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Editor:
J. C. MURRAY, B.A., B.Sc.

Business Manager:
J. J. HARPELL, B.A.

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CIRCULATION.

During the year ending with March 1st, 1908, 91,750 copies of "The Canadian Mining Journal" were printed and distributed, an average of 3,822 per issue.

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CONTENTS.

HIGH GRADING.

In the early days of the Yukon gold excitement gold stealing was known to be prevalent and was winked at. The rich creeks of Eldorado, Bonanza, and Gold Run were particularly notorious as fields of operation for gold thieves. We have been credibly informed that in four years not less than eight or ten million dollars worth of gold was taken from these spectacular workings by persons other than the owners.

The gold mines of Nova Scotia have yielded more gold than shown by official returns. Many of the gold veins of the province are noted for the beauty of the specimen gold that they contain. In the palmy sixties hundreds of ounces found their way out of the mine by unauthorized channels.

The purloining of amalgam from the battery plates of stamp-mills is another prevalent variety of misappropriation.

As indicated before in the "Canadian Mining Journal," silver stealing has assumed serious proportions in Cobalt. Assertions to the effect that high grading is carried on to the extent of more than thirty thousand ounces per month, were received at first with incredulity. But, while it is impossible to estimate precisely the toll exacted by the silver thief, there is strong evidence, both direct and indirect, that the case has not been exaggerated.

Apparently the playful habit of enriching oneself at the expense of a mere mine owner is looked upon as an excusable failing. It is time for this point of view to be corrected.

Gold stealing and silver stealing are unqualified theft, and justice demands that the thieves be punished promptly and efficaciously.

Unfortunately our statute books do not provide effective means for bringing high graders to justice. Strong representations, however, have been made to the Minister of Justice at Ottawa and it is believed that the necessary Federal enactments will be promulgated before the close of this session. If the matter is laid over until next session it will be the duty of all the mining provinces to make a combined effort towards clearing up the situation.

A NOTEWORTHY DISCOVERY.

The world's production of tungsten ores amounts to only four thousand tons, and this in spite of a growing demand. From Queensland and the United States comes the principal supply. The prices paid are not constant, owing largely to the fact that much of the ore is mined in isolated districts where the miner has little chance to avail himself of the best market prices. But usually the price per unit ranges between $5 and $10 per unit for ore carrying sixty per cent. of tungsten tri-oxide. Hence, the mining of tungsten ores is nearly always profitable.

There have been discoveries made of wolframite and scheelite in Nova Scotia, British Columbia, and Ontario, but heretofore the ores have not been found in commercial qualities.

Within the past few weeks, however, a vein of scheelite, four inches wide, has been opened near the gold mine of the Consolidated Mines Company of Canada, at Moose River, Halifax County, N. S.

The vein, which has been traced for five hundred feet, lies in a slate belt. Foot-wall and hanging wall are well defined. The vein is four inches wide and is composed of scheelite, accompanied, unfortunately, by a considerable quantity of mispickel. However, the ore, as mined and without concentration, shows 50 per cent. scheelite, and the separation of this mineral from the mispickel should be a matter of no difficulty.

In a forthcoming issue we shall publish a full account of this new find. Meanwhile we wish to emphasize again the fact that, even in a country as small as Nova Scotia, where mining has been an important activity for many years, there are unsuspected mineral possibilities. It is too true that nearly all the important mineral discoveries in the history of mining in Canada have been accidental. We have now sufficient knowledge of the geology and topography of our country to encourage systematic investigation. The chances taken by the uninstructed prospector can be largely eliminated by intelligent study, practical knowledge, and carefully constructed plans of campaign.

TECHNICAL WRITING.

On another page apears a review of Mr. T. A. Rickard's new book "A Guide to Technical Writing."

We regard the publication of this modest volume as an event both pleasant and significant.

For long Mr. Rickard has thrown the whole weight of his influence in the direction of reform. Once a flagrant sinner himself, according to his own frank confession, he has, with prayer and fasting, chastened and purified his style and diction. One result is that his writings are undoubtedly more widely read and more keenly enjoyed than those of any other writer on mining topics.

It is not possible, of course, to ascribe this pre-eminence entirely to carefully cultivated accuracy in the use of language. Perfection, whether on the printed page or in speech, is a pale thing. But Mr. Rickard's writings are neither perfect nor pale. They are spontaneous, vigorous, eminently readable, and accurate—humanly, not divinely, accurate. They have an inherent charm that can neither be acquired nor transmitted; but they also show the signs of careful workmanship.

Now the path of the reformer is a rocky one. He is usually mistaken for a prig or for a fool, and sometimes he is both.

But the author of this bold and diminutive volume is neither a fool nor a prig. He is a mining engineer. He has wrought in mining fields all over the world. His wide knowledge of mining men and affairs has been honestly gained and earnestly absorbed. He writes as a mining engineer to brothers of his own profession. And he is worth listening to.

If, then, an experienced and cultivated writer feels deeply the need of purifying current technical literary usages, of cutting out what is spurious and superfluous, of cleaving to that which is simple, of choosing that which is correct, it is surely not too much to expect of younger and inexperienced writers that they will seek to avoid the open pit-falls of error and bad taste.

In all seriousness, loose, sloppy writing is inexcusable. Mining men are, for reasons into which we need not enter, painfully prone to carelessness in this direction. A little care, a little thought, the exercise of a little sound common sense would show offenders the justice of Mr. Rickard's strictures and the importance of his mission.

We earnestly hope that "A Guide to Technical Writing" will find its way into every Canadian mining camp and into every Canadian mining engineer's office.

THE GYPSUM INDUSTRY OF NOVA SCOTIA.

The gypsum deposits of Nova Scotia are one of that province's large assets. During the year, 1907 the quantity of gypsum quarried was 332,345 gross tons. With the exception of a few thousand tons calcined and manufactured into plaster in the province,, the whole of this output was exported to the United States.

The value of crude gypsum to the Nova Scotian operators is about one dollar per ton. It is shipped to the various points in the United States where a duty of 50 cents per ton is imposed. The manufactured product is sent back to Canada where it pays a duty of 12½ cents per ton.

Were all the gypsum produced in Nova Scotia calcined and manufactured before exportation the province would gain considerably more than one million dollars per annum.

This statement is strengthened by the fact that Nova Scotia and New Brunswick supply all but a fraction of the gypsum imported by the United States.

The analogy between the gypsum of Nova Scotia and the copper and nickel of Ontario is complete. Both provinces are losing millions annually by exporting raw material instead of finished products.

The Halifax Chronicle makes a strong plea for the assistance of the Federal Department of Mines in giving adequate publicity to the extent and importance of the maritime gypsum deposits. We take it that this is a reasonable and seasonable request. The first duty of the Department of Mines is to give its services to those branches of the mineral industry that most need it and that, in the opinion of those competent to judge, will give a suitable return for effort expended.

Examination of statistics leaves no room for doubt as to the assured future of the maritime gypsum industry. The enormous known deposits in Nova Scotia and New Brunswick, and the exceptional facilities for mining transportation, and marketing, provide ample foundations for large expansion.

INDUSTRIAL.

We commend to the attention of our readers the matter published in the "Industrial Section" of the "Canadian Mining Journal." From our advertisers and other manufacturing concerns, we receive from time to time illustrated descriptions of new and improved types of machinery. Whilst all of this material is frankly submitted for direct and indirect advertising purposes, there is often highly valuable technical information included.

All such special articles, when of sufficient interest to merit publication, will be grouped in our "Industrial Section." The sources drawn upon are not confined to those firms whose names appear on our advertising pages. Whilst, naturally, these contribute matter most regularly, yet notices and special descriptions reach us from many other manufacturing concerns. These we use as opportunity offers.

The central idea of such a department in the Journal is the segregation of anything that smacks of advertising. The pages used are never, under any consideration, sold as advertising space. But the open distinction signified by the title "Industrial Section" marks them as being in a class by themselves and gives us the opportunity of using excellent material without the danger of lowering the general tone of the Journal.

PRINCE EDWARD ISLAND.

The smallest province of the Dominion does not appear in the list of mineral producing countries. It is rich agriculturally, and its shore fisheries are not inconsiderable. But there are no mining activities throughout the length and breadth of the fertile island.

But now, after due weighing of geologic evidence, the Dominion Government has decided that Prince Edward Island is a fair field for prospecting. Therefore the strata that underlie the tight little province are to be explored in the hope of finding coal.

The Island's situation geographically might justify the use of the word "expectation" instead of "hope."

EDITORIAL NOTE.

The Russian Government is contemplating a new State monopoly in platinum. Russia produces about seven tons of the metal annually. Most of this amount is exported to the United States and Germany. The effect of a considerable increase in price would have a serious effect upon the electrical industries. The search for platinum in Canada should be encouraged.

THE MINING OPERATIONS OF THE DOMINION COAL COMPANY.

By F. W. Gray.

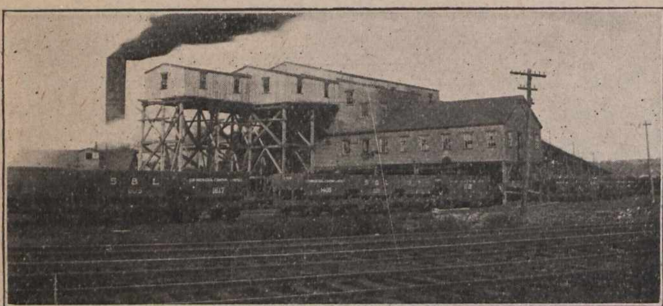
Article II.—The Mines of the Glace Bay Basin. (continued)

Reserve Colliery (No. 5 Colliery, Phalen Seam).—Reserve Colliery obtained its distinctive name from the fact that it was originally opened to work a concession reserved by the Provincial Government for the purpose of encouraging the building of a railway from Sydney to tap the mines of the Glace Bay Basin. This work was undertaken by the Glasgow & Cape Breton Coal & Railway Company, who were afterwards reorganized as the Sydney & Louisburg Coal & Railway Company, under which company Reserve mine was worked until it was absorbed into the Dominion Coal Company's properties.

The first shipments from Reserve are recorded in 1872, when the mine produced 27,802 tons, followed by a production of 63,300 in 1873. During 1874 to 1877 the conditions of the coal trade were so bad that operations were practically suspended. From 1878 to the present time, however, Reserve mine has been a consistent and steady producer. Since the opening of the mine in 1872 about 9,500,000 tons have been produced, of which amount 8,000,000, or 84 per cent. of the aggregate, has been mined under the direction of the Dominion Coal Company since 1893.

The coalfield has ben worked through three main haulages, namely, the French Slope, Main Slope and East Slope, all of which proceed from the outcrop of the Phalen Seam. The Main Slope was closed at the end of 1894, its territory being exhausted. The East Slope rope will shortly be taken off, when the haulage will be limited to the French Slope. This slope is 12,-

Reserve territory, which is the barrier against the work-000 feet in length from the bankhead to the end of ings of No. 2 Colliery. An auxiliary electrical haulage plant has recently been installed at No. 8 Landing, at a point 9,000 feet below the bankhead. This trip haulage will deal with all the coal below that point, and will transfer to the endless main haulage by means of a curve. The power for the trip haulage is generated at



DOMINION, NO. 3.

the Central Electric Plant, and is conveyed down a borehole 420 feet deep to a 100 h.p. Westinghouse motor.

The old main haulage engine was a large engine originally intended to drive the shafting of a large cotton mill, and it operated three haulages by means of friction clutches on a common shafting. It has recently been dismantled and replaced by one of the 28 inches by 60 inches engines from No. 1 Colliery.

The surface power equipment consists of seven Babcock & Wilcox boilers with rated capacity of 1,678 h.p., fitted with Parsons blowers. There are three steel and one brick smokestacks.

The air compressor house contains two Rand Compressors, steam cylinders 36 inches by 20 inches by 48 inches stroke, with a capacity of 3,000 cubic feet per minute, installed in 1900; one straight line Norwalk compressor with a capacity of 2,000 cubic feet, installed in 1905. In 1906 a Walker compressor was added, having a capacity of 3,500 cubic feet. This compressor is of similar design to the four other Walker compressors that the Coal Company have installed. It is compound, steam cylinders 24 inches by 41 inches, air cylinders 23½ inches by 38 inches, with 48 inch stroke, running at 60 revolutions. The whole of the compressor plant is lubricated by an automatic lubricating installation, similar to the arrangement at the other colleries. The operation of the automatic lubrication is economical in the consumption of oil, and is much more cleanly and less dangerous to the enginemen than the previous oil-can method.

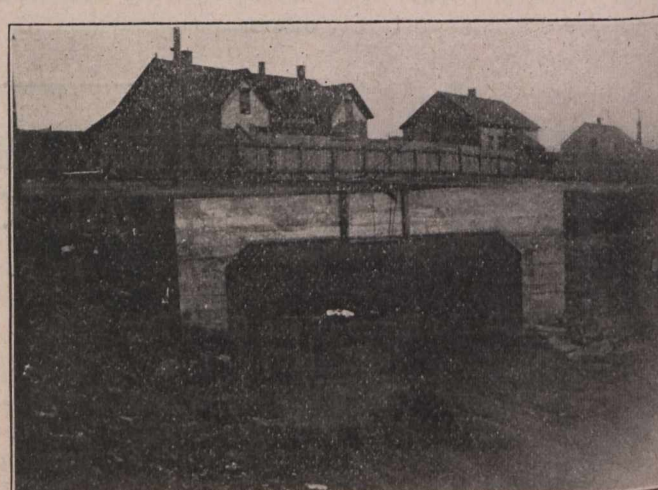
The mine is ventilated by two fans, one situated near the bankhead at Reserve, and the other at the mouth of the East Slope, about one mile distant. This latter fan is of the Guibal type, 24 feet diameter, vanes 6 feet 6 inches wide, running at 100 revolutions, with an original rated capacity of 300,000 cubic feet at 2 inch WG. There are two small boilers at the East Slope which generate steam for the fan engine. The ventilator at Reserve itself is a Chandler fan, 15 feet diameter, with a rated capacity of 205,000 cubic feet at 1.4 inches WG.

