites. | Copper Pyrites. | |
| 2. Minerals which require to be prepared by roasting for the electro - magnetic treatment. These include: Zinc ores containing iron pyrites, copper pyrites in the form of raw ores or washed middlings, tin ores containing sulphur, tin or tungsten ores. | Iron Pyrites. Copper Pyrites. Zinc Blende or Tungsten. | Gangue, Zinc Blende or Tin. | Ores containing Iron Pyrites in which these constituents can be rendered strongly magnetic by partial roasting or calcining with access of air. |
| 3. Feebly Magnetic Ores. | | | |
| *Iron Ores.* | Hematite Ores. Red Hematite Ores. Brown Hematite Ores. Spathic Iron Ores. | Gangue. Zinc Blende. Iron Pyrites. Copper Pyrites. | |
| *Zinc Ores.* | Ferruginous or Manganiferous Silicates. Zinc Blende. Franklinite. | Zinc Blende. Feebly Magnetic or non-magnetic minerals. (Iron Pyrites) Zincite Willemite. | e.g. Broken Hill Tailings containing, besides Zinc Blende, garnets and rhodonite. |
| *Tin and Tungsten Ores.* | Tungsten. | Cassiterite. | |
| *Copper Ores.* | Spathic Iron Ore, Copper Carbonate (if sufficiently magnetic) | Copper Pyrites. Gangue. | |
| | Atacamite. | Gangue. | |
| *Monazite Sands.* | Magnetite. Ilmenite. | Zirconium and other Silicates. | |
| *Concentrates, from jigs, of Diamantiferous Sands.* | Ferriferous Grits or Sands or Ferruginous Silicates (Garnets). | Diamonds. | |
| *Magnesite* | Burnt Magnesite. | Lime, Alumina. | |
| Raw Minerals or Roasted Materials containing as impurities ferriferous minerals. | | | Treated with the object of *cleaning ferruginous sands and clays for the manufacture of glass and pottery.* |

From this list it will be seen that the Ullrich separators not only serve for concentrating ores, but are also well adapted to eliminate ferrous impurities from the raw materials employed, e.g., in the manufacture of glass and earthenware.

The capacity of these separators greatly depends on the magnetic permeability of the ore. In the case of strongly magnetic and coarse-grained material, which may size up to 2 inches, up to 7 tons per hour, may be passed through the machine, whilst with fine material the maximum capacity is about 4 tons. In the case of feebly magnetic materials which may contain pieces up to 3/8 inch diameter, the machines can deal with quantities ranging from ½ to 3 tons per hour.

The power absorbed by the Ullrich separators varies according to the nature of the minerals and ranges from ½ to 2 h.p. The wear is quite insignificant.

The operation of the machine is very simple, and one man can attend ten machines.

Thanks to its merits the Ullrich separator has already met with a considerable measure of success and appreciation. Though it was introduced but four years ago there are already a considerable number of plants operating with Ullrich magnetic separators.

We append a table to illustrate the practical results achieved with these machines:

| Ores | Crude Ores Per cent. | | | Zinc Concentrates Per cent. | | | Iron Concentrates Per cent. | | | Recovery Per cent. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fe | Mn | Zn | Fe | Mn | Zn | Fe | Mn | Zn | Fe | Mn | Zn |
| **Spathic Zinc Blende—** | | | | | | | | | | | | |
| 1. Siegerland | 15.9 | 3.8 | 27.8 | ... | ... | 49.0 | 30.1 | 8.2 | 2.5 | ... | 75.2 | 92 |
| 2. Siegerland | ... | ... | 22.0 | ... | ... | 40.6 | ... | ... | ... | ... | ... | 98.8 |
| 3. Siegerland | ... | ... | 33.1 | ... | ... | 52.9 | ... | ... | ... | ... | ... | 97.5 |
| 4. Sardinia | ... | ... | 38.9 | ... | ... | 55.9 | ... | ... | ... | ... | ... | 92.8 |

| | Crude Ores Per cent. | | Copper Concentrates Per cent. | | Iron Concentrates Per cent. | | Recovery Per cent. | |
|---|---|---|---|---|---|---|---|---|
| **Spathic Copper Ores—** | | Cu | Fe | Cu | Fe | Cu | Fe | Cu |
| Hungarian Ore | 38.9 | 1.01 | ... | 3.97 | 39.8 | 0.131 | 68 | 88 |
| 1. Hungarian Ore (size a) | ... | 3.09 | ... | 6.02 | ... | .... | ... | 84 |
| 2. Hungarian Ore (size b) | ... | 3.75 | ... | 9.60 | ... | .... | ... | 84 |
| Hungarian Ore (size c) | ... | 4.80 | ... | 9.20 | ... | .... | ... | 84 |

| | Crude Ores Per cent. | | | | Concentrate Per cent. | | | | Recovery Per cent. | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Iron Ores—** | Fe | Mn | P | Insoluble | Fe | Mn | P | Insoluble | Fe | Mn |
| 1. Norwegian Magnetite and Hematite Ores of Dunderland (a) | 37.34 | ... | 0.238 | ... | 65.32 | ... | 0.0255 | ... | 80 | ... |
| Iron Ore Co., Ltd. (b) | 27.6 | ... | 0.164 | ... | 64 | ... | 0.0132 | ... | 76.4 | ... |
| 2. Swedish Hematite Ore | 34.6 | 8.9 | 0.349 | 33 | 48.3 | 11.1 | 0.0276 | 12.2 | 79.1 | 70.9 |
| 3. Bohemian Hematite Ore | 56.5 | ... | .... | ... | 68.6 | ... | .... | ... | 93.3 | ... |
| 4. Blast Furnace Dust (American) (a) | 43 | ... | 0.47 | 17.4 | 57.3 | ... | 0.297 | 10.7 | 91.1 | ... |
| Blast Furnace Dust (American) (b) | 43 | ... | 0.47 | 17.4 | 59.1 | ... | 0.25 | 8.5 | 72.4 | ... |
| 5. Roasted Spathic Iron Ore (Siegerland) (a) | 37.2 | 6.9 | .... | ... | 48.1 | 8.5 | .... | ... | 93.5 | 89.5 |
| Roasted Spathic Iron Ore (Siegerland) (b) | 42 | ... | .... | ... | 48.8 | 11.7 | .... | ... | 87 | 86.6 |
| 6. Swedish Magnetite Ore | 34.6 | ... | 0.329 | .. | 51.6 | 8.5 | 0.021 | ... | 88.5 | ... |
| 7. Swedish Magnetite - Hematite Ore | 50.2 | ... | 0.106 | ... | 61.6 | ... | 0.029 | ... | 86.4 | ... |
| 8. Italian Magnetite Ore | 54.5 | ... | .... | ... | 65 | ... | .... | ... | 90 | ... |

Messrs. Jas. W. Pyke & Co., Limited, 232 St. James Street, Montreal, are the Canadian representatives for the Krupp Engineering Works, and will be glad to give any further information to interested parties who may wish to send samples of ore over to the Krupp testing station for examination.

## IRON ORE.

E. C. Eckels, a geologist, giving his testimony in the United States steel hearing, furnished some interesting data on the Newfoundland and Nova Scotia ore deposits. He said that the ore had been located at 1,071 feet below the bottom of Conception Bay, and that the Nova Scotia Iron & Steel Co. is now successfully operating submarine mines. The economically workable ore within five miles of Bell Island is estimated at 3,500,000,000 tons. Besides this, there are billions of tons which are not economically available at this time. In one deposit alone in the Newfoundland district the witness said that the ore runs 30 feet thick and contains about 90,000,000 tons to the square mile.

Mr. Eckels estimated that ore could be brought from the Newfoundland mines to Philadelphia and the eastern steel market at a cost of about four cents per unit. Foreign ore sells at Philadelphia at seven and one-half cents per unit, showing the profit on the Newfoundland ore at Philadelphia and Baltimore. Lake Superior ore cannot be laid down at Baltimore and Philadelphia for less than nine cents per unit, according to the witness, or from two to two and one-half cents per unit more than the foreign product.

# THE GOLD DEPOSITS OF NOVA SCOTIA*

By E. R. Faribault.

**General Character and Distribution.**—The gold in Nova Scotia occurs chiefly in quartz veins, but a small amount of gold has been recovered from detritus. The deposits of auriferous antimony ore occurring in cross-country veins in the Halifax formation at West Gore have been worked considerably for antimony and gold.

The gold-bearing quartz has been reported as occurring in the granite, but the authenticity of the reports may be regarded with suspicion. With this possible exception, all the known veins occur in the sedimentary strata of the Gold-bearing series. Although there are a few important veins that cut across the stratification, most of the auriferous quartz veins are of the inter-bedded type. They occur chiefly in the beds of slate which are found inter-stratified with the beds of quartzite throughout the whole thickness of the Goldenville formation, and their distribution and structure are to a great extent the result of the action of dynamic forces to which the enclosing rocks were subjected. The interbedded veins are found in great numbers, aggregated in groups on the domes along the anticlines; and in some few cases on the pitching portion of the anticlines. Rarely they are formed in the synclinal troughs. The domes thus determine the location of nearly all the groups of veins and each of them may be considered as an independent gold district. Some domes, however, especially in the west, do not show the presence of quartz veins, but this appearance may be simply due to the concealment of the bedrock by drift.

A tabulation made of the principal anticlines with the gold districts located on them, from the map-sheets published by the Geological Survey, shows that to the east of Halifax 33 gold districts are distributed along 14 anticlines in an area 40 miles in width by 100 miles in length.

The gold-bearing districts are much less numerous and generally less productive in the western part of the field than in the east. This is chiefly due to the folding being more gentle and the domes broader, hence the slipping of the beds and fracturing has been less pronounced with the consequent failure to produce channels favourable for the circulation of solutions and the deposition of vein matter.

Quartz, with hardly an exception, forms by far the largest proportion of the vein filling, but occasionally inclusions of country rock or certain minerals are quite abundant. Associated with the quartz, the principal minerals are pyrite, arsenopyrite, calcite and galena, less frequently chalcopyrite, sphalerite, dolomite, chlorite and pyrrhotite, and more rarely scheelite, stibnite, feldspar, rutile and specular iron.

Silver is found in the gold recovered from cross-veins at Leipsigate, Brookfield and some other districts, sometimes in such amounts as to reduce the value of the product to $16 an ounce. But the gold produced from the interbedded veins is generally very fine and varies in value from $19 to $20 per ounce. The gold generally occurs free and visible and is amenable to amalgamation, but it is also in part intimately bound up with the sulphides, thus requiring other methods of treatment for its recovery. In the white, coarsely crystalline quartz it is found in coarse, visible particles, while in the bluish, oily quartz of the laminated veins it is usually disseminated more finely or is found in plates in the layers parallel to the walls. It is generally most abundant on the footwall, is very commonly associated with arsenopyrite, frequently in lenses or nodules forming large nuggets, and almost invariably with galena. Small crystals of gold are sometimes found in rhombic dodecahedra and octahedra, generally distorted, with bevelled edges and finely striated surfaces. Plates and scales are often found in the adjacent slate, but close examination always reveals the presence of minute films or threads of quartz traceable to the parent vein.

**Interbedded Veins.**—As has already been pointed out, the auriferous veins are found on domes, although in some few cases, as at the Richardson mine, they are found on the pitching parts of anticlines remote from domes. In such cases, however, conditions favourable for ore deposition have been brought about by a notable change in the angle of pitch, producing virtually a doming of the anticline that is not apparent at the surface.

The distribution of the veins on any particular dome is intimately related to the rock structure, and complexity is introduced by the unsymmetrical character of the domes. On sharp, closely folded anticlines, where the two limbs form an angle of less than 40 or fifty degrees, the veins are found close to the apex and curve over the anticline, forming a succession of superimposed saddles, similar to the "saddle-reefs" of Victoria, Australia. On broad folds, on the other hand, where the angle formed by the two limbs is over 45 degrees, the veins are found at a greater distance from the axis, but generally within the limit of curvature of the strata of the fold beyond which the dip ceases to increase and becomes uniform. If one end of a dome is flatter than the other, the veins at that end are further removed from the axis than at the other; and if veins occur on both limbs of a transversely unsymmetrical dome those on the limb with the higher angle of dip will be nearer the axis and more abundant than those on the limb with the lower dip. In many districts the veins are found on one limb only, and then they invariably occur on the limb with the higher dip, which is generally the south dip.