The bankhead is new, and was erected in place of the old structure that was destroyed by fire in October, 1906. This old bankhead had grown by successive accretions, and was a wonderful maze of screens and machinery, as such erections usually are. The present structure is of wood, hard pine posts with spruce stringers on concrete foundations, completely housed from the weather, and fitted throughout with stand pipes and hose for fire protection.

The screening plant consists of four sets of screens and picking belts, arranged to deal with the product from the Phalen and the Emery seams. At the present time Nos. 1 and 2 belts deal with the French Slope Phalen coal, No. 3 belt with the East Slope Phalen coal, and No. 4 with the Emery coal. When the East Slope is discontinued Nos. 3 and 4 belts will deal with the Emery output, which is steadily increasing.

The coal from the French Slope, after leaving the haulage rope, is conveyed by an inclined automatic car-haul to a Phillips automatic dump, which unloads on to a feeder belt 7 feet 6 inches long by 4 feet wide speeded at nine feet per minute. This belt discharges the coal gradually, with the minimum of breakage, and well distributed on to a battery of three shaking screens, which in turn discharge on to a picking belt, 38 feet 6 inches long by 5 feet wide, running at sixty feet per minute. The picking belts are well manned by young men, whose business it is to throw out any shale or foreign matter that is detrimental to the quality of coal, which is an easy matter owing to the even distribution of the coal layer and the slow movement of the picking belt. The other three belts are of similar construction, being 40 feet, 52 feet 6 inches, and 54 feet in length respectively. Each set of picking belts discharges on to a transverse loading belt, 39 feet long by 4 feet wide, driven by a 15 h.p. electric motor. The end of the loading belt can be raised or lowered according to the amount of coal in the car being loaded so as to limit the fall to a minimum and reduce the breakage. The screens and picking belts are driven by a 75 h.p. motor, and there is a separate motor for the car haul. Power is obtained from the Central Electric Plant.

The mouths of both the main and back deeps of the French Slope are protected by reinforced concrete ap-



CONCRETE APPROACH TO THE FRENCH SLOPE RESERVE.

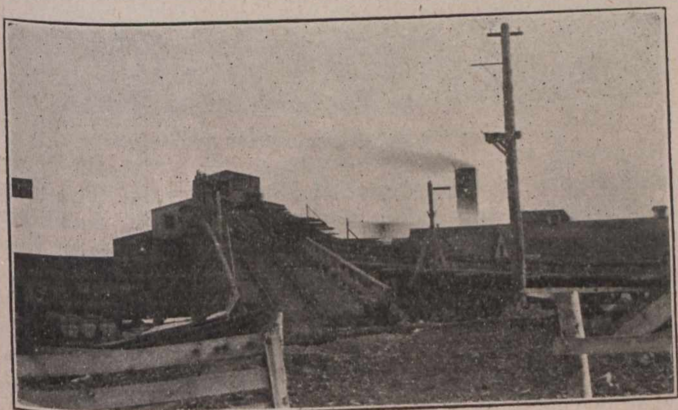
proaches, installed after the bankhead fire. That in the main deep is 90 feet in length and the back deep 30 feet.

The colliery shops are very complete, in order to render the colliery more or less independent of the central shops at Glace Bay. The machine shop contains a crank-shaper, 12-foot lathe, Merrill pipe threader and other machine tools, driven by a small Sturtevant vertical engine. There is also a carpenter and blacksmith's shop with a steam hammer for machine pick sharpening.

There are two lamphouses, one at Reserve, which serves both the Phalen and the Emery seams, and one for the East Slope side of the mine. They are fully equipped with automatic lamp filling and cleaining machinery, and with the Ackroyd & Best safety lamp, which was referred to in a previous notice. There are altogether about 1,200 lamps at this colliery, some 400 of which are in use in the Emery seam.

The mine has the usual complement of mining machines and shearers, and is equipped throughout, both above and below ground with fire hose, chemical extinguishers and water connections on the air lines.

The number of men on the payroll is around 600. At present the mine is double-shifted, and will probably remain so. Reserve Colliery was always a big producer, and on double shift has produced 800,000 tons in one year. The present policy of the Dominion Coal Company is in favor of single shift, as in many collieries the extra tonnage obtained is not always commensurate with the additional labor cost that double shift necessitates. Although it may be taken as a rule in all collieries that increased tonnage mean decreased



Dominion No. 3—Bankhead Approach.

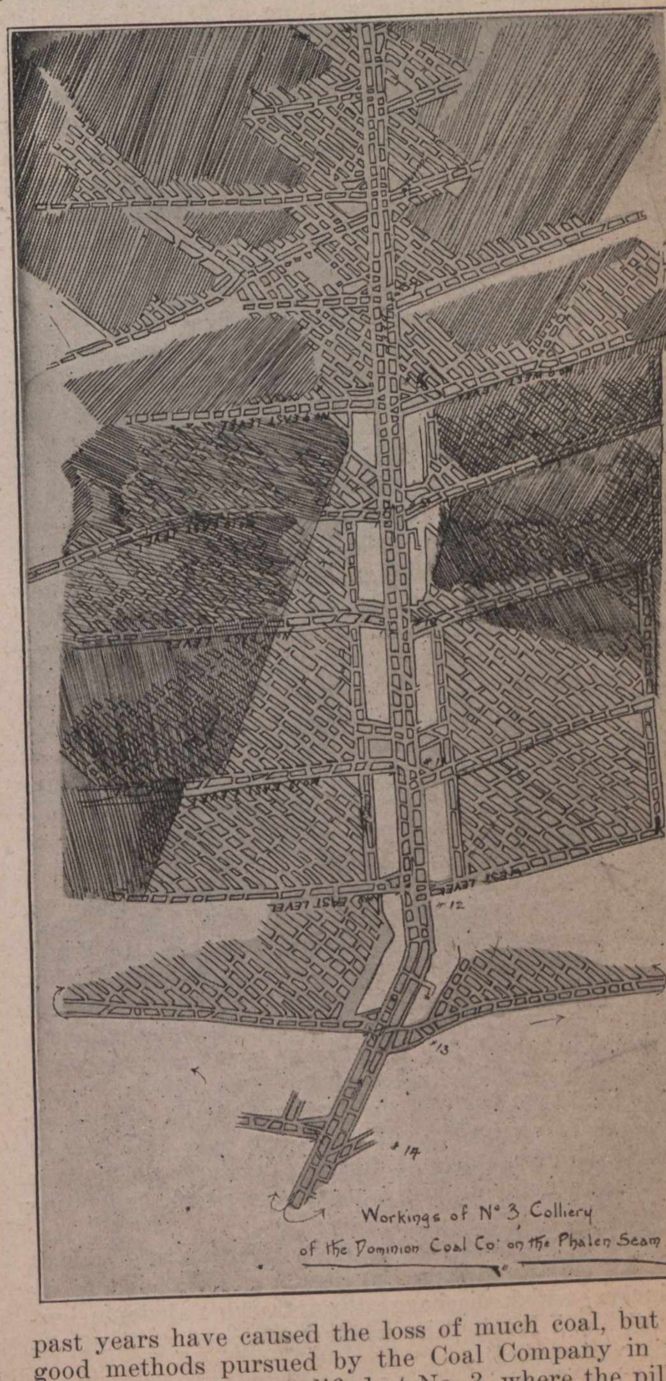
working expenses, yet there are circumstances when large outputs mean anything but economical mining.

Since the bankhead fire the Coal Company have spent a great deal of money around Reserve, and with its well designed bankhead, its new ring fence and the generally neat and trim way in which the surface is kept, the old colliery bears quite a rejuvenated aspect. Outside the fence is the colliery office and store, and near to the office is the fireman's hall, which will shortly be equipped with several Draeger apparatus as an auxiliary to the central rescue station.

Reference will be made more fully to the workings of the Emery seam at this colliery, in a subsequent notice.

No. 3 Colliery.—No. 3 mine is a slope mine occupying that portion of the Phalen coalfield lying between the territory of Caledonia Colliery on the eastern side and Reserve Colliery on the western side. The mine was opened in 1889, and commenced to produce coal in 1900, since which time it has put out 2,750,000 tons of coal, in round figures. The capacity of the mine at the present time is about 36,000 tons per month, on double shift.

The workings of No. 3 Colliery are typical of those of the other mines on the Phalen seam, and the plan accompanying this description will serve to give a fair idea of the methods of working which have been generally adopted in the Phalen seam. The pillar and stall method, or "stoop and room" is used exclusively, with the exception of a small section of No. 6 Colliery. Rooms are driven 20 feet wide, and the size of the pillars left will average 25 feet by 60 feet in No. 3 Colliery. As the workings go to the deep the pillars have of course to be left sufficiently large to withstand the greater strata pressure. This is a matter to which in late years the Dominion Coal Company have devoted particular attention. The inadequate pillars left in



past years have caused the loss of much coal, but the good methods pursued by the Coal Company in this matter are well exemplified at No. 3, where the pillars are being drawn systematically in retreating order outbye from the barrier, and no coal is being lost in the second working whatever.

The territory of No. 3 consists of an oblong piece of clear coalfield, without any disturbance. The main haulage road is laid out on full dip, the pitch being about 7 per cent. The levels are spaced every 450 feet, and substantial pillars, 100 feet by 450 feet have been left, affording adequate protection to the main roadways. The compactness of the mine, its freedom from water, and the workmanlike layout of the underground workings, have combined to make No. 3 an economical and consistent producer, and it is one of the few mines that do really well when double shifted. It is generally referred to in genuine Canadian idiom, as a "pretty nice little proposition."

The chief difficulty at No. 3 has been its long haul. At one time the endless haulage was 11,500 feet in length, which meant the handling of 23,000 feet in 1⅛ inch wire rope. The haulage is now divided into two sections. The upper haul is 8,000 feet in length, and is effected by means of a 22 inches by 42 inches hoist situated near the bankhead. There is an overground haul of about 4,500 feet from the mouth of the slopes to the bankhead, occasioned by the fact that No. 3 bankhead was originally designed to deal with the output from the Phalen and the Emery. The Emery slope, which is quite close to the bankhead was ultimately abandoned. The lower haul is effected by means of an electrically driven auxiliary haulage situated at No. 7 landing, supplied by power from the central power station, the transmission cables being carried down a borehole to a 200 h.p. Westinghouse motor. The present length of the lower haul is about 4,000 feet. The rope used is 1⅛-inch crucible steel in both cases. The mine cars have a capacity of two tons, and the track is 30-pound rails on wooden sleepers.

The surface plant consists of three Babcock & Wilcox boilers rated at 54 h.p. There is one large Walker compressor, compound type, steam cylinders 31-inches by 57 inches, air 32 inches by 51 inches, stroke 60 inches, running at 55 revolutions, with a capacity of 6,000 cubic feet per minute. The air pressure on leaving the compressor is about 75 pounds, and is delivered at the face at about 65 pounds. Some idea of the amount of air pipe that is needed in a machine pick mine may be gathered from the fact that No. 3 mine, which is a small one, has 12,000 feet of 8-inch pipe, 7,000 feet of 4-inch, and 30,000 feet of 1½ and 2-inch pipe.

The mine is ventilated by a 13 foot 6-inch Capell fan, having a capacity of 200,000 cubic feet at 2-inch wg., directly conected to an 18-inch by 18-inch Taylor-Chandler engine. The fan is substantially erected with steel and concrete housing. It is situated at the mouth of the slope, and has a separate small steam plant. The air current is carried direct from the fan a distance of 7,200 feet to the bottom of the deeps, air crossings being built over every landing, and is split at the face of the deep, returning up the main haulage road. The main intake is used also as the travelling road.

The mine water is very small in quantity, and is dealt with by two air-driven Cameron pumps 12 inches by 18 inches, which discharge through the Caledonia barrier at No. 7 level. The water is pumped at the Caledonia water shaft.

The bankhead is a wooden structure, approached by an inclined trestle, the return wheel of the endless haulage being situated at the rear end of the bankhead. The coal is dumped by two rotary Jenckes tipples, on to a feeding belt, over a triple shaking screen battery thence by means of a thirty feet picking belt to the cars. The bankhead has three tracks, for slack, nuts, and screened coal. The screening plant is driven by steam, and the colliery has its own independent electric lighting plant.

The colliery buildings are the usual ones, wash house, lamphouse holding 600 A. & B. safety lamps, warehouse, etc. There is a fireman's hall with hose reels and fire fighting apparatus, which will shortly receive several Draeger aparatus.

No. 3 Colliery is situated in a well wooded bit of countryside, and it is one of the pleasantest of the colliery villages. The miners' houses are built in well spaced blocks of two. Each house contains five rooms,

TYPICAL MINERS' HOUSES AT NO. 3 COLLIERY.

and pantry, and they rent at $6 per month. The management has succeeded in making their workmen "houseproud," and with its whitewashed fences, freedom from unsightly garbage and its surrounding greenery, No. 3 approaches what a colliery village should be from an aesthetic and sanitary standpoint. The management and the citizens of No. 3 are to be congratulated on their public spirited initiative and their regard for those little decencies which make life in a colliery district worth living, and the lack of which is apt to lead to the reign of "shackdom" and dirt.

(To be continued.)

On recently fusing a little tantalum powder, Siemens and Halske placed it in a kind of Crooks' tube instead of an electric furnace. On the anode the metal powder received the bombardment of particles from the cathode, and was quickly fused. A magnet deflected the tiny stream of bundles, and made it act upon any desired part first of the mass of metal exposed at the anode.

To determine when wire hoisting ropes have depreciated beyond the limits of safety has been a difficulty of mining engineers, and to avoid risk—in the absence of exact tests—many ropes have been doubtless discarded while still in fairly good condition. The strength of the ropes is now gauged by a novel use of electric induction. The ropes are passed through a coil of copper wire traversed by an alternating electric current, and the variations of induced current—which exactly correspond to changes in the thickness of the rope—are recorded on a suitable instrument. Dangerous wear or broken strands cause the indicator to give warning.

VALUATION OF MINING PROPERTIES.

By George H. Gillespie, M.E.

(Continued from last issue.)

The profitable lifetime of a mine is an important feature, in that the investment must be returned within the period of the lifetime.

Should a property be purchased at, say, $500,000, and $100,000 be spent on plant, equipment and development, and the resultant net earnings be 20 per cent. per annum, or $120,000, on the total investment of $600,000, this would mean 5 per cent. interest on the investment and 15 per cent. towards return of capital. At the end of seven years the capital invested in the venture would be returned plus interest. It could hardly be considered that the return of capital plus 5 per cent. is a fair return for the risk of the venture. Therefore a higher earning power, or a much more extended lifetime must be looked for to justify the purchase of a property at such a price. The extension of the profitable assumed lifetime would depend largely upon the natural location of the mining property under consideration, a seven years' continuous profitable lifetime for a mining proposition being rather the exception than the rule. Such a price could only be justified by the actual presence in the mine of assured ore at the time of examination to give a production for seven years as indicated, and the extended lifetime. or increased earning power could be justified by the indicated probabilities of the mine ahead of development. It would be safe to assume a reasonable continuity of conditions beyond the point of development, based upon conditions found in the actual ore reserves which had been developed. Provison would have to be made for additional development and working costs caused by increased depth, and in many cases for capital charges for re-equipping surface plants to admit of working at increased depths or on a larger scale.

In the case of the valuation of a silver mine in which the valuation of the ore reserves has been done with reasonable accuracy, but on the market price of silver of a year ago, let us suppose a mine in which $5,000,000 worth of silver ore is blocked out on four sides.

Silver has decreased in value 20 per cent. and the purchase price is $4,000,000, based on values of silver at date of examination.

$5,000,000	—Value ore reserves a year ago.
1,000,000	—Depreciation.
4,000,000	—Gross value at present prices.
400,000	—10 per cent. silver values, smelting charges.
3,600,000	
480,000	—Annual operating charges $160,000, and cost of mining, etc., for annual gross output of $1,500,000.
$3,120,000.	

Therefore, allowing a reasonable working capital in proportion to purchase price, say $500,000, the total investment would be $4,500,000, and against this we would have to-day assured net assets of $3,120,000 approximately. Should these net assets be the result of development to the 300 foot level, and should all conditions be favorable, it would be reasonable to assume that the second 300 feet of depth to be opened up would give ore reserves approximating in value to the first 300 feet. Of course additional working capital and working costs may have to be charged up against the opening up and working of this new ground.

$4,000,000	—First block 300 feet.
4,000,000	—Second block 300 feet.
8,000,000	
800,000	—Smelting charges.
7,200,000	
1,000,000	—Five years' operating expenses.
6,200,000	
1,000,000	—Interest charges at 5 p.c., 5 years.
$5,200,000	

That is, operating this mine for five years to give a gross output of $1,500,000 per annum, at the end of five years the capital invested would be returned plus 5 per cent., and the mine worked out to the 600 foot level, leaving the ground below the 600 foot level to earn the real return for the risk of the venture. This would pre-suppose a continuous average profitable lifetime down to the 900,, 1,200 or deeper levels over a long period of time.

The case above has been that of a small vein or veins of exceedingly high grade silver ore where the gross output is large for a small tonnage of ore.

The fluctuations of the market affect a mine of this nature more than would be the case with a large low grade body of silver ore. The small high grade ore body will usually have a much shorter lifetime. Should it be operated during periods of low priced metal, it has a shorter lifetime in which to look for recovery in prices. Large low grade mines, having a longer lifetime, have a much better chance of good average market prices of products.

The purchase of a property for development, when the development must be spread over a period of years, such period being a period of non-productive operation, must be affected by the fact that capital so expended plus purchase price is losing interest so long as the mine is non-productive. Such loss of interest must be added to the final amount of capital to be returned from the operation of the venture. This feature is of course not alone confined to mining, but is common to most investments in ventures that call for gradual bulding up. In mining it has a greater influence on the problem, when it is considered, as has been already stated, there is only a certain definite ore body from which these charges and commensurate returns on investment must be won.

General.

Mining property that has been properly valued presents one of the best possible fields for investment. My own fixed belief is that the part capital should play in mining is that of creating industrial conditions, and not the purchase of golden but doubtful probabilities.

There is always the chance that a mine will turn out better than the facts observable appear to warrant. This is always the hope of the purchaser, but I do not believe that it would be wise or fair to pay higher prices for this chance. The more nearly mine valuation can be brought to the ideal of engineering which is a science based on facts, the better.

There are, of course, many problems of mine development that call for large expenditures and that are often speculative at their inception. The undertaking of such operations is often legitimate engineering, but I do not think that it is wise to pay large purchase prices for the privilege of taking such risks.

FLUORSPAR.

Abstract of Advance Chapter, Mineral Resources of the United States for 1907, by Ernest F. Burchard.

Character and Occurrence.

Fluorspar or fluorite, chemically calcium fluoride ($Ca F_2$), consists of calcium and fluorine in the proportions of 51.1 to 48.9. The mineral is crystalline, only slightly harder than calcite, and consequently crushes easily. It crystallizes in the isometric system, and is commonly found in cubes. In color it is often white and opaque, although it ranges from a clear, slightly bluish, glasslike substance, through various brilliant shades. It is usually pure, running 98 to 99 per cent. calcium fluoride. Material carrying less than 95 per cent. finds little sale.

Fluorspar has a wide distribution geographically, but in only five States, Arizona, Colorado, Illinois, Kentucky and Tennessee, have deposits been exploited. It is also secured as a by-product of lead and zinc mining in Albemarle County, Va.

Practically, wherever it has been mined, fluorspar occurs as a vein material, although under widely different conditions. In the Kentucky-Illinois district it is the chief mineral of value in many of the veins, lead and zinc being of secondary importance, while in the Castle Dome district of Arizona, jig concentrates of fluorspar are made incidental to concentrating.

Preparation and Uses.

The various uses of fluorspar depend on its chemical composition, fluxing properties, and phosphorescence when heated, and on its optical and gem-like properties. Its preparation involves separation from other minerals, the treatment comprising hand-sorting, crushing, and jigging. Part of the high grade ore is ground and shipped in barrels and sacks; the rest is sold in lump form. Its separation from zinc blende is difficult, but has been accomplished by means of flotation in dilute solution of aluminium sulphate. This basic flotation process is now in successful operation at Marion, Ky. Shallow pans, in which mechanical stirrers are operated are the essential of the equipment.

The principal classes of consumers, in order of importance are, smelters and metallurgists, makers of opalescent glas and enamelled wares, and chemical manufacturers. The highest grade, "American lump No. 1," which runs less than 1 per cent. silica, and is white or clear pale blue in color, is sold either ground or in lumps to the two last classes of consumers. The grinding of the pure, clear spar can be dispensed with for some purposes, as it readily decrepitates to a powder when heated. The second grade, "American No. 2," is used in the production of ferrosilicon and ferromanganese, and in basic, open hearth steel furnaces to give increased fluidity to the slag and to reduce the contents of phosphorus and sulphur. This grade includes colored spar and may run as high as 4 per cent. silica, though most of it is sold with a 3 per cent. guarantee. The lowest grade, "gravel spar," including all that contains more than 4 per cent. silica as well as spar mixed with calcite, is used in iron and brass foundries. Its use makes the metal more fluid and permits the use of greater quantities of lower grades and scrap by carrying phosphorous, sulphur, and other impurities into the slag.

Although flourspar possesses higher quantitative efficiency as a flux than limestone, especially in smelting refractory ores, it can only be used in limited quantities. In England and on the continent the use of fluorspar is more common than in America. Its minor metallurgical uses are in the extraction of aluminium from bauxite, in smelting gold ores, in refining copper, and in refining lead bullion. In the latter process it is first converted into hydrofluoric acid.

Fluorspar is also used for bonding emery wheels, for carbon electrodes to increase their lighting efficiency, and as a constituent of Portland cement.

Production and Prices.

In 1907 the total quantity of fluorspar marketed was 49,486 short tons, valued at $287,342, a gain of 8.690 short tons in quantity and in value, $43, 317 over the output for 1906. This indicates a firm condition in the fluorspar industry, since there was on hand at the close of 1906 a stock of 13,470 tons, which has evidently been absorbed without leaving quite so large a surplus on hand at the close of 1907. Gravel spar was valued at $4.47 per ton; lump spar at $7.51; and ground fluorspar at $10.31 per ton. Small quantities of lump spar were reported to have sold at $18 to $35 per ton.

Up to October, 1907, the demand was generally strong, with prices ranging from 75 cents to $1 in advance of those of 1906. Toward the end of the year there was a decided faling off in production as a result of the depression in the iron and steel business.

Wholesale prices in December, 1907, in domestic lump spar f.o.b. shipping point, ranged from $8 to $10 per long ton; on ground spar, from $11.50 to $13.50 per long ton; and on foreign crude, ex dock, from $8 to $10 per long ton. In May, 1908, the quotations were exactly the same.

The fluorspar imported into the Untied States is said to come largely from English mines, the competition being felt principally along the Atlantic coast.

A new plan for storing gasolene or petrol depends upon the fire-stopping property of wire gauze that gives safety to the Davy mining lamp. A gauze tube is inserted in the opening of the can or tank, extending to the bottom, and the orifice is then sealed up by a plug held in place by fusible solder. If fire occurs near or around the tank, the solder melts and the plug is blown out, when the vapor escaping through the gauze tube burns quietly without explosion. In a test of the method, twelve out of seventeen ordinary cans filled with volatile oil exploded on contact with fire, throwing the burning liquid in every direction, but twelve cans fitted with the safety device failed to explode and the liquid burned quietly and harmlessly.

A Contribution to the Discussion on the Genesis of the Graphite in Argenteuil and Labelle Counties, in the Province of Quebec.

By F. Hille, M. E.

I arrived almost post festum at the meeting of the Canadian Mining Institute that was held last March in Ottawa, having been delayed by the lateness of the trains; the result of this was that I missed the reading of Mr. H. P. H. Brumel's paper on "The Modes of Occurrence of Canadian Graphite."

I now have before me the printed report of his contribution and of the discussion which followed it, as given in the Quarterly Bulletin of the Institute, and find them extremely interesting, not only from an industrial standpoint, but also from the view of economic geology.

The broad discusion of the subject especially impressed me as demonstrating that the members of the Institute are taking a keener interest in these matters, by offering, every man his quota, towards the solution of the phenomena of the origin of ore deposits.

In my own opinion there is no study more fascinating than the quest for a solution of the problems as to how or by what processes the different minerals are deposited in the various rocks in which they are found. And when we look over the field, and are confronted by the observation that in almost every locality we find some degree of dissimilarity or certain distinct features in the occurrence of even one and the same mineral, it is but natural that we should encounter problems, that multiply in proportion as our investigation extends from country to country.

Notwithstanding this, nature has given us certain basic rules upon which we can build the foundation towards a solution of her riddles.

While I was reading Mr. Brumel's paper and the opinions that were expressed by the different members regarding the genesis of graphite, it occurred to me that it might be of interest to offer a hypothesis, which, in my opinion, appears to correspond more strictly to the field evidence than some of those which were brought forward during the discussion.

I wish to take this opportunity of reviewing these hypotheses again, in order to bring them afresh into my readers' minds, and in order to call more particular attention to those points which, to my mind, seem to weaken their probabliity of affording a correct solution.

Four theories were brought out in the paper and in the later discussion.

1. That propounded by Mr. Brumel, the leaching of the "original rocks" thus freeing them of carbon, which was subsequently redeposited as graphite.

2. That of Mr. Coste,—the deposition of the graphite by volcanic emanations, in the form of hydro-carbons.

3. That of Mr. Cirkel—idiogenetic occurrence with the enclosing rocks.

4. That of Dr. Woodman,—which hints at an organic origin.

Let us consider the first hypothesis. Mr. Brumel presupposes that some "original rocks" had contained carbon, and the silicious and other waters had leached out the carbon and redeposited it into the gneiss and along the contact and fissures of the eruptives. He does not state what he implies by the "original rocks." If he means by this term the oldest rocks, then we must regard it as referring to the gneiss as such, he himself calling this an archaean rock. Next in point of age we must consider the limestone, then the diorite, granite, felsite and lastly the diabase. Are these latter Mr. Brumel's "original rocks?"