The interbedded veins have a more or less crescentic outcrop. On the sides of long domes, they form nearly straight lines, but finally curve with the strata around the apex of the fold, and some have been traced continuously around the end of the dome from one limb to the other. But generally the outcrops of veins form only small portions of elliptical curves, and these are most frequently arranged en echelon so that they lie in zones radiating from the centre of the dome and diverging more or less from the major axis according as the fold is broad or narrow. These zones are on those parts of the dome where the strata do not strike approximately parallel with the axis of the fold, but curve towards the axial line. In symmetrical domes, like that of Oldham, there may thus be four zones, and these four zones may be considered as merging into one another so as to favour the formation of veins, the outcrops of which form almost complete ellipses. In most districts, however, there are only two zones of veins, as at Waverley, where they may be regarded as merging into one to form saddles; and in some districts there is only one zone, as at South Uniacke.

*Extracts from article in Guide Book No. 1, published by the Geological Survey for the twelfth International Geological Congress, August, 1913.

Mining operations in several districts have shown that underlying the veins exposed at the surface are other parallel interbedded veins. Each district has thus a vein-bearing zone with a horizontal extent determined by the outcropping veins and with an indefinite vertical extent. In its vertical extension each zone is believed to be roughly parallel with the axial plane of the anticline. The distance of the exposed veins from the axis depends on the dip of the strata, and it is probable that the distance from the axial plane of any portion of the zone of veins extending into the earth is also dependent on the dip; if the fold gets sharper with depth, the zone of quartz veins probably approaches the axial plane, or if it flattens with depth, the zone of auriferous veins recedes from the axial plane.

**Corrugated Veins.**—Interstratified veins often exhibit a remarkable folded or corrugated structure within the beds of slate that contain them. The corrugations, or crenulations, usually occur at or near the apex of the anticline and sometimes in the syncline, and run parallel with one another and in a direction approximately parallel with the axis of the fold. At the apex of the fold the corrugations dip with the dip of the strata, which then corresponds to the pitch of the fold, but on each side of the apex they radiate more or less from the centre. The aptitude and interval of the folds generally vary with the thickness of the vein and of the enclosing bed of slate. Also the nearer the veins lie to the anticlinal axis the more pronounced these corrugations become. In some veins the folding has been so intense as to separate the quartz with disconnected rolled portions. The name "barrel" quartz has been given to the larger corrugations, because when such a corrugated deposit was first uncovered at Waverley, it looked to the miner like the back or top of barrels lying in rows.

Where one of the corrugations becomes enlarged or some part of a vein swells out and takes on some peculiar form extending for some distance in one direction, this portion of the veins is called a "roll." A roll is generally richer than other parts of the vein. Its position is usually dependent on some peculiarity of rock structure, such as some small subordinate crumple, some slight flexure in the beds indicating an incipient crumpling or some zone of fracturing. As such structures usually affect a great thickness of strata, a number of veins are affected by similar conditions and a roll in one vein is succeeded by similar rolls in the underlying or overlying veins. Series of such rolls are found in most districts and constitute one of the principal and more persistent forms of ore deposits.

**Thickness of Interbedded Veins.**—The thickness of the interbedded veins varies from a fraction of an inch to 20 feet (6 m.). The greater number may not be over an inch (25 cm.), but those that have been worked, generally vary from 3 to 18 inches (7 to 45 cm.). The largest veins are usually found on sharp anticlines in the shape of saddle veins. Saddle veins attain their maximum thickness at the apex of the fold and become thinner as they extend down on the limbs. Thus the Richardson saddle vein, while 20 feet (6 m.), thick at the apex thinned down to 6 feet (1.8 m.) at the 300-foot level. Some leads have been followed in depth several hundred feet with little or no decrease in size, but others have been found to pinch to a mere film and it is probable that nearly all of them pinch out at no great depth. The Dominion lead at Waverley was found to decrease from 15 inches (40 cm.) on the surface to a mere film of quartz with small lenticular pockets at 500 feet (150m.) and to be completely wanting at 600 feet (180m.).

Veins are frequently thickened by local disturbances, such as a bend, a crumple or a faulting of the strata.

Although leads show a great similarity and are very numerous, yet many of them possess a certain individuality, some peculiarity of colour, structure, lamination, distribution of sulphides, quantity or form of gold, serving to distinguish them from others of the same district.

**Cross or Fissure Veins.**—A few important veins cut across the strata for a considerable distance, and in some districts they form the principal auriferous deposits. These cross veins, often spoken of as fissures, sometimes curve and branch, contain inclusions of country rock, and have a gouge on the walls. All the most important are found on domes, generally cutting the main anticline at various angles. They occur chiefly in the Goldenville formation, but also in the Halifax formation, especially at the base. Seldom does a cross vein lie in the fault plane. In the case of the Cope lode of Central Rawdon and the Baker vein of Oldham, which are exceptions to this rule, the faults are probably younger than the veins.

The thickness of the cross veins is less regular than that of the interbedded veins, probably because they generally intersect alternating beds of different hardness. They do not attain great thickness, except sometimes at their intersection with interstratified leads, flexures or rolls. The mineral content is generally the same as that of the interbedded veins, but the laminated structure is wanting. In many cases the value of the gold extracted is much reduced by the presence of silver. At West Gore enough stibnite was found to form gold-antimony ore deposits of considerable value and extent.

**Bull Veins.**—There is another kind of vein differing from those already described. It may cross the strata or roughly lie in a stratification plane. It shows little or no trace of lamination, carries few metallic minerals and is composed of white crystalline quartz in which geodes with quartz crystals are sometimes found. These veins are usually thicker than the others, varying from one to several feet. They are not auriferous and are known as bull veins.

**Angulars**—Many of the main veins have branches passing into the foot or hanging wall. These branches are termed angular, and they play an important part in the ore deposition in certain veins. The point from which an angular passes from the main vein into the hanging wall is usually higher than that from which it passes into the foot wall, and the intervening portion of the vein is frequently thicker and richer than other portions. Their distribution and attitude are dependent on the structure of the dome. In some parts of a dome they may be numerous or completely absent; they may have a general strike and dip quite different from what is found in another part of the dome. In crossing the bedding, they generallly run nearly perpendicularly to the quartzite, but obliquely through the slate. In a closely folded anticline they are more numerous at or near the apex, where they often form a reticulated system of veins extending along the axial plane from one lode to an overlying or underlying one.

The quartz of the angulars differs from that of the main veins in being of a fine, granular texture, free from laminations.

(To be continued.)

# JEFFREY SHORTWALL MINING MACHINE

The principal parts of this machine may be grouped as follows: Motor, reserve switch, starting box, gearing, friction disc clutch, feed drum, retarding drum, cutter bar, truck and electric cable reel. All of these, with the exception of the truck and cable reel are mounted on a cast steel frame, known as the bed frame. The motor is mounted on the rear of the bed frame and is of the consequent pole type, having two series and two shunt coils. The armature is of the drum wound type and is mounted in a horizontal position. The motor is built either open or enclosed, and all of the late type are equipped with ball bearings on the armature shaft. The reverse switch is entirely enclosed. It consists of four stationary contacts mounted on a slate base and two movable contacts mounted on a heavy moulded insulation centre. All "live" parts are well insulated from the box and operating handle. The reverse switch (as the name implies), is used for obtaining two directions of rotation of the motor, for cutting in either direction and for operating the self-propelling truck.

The driving mechanism of the truck is supported by a bearing mounted on the rear of the truck and known as the sprocket and worm shaft bearing. It consists of two shafts, one in line with the armature shaft, and on which is mounted a clutch and worm. The other shaft is at right angles to this and on it is mounted a worm wheel and 6 tooth drive sprocket. The worm wheel is keyed to a sleeve mounted loose on the sprocket shaft and is driven by the worm mentioned above. The worm wheel also forms a housing for the friction disc clutch, which drives the sprocket shaft. The speed of the truck may be varied from 0 to 350 feet per minute and is regulated by the pressure applied on the discs. Trucks of former design were equipped with a jaw

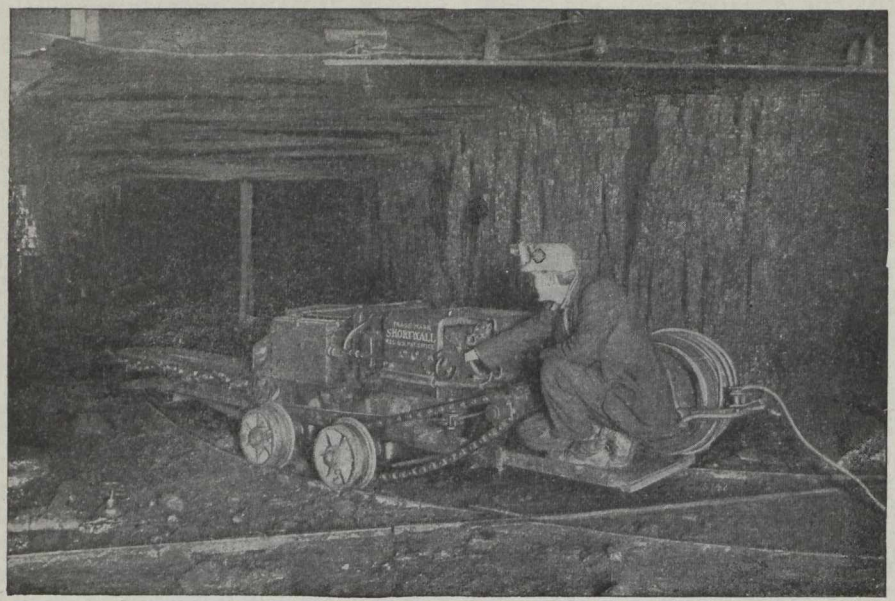


**Figure 1. Illustrating the method in which the machine enters the room on its own truck**

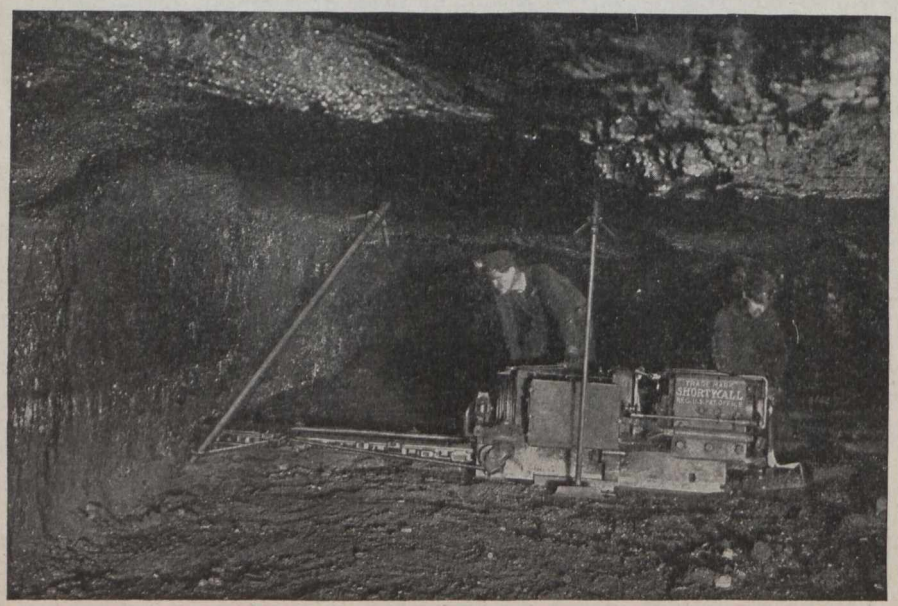


**Figure 2. Illustrating method of sumping**

clutch in place of a friction disc clutch. The 6 tooth drive sprocket is connected by No. 152 steel roller chain making all four wheels drivers. A bank brake is used for stopping the truck, or controlling the speed on grades. It is operated by the same lever used for the friction disc clutch. With one movement of the lever the pressure is released from the discs and applied to the brake.

The machine is brought into the room on its own truck as is illustrated in Fig. 1.

The machine is unloaded by releasing the pin clutch on the truck which connects with the clutch on the end of the armature shaft, raising the jack arm (beneath the starting box), starting the motor and throwing the shifting lever to the right. This operation causes the clutch to engage with the clutch gear and gives the fast speed which is used for handling the machine.

Where the props are set close to the face, it is necessary to move the machine to the face before moving to the rib, using the idler sheave wheel hooked in the cutter bar in order to move the machine in limited space. The angle at which the machine is placed for making the sumping cut depends almost entirely upon the nature of the coal to be cut and the condition in which it is necessary to leave the rib. Under ordinary circumstances, the machine is placed at an angle of 30 degrees to the right hand rib, although in some places it may be placed at an equal distance between the face and rib.