If we were to make use of microscopic examination, I doubt much whether we would discover in the eruptive rocks last named, with the probable exception of the diabase, even the slightest traces of graphite; had these been the vehicles that carried the carbon we would still expect to find a certain amount of carbon yet in the rocks, it being inconceivable that the solutions should have leached every particle out of the rock.

Mr. Brumel makes the further statement that the contact of these eruptives with the limestone showed only silicate of lime, and with the gneisses, sulphate of lime; this would signify that the granite emanations carried principally silicates, while the diorite carried more sulphates. If, however, these intrusives had contained carbon, their point of contact with other rocks, (the veins excepted, which were produced by a later incident), should undoubtedly show carbon also, in some form or other. I am exceedingly curious to learn in what form the carbon existed in these original rocks, in order to allow it to submit so readily to the leaching process by silicious and other—perhaps sulphurous—waters. It is not to be expected that hydrocarbons would be found deposited in an eruptive rock, at least not until it is cooled, and we are almost compelled to believe that, on account of the intrusion of the four later eruptives, the rocks must have retained an intense heat for a very long time. More than this, a combination of carbon and sulphur could hardly be obtained in the manner suggested, and even granting that this were possible, the resulting combination, CS_2, or CS, would be so unstable a compound that in its course of travel through the fissures and cracks of other rocks, it would seek an exit by the best and shortest outlet to the surface—and then where would the graphite come in?

This hypothesis seems to me to be extremely unconvincing, until some further light is shed upon several of the points.

2. The second theory attributes the production of graphite to a process of injection of hydro-carbons into the openings of rocks other than that from which it came. There is, perhaps, a possibility that something of this nature may have taken place, but in order to ensure the complete success of the process suggested in this hypothesis, we must presuppose the active presence of three important factors, viz., (a), the meeting and combination of emanating carbon with similarly hydrogen, in a somewhat cooler portion of the vent through which they were seeking an outlet to the surface. (b), The condensation of these hydro-carbon vapors and their deposition into the yet cooler fissures, of various sizes, of the different rocks, and, (c), ultimately the conversion of this mineral into graphite, by considerable heat, produced, either by the last of the erup-

tive rocks, or by intense pressure, without the admission of air or oxygen, in fact, I might say, almost in a vacuum. That hydro-carbons are produced by such a process as I have described is certain, but it is, without doubt, a very delicate one, to produce graphite from them by eliminating the hydrogen from the carbon without evaporating both elements. In addition to this, the statements that were made above, regarding the continuous heat produced by the rapid succession of divers eruptives, still holds good here, and this goes to show that hydro-carbons could not have long remained in a state of condensation in these rocks, as this condensation could only have occurred at a time when the diorite, granite, and felsite had cooled sufficiently to permit it.

3. The third hypothesis supposes that the graphite might have been deposited at the same time as the constituents of the gneiss, and that this rock is a sandstone, not an eruptive, and that the graphite could not have been taken up by it in a disseminated condition. And the further opinion was advanced that the graphite had not been deposited as such, but as an "original mineral," and later converted into its present state.

In reply to this let me say: Mr. Brumel, at the beginning of his paper brought to our attention the fact that the graphite was found in the Archaean rocks; if this be the case, then we have to deal, not with a metamorphosed sandstone, but with a Laurentian gneiss of volcanic origin, and somewhat altered and shattered, in situ, by the later intruding or extruding rocks. Were this rock of sedimentary origin the microscope would soon inform us of its true nature. On account of the stresses which it underwent, it became pervious to the inflow of vapors and fumes, especially under pressure, just as a porous sandstone would, as may be shown by the different secondary minerals contained therein. Why a sandstone should not absorb these volcanic products I fail to see, for we must not lose sight of the fact that there are porous sandstones, crushed sandstones and also impervious sandstones.

Let us now consider why the claim that the graphite might be an idogenetic product with the sandstone cannot be supported by field evidence. First, take into consideration only the enormous time that must have elapsed from the beginning of the formation of a sandstone of such considerable extent to the time of its solidification, and again to the period of the eruption, first of the basic and later of the acid type of rocks, and lastly, to the time of the diabase eruption—a decidedly long period of time indeed! Now we have seen that there are graphite deposits of all descriptions, in and in contact with these younger eruptive rocks, graphite, very pure and of crystalline structure. Whence did this portion come? Was there a constant supply of this carbon furnished over this long period, sufficient, not only to satisfy an immense deposit of "sandstone," but also to fill the fissures in rocks of a much later age over a very considerable area? Another matter upon which I would desire to be enlightened is what are we to understand by an "original mineral of carbon" that is deposited together with the constituents of a sandstone, and changed later into graphite. If it is not a volcanic emanation product, then it must have had an organic origin. There is, however, no basis for our supposing the existence of organic life in archaean times, and we are thrust back to the conclusion that, after all, it must be a carbon originating from the only source from which we could expect that element to be derived, viz., a plutonic source. For these reasons I do not think that this whole hypothesis is tenable.

4. The remarks contributed by Dr. Woodman to the discussion on the paper are the only criticism which introduces the organic origin of carbon, especially as regards the second of the examples which he quotes. The first instances cited by him are not sufficiently elaborated and explained to give us a definite picture of the geological features of that district, nor is there any elucidation of how the black slates arrived there, or what is their nature and composition, whether clay-slates or the remains of former volcanic ash-beds. His second example has no possible connection with the subject of Mr. Brumel's paper, which is dealing solely with a graphite occurrence in veins and impregations in an Archaean rock stratum, in which there was not the remotest possibility of the formation of organic coal beds. The only service rendered is perhaps to show in how many different ways graphite might be formed.

I will now, with the reader's permission, explain my own views as to the manner in which these graphite deposits came into existence in the localities under consideration by Mr. Brumel.

Before taking up the origin of the graphite itself, it is necessary for us to take into consideration the manner in which the receptacles, that is the openings, fissures and cracks, in the different rocks were formed, and in what sequence.

We have already seen that the gneiss is the oldest of the series, and next probably comes the limestone, then following in regular order the diorite, granite and felsite, and last of all the diabase. Now it is obvious that the fissures in the gneiss and the limestone were produced by the eruptive rocks which followed later, the fissures in the diorite by the granite, felsite and, perhaps also, the diabase, while the contact fissures were the result of either the stresses accompanying the eruption of each successive rock, or of the contraction of these eruptives as well. A portion of these fissures in the gneiss and limestone was filled by the silicates of the granites and the sulphates of the diorites; there is, therefore, no evidence to show that either the diorite or the granite have contributed to the origin of the graphite. There is now only one crack left to which we have to look for the parentage of the mineral in question, and this is the diabase. There is every probability that here, as we find in so many other localities, the trap rock was the original source.

I have had opportunities of examining a large number of graphite deposits in the archaean and post-archaean rocks, and in every case I have been able to trace their origin to the diabase, and the principal basis of proof rested upon the fact that this rock itself carried in some cases considerable, and in other cases appreciable amounts of this mineral.

We find in this locality a number of deposits of graphite, although they are of no great extent and the mineral is somewhat impure; we find further a number of diabase dykes, being the plutonic facies of exposed laccolites, which are heavily saturated with graphite; we have several diabase craters and numerous dykes, nearly every one of which shows more or less graphite; in the immediate vicinity of some of these trap dykes we find a number of small nests of anthraxolite; we have also a large area covered with the co-called "black slates," which are merely solidified ash-beds, the exhalations or explosion products of our diabase volcanoes, and these contain, in places, a large percentage of graphite.

I also observed graphite deposits and incrustations along the trap rocks in the American Rockies, which I visited last year, and have met with a similar occurrence in different parts of Europe, but after all, these instances which have come under my personal observation, are insignificant as compared with the many similar occurrences of which we have knowledge that are scattered throughout the world.

Let us now consider how we can account for the origin of the graphite in the localities here under discussion. Mr. Brumel mentioned the fact that in several places the graphite is found in contact with the diabase, but very little importance was given to this rock in the course of his paper, the reason for this being, probably, owing to the outcrops being rather infrequent, and the graphite deposits in contact with it being of no great commercial importance. However, we ought not to overlook the fact that the diabase occurs not infrequently in the form of immense laccoliths, and that sometimes only a few small apophyses are found breaking through to the surface, or have been exposed by the erosion of the overlying strata. Let us accept this as having occurred in the locality in question, and suppose that the vapors and fumes of this laccolith, composed of carbon as well as other constituents, had been compressed into the fissures and fractures of the rocks above named, where they were retained in a condensed form as graphite. Just as from a volcano there are poured forth, with tremendous force, ashes including particles of graphite, in combination with steam and other gaseous elements as an explosive and triturating vehicle, so also could graphite, with gases as the carrying agents, be injected into the smallest interstices and crevices of the rocks. Again, if we grant that it is possible that a magma, injected into any rock strata, can carry graphite almost to saturation, then we must also admit the possibility not only that this carbon escaped from this magma, with other gases, but also that such gases found an outlet from some source at a far greater depth, and were deposited in a cooler stratum in the form in which we find them there to-day. The fissures which we now find on the surface might have been at the time that this deposit was injected, in a stratum hundreds, or even thousands of feet below the former surface of the earth, and they may be regarded as vents which had attained a certain degree of temperature favorable to the deposition and retention of the graphite.

The explanation that I have given above is perhaps the simplest possible of the genesis of the Quebec graphite, being based upon phenomena with which most of us are, or should be quite familiar, but we usually are only too apt to seek for our solutions of the processes of nature by piling hypothesis upon hypothesis, a method that only results in irritating us, and eventually carries us farther and farther away from the goal we seek.

The processes of nature's laboratory are, after all, simple enough, if we only endeavor to study them patiently and read them correctly, but this cannot be done in our studies, nor can the knowledge be acquired from books. No, indeed; rather should we go out and, as it were throw ourselves into nature's arms and allow her to show us the products of her laboratory, pick up every little stone and mineral, piecing them together like the pattern of a mosaic, and resolving them into one harmonious whole, and the result will always be a beautiful and perfect picture.

THE TECHNICAL ANALYSIS OF MAGNETITE, HEMATITE AND LIMONITE.

By R. Bolling.

In the Sydney district all of the above minerals are reduced to pig iron in the blast furnaces located at South Sydney and Sydney Mines. About 600,000 tons of ore are smelted annually. Systematic sampling and analysis are of course necessary from a metallurgical standpoint as well as for the computation of the bounty donated by the government to foster the steel industry in Canada.

Sampling.

There is no royal road to securing a representative sample of a cargo of iron ore. Some experience in this business is perhaps the best teacher, in fact, the I. C. S. schools at Scranton, Pa., who will teach and guarantee a position in any line from a "showcard writer" to that of mining engineer are silent on the subject of sampling. It cannot be taught, even by mail. It must come from personal observation and has to be learned on the spot. Fresenius tritely remarks in the preface to his "Quantitative Analysis," "the larger the sample, the more accurate the analysis," but adds "the smaller the sample, the sonner the analysis will be finished." It is well to steer a medium course in taking samples. My practice is to take 20 pounds from a railroad car and 200 to 500 pounds from steamers.

Crushing.

Jaw crushers working on the Blake principle are satisfactory on hard lump ore. They must be driven by power. All of the sample should be crushed to pass a half-inch sieve. The sample, if heavy, should be worked up in sections, in the quartering operation. The simplest method of mixing preparatory to quartering is to throw the mass of ore in the centre of a large rubber cloth blanket. This is then held by the corners by two men and a rolling and oscillating motion imparted to the sample. Results are very satisfactory as regards uniformity of the mass.

Drying.

Moisture must be accurately determined. The sample quartered down to from 5 to 50 pounds depending on the original sample, is weighed in flat copper receptacles, and dryed on a steam table to constant weight.

Grinding.

There is only one kind of machine that was ever intended for grinding iron ores, this is the ball mill. Its work is perfect. Large mills with drums 20 to 30 inches should be used. They must be "rinsed" out with the ore from a discarded quarter of the sample to be ground, before applying the power.

Agate Mortar Fine Grinding.

Sample from the ball mill is bottled and a small portion, 5 to 8 grams, ground in the fine mortar, until it feels free from grit.

Preliminary Tests.

Spread the ore powder on a glass plate and draw the poles of a horse shoe magnet over. If it attracts entirely it is magnetite, if partially, it should be treated as magnetite, if not at all it is either hematite or limonite. Heat a small portion in hard glass test tube, if limonite, moisture condeses on the cool walls. These tests will indicate the kind of ore, whether magnetite, hematite or limonite. They also decide the method of treatment. Magnetites are only partially soluble in hydrochloric acid, whereas hematite and limonite are completely soluble except in rare instances.

Getting the Ore in Solution.

This is an important step in its analysis. More low results come from neglect or inexperience at this point than from awkward manipulation. You can never feel easy in your mind if little black specks are seen after the ore is supposed to be dissolved. Begin right and the analysis will be finished much quicker. It is no use attempting accurate analysis if the agate has not been rubbed long and hard. It is not pleasant, but repays the grinder in mental satisfaction afterwards.

Magnetite.