The sumping cut is made by turning the eccentric to engage the pin clutch with the chain sprocket, and then starting the motor. The clutch shifting lever is then thrown to the left—this causes the clutch to engage with the clutch pinion and gives the slow speed which is used for cutting. As the cutter bar advances into coal, the machine will slowly swing toward the right hand rib. In some cases, however, this movement is so rapid that it is necessary to use the rope from the rear drum to retard the rear of the machine.

After the sumping cut is completed, preparations are made for cutting across the face. The feed rope is unwound from the drum and carried across to the left hand rib, where it is fastened to the bottom plate of a jack placed about 18 inches from the face of the coal. The retarding rope is fastened to the jack which was used for the feed rope while sumping.

In cutting across the face, the slow speed is used, which, as explained heretofore, is obtained by throwing the clutch shifting lever to the left. The retarding rope, which is controlled by the steed band on the drum, is used to hold the machine at the proper angle to the face.

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# DESULPHURIZING SILVER ORES AT COBALT

Mr. James J. Denny, writing in the Mining and Scientific Press, gives the following account of the process of desulphurizing silver ores as worked out by him and now in use at the Nipissing low-grade mill. "In the fall of 1911 I undertook a series of experiments in connection with the projected Nipissing low-grade mill to test the possibilities of several proposed methods of treatment and to discover, if possible, an all-cyanidation process that would improve on the general practice.

"After a considerable amount of experimenting I found that my results varied greatly, and to determine the cause I ran separate tests on the principal silver-bearing veins. My experiments showed that while some veins gave excellent results by ordinary cyanidation methods, the tailing from the treatment of other veins was persistently high, owing to the presence of varying amounts of the complex minerals, pyrargyrite, tetrahedrite, proustite, dyscrasite, and argentite. Some of the veins on the Nipissing property contain considerable amounts of these minerals, and my experiments were therefore directed to discover some inexpensive chemical or electrical process for breaking up these refractory compounds and so rendering them amenable to cyanidation. Working along these lines, I finally discovered that all of these minerals excepting dyscrasite were readily decomposed into their respective elements when brought into direct contact with aluminum in an alkaline solution. This preliminary reducing treatment left the silver in a spongy metallic state and when followed by the usual cyanidation process the results were found to be very satisfactory.

"By the preliminary treatment the silver, and in part at least, the antimony and arsenic, are reduced to the metallic state, and are so found. The reduction is accomplished by the nascent hydrogen resulting from the action of caustic soda on the aluminum according to the following equation:

(1) $2Al+2NaOH+2H_2O=Na_2Al_2O_4+6H$.

The probable reactions involved in complete reduction are indicated by the following equations:

(2) Argentite.

$6H + 3Ag_2S + 6NaOH = 3Na_2S + 6H_2O + 6Ag$

(3) Pyrargyrite.

$6H+Ag_3SbS_3+6NaOH=3Na_2S+6H_2O+3Ag+Sb$

(4) Proustite.

$6H+Ag_3AsS_3+6NaOH=3Na_2S+6H_2O+3Ag+As$.

The reactions being reversible, probably the arsenic and antimony are not completely reduced to the metallic state in practice, and the investigation of the subject is rendered difficult by reason of secondary reactions by which the arsenic and antimony are possibly redissolved to form arsenates and antimonates by the excess caustic of the reducing solution, and the protective alkili of the cyaniding solution. The working solution shows the presence of these compounds, "but in practice they are found to have no detrimental effect either in the reducing or the cyaniding treatments. The solution assays, antimony 0.0084% and arsenic 0.026 per cent.

"I then undertook a large number of tests on a commercial scale, using ordinary run-of-mine ore to determine the following points: (a) the effect of the reducing treatment; (b) the time of treatment; (c) the degree of comminution required to give the best economic results.

"These results show clearly that on the run-of-mine ore the desulphurizing treatment raises the extraction appreciably and greatly reduces time. These and similar experiments establish the efficacy of the desulphurizing process and point to 48 hours as the most economic time of treatment.

"It was early apparent in this preliminary investigation that extremely fine grinding was absolutely essential to give a high extraction in the desired time (48 hours), and this fact has been substantiated by many later experiments.

"The method of treatment as outlined above was immediately put into practice at the Nipissing low-grade mill on the recommendation of Charles Butters, the consulting engineer."

# THE DISASTROUS EXPLOSION AT THE UNIVERSAL COLLIERY (SOUTH WALES)*

So terrible is the disaster at the Universal Colliery, which lies near a tributary of the Rhymney, amongst the barren hills of East Glamorganshire, that the whole industry must be reduced to a numbed silence. The immensity of this calamity—the greatest, numerically, that has ever visited the British coalfields—coming at a time when science has half promised us that to-morrow shall see the end of all colliery explosions, stuns and bewilders. Pity and grief for the time must be supreme; but the energy and heroism of the rescuers, some of the best stuff that Wales possesses, give the first trumpet call to renew the battle, and, whatever errors may lie hidden for the present with the dead men behind the wall of fire at Senghenydd, we can at least hope that they may direct us nearer the truth, and so be the means of saving generations of pitmen yet to come.

Below is given a list of the most serious explosions that have occurred in British Collieries since 1851:

| Mine. | Date of Explosion. | No. of Deaths. |
|---|---|---|
| Ince Hall, Lancashire, | Feb. 18, 1854 | 89 |
| Cymmer, South Wales, | July 15, 1856 | 114 |
| Lund Hill, Yorkshire, | Feb. 19, 1857 | 189 |
| Burradon, Northumberland, | March 2, 1860 | 76 |
| Risca, South Wales, | Dec. 1, 1860 | 142 |
| Oaks, Yorkshire, | Dec. 12, 1866 | 361 |
| Talk-o'-the-Hill, Staffordshire, | Dec. 13, 1866 | 91 |
| Ferndale, South Wales, | Nov. 8, 1867 | 178 |
| Moss Pit, Lancashire, | Sept. 6, 1871 | 70 |
| Swaithe Main, Yorkshire, | Dec. 6, 1875 | 143 |
| Blantyre, Lanarkshire, | Oct. 22, 1877 | 207 |
| Haywood Wood, Lancashire, | June 7, 1878 | 189 |
| Abercarn, South Wales, | Sept. 11, 1878 | 268 |
| Risca, South Wales, | July 15, 1880 | 120 |
| Seaham, Durham, | Sept. 8, 1880 | 164 |
| Naval, South Wales, | Dec. 10, 1880 | 101 |
| Trimdon Grange, Durham, | Feb. 16, 1882 | 74 |
| Clifton Hall, Lancashire, | June 18, 1885 | 178 |
| Mardy, South Wales, | Dec. 23, 1885 | 81 |
| Udston, Lanarkshire, | May 28, 1887 | 73 |
| Llanerch, South Wales, | Feb. 6, 1890 | 176 |
| Morfa, South Wales, | March 10, 1890 | 87 |
| Park Slip, South Wales, | Aug. 26, 1892 | 112 |
| Thornhill, Yorkshire, | July 4, 1893 | 139 |
| Albion, South Wales, | June 23, 1894 | 290 |
| Universal, South Wales, | May 24, 1901 | 81 |
| National, South Wales, | July 11, 1905 | 119 |
| Maypole, Lancashire, | Aug. 18, 1908 | 75 |
| West Stanley, Durham, | Feb. 17, 1909 | 167 |
| Whitehaven, Cumberland, | May 11, 1910 | 136 |
| Hulton, Lancashire, | Dec. 21, 1910 | 344 |
| Cadeby, Yorkshire, | July 9, 1912 | 87 |
| Universal, South Wales, | Oct. 14, 1913 | 427 |

It will be seen that this ill-fated colliery has already been the scene of a disastrous explosion, which occurred in the early morning of May 24, 1901. That explosion was even more violent than the last, practically every part of the workings being penetrated, and 81 of the 82 men at work in the pit at the time were killed. In the light of after events it is a notable fact that Prof. William Galloway, who made a report following the explosion, urged that it was a conspicuous example of a coaldust explosion. He says:

"The intake airways contained pure air and inflammable coaldust, but no firedamp; the return airways contained air mixed with all the firedamp produced in the workings, and uninflammable stonedust, but no coaldust; and as the return airways, speaking generally, were untouched by the explosion, the conclusion that the coaldust when mixed with air played the part of an inflammable quasi-gas in the explosion seems to be irrefragible."

He added: "It is evident that an explosion of coaldust in a confined space like the workings of a mine is of a totally different nature from the conceptions of it that have been published from time to time both in this country and on the Continent."

Prof. Galloway considered that the explosion was due to a shot igniting coaldust, but no very positive evidence was available. At the same time he pointed to the dry and dusty condition of the mine, and particularly called attention to the faulty construction of the trams. The jury added a rider to their verdict asking that Parliament should make watering compulsory in all mines of this character.

Read now, after the lapse of 12 years, these quotations from Prof. Galloway's report give food for thought. Have we travelled very far in that time? It is a question which we scarcely care to answer. The original cause of Tuesday's explosion cannot yet be even surmised, but there is abundant evidence that, if coaldust was not ignited in the first instance, it was largely responsible for the propagation. The course of the explosion wave against the current is a familiar phenomenon of coaldust explosions, and the impressions of survivors within the area are consistent with the supposition. Why the force of the explosion emerged with such violence up the downcast instead of traversing the eastern workings has yet to be explained; it may have been due to the condition of the roadways, or again to some of those divergent forces which have been studied so carefully by the French investigators. This divagation of the explosive wave to the upper air, at any rate, probably saved the lives of half the men in the pit.

It has never been the policy of the Colliery Guardian to hazard reckless opinions as to the cause or incidents of an explosion upon the morrow of its occurrence. Such speculations should always be left until the facts are ascertained. There are many points upon which it will be of great interest to have information in the present case—such as the steps that had been taken at this colliery to prevent or mitigate explosions and their efficacy in the light of actual experience; the utility of the breathing appliances employed in the work of recovery; the bearing of the accident upon such latter-day questions as the reversal of the air current, the construction of stoppings, etc. It seems probable that the condition of the mine may afford valuable evidence on all these subjects, to the ultimate advantage of all those whose livelihood is bound up with the getting of coal.

We cannot pass from this phase of the Universal explosion without remarking that once again the upholders of the high-barometer theory are claiming its substantiation. On this occasion they are guilty of a definite misstatement of fact. Any of our readers who care to examine the weather charts for the past week will see that for some time prior to Tuesday a low-pressure system was advancing from Iceland towards these islands after a period of tolerably high barometer. To say, as does the Morning Post, that "at the time of the explosion the barometer was declining

*From the Colliery Guardian.

slowly at the scene of the accident, but it was still as high as 30¼in. over the estuary of the Severn, a height considerably above the normal for the district," is directly to ignore the fact, well known to mariners and others for whom the barometer is more than a toy, that it is not the height but the tendency of the mercury column that matters. Of course, we do not go to the extremes of our contemporary and conclude summarily that this falling glass in itself was the cause of the Senghenydd explosion, but possibly it formed a link in a chain of coincidences.

It may at once be stated that, in this case, shot-firing can be removed from the list of suspects, as blasting was only carried out at week-ends. The explosion appears to have been strictly limited in its effect, so that had it not been for the outbreak of fire before the rescue parties could reach the working faces, it is probable that accurate data would even now be in the possession of the experts. This malignant fire seems to have selected a site of all the most unfortunate, effectually barring entrance to a wide network of workings beyond; it does appear, indeed, that after we arrive at the point when it is possible to control the dynamic consequences of an explosion, we have still an even more potent enemy in fire. In every disaster of recent years—Whitehaven, Hulton, Cadeby Main and Cadder—the fire element has been predominant. This seems to indicate the absolute necessity of preventing the initial ignition, instead of setting dubious traps to ensnare the explosive wave after it has started on its errand of death. Further, it is becoming increasingly obvious that if the trained rescue brigade is to fulfil its natural function, it must be better equipped for dealing with the fire peril. In this way, experience is once more bringing us back to original intentions.

# THE MINE SURVEYOR*

By Alex. Richardson, M. Inst. M. M.

Mine surveying is to-day recognized throughout the Union as a distinct profession. This recognition is partly due to the increased responsibility attaching to the work through the magnitude and systematic organization of modern mining operations, but mainly owing to its being necessary for mine plans to be signed by a certificated mine surveyor before the Government will officially accept them. Now every profession has its own characteristic scope, and calls for special skill in certain directions; and it is therefore desirable that anyone who aims at becoming a surveyor should devote particular attention to those lines of study which have a direct bearing on his work. With the object of assisting students of surveying, or those just beginning as assistants on the mines, to form an idea of the knowledge that will be required of them, I have drawn up a concise syllabus embracing those subjects which experience has shown me require closer attention than others.

**Arithmetic.**—Addition, subtraction, multiplication, and division; their tabulation, short cuts, abridged methods and checks. Greatest common measure. Least common multiple. Fractions. Decimals; rough tests for checking the position of the decimal point. Alligation. Square and cube measure. Ratio, proportion, and rule of three. Application of the terms average and per cent. Square root. Calculation of numerical values from simple formulae. Weights and measures.

**Algebra.**—Addition, subtraction, multiplication, and division. Brackets. Fractions, Factorisations, Indices. Transformation and simplication of formulae. Simple, simultaneous, and quadratic equations.

**Geometry and Mensuration.**—The theorems, problems, and corollaries of Euclid, books 1 to 4, 6 and 11, but not with strict adherence to the Euclidian order and method. Scales. Drawing to scale. Problems relating to lines, circles and plane figures. Location by rectangular co-ordinates. Projection of points and lines. Projection of plane figures on inclined planes. Line plane and plane. Areas of plane figures with rectilinear and curvilinear boundaries. Areas of surface of solids. Volumes of regular solids. Volumes of excavations, embankments and irregular solids. Density and relative density. Capacities and weights of structures. Use of planimeter. Measurement of quantities from plans. Measuring quantities and extending in schedule form.

**Trigonometry.**—Measurement of angles. Trigonometrical ratios. Application of algebraical signs. Trigonometrical ratios of two angles. Formulae for the division of angles. Relation between the sides of a triangle and the trigonometrical functions of the angles. Transformation and reduction of trigonometrical expressions. Logarithms. Mathematical tables. Properties of triangles. Solution of triangles. Measurement of heights and distances.

**Geology and Mineralogy.**—The external and internal forces effecting changes in the earth's crust, and the processes of disintegration, transportation, and deposition. Laws of stratification. Subsequent features; jointing, inclination, folding, and faulting. Sedimentary, metamorphic and igneous rocks; their formation, characters, and modes of occurrence. The simpler forms of ore deposits. Common rock-forming minerals. Methods of determining the strike and dip of strata, faults, dikes, and veins. Dip and strike problems. Faults and fault problems. Methods of physical and chemical examination by which minerals and rocks can best be identified in the field and in the laboratory. Geological sketch mapping and section drawing. Preparation of geological reports.

## MINE VALUATION.

Careful and systematic methods of sampling, booking, and preparing the sample for assay. Correct sampling procedure to adopt in difficult or unusual cases. Preparation of well arranged written or graphic records for easy reference. Right and wrong ways of averaging, and a clear understanding of the principles involved. Calculation of stoping and milling widths, tonnages, and values, of the ore reserves of a mine. Incidence of stoping width and sorting on the yield, working cost, and profit.

## SURVEYING.

Use of the steel tape in ordinary and precise work. The transit theodolite, its types, construction, adjustment, care, and use. Field books and methods of book

*From Presidential address, Chemical Metallurgical and Mining Society of South Africa.

ing. Sources of error. Prevention and elimination of error, instrumental or otherwise. Degree of accuracy required in different classes of work, and the simplest ways of obtaining it. Co-ordinates, their calculation and application. Problems and exercises in the use of co-ordinates. Traversing with the theodolite. Minor triangulation. Connecting surface and underground. Dumpy and wye levels, their construction, adjustment, care, and use. Levelling. Tacheometric surveying and levelling. Setting out above and below ground. Contouring. Sketching. Overcoming obstacles inseparable from underground surveying. Development and stope measurement. Concise methods of south African survey practice. Inclusive checks for the detection of error in instrumental, booking, calculating, and plotting work. Lettering, and general draughtsmanship. Enlarging and reducing plans, tracing, and blue printing. Supreme importance of accuracy in all departments of survey work.

**MISCELLANEOUS.**

Manipulation of calculating machines. Methods of statistical presentation. Sufficient knowledge of structural design for the preparation of plans, specifications, and quantities relating to the simpler forms of foundations, dams, buildings, etc. Use of technical books and periodicals. Collection of significent data, and the compilation of reports. Ordinary mining methods and mining routine.

You will notice that, in the foregoing syllabus, I have made mention of several elementary divisions to which reference might seem to be more fittingly made in the prospectus of a preparatory school. I have included them because I wish to draw attention to the desirability of acquiring a more specialized knowledge of such simple processes than the average school or college course enables one to obtain. It is not common, for instance, to find, outside of financial circles, men who can cast long columns of figures with accuracy and despatch, or who are acquainted with the many time-saving arithmetical devices of the expert computer; and the mine surveyor will find that familiarity with such matters will ease his work considerably. Several things, such as the determination of azimuth from the sun or stars, the microscopical identification of rocks from thin sections, etc., I have omitted from my list because they come outside his ordinary work; but at the same time, he will be all the better equipped for any emergency if he knows how to carry them out.

Having now dealt with the training of the mine surveyor, I shall, following the practice of historians, skip a few uneventful years, and take up his work at a point where, after obtaining his certificate, he has been appointed to a producing mine of moderate size. On entering on his duties, his first care will be to ascertain what plans are in existence, and if they have been prepared in accordance with the government regulations, and that sufficient essential data exist to enable him to carry on and bring them up to date. Should the plans be much in arrear, he will proceed with the underground survey first; but before doing so he will assure himself that the instruments with which he is to work are in proper order and adjustment. In carrying out this extension of the underground survey, he will on each level begin several stations in from the last available one, and so, by overlapping, check the work of his predecessor at several points. While this work is proceeding, he will attend to any matters of urgency that crop up, such as giving lines for developers to work to, measuring up contract work, and so forth. The surface plan will then engage his attention, and, in addition to surveying in recent additional works, he may have occasion to check the position of some of the beacons by means of minor triangulation. At all times and seasons, his services will be in danger of being requisitioned by the engineer, to mark out sites, give centre lines and levels for construction work, measure up contract masonry and earthwork, and, generally, to attend to various matters appertaining to the office of clerk of works. He will also peg out and give levels for some tennis courts, and find out how few laps to the mile the sports ground will conveniently accommodate. The plotting of additional survey and geological data will always be in progress, as will also be the recording of development values and general mine sampling results. Special plans will have to be prepared from time to time for the Mines Department, consulting engineer, municipality, insurance company, and others. He will also be expected to make a thorough study of the faults and dikes in the mine, in order that he may assist the manager in correlating them, determining their course, and in forecasting the conditions likely to obtain in the lower levels, so that development may be planned out without incurring the risk of disagreeable surprises. The measuring of contract stope and development faces will necessitate the expenditure of much pedestrian energy, and require close application at the end of the month; and in the pursuance of this arduous duty something will be learnt of the value of tact and patience as neutralizers of acerbity. Once every year, at least, the ore reserves of the mine will have to be recalculated, and this work will call for considerable judgment in determining which blocks may be legitimately classed as developed, the stoping widths likely to be obtained in breaking the ground, the best way of arriving at the value of those blocks whose peripheries have been irregularly or incompletely sampled, and in estimating the value of many other factors not amenable to rule. He will, if ambitious, keep the mine manager's certificate and the mine manager's position in view, and endeavour, by taking an active interest, if possible participation, in every phase of underground work, with a studious regard for the surface departments, to qualify himself for taking control of the mine should it ever become his privilege to do so.

## LABOUR AND CAPITAL

It is very much the fashion nowadays, even with those of otherwise sane judgment, to speak of capital invariably as the villain of the piece and labour as the long suffering, exploited hero. There is as little common sense in this attitude of mind as there would be in considering the right hand and the left as irreconcilable enemies. In fact, each is indispensable to each, and harm to the one inevitably reacts on the other. In the history of capital there are many dark pages; but will any fair-minded judge affirm that the book of labour is unstained? Long ago it has passed into an axiom among captains of industry that high wages, good conditions, security of employment, and shorter hours are a sine qua non of the best production. As civilization progresses these things grow increasingly evident, and only doctrinaires, fanatics, and self-seeking demagogues will deny them. But all this, like all natural processes, is slow in growth, and your enthusiast, who would build Rome in a day, cannot wait for its realization. He is impatient for the millennium and cares not greatly through what disasters he travels to attain it. After all, it is his dupes who suffer when they discover that the earthly paradise has a disturbing affinity with the poorhouse.

# THE NANAIMO STRIKE

The Daily Colonist, Victoria, publishes the following account of the sentencing of men found guilty of rioting in connection with the U. M. W. A. strike on Vancouver Island:—

In passing sentences, His Honour said: "It is the custom when sentences are given that the judge make but little comment thereon, but in this case I am going to depart from the usual custom, for these cases are out of the ordinary, and call for a few remarks from me. Let me say to you men, before going any further, that you have been well defended, and this has been shown not only in the handling of your cases, but in the selection of those of you who pleaded guilty or not guilty. Your counsel has said all that could be said, and if I have found you guilty it is not because your counsel has erred, but because you have woven around you a net of circumstances beyond the power of any counsel to untangle.

"This was not an ordinary riot. It was not a sudden ebullition of pent-up feeling, but it shows all down the line a deliberate scheme, a design from one end to the other. The riots at Nanaimo, South Wellington, Extension and Ladysmith were all for one purpose, were simultaneous and carried out with one line of action. Bombs were thrown, property destroyed and peaceful citizens made to flee for their lives, and a persistent state of terrorism indulged in. After the bomb-throwing at the Temperance Hotel, parades were formed, evidently for the purpose of showing your numerical strength, and that you were in charge of the situation.

"After this, mobs ran at large all over the city, picking out various houses and stoning them. Then, later on, another mob or two went around on what they termed a 'peace mission,' but which really meant that a band of lawless citizens went around ordering peaceful citizens out of town at the risk of their lives. And these people had a right to work as you had. Anything less than this is mob rule.

"Your counsel has made to me various pleas. He has told me that many of you pleaded guilty, and that this is a factor which must be taken in consideration. I have looked over your faces to see if I could see any sign of sorrow or repentance for what you have done, but I fail to find one man among you to express sorrow for his lawless act.

"Your counsel knows there is no more sympathetic man than myself, one ever ready to extend mercy, but I have read over all the depositions and find but little mercy you have shown. I read where homes in which there was sickness were not free from missiles which you threw, and little children hid in cupboards and under beds to escape rocks thrown upon them in merciless fusilade. The only time any mercy was shown was when one of you said: 'Don't throw a rock at that house; there is measles there,' and when the cowardly bombs were thrown at the Temperance Hotel and at the home of Alex. McKinnon, the only mercy shown was the mercy of God.

"I was appealed to on behalf of your wives and children, but what do I find here? I find your women singing, 'Drive the scabs away,' and throwing rocks themselves, and these actions take away very much of the strength of the appeal for mercy on your behalf because of your women. The evidence shows not only a riot here, but that a far more serious charge might have been laid against you.

"I recognize I have a duty to perform, painful in the extreme, but the law-abiding people in this community must be protected and punishment meted out, so that there may be no further occurrence of these lawless riots.

"I have arranged you into three lists according to your degree of guilt.

"In the first list are Paul Deconich, Samuel Guthrie, John Morgan, William Simpson, jr., and Joshua John Taylor. The maximum penalty for rioting is two years. I have gone down the line, through the depositions, and find Guthrie and Taylor to be the leaders, to be fomentors and not peacemakers, in a determination to carry out an illegal purpose. Deconich, Morgan and Simpson, while not leaders in the rioting, the evidence showed you in this thing from beginning to end, and I see no reason why I should give you any clemency on account of your age, and I will therefore sentence you all five to a term of two years in the penitentiary, the sentences to date from now.

"In the second list I have placed John Ollsopp, jr., J. H. Armstrong, Charles Axelson, William Bauld, George Bombero, Sam Brightman, James Colley, Robert Cossar, Peter Galuska, H. H. Langdon, Duncan McKenzie, John McKenzie, Joseph Mairs, jr., James Marshall, Charles Mortimer, Steve Mrus, Steve Puyanich, George Portray, William Stackhouse, Martin Slogar, James Wallace, Robert Walkinshaw and Charles Yoga. I do not find you men as deeply involved as the ringleaders, but you were engaged in the work of destruction, and the sentence of the court is one year's imprisonment and a fine of $100, or, in default, four months.

"In the third list are Henry Dyer, John Fisher, Ernest James, Alvar Kotilla, Richard Morgan, sr., William Paterson, William Sterling, John Scott, Henry Taylor, Richard Whisker, and Edward Williams. I find you men not to be involved very deeply, and the sentence of the court is three months in jail and a fine of $50, or, in default, two months.

"Dyer, you were shown to be badly mixed up in this affair, but you were the only one who told me the truth when I asked for a statement from the accused, and when the work of destruction was going on, you were the only one who had any sympathy in your heart for the victims of the mob's vengeance."