Fuse 5 grams of ore and 15 grams of sodium carbonate (dry) in a large 60 c.c. platinum crucible with lid, for thirty minutes over an air-gas blowpipe. It is better to start the fusion with the air shut off for the first few minutes and then gradually increase the air blast to the maximum. Cool and place in a large 500 c.c. porcelain casserole and heat on the electric hot plate or other hot metal surface, adding 400 c.c. of HCl, 1.10 sp. gr., to dissolve the fused mass and covering with a clock glass. After a short time the crucible can be examined and if no fused material is cemented to its sides it can be removed and rinsed off with water. Having taken out the crucible and its lid, the casserole is allowed to stand on the plate until nearly all the acid is evaporated, then cautiously moved to a cooler part and there watched while it evaporates to dryness. Heating must be continued until every trace of HCl is driven off.

Limonite and Hematite.

Fusion can be dispensed with if .5 grams of ore are weighed into a 500 c.c. casserole and heated with 400 c.c. of HCl, 1.10, in the same manner as described for the magnetite sample. The sample can now be treated in the exactly the same manner, viz.: The residue dissolved with 50 c.c. HCl, 1.20 sp. gr., diluted with water and the silica separated by filtration. The filtrate is caught in a 500 c.c. volumetric flask and, after washing with dilute acid and hot water, the silica is removed from the filter, ignited in a platinum crucible and weighed, the weight divided by 5 and multiplied by 100 gives the percentage of silica. The contents of the volumetric flask are now brought up to the mark with cold water, a rubber stopper inserted and the contents thoroughly mixed. With pipettes measure into appropriate beakers, 100, 125 and 75 c.c. of the ore solution, and proceed thus: The 100 c.c. and 125 c.c. portions are evaporated down to near dryness and strong nitric acid added, then evaporated a second time and finally a third time. Phosphorus is determined in the 100 c.c. portion by the well known molybdate precipitation and titrated with nitric acid solution, after solution in standard caustic potash, of a strength of about .00014, or thereabouts of phosphorus. The alkalimetric method of estimating phosphorous is very simple and exact. Two solutions of acid and alkali are balanced against each other and then standardized against a standard steel or pig iron.

The beaker with the 125 c.c. portion is now diluted with water, transferred into a liter flask, zinc oxide emulsion added to precipitate the iron, mixed, and 500 c.c. filtered off through cotton, heated to boiling and titrated with decinormal KMn O_4 solution, 1 c.c. equivalent to .0016 gram of manganese. This is Volhard's method and for simplicity and accuracy it can be recommended.

The beaker with 125 c.c. portion is transferred to a one liter beaker, neutralized with ammonia, sodium acetate solution added and iron, alumina and phosphorous precipitated by boiling. Filter, and wash with hot water, and boil up with water and wash again to free precipitate from all soluble salts. To filtrate add bromine water and then ammonia, warm on hot plate a few hours and filter. To filtrate which must be boiling, add hot ammonia oxalate and filter off lime, titrate the precipitate with K Mn O_4 solution, each c.c. of the decinormal solution being equal to .0028 gram lime. The filtrate from the oxalate precipitation is evaporated to small bulk, 100 to 200 c.c. cooled, and magnesia precipitated by microcosmic salt, after addition of 25 c.c. of ammonia. Filter and wash with 10 per cent. ammonia, ignite and weigh as Mg_2 P_2 O_7, and calculated to Mg O. The precipitate which now contains all the phosphorus, iron and alumina, is dissolved in hot dilute HCl, and diluted to 500 c.c. neutralized to just acid with ammonia, 10 grams sodium thio-sulphate and 1 gram sodium phosphate added and the solution boiled for 20 minutes. The aluminium phosphate is then filtered off, ignited in a porcelain crucible and weighed as $AlPO_4$ and calculated to Al_2O_3. One hundred c.c. of the ore solution is now drawn by pipette, run into a 300 c.c. flask, reduced with granulated zinc for two hours, acidulated with a little dilute H_2SO_4, filtered into a large flask and titrated with decinormal $KMnO_4$ solution, each c.c. of which is equivalent to .00056 gram of metallic iron. The remaining 100 c.c. of ore solution is evaporated down to 50 c.c. and 5 c.c. of 10 per cent. barium chloride added just after boiling, and the sulphur precipitated as Ba SO_4 and filtered and weighed after ignition.

There are the usual determinations made in iron ore analysis and for routine work will be found to give accurate checks when run in duplicate. Combined water can be determined by heating one gram of ore red hot for 30 minutes, weighing and dividing the weight of water loss by 1, multiplying by 100, giving the per cent. The only novelty about the famous Wabana ore from Bell Island, Newfoundland, is the fact that it carries traces of vanadium. Some of the imported Spanish ore, namely, Carthagena, carries a little galena. The other ores are native and Swedish of great purity.

WORKING COSTS OF MINES, AS PRACTISED ON THE RAND.

By John A. Dennison, Member.

(Paper read before the Institute of Mining and Metallurgy.)

Mining is essentially a commercial business and therefore should be conducted on lines which approximate as closely as possible to the recognized forms of established businesses.

Accounts are kept for four principal reasons:

First.—For the convenienec of the manager of the mine, who naturally has to follow the cost of each department closely.

Second.—To enable consulting engineers and controlling firms to see the cost of each branch of work, both on the surface and underground, with a view to cheapening or improving such work.

Third.—To supply Government with statistics.

Fourth.—To enable the mine owner or shareholder (who frequently knows little about mines) to see how his business is progressing, the amount of profit made, or the dividend he is likely to receive.

"Simplicity" in mine accounts should be aimed at, as it means less staff, less cost, and renders the accounts more easily understood by the owner of the business, i.e., the shareholder.

The following notes touch on the main controversial points in working costs of gold mines, particularly on the Rand:

Capital Expenditure.—All initial expenditures on machinery and plant, buildings, dams, shafts, development, head-gears, etc., up to the time of crushing is of course capital expenditure, from money provided generally from working capital shares or loans. Any surplus working capital that there might be would soon be spent in completing the plant, and in improvements. The trouble arises after the plant starts producing, when all the working capital is exhausted, how to deal with the further expenditure on similar items which goes on more or less during all the life of the mine, i. e., whether to charge it to capital account or to working costs. If the items are large (duplication of mill, new vertical shaft, new cyanide or slimes plant), and the necessary money is raised by a new issue of shares, debentures, or special loan, such expenditure is generally considered capital expenditure. But if the items are smaller ones occurring and recurring during the life of the mine, and are paid out of the profits, the mine owner or shareholder will, so far as he is concerned, consider them "working costs," i. e., as the difference between the revenue and the net profits he receives. It does not really matter much to the shareholder how the expenditure out of the revenue is allocated, so long as he can see at once by glancing at the monthly or annual reports how much net divisible profit has been made. So that in such reports it is essential that when some of the expenditure is charged to capital account the working costs and profit should not be shown alone, but the capital expenditure and net profit should also be shown.

The ideal method, and perhaps the simplest (though only adopted in a few cases) is to close all capital accounts when the plant is complete and running, and the original working capital is exhausted; and not to re-open them except for special expenditure of money specially raised.

Working costs naturally vary in different countries, on different fields, and also on the same fields; in the latter case, owing to relative size of plant, hardness of rock, dip and thickness of reef, etc., But many managers are more or less driven by directors or the public to show low working costs, as it is unfortunately often considered that low working costs mean good management, whereas of course they often mean poor policy, and slightly higher costs might result in additional net profit.

Such pressure, however, whether direct or indirect, often drives a manager to charge as much as possible to capital account, and as little as possible to working costs, both for his own sake, and sometimes possibly for "window dressing," in order to show a large working profit. Each manager has his own ideas as to what constitutes capital expenditure, and sometimes managers differ very widely in their methods and ideas.

Looking at a mine again as a commerical business, it seems necessary or advisable that "working costs" should in some way reflect the amount of capital exneded, either through "depreciation" or interest and redemption of loans, etc. The prevalent practice, however, seems to be not to include "depreciation" in working costs, even when it is allowed for, but to write it off "premium on shares" account, or some other equally useful account, so that it does not directly show in costs. It therefore follows that costs of 20s. per ton may be very good if only £500,000 have been spent on equipment, etc., but very high if £1,000,000 have been spent. The consequence of the usual practice of making no allowance for depreciation or redemption of capital in mine costs is that it is often impossible to see how much real profit is being made; in fact, in cases where working capital shares have been issued at a premium the profits or dividends often seem large on the nominal capital, but would be much smaller on the total amount of money raised for working capital, and still smaller if on the total amount spent, including capital expenditure out of profits, which in time amounts to large sums. Sometimes, indeed, if the whole expenditure were considered, the "profits" shown would not be sufficient to redeem the capital, much less pay interest on it. Curiously enough, money spent on capital account is often looked upon as additional working capital raised, i. e., that interest on and redemption of such money must be allowed for before the additional plant can be correctly said to have produced any additional profit.

Capital Expenditure.

Capital expenditure on the Rand may be divided into two groups:

1. Initial expenditure to bring a mine to the producing stage.

2. Subsequent expenditure.

1. The initial expenditure may be divided into four headings:

(a). Property Account.—No depreciation is allowed for this in balance sheets or working costs, and it stands at its original cost right through the limited life of the mine, though the exhaustion of ore makes it less and less valuable.

(b). Machinery and Plant, Buildings, Dams, etc.—In some cases depreciation is written off every year to premium on shares account, or appropriation account, in other cases not at all, it being considered that as the money has been spent in bringing the mine to the producing stage, depreciation of the account would mean the creation of a cash reserve and payment of smaller dividends, if it had to be debited to profit and loss account.

(c). Shafts.—All initial expenditure on vertical and inclined shafts is left as an asset in the balance sheet, i. e., neither depreciated nor redeemed.

(d). Development.—In the largest group of mines initial expenditure on development, i. e., sufficient to bring the mine to the producing stage, is not written off, depreciated, or redeemed at all, it being decided to keep ore reserves to this or a higher level by current development, which is charged direct to working costs.

In many other mines this initial expenditure on development is debited to what is practically a capital suspense account, and is used for calculating current development redemption rates, eventually being redeemed during the last two or three years of the mine's life.

In other cases—by fixing the rate of redemption slightly above the average cost—this account is gradually extinguished, after which the ore reserves form an asset for which no credit is taken, and all current expenditure on development goes to working costs.

As regards—

2. Subsequent capital expenditure, i. e., after the milling stage is reached, there are many methods employed, and each mine management has its own ideas as to what constitutes capital expenditure. Any new expensive machinery, increase of plant or buildings, or new shaft, is charged to capital account, all repairs and renewals being charged to working costs. Sometimes a manager is given an allowance of £500—£1,000 per month (chargeable to working costs) for renewals of machinery and plant, and he has to make this sum do; this is a good arrangement in some cases, but it breaks down when any heavy expenditure is necessary. Some mines on the Rand have at times closed their capital accounts altogether, all further expenditure being charged to working costs; but most of them have at later dates re-opened the capital accounts for various reasons.

The chief trouble is in regard to inclined-shaft sinking, cutting stations, driving, winzing, raising, cross-cutting, box-holing, etc. In one large group of mines all such expenditure is called "development" and is charged to working costs monthly, care being taken to spend as far as possible an equal sum every month sufficient to keep the ore reserves up to a fixed standard (2—3 years ahead of the plant), and generally to increase the total tonnage gradually. This system deserves consideration, as it is the simplest, and gives the shareholder the clearest idea of the position.

Another favorite system on the Rand is to consider all current sinking of inclined shafts, cutting stations, and sometimes main cross-cuts, as capital expenditure, and not as "development." In such cases only the costs of driving, winzing, raising and box-holing are considered to be "development," and these are debited to a separate capital account, which is practically a suspense account.

At stated intervals, the total sum standing at the debit of this account, say £150,000, is divided by the total tonnage of milling ore estimated to be developed (after allowing for sorting out waste), say 1,000,000 tons, and the resulting figure of say 3s is charged to the next month's woking costs per ton milled. In many cases this figure is altered monthly, according to the rough estimates of tonnage "developed" by driving only, i. e., each foot of driving is calculated to develop a certain tonnage acording to length of "backs," etc.

Some mines carry this system farther, and eliminate from the calculation the milling ore obtained from development drives, etc., thus redeeming monthly only the portion of tonnage milled which came from the stopes. Even this is not strictly accurate, as it does not allow for the sorting out of some of the development rock.

The aim of this system of development redemption is, of course, to charge to the working costs of one month only the correct and fair proportion of the development expenses. The result is that, in pushing development ahead, a huge capital suspense account is created, which will doubtless be liquidated at the end of the mine's life.

The advantages of this system are obvious; the chief objection to it is that, even on the Rand, there is a considerable amount of poor and unpayable ore in the total ore reserves upon which the redemption rate is calculated, so that the payable ore, or the ore milled, is redeemed at the average cost of developing payable and unpayable ore together. It is admittedly difficult to calculate, even approximately, the total tonnage developed monthly, and still more difficult to calculate correctly the paying tonnage.

At annual valuations, corrections of 50,000 tons are occasionally made, and a large tonnage of developed ore is sometimes lost through caving-in stopes. Even on the Rand, blocks of ore which appear to be payable from development asays, are often found to contain a large proportion of unpayable rock. Certain standard factors, such as the percentage sorted out, stope widths, dip, etc., are used for the monthly calculation of tonnage developed, but the actual figures frequently differ from the standard ones.

It does not, therefore, appear safe to calculate development redemption on a strict mathematical basis, and, in my opinion, the rate adopted should not only be the total expenditure divided by the probable tonnage of payable ore, but should also allow a considerable margin for safety, thus gradually extinguishing the development capital account.