Mr. Leighton, counsel for the prisoners, submitted that His Honour should consider the length of time the men had already served, and make the sentences date from the day of arrest, which request His Honour granted.

Concluding his remarks, Judge Howay said: "In conclusion, I want to say this is the most painful matter I have ever undertaken, and if I were to consider my own feelings this is the last thing I would wish to do. But in my position I must recognize the community as a whole, and I feel, and I believe, the public will feel, that I have exercised an extremely fair tempering of justice with mercy. I wish to thank the officers of the militia and the court officials for their kindness and services during the progress of these trials."

The court thereupon adjourned.

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The satisfaction which all law-abiding citizens must feel at the vindication of law and justice and at the dignified and merciful manner with which they have been administered in the case of the Nanaimo strikers, is tempered with a feeling of regret, amounting to sad-

ness, that so many men habitually peaceable and law-abiding, who under ordinary circumstances could not be induced to overstep the bounds of reason and moderation, should have been brought within the clutches of the law. There is little satisfaction at any time in meting out punishment to men who are not habitually criminal and while there may have been no alterative in the present case, there is no doubt that Judge Howay spoke truly when he said that he had never been called upon to perform a more painful duty. The feeling of sadness is deepened when one reflects on the occupation of these men, an occupation at all times hazardous, the only occupation which deprives its followers of at least eight hours daylight every day and compels them to toil in Cimmerian darkness. Not only are miners at the mercy of the natural elements and natural laws, but they are only too often the victims of the oversight and carelessness of officials or of their fellow workmen.

There is no class of workers in the world which has so seized upon the popular imagination, which has so aroused popular sympathy, or which has written its history more indelibly on the pages of industrial records by deeds of valour unexcelled on the battle-field. Then perhaps, there is the last consideration that these men are engaged in a perilous calling in order that their more fortunate fellows, whose occupation is both lighter and pleasanter, may be furnished with one of the prime necessaries of life. That half a hundred of such men should have to be punished by terms of imprisonment because in a mad moment they followed the advice of unscrupulous leaders must ever be a matter for regret.

Now that the law has had its "pound of flesh" and bitterness has been brought into many a home, it is surely time to consider whether some means cannot be devised for preventing the recurrence of what is nothing short of a social calamity. It is true that the remedy rests to a large extent in the hands of the miners themselves. No plea can justify acts of violence, but there were many circumstances which tended to provoke the recent uprising and which without mitigating its illegality render the consequences less worthy of censure than if there had been no provocation. All men have to suffer for their own ignorance and folly and coal miners cannot be exempt from this natural law. They cannot be compelled to choose wise counsellors and honest leaders, but if it be possible to devise any means, legislative or otherwise, to limit the possibilities of such unscrupulous leadership as has brought the Nanaimo strikers to the recent pass, it should be done without delay. The miners are not so ignorant that they cannot learn a lesson. It may have to be knocked into them by many hard blows, of which the Nanaimo strike is one of the hardest on record, but now that is a thing of the past there is room for mediation and conciliation, not of the stereotyped class, but of the kind which honestly seeks to help those who cannot help themselves and who at ordinary times are amenable to reason. The Week puts forward a plea for more sympathetic consideration of the coal miners' claims without for one moment receding from the position it has always taken in condemnation of their excesses during the recent strike. It goes further, and urges that such an attitude is necessary if the future of coal mining on Vancouver Island is to be peaceable and profitable.—The Week, Victoria, B.C.

## IRON IN 1913

The American Iron & Steel Association reports that the production of pig iron in Canada in the first six months of 1913, including ferrosilicon and ferrophosphorus, amounted to 545,981 gross tons. The output in the whole of 1912 was 912,787 tons. The production of pig iron in the two halves of 1912 is not available. Of the total in the first six months, 532,431 tons were made with coke and 13,550 tons with charcoal, coke and electricity, etc. The production of basic pig iron in Canada in the first half of 1913 amounted to 292,625 tons, bessemer pig iron to 125,052 tons, and foundry pig iron, ferrosilicon, ferrophosphorus, etc., to 128,304 tons. Forge pig iron was not reported. Of the 545,981 tons of pig iron produced, 345,810 tons were delivered to mixers, openhearth furnaces, etc., in a molten condition, 141,680 tons were sand cast, and 58,491 tons were machine cast.

On June 30, 1913, Canada had 20 completed blast furnaces, of which 13 were in blast and seven were idle. Of the total 16 furnaces usually use coke for fuel and four use charcoal. In the first half of 1913 two plants made ferrosilicon and ferrophosphorus in electric furnaces. During the first six months of 1913 the number of furnaces actually in blast during a part or the whole of the period was 15, of which 14 used coke for fuel and one used charcoal. The average number of days the 15 furnaces ran was 167.6, which would give an average make per furnace day of 217 tons.

One entirely new furnace was completed in Canada during the first six months of 1913, No. 7 coke furnace of the Dominion Iron & Steel Co., at Sydney, Cape Breton, Nova Scotia, which was first blown in on May 22. It has an annual capacity of 91,250 tons of basic pig iron.

Two blast furnaces were being built in the Dominion on June 30. One of these furnaces will be operated by the Canadian Furnace Co., Ltd., at Port Colborne, Ont. When completed it will be 85 x 19½ ft. and will have an annual capacity of about 125,000 gross tons of bessemer, foundry and malleable pig iron. Lake Superior ore and Connellsville coke will be used. It is almost ready to blow in. The other furnace is being built at Parry Sound, Ont., by the Standard Iron Co., Ltd., of Montreal. When completed it will be 60 x 12 ft. and will have an annual capacity of about 36,000 gross tons. Charcoal will be used for fuel. Hematite and magnetite ores from Michigan and Ontario will be used. The Standard Iron Co. also operates a charcoal furnace at Deseronto, in Ontario. The annual capacity of the 20 completed blast furnaces on June 30, 1913, was 1,391,550 gross tons, and of the two building furnaces 161,000 tons, a total of 1,552,550 tons.

## MEETING OF TORONTO BRANCH, CANADIAN MINING INSTITUTE.

A meeting of the Toronto branch of the Canadian Mining Institute was held at the Engineers' Club on Saturday, Nov. 8. The reports of Chairman Jas. McEvoy and Secretary A. G. Burrows were presented. A. M. Hay was chosen chairman for the ensuing year and R. E. Hore secretary. The executive committee is composed of D. A. Dunlap, G. C. Bateman, C. E. Smith, W. F. Ferrier, A. J. Young, J. M. Clark, W. G. Miller, J. C. Murray and H. E. T. Haultain.

The chief topic discussed was that of securing permanent headquarters for the Institute. It was announced that friends are willing to make liberal donations for the purpose.

# PERSONAL AND GENERAL

Dr. F. H. Hatch has been elected President of the Institution of Mining and Metallurgy for the forthcoming year.

Mr. Geo. Watkin Evans, consulting coal mining engineer of Seattle, has completed the examination of the Matanuska coal field of Alaska for the United States navy. Mr. Evans will soon resume his private practice in Seattle.

Mr. Julius M. Cohen has resigned his position with Graphite, Limited, St. Remi d'Amherst, Que., to accept the position of assistant manager with the Porcupine Crown Mines, Limited, Porcupine, Ont.

Mr. W. F. Battersby has been appointed mill superintendent at the Dome, South Porcupine, succeeding Mr. Languth, who is giving all his time to the construction work in connection with the additions being made to the present mill.

The Western Mining Directory Company, Denver, Col., is preparing a 1914 edition of the International Mining Manual.

Mr. Jas. Ashworth addressed the Vancouver, B.C., Chamber of Mines on November 3 on "Notes on the Coalfields of the Coast Inspection District of British Columbia."

Mr. T. Walter Beam has returned to Denver, Colorado, U.S.A., after having spent the summer and autumn in Camp Hedley, in charge of the diamond drill operations of the New York Syndicate No. 2, which has under option of purchase a group of mineral claims in the vicinity of Hedley, Similkameen, B.C.

Mr. Melbourne Bailey, of Barkerville, B.C., manager of the John Hopp hydraulic placer-gold mines in Cariboo district, was in Victoria for several days in October, where he was a witness in a water-record dispute case that was before the Supreme Court.

Mr. Chas. F. Caldwell, managing director of the Utica Mining Co., of Kaslo, B.C., was in Winnipeg, Manitoba, last month, in connection with transportation difficulties during the reconstruction by the Canadian Pacific Railway Co. of the Kaslo & Slocan Railway, upon which the Utica mine depends for transportation facilities.

Mr. W. A. Carlyle has gone to South Africa.

Mr. Patrick Clark, of Spokane, Washington, U.S.A., who holds a comparatively small proportion of the shares in the Standard Silver-Lead Mining Co., was at the company's mine and concentrating mill, near Slocan Lake, B.C., last month.

Mr. E. J. Conway is in charge of the camp the Granby Consolidated M., S. & P. Co. has established at Swamp point, near Maple bay, Portland canal, in the vicinity of which are some large deposits of limestone on claims purchased by the company in case lime flux shall be needed when the company's blast furnaces shall be running at Anyox, Observatory inlet, a towing distance of 65 miles.

Mr. H. W. DuBois, of Philadelphia, has been investigating a prospective water power on an arm of Quesnel lake, Cariboo district, B.C.

Mr. D. B. Dowling, of the Geological Survey of Canada, left Ottawa on October 23 for the Okotoks district, south of Calgary, Alberta, to make investigations there in connection with the reported recent encountering of oil in a bore in that part of the country.

The death was announced last month of Mr. W. M. Doull, of Montreal, who was associated with the mining and smelting industries of British Columbia through his connection, as president, with the West Kootenay Power & Light Co., which supplies electric power to several of the larger companies engaged in mining and smelting in that province. Mr. Chas. R. Hosmer has succeeded Mr. Doull as president of the Power Company.

Mr. Geo. E. Farish, for some time manager of the Motherlode Sheep Creek Mining Co., operating a gold mine and stamp mill in Nelson mining division, B.C., in which enterprise several Ontario capitalists are largely interested, recently left Nelson for San Francisco.

Mr. Irving R. Gard, for nearly three years engineer in charge of the drafting room of the Canadian Collieries (Dunsmuir), Ltd., at Victoria, B.C., recently left that city for the United States, the important engineering works in hand during the period mentioned having now been advanced nearly to completion. It is probable Kentucky will be the next scene of Mr. Gard's professional activities.

Mr. A. B. W. Hodges, for years local manager in Boundary district of British Columbia for the Granby Consolidated M., S. & P. Co., and afterwards general manager for the Cerro de Pasco Mining Co., at Lima, Peru, has opened a consulting engineering office in Los Angeles, California.

Mr. John Hopp was last month successful in defending his right to the use of water from the upper part of Lightning creek, Cariboo, which right had been disputed by Mr. L. A. Bonner, representing an English company that is engaged in a venture having for its chief object working old river channels for placer gold. Twice part of Mr. Hopp's Lowhee ditch was destroyed by dynamite for which offence Mr. Bonner was sent to jail. During recent months water gates have been surreptitiously opened and the water run to waste. Possibly Mr. Hopp's use of the water will not again be interfered with, but this remains to be seen.

Mr. Ernest Levy, representing in British Columbia Messrs. Alexander Hill & Stewart, of London, engineers in charge of the operation of the mines of the Le Roi No. 2, Ltd., at Rossland, and the Van-Roi Mining Co., in Slocan Lake district, recently spent a week examining mineral claims on Rocher Deboule mountain, in Skeena district, in which Old Country people are interested.

Mr. Oscar Lachmund, general manager for the British Columbia Copper Co., Ltd., has returned to Greenwood, Boundary district, from a visit to the company's headquarters office, in New York.

Mr. Chester F. Lee, of Seattle, Washington, U.S.A., has been examining ground covered by placer-gold leases and extending some ten miles up Similkameen river from Princeton, B.C.

Mr. W. A. McDonald has been appointed manager for the new owners of coal lands on which the Columbia Coal & Coke Co., of Winnipeg, Manitoba, during recent years expended a comparatively large sum of money in doing work that proved of little value in the direction of developing commercial coal. Under the new auspices, exploration and development work will be done on parts of the property believed to give promise of much better results from a coal-mining point of view, while townsite exploitation will be relegated to the background.

Mr. I. L. Merrill, president of the Hedley Gold Mining Co., during October, paid another visit to the company's gold mines and 40-stamp mill, in Camp Hedley, Similkameen, B.C. Other directors of the company

were also there. Besides looking through the mine under the guidance of Mr. G. P. Jones, general superintendent, Mr. Merrill gave his attention on the spot to matters connected with the development of additional hydro-electric power preliminary to considerably enlarging the output of ore from the company's Nickel Plate group of mines in which the proved ore reserve at the close of the last fiscal year was estimated at more than 400,000 tons of an average assay value of $11.35 a ton.

Mr. G. J. Milton, manager of the Tantalus coal mine, Yukon Territory, was one of a number of mining men from the North who left the Yukon late in the autumn to spend a winter vacation on "the outside."

Mr. G. W. Otterson, manager for the Kildare Co. on Slate creek, in the Omineca River district of British Columbia, has completed his season's placer-gold mining work and left the district for Ottawa, to report results to his principals.

Mr. H. Peploe Pearse was in Victoria at the end of October from Birch creek, Atlin camp, in which part of British Columbia he has been in charge of hydraulic placer mining for several years.

Mr. Newton W. Pilger, of Butte, Montana, U.S.A., is superintendent at the Iron Mask mine, near Kamloops, B.C., where mining operations were resumed a short time ago. Mr. E. G. Wallinger, of Duluth, Minnesota, is general manager for the United States Company now owning this property.

Mr. Noble W. Pierrie, of Vancouver, B.C., was married to Miss Mabel Corbett on October 16.

Mr. C. H. Poirier, of Poillon & Poirier, New York City, has been examining the Golden Zone mine, in Camp Hedley, B.C.

Mr. Wm. Fleet Robertson, provincial mineralogist for British Columbia, last month paid a visit to Barkerville, Cariboo, in company with Dr. Alfred W. G. Wilson of the Mines Branch of the Canada Department of Mines. Returning southward, several days were spent in the vicinity of Slocan lake and of Nelson.

Mr. Elias Rogers, of Toronto, president of the Crowsnest Pass Coal Co., was at the company's mines in Southeast Kootenay, B.C., at the end of October.

Mr. W. J. Rolfe, of Toronto, has been examining mining property in Portland Canal mining division, British Columbia. Mr. Ralph Stokes, who was with him in the Portland Canal Camp, went thence to Juneau, Alaska.

Mr. R. T. Stewart, who for some time had been mine manager for the Corbin Coal and Coke Co., operating in Southeast Kootenay, British Columbia, a short time ago left that ditsrict for the Brazeau coal field in Alberta.

Mr. R. P. Trimble, who for some time past has been actively associated with the development of mineral claims in the Rocher Deboule mountain part of Hazelton district, Omineca mining division, recently left there on a month's visit to Portland, Oregon. He lately arranged to acquire the Great Ohio group of mineral claims, in Rocher Deboule camp, and let a contract for making a trail, erecting buildings and driving an adit.

Mr. John Vallance, for about eight years closely identified with the development of the Standard silver-lead mine, in Silverton camp, B.C., and in recent years mine superintendent there, has left on a visit to Montana, U.S.A.

Mr. W. E. Zwicky, of Kaslo, B.C., for many years in charge of mines in Slocan district, has been on a business trip to Winnipeg, Manitoba.

The Orenstein-Arthur Koppel Co. have issued a catalogue, No. 900, describing rails, tracks, switches, dump cars, platform cars, buckets, electric locomotives, etc. The Canadian Fairbanks-Morse Co., Ltd., Montreal, are the selling agents in Canada.

The McKiernan-Terry Drill Co. has issued a bulletin describingrota ting hammer drills for sinking, stoping and drifting. Canadian Allis-Chalmers, Ltd., Toronto, are the selling agents for Canada.

## HOLLINGER.

Gross profit for the four weeks ending October amounted to $131,510.18.

The approximate average value of all ore hoisted was $17.44.

Waste rock from development amounting to 1,218 tons was hoisted, bringing the total of ore and waste up to 12,650 tons.

Based upon the tonnage of ore and waste hoisted the cost per ton for mining was $2.720.

One thousand tons were added to broken ore reserves.

Two thousand tons were drilled off ready for shooting.

The mill ran 88 per cent. of the possible running time, treating 11,850 tons, of which 164 tons were treated for the Acme Gold Mines, Limited.

The average value of all ore treated was $17.39, approximate extraction 96.70 per cent. Milling cost, $1,594.

Costs show an increase over those previously reported. This increase is primarily due to shutting down the tube mills for the purpose of relining. It will be noted that the mill only ran 88 per cent. of the possible running time, treating 11,850 tons, while the tonnage treated during the previous four weeks was 12,264. This reduction in tonnage treated has naturally resulted in an increase in the costs per ton in all departments.

An unusual item is "strike expense $2,834.30," which has added 24.2 cents per ton to costs. This item included legal fees and expenses incurred during the recent strike and is, we believe, the last expenditure which will be charged under this heading.

Work in the mine continues to show satisfactory progress, 573 feet of drifting having been added to development work during the four weeks. Approximately 100 feet of drifting has been done upon the 425 ft. level upon No. 1 vein, and the values and widths encountered are extremely gratifying, showing as they do that there is no falling off in grade or width of ore.

Work was started upon the winze, which will be carried to 550 feet with as little delay as possible.

## GRANBY.

The Granby management continues to acquire new properties. It has recently exercised its option on the Midas mine in the Valdez section of Alaska, which is showing copper ore running 5 per cent. or better. The Snowshoe claim in the Phœnix camp is understood to have developed satisfactorily, and if the option has not already been exercised, it is expected to be acquired in the near future.

Still a third property is under option which, if present indications hold good, will prove a worthy successor to the original Granby property itself.

Thus far the management has made no statements regarding the extensive development and exploratory work which it has undertaken entirely apart from the Hidden Creek development, but the directors have apparently set out so to rehabilitate the company's ore reserves that earlier errors will be forgiven if not entirely forgotten.—Boston News Bureau.

# SPECIAL CORRESPONDENCE

## PORCUPINE, SWASTIKA AND KIRKLAND LAKE

**Hollinger.**—For the four weeks ending Oct. 7th the Hollinger gold mines made a gross profit of $131,510, against $145,866 in September. This decrease, Mr. Robbins explains, is due to the fact that the tube mills were shut down for the purpose of being relined and the mill only ran 88 per cent. of the possible time. The approximate value of all ore hoisted was $17.44 per ton. The surplus now stands at $722,579. Approximately 100 feet of drifting has been done upon the main vein at the 425 ft. level. There has been no falling off in width or grade of ore.

Mr. P. A. Robbins, general manager, states in his report that the costs show an increase over those previously reported. This increase is primarily due to shutting down the tube mills. The mill only treated 11,850 tons, while the tonnage treated during the previous four weeks was 12,264. This naturally resulted in an increase in the cost per ton in all departments. Work in the mine continues to show satisfactory progress, 573 ft. of drifting having been added to development work during the four weeks.

Based upon the tonnage of ore and waste hoisted the cost per ton for mining was $2.72.

1,000 tons were added to broken ore reserves; 2,000 tons were drilled ready for blasting.

**The Hughes Porcupine Mine** has shut down temporarily. There has been considerable trouble in getting adequate power.

**The Dane Mining Company** lost by fire its cooker, dining-room, office and one bunk-house, with all contents and stores. The loss is estimated at about $5,000. Re-building will commence at once. The property is about six miles from the Dane station on the T. and N. O. property, and the company is mining for copper.

**Teck-Hughes.**—In the place of Mr. John Redington, who has resigned, Mr. Alex. Smith has been appointed. He has taken active charge of operations already. Mr. Alex. Smith is a member of the firm of Carter and Smith in Toronto. He was for some years in South Porcupine, coming to the gold camp from Cobalt. He has had experience in Mexico.

**The Tough-Oakes** property has shipped another car of high grade ore. It consisted of 30 tons and has been sent to Campbell and Deyell for sampling. This makes the fifth car to be shipped from the Tough-Oakes. Previous total tonnage was 104.20; average gold content, 23.37 ounces per ton. This last shipment is said to be of much the same grade as previous consignments.

**McIntyre.**—The September figures of the McIntyre Porcupine mines show that the mill treated 2,786 tons during the month of 30 days, an average of 93 tons of ore per day, producing $28,015, or at the rate of $913 per day. The average value of the ore is thus shown to be $10 a ton. Operating costs $28.127, slightly in excess of the amount produced. During October the mill will treat 135 tons per day, which would be increased to 160 tons per day.

**Hollinger Reserve.**—The Kerr Lake Mining Company is now operating the Hollinger Reserve property in Ogden township. It is now sinking a winze below the 200 ft. level on the main vein. Six weeks ago the Hollinger Reserve claims were sampled by Mr. Robert Livermore for the Kerr Lake, with the result that an option was taken. It is the intention to develop the property at the 300 ft. level. About 40 ft. more of sinking will be necessary to make the next level.

**Porcupine Crown.**—In the 60 ft. of sinking in the winze of the main vein below the 400 ft. level at the Porcupine Crown mine, five feet of vein matter averages $80 to the ton. At 300 ft. the vein showed a continuous ore shoot of 600 ft., being cut off at one end by a fault. The 400 ft. level promises to be fully as long. In regard to the rumor that the company will increase its acreage by the purchase of the Vipond, the Airth and the North Thompson claims, it is understood that nothing definite has been decided upon yet, though undoubtedly negotiations have been entered into.

The September clean-up amounted to $29,000, and as the current expenses were in the vicinity of $4,000, the net surplus was a handsome one.

**North Dome.**—Owing to the unfavourable development of the Timiskaming mine it has been decided to stop work on the North Dome prospect at Porcupine. This property has already been paid for, but it is desired to stop the drain of current expenses for development there and conserve the surplus remaining for the Timiskaming Company to endeavour to find more ore at the silver mine.

**Bartlett and McArthur Township.**—A syndicate of influential Cobalt mining men has taken an option on the St. Paul Hewitt and Hull claims. The operations under the direction of Mr. Robert Bryce have already commenced. These claims are situated in the townships of Bartlett and McArthur, south of the Porcupine district proper. There are five claims in all and stripping will commence at once in order that the veins may be sampled. To date rough sampling indicates the possibilities of a big ore body of low grade. The road has been cut by the government from South Porcupine to the scene of operations.

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## COBALT, GOWGANDA, AND SOUTH LORRAIN

**Kerr Lake.**—Results from the draining of Kerr Lake have already been remarkable. The basin of Kerr Lake is now free of water, but there is between 14 and 15 ft. of slime, that will be more difficult to get rid of. Little attempt will be made to do so before the freeze-up this year. However, the banks of the basin are now quite dry, and Kerr Lake has commenced to prospect with remarkable results. Three veins have been discovered on the surface—two to three inches wide of high grade ore. They have also been cut below. Seams that did not appear very profitable to follow up were found to widen out into good high grade ore.

But the remarkable discovery is on the extension of the East Main vein, which has been trenched for 200 to 250 ft. on the surface. For almost the entire length there is high grade ore. At the northern or Drummond end of the property it is from two to three inches wide, but the trench towards the main shaft opened up a remarkable ore body.

The vein runs parallel to shore line of Kerr Lake near the scow upon which the pumps are working, and between them and the camp's buildings. Near the pumps there is a fault, which throws the vein about three ft., and it is remarkably well defined. Alongside the massive smaltite and silver vein which is at this spot from nine to ten inches wide of "plate" sil-

ver there runs a small calcite lead, also full of silver. The vein, which has not yet been stripped to the boundary of the Kerr Lake, is heading directly for the Drummond Fraction, and the Caribou-Cobalt. It is probably the main vein of the Drummond, from which so much silver was obtained in the early days of the camp. Very little stoping has been done on the East Main vein above the 140 ft. level. On the 140 ft. level the vein while high grade is not half so wide as on the surface. The last annual report states that the East Main vein has been stoped only a short distance above the 140 ft. level. The production for the year ending August 31 from the East Main was 140,366 ounces only.

The East Main is without doubt the most spectacular surface showing in the Cobalt camp, and it is doubtful if there ever was one to equal it—length, grade and width being all taken into account.

**La Rose,** for the period ending Sept. 30 showed cash and ore in hand of $1,882,833. President McGibbon states that net value production for the first nine months amounted to $905,039. More high grade ore had been taken out than had been estimated in the reserves at the beginning of the year and profit on mill rock has been 23 per cent. of the total estimated as the reserves, while the dumps remain practically unchanged. On the other hand, the high grade ore reserves are considerably less.

Pan Silver.—Some patches of high grade ore have been found on both the Calumet and Patterson claims of the Pan Silver Mining Company in Southeast Coleman. These finds were made in crosscuts at the 200 ft. level. The Pan Silver is controlled by the Cartwright interests.