As regards Shaft Sinking and Main Cross Cuts: I submit that the cost of current work after milling starts should be included under the heading of "development," and be dealt with in the same manner. Theoretically, perhaps, in a mine with a defined boundary line in depth, the last 100 feet of shaft sinking, say from the 23rd to the 24th level, should be charged against the tonnage developed by that footage, and the 100 feet between the 22nd and 23rd levels would be charged half to the ore between these levels, and half to the ore between the 23rd and 24th levels. Thus the lowest or 24th level ore would have to bear a proportion of the cost of the whole shaft down to the 23rd level, as well as the whole cost between the 23rd and 24th.

For example, supposing an incline shaft cost £30 per foot for 2,400 feet, levels 100 feet apart, the ore developed down to the 1st level would be debited with only 1-24 of the cost of the 100 feet of shaft, viz. £125, the remaining £2,875 being charged to a capital suspense account, while the ore in the lowest 100 feet of the mine would have to bear the cost of 100 feet of shaft, viz., £3,000, plus its proportion of 2,300 feet, viz., £8,325, on a total of £11,325.

Even this large total would be insufficient, as the cost of sinking increases somewhat with depth. The impossibility of calculating the exact length the shaft will reach, and estimating whether payable ore will be found all the way down, even if lateral boundaries are parallel and the width of reef constant, preclude the acceptance of this method, in its entirety at least; and the consequent separate suspense accounts involved for the ore developed by each level would lead to hopeless complications.

Note.—This system might be possible on the Rand, but would naturally be impossible for ordinary mining where the ultimate depth of the shaft is quite unknown.

Therefore, it seems more advisable that the cost of sinking the incline shaft from the surface, or from the bottom of the vertical shaft, to the first level should be borne entirely by the ore developed by that level (obviously such ore could not be developed without it), and the next 100 feet charged to the second level ore, and so on. Here again the book-keeping involved would be far too complicated; the money has been spent, however little or much ore may afterwards be developed from it, and therefore the system of charging the whole cost of current shaft-sinking direct to development and to working costs seems the best and safest; unless, perhaps, one charges out a sufficient average sum per month to pay for a year's shaft-sinking.

As regards Additions and Renewals to Machinery and Plant, beyond ordinary maintenance, after the initial plant is completed, the system adopted should depend upon whether the money is provided out of profits or raised separately. If raised by means of an issue of shares, it would doubtless be considered capital expenditure, and in some cases depreciation would be charged somewhere in the balance sheet or appropriation account, but, according to present practice, would not show in working costs.

If the money is raised by an issue of debentures or a loan, under the present system the interest is sometimes charged to working costs, but generally to an appropriation account, and the redemption of the debentures or loan is not shown in working costs. The result of this system is that capital expenditure goes on year after year, especially in directions that will show any decrease in "working costs"; the decrease generally follows, but as the costs contain no portion of the extra expenditure it is almost impossible to tell whether the saving in costs has been sufficient for the interest and redemption of the additional expenditure.

Personally, I think the system of a monthly allowance in working costs for additions to plant and machinery is in most cases the best, provided this allowance is used as a fund which is only overdrawn in exceptional cases. If by this means the plant is maintained at full value there would not appear to be the same necessity for depreciation.

Depreciation.

Depreciation on original machinery, plant, buildings, etc., is a very vexed question. Generally speaking, companies whose head offices are in London are compelled by their auditors to write something off annually for this, but it is rarely shown in working costs. Companies with head offices in the Transvaal and elsewhere seem to do more as they like, and frequently no depreciaton is written off.

Profits Tax.—This is never included in "working costs;" there seem to be many reasons which can be adduced for and against this system.

Stores on Hand.—This item in the balance sheet should include only such stores and spares as are suitable for current requirements. All accumulations of discarded appliances or deteriorated stores should be written off every few months, the loss being charged to "working costs" in average monthly instalments. As it now stands the depreciation on this item in many cases is in reality very large, and should, I submit, always be charged to working costs. In Australia, I believe, a representative of the auditors personally checks the stores on hand annually, and this seems in some respects the best method; but as far as I am aware, no valuation by outside parties takes place in the Transvaal, California or Colorado.

Suspense Accounts.—Some few mines manage to do without these accounts (which are never disclosed in the monthly or quarterly reports issued to shareholders, and are very rarely disclosed clearly in annual reports), but on the majority they seem to be regarded as necessary evils, and at times they are almost unavoidable. Annual payments for fire insurance and licenses, as well as recruiting fees for native labor, etc., are generally charged to suspense accounts and working costs debited monthly with a proportion. They are also used for sundry repairs, small renewals, conveyor belts, etc., and frequently amount to large sums, which are partially liquidated when an exceptionally good month affords an opportunity

Such accounts are very useful and are perhaps allowable under strict supervision, but the ideas of managers differ very widely as to the items debited to these accounts and the time allowances for repayment. The object is, of course, to show regular working costs as low as possible. At times, when inspecting mines, I have had some difficulty in ascertaining the full amount of such suspense accounts,, especially when, owing to a complicated system of dual control, some of the accounts are kept at the mine and some at the head office; but they often account for some of the difference between the published monthly profit and the improvement in the cash position.

Gold Reserves.—Most of the Transvaal mines have kept a certain amount of undeclared gold in reserve during the past few years with a view to showing regular outputs; at times these reserves have amounted to as much as 10,000 or 20,000 ounces, not kept at the mine, but realized by the bank in the ordinary way, credited to the general account, and in many cases the money has been spent. The legality of such a course has been questioned, and some mines have now abolished the system; others continue it, but publish the position of the reserve at the same time as the monthly or quarterly "profits"; and a few retain the original system of undeclared gold reserves, though the present tendency is to abolish the system. Without touching on the legality or propriety of the system I would point out that it leads to many regrettable complications in the accounts and reports.

The figures relating to value of ore milled, percentage of extraction, yield per ton, etc., in the manager's monthly or quarterly reports, are necessarily inaccurrate by the amount of the reserve added to or taken from the output, and actual results have to be modified to suit a policy of averaging. This practice considerably reduces the value of the published figures for comparing current results. A statement of the amount of the reserve gold at the annual meeting does not help a shareholder to gauge the real profit in any one month or quarter. Sometimes the value of ore milled and yield per ton only are altered, sometimes only the extractions and yield per ton; sometimes all three; so that it becomes difficult at times to follow the actual results.

Directors and consulting engineers therefore do not always get the actual figures which are necessary for a close scrutiny of mining operations, and are sometimes confused by the methods they themselves allow; and even managers have been known to be inconvenienced by the two different sets of results. On would think that the gold reserve would have to be shown in the annual report; but this difficulty was in some cases got over by including it in the item of "sundry creditors."

In addition to the above, there are of course minor elastic methods of regulating declared outputs, such as "cleaning up" cyanide works, etc., a few days earlier or later, occasional steaming of battery plates, reserve amalgam, and small rich patches of ore kept in reserve underground for assisting the output during the latter days of the month; but these items only occur at rare intervals, and do not amount to very much. It sometimes happens, too, that dividends declared for a certain period are facilitated by the fact that they are not payable until a month or so after the period has ended.

Head Office Charges.—These are sometimes included in working costs where the head office is near the mine, say in Johannesburg; in other cases they are not so included. This is a frequent cause of difference in working costs. Sometimes the management expenses, salaries of manager and consulting engineer, etc., are included in general charges under working costs; sometimes they are given separately.

Realization of Gold.—On the Rand this item of cost is frequently debited to gold account, the net yield only being shown the lowest possible in monthly and annual reports, thus showing the lowest possible working costs. In many other cases it is charged as a separate item or under general charges to working costs; and in one case it is deducted from the yield in monthly reports and included in working costs in the annual report.

There are many arguments for both systems, but from a mining point of view it seems very advisable to keep the proceeds of the sale of gold quite distinct from all charges, otherwise it affords no guide to the value won from the ore, and does not compare with the extractions.

From a commercial point of view, too, it would appear advisable to include it in working costs, otherwise one cannot easily see the cost of different methods of realization and the extra expense due to distance from recognized markets, nor the loss or gain due to the very varied fineness of the bullion shipped.

One of the results of all this straining after regular yields and proofs, and making a fetish of low working costs, is seen in the fact that annual dividends only amount to 70 to 80 per cent. of the monthly declared profits of the Transvaal mines, presumably to some extent also on other mines.

It seems impracticable to lay down rules for guidance as to how the smaller details of working costs are to be kept in mines all over the world, as the conditions vary so much on different fields and in different mines on the same field, and according to the metal mined. Questions such as the method of pay-tickets, the points where the surface tramming begins and ends, the allocaton of power and labor costs, etc., are all dependent upon local conditions. Moreover, the books of Messrs. A. G. Charleton, Nicol Brown, Prof. James Lawn, and others, give ample guidance in regard to detailed systems that are advisable when they can be adopted.

My idea is that the Standardization Committee might think it wise to confine its questions and ultimate recommendations to principles and large systems such as I have outlined, rather than enter upon an endless discusion of minute details which would be still more difficult to bring into line. It may be argued that most of the points referred to herein are matters to be settled by boards of directors and auditors rather than by managers or consulting engineers. It seems to me, however, that it is of vital importance to the latter to have their working costs kept in such a way that they can easily see the full actual cost of their operations on a commercial basis.

In most cases, too, the directors or financial committee allow a great deal of discretion to their managers or consulting engineers in these matters; and in any case the latter always have considerable influence which can be exercised in straightening out such questions.

Every manager would, I feel convinced, prefer his working costs to be kept on a simple inclusive basis, but for the continual demand, expressed or implied, for low "working costs."

Directors would also benefit by simplicity in costs, except for the glamor of low "nominal" costs and high "nominal" profits; and reports and cost sheets would be easier to grasp.

Shareholders, too, who after all are the owners of the mines, would much apreciate simple inclusive statements of working costs which they could understand. In fact, the nearer the dividends coincide with declared monthly profits, the more pleased will shareholders be, as their usual way of adding up monthly declared profits and calculating on receiving the full amount in dividends often lead to disgust; and anything which may prevent the ordinary shareholder from seeing clearly the actual progress of his venture is, I think, to be deprecated. In the long run, mining engineers and the mining industry can only suffer from such a procedure by the undue loss of public interest.

Up to quite recently the book-keeping and statistical staff of each mine on the Rand has been very large. In addition to statistics for the manager and each department head, endless statistics have to be prepared for the consulting engineer and the controlling firm, as well as for the government and Chamber of Mines. All of these entail expense, as the costs have to be allocated in order to fit each system. In fact, more than one manager has mentioned to me that the head office officials seem to consider that the mine ought to be run to suit the system on accounts instead of vice versa. There is now, however, in some quarters, an attempt to curtail some of the statistical work.

In contradistinction to this plethora of statistics, much might, I think, be learned from the systems in use on Californian mines. I visited one mine there (where a 60-stamp plant was in full swing) and noticed that one man acted as secretary, surveyor and assayer. The statistics kept were very simple, everything spent went straight to working costs and the latter were amongst the lowest in the State.

I would, therefore, again urge that, in making recommendations for the standardization of working costs, the objects to be aimed at should be simplicity, and that calculations of development, redemption rates, etc., should not be made to the third place of decimals, but that a large margin of safety should be allowed for the well known uncertainties of mining, even on the Rand.

In conclusion, I should like to state that, although for the purposes of the committee it has appeared advisable to mention some of the little inconsistencies and variations in the systems in use on the Rand, which I hope will be straightened out in time, yet I think it is agreed that mines on the Rand are more generous than most other gold mines in the amount of detailed information they give shareholders and the public; and I have so much admiration for the system of mine accounts and cost sheets in use on the best-regulated mines of the Rand, that I consider their system, with certain necessary modificatons, would form a useful basis for the standardization—as far as may be considered practicable—of mine accounts and cost sheets on gold mines throughout the world.

LIST OF THOSE TAKING PART IN THE SUMMER EXCURSION C. M. I. AS AT JULY 16, 1908.

Official.

Jas. Barrowman, Esq., Secretary Mining Institute of Scotland, Staneacre, Hamilton, Scotland.

Walter Johnson, Esq., (representing Iron & Steel Institute), c/o Messrs. Bell Bros., Middlesbrough, Eng.

Mr. Hugh F. Marriott, (representing Institution of Mining & Metallurgy), Mining Department, Messrs. Wernher, Beit & Company.

Wm. Frecheville, Esq., Past President Institution of Mining & Metallurgy (representing same).

John Ashworth, Esq., President Manchester Geological & Mining Society, Hanover Chambers, 8 King street, Manchester, Eng.

W. D. Wight, Esq., President South Wales Institute of Engineers, Park Place, Cardiff, Wales.

Prof. Dr. H. Potonie, Gross-Litchterfelde-West, Potsdamerstr, 35, Berlin, Germany.

W. H. Head, Esq., Sub-Editor The Mining Journal, 46 Queen Victoria street, London, E. C., Eng.

Louis Detrez, Esq., President L'Association des Eleves des Ecoles Speciales, Liege, Belgium.

Unofficial.

Dr. Frank D. Adams, McGill University, Montreal, Que., Stage I.

Rodger Beck, Esq., c/o Wm. J. Rees, The Laurels, Swansea, Wales.

C. E. Bloomer, Esq., Shenstoneville, Hales Owen, Eng., Stages I, II, III.

Geo. H. Campbell, Esq., Toronto, Ont., Stages I, II, III.

Dr. Wm. Campbell, Department of Metallurgy, Columbia University, New York, N. Y., U. S. A., Stages I, II, III.

Thos. Carlisle, Esq., 26 Brown street, Workington, Cumberland, Eng., Stages I, II, III.

R. E. Commans, Esq., London, Eng., Stage I.

Sherard Cowper-Coles, Esq., Grosvenor Mansions, Victoria street, Westminster, S. W., Eng., Stages I, II, III.

Albert N. Entwistle, Esq., Royal Mint., Ottawa, Ont., Stage II.

Chas. Fergie, Esq., Dominion Coal Co., Glace Bay, N. S., Stages I, II, III.

Stanley G. Flagg, Jr., Esq., c/o Messrs. Stanley G. Flagg & Co., 242 N. 19th street, Philadelphia, Pa., U. S. A., Stage I.

John Hogg, Esq., Silverbank, Cambuslang, Scotland, Stages I, II, III.

Mark Hurll, Esq., 144 West Regent street, Glasgow, Scotland, Stages I, II, III.

D. B. Langford, Esq., c/o Messrs. Grindlay & Co., 54 Parliament street, London, S. W., Eng., Stages I, II, III.

Sam Mavor, Esq., 47 King street, Bridgeton, Scotland, Stages I, II, III.

J. C. Murray, Esq., Editor "Canadian Mining Journal," Confederation Life Building, Toronto, Ont., Stages I, II, III.

J. Obalski, Esq., Superintedent of Mines, Quebec, Que., Stages I, II, III.

W. J. Rees, Esq., The Laurels, Swansea, Wales.

Gordon McI. Pyke, Esq., Box 893, Montreal, Que., Stage III.

Walter Rowley, Esq,. 20 Park Row, Leeds, Eng., Stages I, II, III.

Nicholas Richardson, Esq., General manager North Atlantic Collieries, Limited, Port Morien, Cape Breton, N. S., Stage III.

Dr. Heinrich Ries, Department of Geology, Cornell University, Ithica, N. Y., U. S. A., Stages II,III.

A. Sinn, Esq., Bienne, Switzerland, Stages I, II, III.

Alcutt Smith, Esq., Hartley Hall, Columbia University, New York, N. Y., U. S. A., Stages I, II, III.

Sydney W. Smith, Esq., 76 Norroy Road, Putney, London, S. W. Eng., Stages II, III.

Andrew Watson, Esq., 21 Bothwell street, Glasgow, Scotland, Stages I, II, III.

C. McDermid, Esq., Secretary Institution of Mining & Metallurgy, Salisbury House, London, E. C., Eng., Stage I.

THE IRON ORES OF CANADA.

By C. K. Leith, University of Wisconsin, Madison, Wis.

(Ottawa Meeting of the Canadian Mining Institute, March, 1908.)

I hasten to disclaim intention of attempting a comprehensive discussion of all known Canadian iron ore deposits. While I have seen most of the principal deposits in Canada and Newfoundland, and others have been examined by associates and assistants, I cannot claim to have sufficiently detailed knowledge of a considerable part of them to warrant detailed discussion. tention will be called rather to certain general features of comparison of Canadian ores with the several types of deposits of the United States which have been more fully exploited and studied, and thus view the Canadian iron ore situation with a perspective not otherwise easily gotten. For the purposes of this discussion, the Newfoundland ores are included with the Canadian ores, because they are controlled, mined and largely used by Canadian interests. So far as is necessary, information will be drawn from the various careful descriptions of Canadian ores published by the Dominion and Provincial Geological Surveys or Mining Bureaus.

The classification of iron ore deposits we shall use is partly a new one based upon recent detailed studies of the Lake Superior ores and ores of the Western United States.

All metallic ores are derived ultimately from the interior of the earth, whence they are delivered by igneous eruptions near or to the surface, there to undergo various distributions and concentrations under the influence of meteoric waters and gases. The variations in composition, shape, and commercial availability of an ore are controlled by variations of conditions under which the ores have reached the surface and have been distributed. The variations have developed the following types of North American iron ore deposits:

(1) Magmatic Segregation Type.—Ores brought to the outer part of the earth in molten magmas but retained in them during crystallization, with the result that the ores form part of the rock itself, just as do the feldspar and other minerals. Such are the titaniferous magnetites, containing refractory silicates, and frequently sulphur and phosphorus, in deleterious quantities. While known in enormous quantities over North America—in Canada principally along the Lower St. Lawrence river, and in the Chaffey and Matthews mines of Lower Ontario—smelting is not beyond the experimental stage and they are nowhere used at a profit.

(2) Pegmatite Type.—Ores which are carried to or near the surface in magmas and are extruded from them, in the manner of pegmatite dikes, after the remainder of the magma has been partially cooled and crystallized. They are deposited from essentially aqueous solutions mixed in varying proportions with solutions of quartz and the silicates. To this class belong some, and perhaps all, of the magnetite deposits along the contacts of limestone and igneous rocks constituting the greater part of the iron ores of the Western United States, and most of the magnetite ores of Vancouver and Texada Islands, and elsewhere in British Columbia. The assignment of the British Columbia magnetites to this type is based on a personal comparison of them with ores in Southern Utah believed to be of this type, the origin of which is discussed in some detail by Mr. Harder and myself in Bulletin No. 338 of the United States Geological Survey. The essential features of these deposits are their highly crystalline, magnetic character, their content of garnet, amphibole and other silicates, local abundance of sulphides and of apatite. The area of these deposits at the surface varies up to about 0.2 of a square mile. They are easily located by their outcrops or by the fragments strewn down the slopes, but it is not so easy to determine the shape and extent of the deposits when found, because of their extremely irregular association with wall rock. It is not safe to assume that they extend a foot beyond the zone of direct observation. Their vertical dimensions and shape and their mineralogical composition at depth are relatively unknown. Mining operations in the west on this class of deposits have not been extensive enough to determine these facts, such deposits having been mined principally in but few localities, at Texada Island, at Fierro, New Mexico, and in the Monterey and Durango deposits of Mexico. In the United States and Mexico certain similar deposits, but not all, have been found to take on pyrites and garnet with depth.

A small amount of ore has been mined from Texada Island. The better ore averages about 55 per cent. iron content, and from this down; much of it is below Bessemer limit in phosphorus, and sulphur is in amounts requiring roasting. Garnet and amphibole are both abundant, locally requiring hand sorting. Silica varies, inversely as the iron, up to about 11 per cent. All of the ore contains a small amount of copper, locally as much as 4 per cent. The shapes of the deposits are extremely irregular. Seldom do the widths exceed 100 feet. In depth they are best shown by a tunnel 300 feet below the surface which discloses ore with essentially the same width and composition as at the surface.

The ores on the west coast of Vancouver Island have had only a little development work done on them. They likewise vary widely in iron content; phosphorus is low, sulphur is usually high, silica varies up to about 26 per cent.

Making due allowances for lack of development and possible shallowness and change of character with depth, it is still certain that there is a large known tonnage available in British Columbia, which will be used when West Coast demands warrant the establishment of a local steel industry, instead of the importation of finished products from the east. There are indications that this time may not be far distant. While suffering somewhat from their composition, they are easily and cheaply mined, and being located directly upon the coast, will have the cheapest transportation. So far as the ores have been used only in the State of Washington, and the recent rapid development of the Northwestern United States suggests that their further immediate use will be in Washington, notwithstanding duty, at least until such time as sufficiently large ore reserves in this part of the United States become developed or until the population of British Columbia requires a steel industry of its own.

To the pegmatite type are provisionally assigned the ores of the Atikokan and Hutton districts, of Ontario, where the magnetites have the mineralogical and chemical constituents of this class and show such intimate relations with greenstones as to suggest a direct derivation from them. They lack the bedded structures, characteristic of ores of class (3) to be described, though in the Hutton district the bedded iron formation rocks are also present. The extremely irregular association of the ore with greenstone makes it difficult to outline the deposit even a few feet in advance of exploration. The Atikokan deposits are high in sulphur, 2 to 5 per cent., requiring roasting. At Hutton the sulphur is low so far as explorations yet go, and phosphorus runs about 1 per cent.

To this class of ores also may belong at least a part of the magnetites in the pre-Cambrian Grenville series of New Jersey[1], some of the magnetites of the Adirondacks of New York[2], some of the magnetites in the Grenville series of Southeastern Ontario[3], and the magnetites of Cornwall, Pa.,[4] and Cranberry.[5]

These deposits have essential features in common and mineralogical and chemical similarities to the western ores of this class It may be that part of the Ontario Grenville ores belong rather with the following class (3), suggested not only by their characteristics, but by Dr. Miller's recent correlation of certain associated rocks with the Keewatin series of the Lake Superior region, which contains ores belonging to class (3).

The Grenville ores of lower Ontario are interbanded lenses of magnetite, gneisses and amphibolites, closely associated with, and partly in direct contact with, crystalline limestones of the same series. The ores vary from lean unworkable magnetite gneiss, carrying a small percentage of magnetite ribs as compared with gneissic ribs, to deposits of nearly pure magnetite. The iron formation bands are lens shaped and discontinuous. Their greatest width is probably less than 150 feet. They have been mined to a depth of 350 feet, but most of the workings are less than 100 feet. The better grade ores average much the same in iron as the better grade western magnetites of this class, that is about 55 per cent., and from this down. Phosphorus is usually below the Bessemer limit, adding much to the availability of the ores. Sulphur is usually too high to allow the ore to be used without roasting, seldom running less than .05 per cent., though by hand cobbing the sulphur content may be kept down somewhere near this limit. Concentration of certain of the leaner grade ores is likely to be commercially feasible in the future, though this is yet a moot question, especially with reference to the satisfactory elimination of sulphur. In a few places titanium is present.

Hematite has been mined at Wallbridge, Dalhousie and McNab in Eastern Ontario in similar geological relationships. According to Willmott,[6] there is reason for believing that they are oxidized portions of iron pyrites bodies lying below.

A deposit of magnetite not far from Bathurst, New Brunswick, seems from its available description[7] to belong to this class of pegmatite ores, but I do not have sufficient information to discuss it.

(3) Lake Superior Sedimentary Type.—Ores brought to the surface by igneous rocks and contributed either directly by hot magmatic waters to the ocean or later brought by surface waters under weathering to the ocean or other body of water, or by both; from the ocean deposited as a chemical sediment in ordinary succession of sedimentary rocks; and, still later, under conditions of weathering, local enrichment to ore by percolating surface waters. To this class belong most of the producing iron ores of the Lake Superior region, those of the Michipicoten district of Canada, and most of the non-producing banded iron formation belts of Ontario and Eastern Canada. The Lake Superior ores constitute the world's largest reserve of high grade hematite, more or less hydrated, much of it of Bessemer grade, and little of it high either in phosphorus or sulphur.

The ores of this class differ in origin from those of the preceding classes in that the iron, instead of being directly deposited near igneous rocks as ore, is distributed by the aqueous sedimentation and deposited with a large amount of interlayered silica in banded "iron formation," containing about 25 per cent. of iron, too poor to be used directly as ore, and requiring that the silica be locally taken out before they are of value. This ore may or may not show close areal association with the parent igneous rocks. It is obvious that gradation phases are to be expected between groups (2) and (3), and that many ore deposits can with difficulty be assigned definitely to one or to the other.

It has long been known that the Lake Superior ores were concentrates in certain sedimentary iron formations. It was believed that these sedimentary iron formations were derived from the weathering of basic shores containing much basic igneous rock usually called "greenstone." As a result of further study it has been found necessary to conclude that the iron formations have not only been derived from greenstone by weathering, but have actually been contributed by greenstone magmas directly to the water in magmatic solution and that there are all intermediate stages between the two processes. It begins also to appear that the iron, copper, nickel and silver ores of the Lake Superior and Lake Huron districts are related in a great metallographic province in which the characteristics and distribution of the different ores are initially controlled by igneous rocks.

This conclusion has an essential bearing on exploration, for if the iron is specifically related to certain greenstones, just as the Sudbury ores are to the norite, then it follows that its distribution may be somewhat freakish, as it is in any ores related to igneous activity, as for instance, the gold ores of the west, and that it cannot by concluded from similarity in succession or structure that iron ores should necessarily be found in a distant district, though the redistribution as sedimentary rocks which the iron ores alone have undergone has greatly increased their area and the chances of finding them.

As first deposited the iron formation consisted essentially of chemically precipitated iron carbonate or ferrous silicate (greenalite) with some ferric oxide, all minutely interlayed with chert. When these were exposed to weathering, the ferrous compounds, the siderite and greenalite, oxidized to hematite and limonite, essentially in situ, although some of it was simultaneously carried and redepoisted. The result was ferruginous chert called taconite or jasper, averaging less than 30 per cent. of iron. The concentration of the iron to 50 per cent. and over has been accomplished principally by the leaching of silica bands from the ferruginous chert and jasper. Infiltration of iron has been on a smaller and more variable scale. The leaching of the silica develops pore space, and allows the iron layers to slump, thereby enriching the formation sufficiently to constitute an ore.

It has been found, further, that during this leaching of silica the character of the iron bands has not essentially changed and that therefore the nature of the ore deposits is determined largely by the character of the ferruginous chert. The phosphorus is in the iron bands, rather than in the chert, and therefore the leaching of the chert tends to raise the percentage of phosphorus in the ore, but there has been also later introduction of phosphorus, making the phosphorus content of the ore considerably higher than that of the parent rock.