**Gould.**—After four or five years of more or less continuous development some high grade ore has at length been found on the Gould lease on Peterson Lake. This lease is being worked by the Porcupine syndicate. The Porcupine syndicate pays 25 per cent. gross royalty of all ore mined to Peterson Lake and deducts the operating expenses; the net profits are then equally divided between the Gould and the Porcupine syndicate.

The vein was cut in a cross cut at the 200-foot level, and is about two inches wide. There is little doubt that it is an extension of the Seneca-Superior ore body.

**Penn Canadian.**—Between three and three and a half inches of two thousand ounce ore has been cut in development work on the 300 foot level of the Penn Canadian mine. The crosscut was driven northwest and encountered the ore at a distance of 350 ft. The vein is in the conglomerate.

In addition to the vein proper the wall rock should make good milling ore for several feet. No work had previously been done in this section.

**Crown Reserve.**—Some ore shoots hitherto overlooked in old stopes of the Crown Reserve have been found within the past month. New ore bodies have been found on No. 14 on the 200 and 220 ft. levels and on Nos. 17 and 24 on the 100 ft. level. On the 100 ft. level some high grade has been found on the No. 14 vein in the west drift at a point believed to be barren. No. 2 is also yielding unexpectedly good results.

**Kerr Lake as it appears to-day**

**Temiskaming and Hudson Bay.**—At the annual meeting of the Temiskaming and Hudson Bay Mining Company in New Liskeard the following officers and directors were elected. Geo. Taylor, president; A. A. McKelvie, vice-president. Directors—Messrs. T. McCamus, D. M. Ferguson, John Duncan, S. S. Ritchie, D. L. Sherrill; secretary treasurer, F. L. Hutchison. The only new member of the board is D. L. Sherrill of Buffalo.

The total production for the year was 659,927 ounces, or a slight falling off as compared with last year. The cost per ounce was 18 cents, dividends paid during the year, 2,400 per cent, or $186,264.

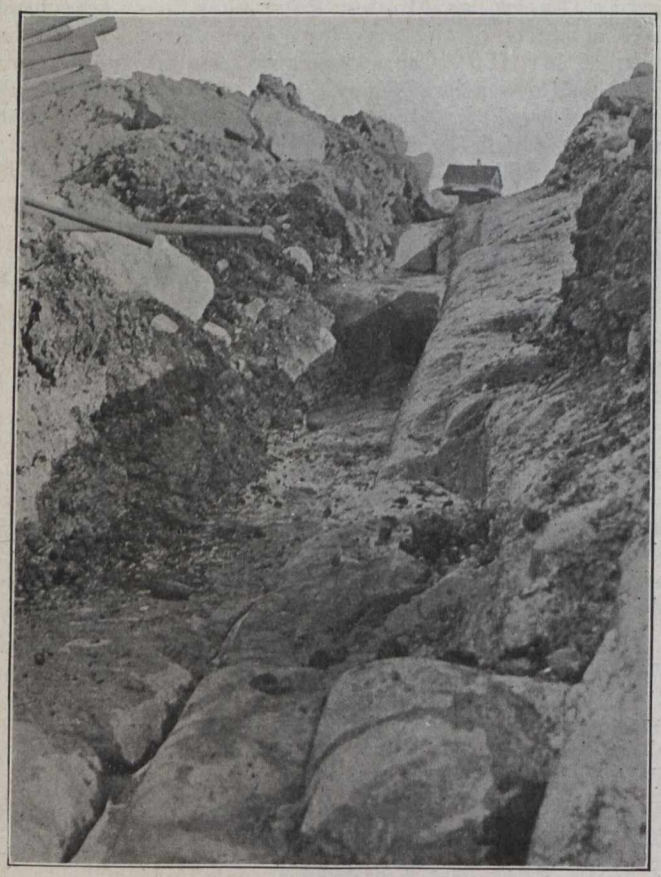
The work on the Gowganda property was discontinued in July.

The Hudson Bay output for the month of September was 1,776 tons crushed; average assay head ounces, 23.9; average assay tails from the mill, 3.1 ounces; ex-

traction per cent., 87.4; month's production, 42.643 ounces.

**Colonial.**—Working with one machine on the lowest level of the Colonial, the man left in charge of that property, which has been shut down for some time, found some good ore. Two rounds were taken out in an old drift when the good ore came in. The vein itself is about two inches wide of high grade, and there appears to be some milling rock.

**Caribou-Cobalt.**—Recent developments on the Caribou-Cobalt include opening up of high grade ore on vein 11 at the 100 ft. level and the cutting of two high grade veins in No. 5 shaft. Drifting on the 100 ft.



**Extension of East Main vein, Kerr Lake Mining Co. Vein is here 9 to 10 inches wide of bonanza ore.**

level of Vein No. 11 has opened up an ore body 50 ft. long, one to three inches wide of high grade ore, together with mill rock extending from two to four feet on each side of the vein assaying from 25 to 30 ounces. Ore of the same quality still continues in the breast of the drift. A cross cut driven on the 100 ft. level of No. 5 shaft, under the old workings at No. 1 shaft, has cut two high grade veins, each one to two inches wide, of 2.000 ounce ore. The adjacent mill rock assays 30 ounces. The property has been milling about 100 tons daily at the mill of the Dominion Reduction Company. and the Northern Customs concentrator.

## NOVA SCOTIA

**The Dominion Explosives Act.**—An article went the round of the Canadian newspapers recently which forecasted a great improvement in mining conditions and a decrease in mining accidents when the regulations of the new Federal Explosives Act become effective. There appears to be considerable misapprehension with regard to the scope and intent of this salutary enactment. It is not in any sense an "Explosives in Mines Act," similar to the regulations governing the use of explosives in coal mines in Great Britain before the passing of the Consolidated Coal Mines Regulation Act last year. The intention of the Dominion Explosives Act is more particularly to regulate the manufacture and the transportation of explosives. It provides for proper and safe conditions in explosives manufactories and for standardization of the ingredients and the quality of explosives, and provides machinery for the establishment of a list of "Permitted Explosives" along the lines followed by the Home Office in Great Britain. Provision is also made for safeguards in transportation. The new legislation has for some time been necessary, as it is apparent that the manufacture and transportation of such a dangerous commodity can be properly regulated only by a Federal law, seeing that explosives made in one Province may be intended for use in several different Provinces. It is slightly gratuitous, however, to conclude that there will be any diminution of mining accidents when the new bill becomes law, at any rate, so far as the coal mines of Nova Scotia are concerned. There have been some very distressing accidents arising from the careless and improper handling of explosives in railway construction work in Canada, but the percentage of accidents in coal mines arising from the use of explosives is quite small. It is, however, a matter for congratulation that the tendency of modern coal mining practice is towards the elimination of the use of explosives in coal getting, and coal operators, of their own initiative, are continually making more stringent the regulations governing the firing of shots.

**The Stag Canon Explosion.**—The Nova Scotian readers of the Journal were interested to notice that the rescue corps who endeavoured to penetrate the workings of the Stag Canon mine, near Dawson, New Mexico, after the recent explosion, were headed by Mr. J. B. Morrow, of Halifax. Mr. Morrow canvassed the Province for the Canadian Mining Journal in 1907, shortly after the familiar present cover of the Journal replaced its predecessor the Canadian Mining Review. For some time Mr. Morrow has been in charge of the well-equipped station of the Stag Canon Company, and his friends will await with interest more definite accounts of the rescue work in which he took part. The explosion has also further interest for Canadian readers in that one of the principal shareholders is Dr. James Douglas, a gentleman whose benefactions to students of mining in the Dominion are well known.

**October Output.**—As forecasted in the middle of the month the outputs from the Glace Bay Mines of the Dominion Coal Company in October will total 437,000 tons, or 12,000 tons greater than the largest previous monthly output record. As October is for some reason invariably a good producing month it is more than likely that this new record will remain unapproached for some time to come.

**Broughton Mine.**—The first coal shipments from the Broughton mines were made towards the end of October. An arrangement has been come to between the Dominion Coal Company and the Cape Breton Coal, Iron & Railway Company covering the transportation of coal from the Broughton mine to Louisburg pier, and regular shipments will no doubt be made from now on. The Cape Breton Co. has received 30 wooden cars, of thirty tons' capacity each. The Broughton colliery is putting out about 100 tons daily. Now that arrangements have been made for shipping, the output will be increased.

## BRITISH COLUMBIA

News from Atlin and Cariboo districts is to the effect that in those placer-gold mining camps the season's gravel-washing operations are practically at an end. No particulars of the quantity of gold recovered are yet available, but it is probable that the production of the 1912 season has been exceeded. The figures for last year were: Yield of Cariboo district, Cariboo division, $180,000; Quesnel division, $50,000; total, $230,000. Of Atlin division, $290,000. Then there was $8,000 from Omineca division, $9,000 from several divisions in Cassiar district, and $18,500 from various other parts of the Province. The total value of the year's production of placer gold was $555,500. It is quite probable the 1913 total yield will be found to have been the highest in value of any year since 1907.

In connection with lode mining, a noticeable feature is the considerable increase in the quantity of ore received at the Consolidated Company's smeltery at Trail. For the week ended October 30, the quantity received was 9,460 tons, while for the immediately preceding week it was 9,197 tons. The highest weekly figures in previous recent weeks were—for week ended Sept. 18 7,950 tons and Sept. 4 7,917. The greater part of the increased quantity came from the company's own mines, though the Bluebell in Ainsworth division, the Standard in Slocan, and the Iron Mask at Kamloops each contributed appreciably to the total increase.

### CARIBOO.

**Barkerville.**—The manager of the John Hopp hydraulic placer-gold mines early in October stated that there was enough water in the big reservoir on one of the properties to allow of continuance of sluicing until about the end of the month. Shortly afterward the first snowfall of the season occurred; about two inches of snow fell, but bright weather following, it quickly melted. At the end of October the indications were that there would be several weeks of "Indian summer" before the winter set in.

The Supreme Court of British Columbia has dismissed, with costs against the plaintiff company, an action of the Lightning Creek Hydraulic Co. vs. John Hopp, claiming an injunction against the defendant's further use of certain water, and damages. The plaintiff company alleged that under a water record obtained in 1897 it was entitled to 1,000 inches of water from Lightning creek, and that the defendant had taken water from above plaintiff's intake, thus diverting water the latter should have had. Defendant contended that plaintiff's water record lapsed in 1902, while his own record for 500 inches of water, obtained in 1898, had ever since been kept in good standing, so that he was entitled to the water. The dispute had attracted general attention among those interested in placer-mining in the district, where Mr. Hopp has for years operated large hydraulic mines.

**Quesnel.**—Mr. Hebson reports that excellent progress has been made in the development of the Yanks mineral claim, on Snowshoe creek. In the lower tunnel the vein is 8 ft. in width, and the ore contains good value in gold.

### LILLOOET.

From the Lillooet Prospector it is learned that Mr. J. M. Williams in the later half of October went to property of the McGillivray Mountain Mines, Ltd., accompanied by several miners, to do development work through the winter. It is stated that Mr. F. J. Crossland's report on the property is so favourable that those interested have decided to proceed to develop it.

Mr. Fred. M. Wells, who in quite recent years has been in charge of development work at the mine of the Surf Inlet Gold Mines, Ltd., on Princess Royal Island, lately examined Dr. Christie's mineral claims on a tributary of the north fork of Bridge river, on which there has been opened a quartz vein containing gold, silver, and copper.

For many years a noted Indian character was accustomed to periodically put in an appearance at Lillooet with gold, but it was not during his lifetime discovered where he obtained it. Since his death another Indian, known as Mission Peter, has been searching for the source of riches so long kept secret. Lately he induced Mr. C. L. Copp, for some time superintendent for the Coronation Mines, Ltd., operating on Cadwallader creek, a tributary of Bridge river, to go with him to the vicinity of Whitewater river. Since their return to Lillooet the statement has been published that an old sluice box was shown to Mr. Copp at one place where placer mining had been done years ago, and, on prospecting the ground, good results were obtained, the gold obtained being coarse. It is claimed that not only has a new placer field been found, but that there were seen in the neighboring country indications of gold-bearing quartz.

### AINSWORTH.

Shipment of ore from the Highland mine adds another to the list of producers in Ainsworth camp. The Consolidated Mining & Smelting Co. has acquired this property; the concentrating mill has been overhauled, the aerial tramway from mine to mill put in running order, and development work undertaken. Latterly shipment of ore has been in progress.

In the western part of Ainsworth mining division, work has been continued at the Utica; driving another cross-cut adit on the Eureka is making satisfactory progress; some ore is being sent out from the U.S. claim in Jackson basin; further development of the Whitewater group by Retallack & Co. is being pushed on, and supplies have been taken up to the Panama so that work may be continued throughout the winter.

### SLOCAN.

A proposed reorganization of the Lucky Jim Zinc Mines, Ltd., is being considered. The present pressing need is money—to pay off existing debts and make provision for concentrating the large quantity of available ore unsuitable for shipment without previous concentration.

Encouraging reports come from the Rambler-Cariboo mine, which is stated to now be realizing a fair profit on mining and milling operations. The work of driving a deep-level crosscut adit on the Payne is being continued; near Sandon, the Richmond-Eureka, Ruth, Slocan Star, and Wonderful are all being worked; in the vicinity of Cody, the Colonial, Reco, Surprise, and Noble Five, have all been operative, and work is to be continued throughout the winter at most of them. Near New Denver, the Apex is being developed; in Silverton camp, the Standard is well maintaining production and doing important new development work as well, the Hewitt mill is being prepared for operation, the outlook for the Van-Roi has improved, and the Lucky Thought is making promising progress. In Slocan City division, the Eastmont, Neepawa, Black Prince, Ottawa, and others are being worked.

# STATISTICS AND RETURNS

## COBALT SHIPMENTS.

No less than nineteen cars left the Cobalt camp from Cobalt and Kerr Lake last week, but the fact that half of this was low grade indicates that the great increase in tonnage did not necessarily mean the same proportion of increase in silver ounces.

The Trethewey shipped two cars, one of high grade ore and one of low grade. The Crown Reserve car went to Hamburg, Germany, and was of very high grade ore.

Bullion shipments were lower than usual. Kerr Lake is now marketing its own bullion.

The shipments from the Cobalt camp for the week ending Nov. 7 were:

| | High. | Low. | Total |
|---|---|---|---|
| Cobalt Townsite | | 504,000 | 504,000 |
| Trethewey | 50,870 | 42,380 | 93,250 |
| Penn-Can | 101,490 | | 101,490 |
| Cobalt Lake | 62,950 | | 62,950 |
| Coniagas | 257,000 | | 257,500 |
| Crown Reserve | 62,850 | | 62,850 |
| La Rose | 87,010 | 80,000 | 167,010 |
| McKinley-Dar | **56,460** | | **167,010** |
| | 679,460 | 626,380 | 1,305,840 |

The bullion shipments for the week ending Nov. 7, were:

| | Bars. | Ounces. | Value. |
|---|---|---|---|
| Nipissing | 87 | 102,812.77 | $61,687.36 |
| Kerr Lake | 14 | 15,152.00 | 7,291.00 |
| | 101 | 117,964.77 | $68,478.36 |

The bullion shipments for the year now total:

| | Ounces. | Value. |
|---|---|---|
| Nipissing | 5,147,596.91 | $2,958,900.08 |
| Penn-Can | 31,299.60 | 18,750.90 |
| Buffalo | 1,301,409.90 | 809,301.57 |
| Crown Reserve | 428,060.00 | 261,278.25 |
| Dom. Red | 373,672.40 | 216,385.00 |
| Townsite | 36,818.40 | 30,364.04 |
| Miscellaneous | 3,920.00 | 1,623.00 |
| Timiskaming | 25,561.70 | 14,948.04 |
| O'Brien | 146,542.77 | 78,423.66 |
| Wettlaufer | 15,869.00 | 9,757.00 |
| Miller Lake | 3,710.20 | 2,053.00 |
| Colonial | 635.00 | 374.00 |
| Trethewey | 15,199.83 | 9,300.04 |
| Casey Cobalt | 2,394.00 | 1,520.00 |
| Kerr Lake | 82,969.79 | 48,164.48 |
| Bailey | 1,839.00 | 1,103.40 |
| Cobalt Lake | 1,717.80 | 996.36 |
| City of Cobalt | 2,808.45 | 1,702.00 |
| Preston E. D. | 3,452.60 | 2,002.50 |
| Cob. Comet | 3,503.65 | 2,079.13 |
| Lumsden | 1,814.40 | 1,079.00 |
| Beaver | 1,837.00 | 1,138.94 |
| Hargraves | 1,977.00 | 1,205.00 |
| McKinley-Dar | 17,158.00 | 10,294.00 |
| | 7,640,759 | $4,524,853.89 |

## BRITISH COLUMBIA ORE SHIPMENTS.

Ore receipts at the Consolidated Mining and Smelting Co.'s works at Trail during the four weeks ended October 23, were as under:

| | | Tons. |
|---|---|---|
| **From East Kootenay—** | | |
| Monarch | | 158 |
| St. Eugene | | 122 |
| Sullivan | | 3049 |
| | | 3,329 |
| **Ainsworth—** | | |
| Blue Bell | | 947 |
| Highland | | 219 |
| No. 1 | | 374 |
| Retallack & Co. | | 85 |
| Silver Hoard | | 199 |
| Utica | | 38 |
| | | 1,862 |
| **Slocan—** | | |
| Black Prince | | 41 |
| Eastmont | | 18 |
| Idaho-Alamo | | 45 |
| Ottawa | | 34 |
| Rambler-Cariboo | | 236 |
| Richmond-Eureka | | 101 |
| Ruth | | 72 |
| Slocan Star | | 62 |
| Standard | | 1543 |
| Surprise | | 56 |
| Sundry small lots | | 18 |
| | | 2,226 |
| **Nelson—** | | |
| Big Bump | | 26 |
| Emerald | | 74 |
| Molly Gibson | | 364 |
| Queen | | 74 |
| Second Relief | | 38 |
| Silver King | | 1032 |
| Yankee Girl | | 325 |
| | | 1,933 |
| **Rossland—** | | |
| Centre Star Group | 12,798 | |
| Josie (Le Roi No. 2, Ltd.) | 1,604 | |
| Le Roi | 6,465 | |
| | | 20,867 |
| **Lardeau—** | | |
| Ajax | | 68 |
| **Kamloops** | | |
| Iron Mask | | 277 |
| **Boundary—** | | |
| Rob Roy and Belle | | 16 |
| **State of Washington, U.S.A.—** | | |
| Ben Hur (Republic Camp) | 1,127 | |
| Bonanza | 125 | |
| Paragon | 7 | |
| United Copper (Chewelah) | 211 | |
| | | 1,470 |
| Total | | 32,048 |

# MARKETS

## STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

November 10, 1913.

**New York Curb.**

| | Bid. | Ask. |
|---|---|---|
| American Marconi | 3.25 | 3.50 |
| Alaska Gold | 20.12½ | 20.37½ |
| British Copper | 2.37½ | 2.50 |
| Braden Copper | 6.25 | 6.50 |
| California Oil | 190.00 | 192.00 |
| Chino Copper | 36.50 | 36.75 |
| Giroux Copper | 1.12 | 1.50 |
| Green Can | 6.00 | 7.00 |
| Granby | 65.00 | 68.00 |
| Miami Copper | 21.00 | 22.00 |
| Nevada Copper | 14.00 | 14.25 |
| Ohio Oil | 131.00 | 133.00 |
| Ray Cons. Copper | 17.25 | 17.50 |
| Standard Oil of N. Y. | 152.00 | 154.00 |
| Standard Oil of N. J. | 373.00 | 376.00 |
| Standard Oil (old) | 1150.00 | .... |
| Standard Oil (subs.) | 725.00 | .... |
| Tonopah Mining | 4.50 | 4.75 |
| Tonopah Belmont | 7.12½ | 7.25 |
| Tonopah Merger | .57 | .59 |
| Inspiration Copper | 14.00 | 15.00 |
| Goldfield Cons. | 1.43 | 1.50 |
| Yukon Gold | 2.00 | 2.12 |
| **Porcupine Stocks.** | | |
| Apex | .00½ | .01 |
| Dome Extension | .05½ | .06 |
| Dome Lake | .18 | .18½ |
| Dome Mines | 9.75 | 10.50 |
| Eldorado | .00½ | .001 |
| Foley-O'Brien | .15 | .17 |
| Hollinger | 17.70 | 17.90 |
| Jupiter | .09 | .09⅛ |
| McIntyre | 1.50 | 1.80 |
| Moneta | .02 | .04 |
| North Dome | .... | .40 |
| Northern Exploration | .75 | 1.25 |
| Pearl Lake | .11½ | .12 |
| Plenaurum | .... | .70 |
| Porcupine Gold | .11 | .11¼ |
| Imperial | .01½ | .02 |
| Porcupine Reserve | .... | .06 |
| Preston East Dome | .01½ | .02 |
| Rea | .12 | .18 |
| Swastika | .03 | .03¼ |
| Standard | .00½ | .01 |
| United | .... | .01 |
| West Dome | .05 | .10 |
| **Cobalt Stocks.** | | |
| Bailey | .07 | .07¼ |
| Beaver | .33½ | .34 |
| Buffalo | 1.70 | 1.75 |
| Canadian | .12 | .20 |
| Chambers Ferland | .12¾ | .13 |
| City of Cobalt | .25 | .35 |
| Cobalt Lake | .53 | .59 |
| Coniagas | 7.25 | 7.50 |
| Crown Reserve | 1.75 | 1.78 |
| Foster | .07½ | .09 |
| Gifford | .0½ | .02 |
| Gould | .04¼ | .04⅜ |
| Great Northern | .09½ | .10 |
| Hargraves | .02½ | .04 |
| Hudson Bay | 69.00 | 70.00 |
| Kerr Lake | 4.30 | 4.40 |
| La Rose | 1.75 | 1.77 |
| McKinley | 1.31 | 1.35 |
| Nipissing | 7.60 | 7.70 |
| Peterson Lake | .27 | .27¼ |
| Right of Way | .04 | .05 |
| Rochester | .03 | .04 |
| Leaf | .01¾ | .02 |
| Cochrane | .... | .40 |
| Silver Queen | .04 | .05 |
| Timiskaming | .12 | .12½ |
| Trethewey | .27 | .29 |
| Wettlaufer | .07 | .09 |
| Seneca Superior | 2.25 | 2.50 |
| Porcupine Crown | 1.25 | 1.30 |
| Teck-Hughes | .... | .... |

## TORONTO MARKETS.

Nov. 11—(Quotations from Canada Metal Co., Toronto).
Spelter, 5 cents per pound.
Lead, 5. 75 cents per pound.
Tin, 43 cents per pound.
Antimony, 8½ cents per pound.
Copper, casting, 17 cents per pound.
Electrolytic, 17½ cents per pound.
Ingot brass, 11 to 15 cents per pound.

Nov. 11—Pig Iron—(Quotations from Drummond, McCall & Co., Toronto).
Summerlee No. 1, $26.00 (f.o.b. Toronto).
Summerlee No. 2, $25.00 (f.o.b. Toronto).

Nov. 11—(Quotations from Elias Rogers Co., Toronto).
Coal, anthracite, $8.00 per ton.
Coal, bituminous, lump, $5.25 per ton.

## GENERAL MARKETS.

Nov. 7.—Connellsville coke (f.o.b. ovens).
Furnace coke, prompt, $1.90 per ton.
Foundry coke, prompt, $2.75 per ton.

Nov. 7—Tin, straits, 40.00 cents.
Copper, prime lake, 16.62½ cents.
Electrolytic copper, 16.25 cents.
Copper wire, 17.50 to 17.75 cents.
Lead, 4.35 cents.
Spelter, 5.37½ cents.
Sheet zinc (f.o.b. smelter), 7.50 cents.
Antimony, Cookson's, 7.55 to 7.60 cents.
Aluminum, 19.75 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, hard, 10 per cent., $46.00 to $48.50 per ounce.
Platinum, hard, 20 per cent., $50.00 to $52.50 per ounce.
Bismuth, $1.95 to $2.15 per pound.
Quicksilver, $38.00 per 75-lb. flask.

## SILVER PRICES.

| | New York. cents. | London. pence. |
|---|---|---|
| Oct. 24 | 60¼ | 27⅞ |
| " 25 | 60 | 27¾ |
| " 27 | 60⅛ | 27 13/16 |
| " 28 | 59¾ | 27⅝ |
| " 29 | 59½ | 27½ |
| " 30 | 59½ | 27½ |
| " 31 | 59¾ | 27⅝ |
| Nov. 1 | 59⅝ | 27 9/16 |
| " 3 | 59⅜ | 27 7/16 |
| " 4 | .. | 27 7/16 |
| " 5 | 59½ | 27½ |
| " 6 | 59⅞ | 27 11/16 |
| " 7 | 59⅞ | 27 11/16 |
| " 8 | 59⅞ | 27 9/16 |
| " 10 | 59½ | 27 9/16 |