For flat-lying formation such as the Mesabi from 4 to 8 per cent. of the surface of the formation and less than 2 per cent. of the volume of the part of the formation lying vertically below this exposed surface have been altered to ore. For steep dipping formations like the Gogebic, about the same percentage of the volume has been altered to a depth of 2,000 feet.

There are a number of other facts of both scientific and commercial interest, especially relating to the quantitative determination of the various factors which have entered into the development of the present known deposits, which will be published by the U. S. Geological Survey, in a general monograph, by C. R. Van Hise and C. K. Leith and others.

I have discussed the Lake Superior ores only so far as necessary to bring out certain essential features of this class of ores in Canada and their bearing upon availability. There are many iron formation belts of this class, but they have been found to have undergone local enrichments to important ore deposits only in the Michipicoten district, and to some extent in the Animikie district.

In the Michipicoten district the ores are principally non-Bessemer and in portions of the deposits high in sulphur. Their occurrence beneath the peculiar Boyer Lake basin with walls of chert, tuff and carbonate, is well described by Coleman and Willmott.[8]

In the Animikie district the iron formation is an eastward continuation of the Mesabi iron formation, but it is less than 200 feet thick, as compared with 700 to 1,000 feet in the Mesabi, and has undergone enrichment only in thin layers interbedded with cherts and along a few fault planes. The thickness of the ore beds that may be mined will depend on how low a grade can be used and the success of hand sorting in keeping the ore up to this grade. Under any conditions much rock must be handled. On the other hand, the ores have great horizontal extent, are near the surface, are red hematite, low in phosphorus, with low sulphur, and practically on the shore of Lake Superior, justifying the hope that they may be used.

Two important questions remain to be solved in connection with the lean iron formation of the Lake Superior type so widely distributed in Ontario and elsewhere in Canada: (1st) Is their apparent lack of second concentration a real one? and (2nd) if so, what has caused it? On the assumption that the apparent lack of concentration is a real one, Van Hise has suggested that perhaps a part of the enriched portions has been removed by deep glacial erosion. Another alternative is that the structural conditions have not favored abundant flow of surface waters necessary for the leaching of the silica. A third possibility here most favored is that the original texture of the iron formations or proportions of the original constituents have been somewhat different from those of the Lake Superior region, and that they have not allowed access to the waters necessary to leach the silica. The formations are principally Keewatin and in general are more dense, crystalline and magnetic than the Huronian iron formations of the Lake Superior region. Some of these differences are doubtless due to secondary alterations, but it is not easy to account for all of the differences in this way. It is a significant fact, noted by Willmott,[9] that only 7 per cent. of the ore in the Lake Superior region have come from the Keewatin series, and that the Upper Huronian series, carrying 71 per cent. of the total, is not widely represented in Canada.

All these explanations and posibly others may apply. On the other hand, much more exploration is necessary to show that there really has not been concentration of large ore deposits in the known Canadian iron formations. The fact is again cited, that, in the producing Lake Superior districts, the proportion of ore, even under most favorable conditions, constitutes less than 8 per cent. of the surface of the iron formation and usually much less, and in volume it constitutes less than 2 per cent. Only rarely have the ores been discovered at the surface. Underground exploration through drift and rock has been necessary. In but few localities in Canada has there been adequate search for these localized concentrations within the iron formations. This fact is sometimes lost sight of because of marked tendency to use the term "iron ore" for the banded, unconcentrated "iron formation," and to speak of such formation as "lean, banded ore." In the Lake Superior region "iron formations" and "iron ores" are discriminated. It is not impossible that mechanical concentration of the iron formation may result in the production of ore, but it is unnecessary to argue the commercial advantage of finding some part of the iron formation in which nature herself has done the concentrating.

(4) Clinton Sedimentary Type.—Sedimentary ores deposited in oceans from weathering of the land areas in which the iron is either disseminated in igneous rocks or has undergone some of the concentrations outlined in (1)((2) and (3). To this class belong the "flax seed" ores of the Clinton and other beds of the Appalachians and Wisconsin, the ores of the Torbrook and Nictaux areas of Nova Scotia, and those of Bell Island in Newfoundland. They have now been discovered in Missouri.[10] They are also believed to differ in origin essentially from those of the preceding classes in that they are immediately derived by weathering processes, that they were deposited in the ocean as iron oxide rather than as ferrous salts, and that they have undergone no further concentration, being mined essentially in the condition in which they were deposited. There has long been some doubt as to whether or not these ores might not represent two concentrations, but work in the Southeastern United States by Eckel, Burchard and others,[11] for the U. S. Geological Survey, and our own observations in Wisconsin, seem to show one concentration.

On Bell Island the ores are beds dipping about 9 degrees to the northwest, in two main seams. The lower or Dominion seam averages about 10 feet in thickness, though variable, and extends across the island for about 3 miles along the strike and down the dip for perhaps half a mile, covering an area of 818 acres, although not productive for this entire area. The upper seam occupies an area about 1 by 1-3 mile (240 acres), averaging 7 feet in thickness and is not all productive. The mining has been largely open pit, but is becoming more largely underground as the ore is followed down the dip. They are now being followed under the ocean by drifting. Much of the upper bed averages about 52 per cent. in iron, and the lower bed about 50 per cent. Recent shipments are reported to be under 50 per cent. Phosphorus averages 1 per cent. The ores are adapted to basic Bessemer or open hearth treatment, and for the former receive a bonus for high phosphorus from some European consumers.

In the Torbrook and Nictaux areas the ores are of similar kind, but the beds differ from those of Belle Isle in being thinner and inclined, requiring deep mining and handling of waste rocks.

Ores of this kind occupy a definite stratigraphic position, are easily explored for, and so far as their future in Canada is concerned, they have already been pretty well discounted.

(5) Carbonate Ores, derived from weather of rocks, transporated and deposited with organic reducing material in bogs; now found in thin beds usually associated with coal seams or carbonaceous shales. These have been extensively mined in the coal bearing and adjacent areas of the Eastern United States, but not in Canada. Their present production in the United States is almost nil. Where exposed to weathering they alter to limonite or brown ores, considered under the following heading. Iron carbonates constitute minor phases of class (3).

(6) Brown or Hydrated Ores, developed either from the weathering of iron carbonates mentioned in the preceding heading, or of limestones containing carbonate or other iron minerals, or by replacement of limestones or by deposition in glacial drift, or by bog deposition, or by some combination of them. The few limonites in class (3) are not here included. Being often residual products of weathering, they are characteristically mixed with other residual products of weathering, particularly clay. To use these ores it is necessary to wash out the other residual products, a process which nature neglected to attend to. The ores are characteristically hydrous and high in phosphorus, but when washed are found highly suitable for open hearth furnace practice.

The bog ores of Quebec presumably belong to this class.

Related to classes (5) and (6) are the Londonderry ores of Nova Scotia, consisting of carbonates of iron, calcium and magnesium, showing more or less alteration to limonite in irregular vein-like masses, in slate and quartzite. These ores are low grade, fairly high in phosphorus, manganese and silica, and are extremely irregular in their shape and distribution. Their origin is in doubt.

(7) Magnetic Sands.—Magnetic sands are developed from the erosion of classes (1), (2) and (3). As exposed along the lower St. Lawrence river they seem to be principally from classes (1) and (2), and are therefore high in titanium. They form beds from ½ inch to 2 feet in thickness, with wide extent. Their availability is still in doubt.

Commercial Importance of the Several Classes of Ores.—The proportions of the several classes of ores mined in the United States, Canada, and Newfoundland for 1906, appear in the subjoined table. Where the origin of the deposits is in doubt, the classification of their production is in doubt but the production from such types is too small to introduce any essential error into the figures given.

Production of Iron Ores in 1906.

	U.S.	Canada and Newfound land.
Class 1. Magmatic .. segregation (magnetite)	.00	.0
Class 2. Pegmatite type (magnetite)	5.2	
Class 3. Lake Superior sedimentary type (hematite)	80.	12.29
Class 4. Clinton sedimentary type (hematite)	8.	78.34
Class 5. Carbonate type	1.	
Class 6. Brown ore type (limonite)	5.8	8.51

The dominance of class (3) (Lake Superior ores) in the United States production shows how desirable it is to have the ores go through nature's concentrating mill. These are the only ores which have undergone second local enrichments. That the less desirable grades of ore should compete at all with the Lake Superior grades is due largely to lower freights between ores and furnaces, between fuel and fluxing materials and furnaces, and between furnaces and consuming centres. Iron ores differ from most other metallic ores in that their great bulk, as compared with their value, requires cheap transportation, which operates in develop certain low grade deposits well situated in this regard at the expense of better grade ores.

Turning to the Canadian production, it appears from the table that the proportions of different classes of ores mined are quite different from those of the United States, and that a far larger proportion of Canadian ores is being drawn from less desirable classes. The class which produces 86 per cent. of the United States production produces only 12.29 per cent. of the Canadian production.

It appears, therefore, that in order to compete with the United States on equal terms so far as grades of ore are concerned, Canadian ores of the Lake Superior type must be more largely developed. The proportions and amounts of ores of the Lake Superior type now mined in Canada are not far different from those of the United States fifty years ago, before the advent of high grade Lake Superior ores had revolutionized the industry. It is not meant to imply that Canada is fifty years behind the times in this regard, but rather to call attention to its latent possibilities for the future and probable direction of development. It does not follow that the production of ores other than of the Lake Superior class may not also increase, because of low freights or artificial aids in the way of tariff or for other reasons.

Similar conclusions seem to follow from a consideration of ore reserves. I fully realize the uncertain nature of estimates of undeveloped deposits and the wide variety of figures that may be gotten by conscientious observers with different points of view or different methods, but certain essential features of our knowledge concerning reserves are fairly well established and a brief summary of them will help to bring the Canadian iron ore situation somewhat more definitely before us.

The titaniferous ores of class (1) not being mined, there is no point in attempting to warrant estimates.

The British Columbia magnetites of class (2) have been subject to a wide range of estimates depending upon how low a grade of ore is included, upon the depth arbitrarily assigned, and upon the extent to which isolated portions of deposits are assumed to be continuous. Using only the extents and depths known, the tonnage of ore of commercial grade may be measured in a few tens of millions.

The difficulty of estimating the Atikokan and Hutton ore of class (2) is due to their mixture of greenstone, making it impossible to predict in advance of exploration of extent of the deposits. In both districts the explorations show at least several millions of tons.

For the Lake Superior ores of type (3) in the Michipicoten district, Coleman and Willmott have estimated a reserve of possibly two millions of tons. Some of this reserve is of doubtful value because of high content of sulphur. In the Animikie district the tonnage is problematic because of conditions described for that district, but at best the ores to be recovered is not in large amount. The reports of hundreds of millions of tons of the Lake Superior type is various parts of Canada so frequently seen in print are without foundation except as they cover commercially non-available lean iron formation rather than ores. Even under the best conditions but a small fraction of the iron of these formations is likely to be in ore of commercial grade.

The Grenville ores of lower Ontario show wide variations of estimates, depending upon the factors chosen. The known dimensions of commercial grades indicate not more than a very few millions of tons.

The similar beds of Nova Scotia are so thin that only a part of them can be counted as commercially available. A commercial estimate has been four million tons to level of 700 feet on the principal group of properties.

It appears in general, then, that the poportion of reserve of Canadian ores of the Lake Superior type to the total reserve is probably not greater than the proportion of their annual production to total annual production. It is not held for a moment that the tonnage of some of these deposits to be ultimately developed may not be considerably larger than here indicated, but whether they be increased or decreased, it will be because of introducing factors of depth or grade partly common to all of them. This is not likely to change their proportion sufficiently to obscure the fact that the most desirable ores of the Lake Superior type of class (3) are not yet developed in large enough tonnage to insure the future competition of Canadian iron ores with those of the United States on an equal basis. In competition with the great reserves of high grade ores of the Lake Superior region the principal Canadian reserves thus far developed suffer handicaps in grade and in content of deleterious constituents. These handicaps are and will be overcome to a certain extent by bounties or locally by favorable conditions of transportation, but that they exist is shown by the extremely vigorous search for iron ore of the Lake Superior type by Canadian mining interests, by the importation of Lake Superior ore to the amount of 4-5 of the ore used in Ontario, and by the recent increase in proportion of ore imported to home production, due to Canadian demand for finished products having gone ahead of the production from Canadian ores.

That ores of the Lake Superior type are in larger quantities in Canada than are now known seems likely, in view of the position of the Lake Superior region as a mere southern fringe of the great Canadian area of the pre-Cambrian rocks. Their discovery will require clearer search than has been previously made in any but isolated localities, for it is not only necessary to find the iron formation, but to find the small fraction of this formation which happens to have been concentrated. The vast area, the difficulties of travel, and the drift covering, requiring drilling, all combine to make the task a difficult one and partly explain why the search is not farther advanced. On the other hand, exploration may never develop abundant ores of the Lake Superior type for geological reasons discussed under class 3.

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BOOK REVIEWS.

Rocks and Rock Minerals.—A Manual of the Elements of Petrology Without the Use of the Microscope. By Louis V. Pirsson, Professor of Physical Geology in the Sheffield School of Yale University. 12 mo., V + 414 pages, 74 figures, 36 full-page half-tone plates. Cloth, $2.50 net (10/6 net). John Wiley & Sons, New York, 1908.

Not all mining men have an intimate knowledge of petrology, or the science of rocks. Even those who have had the advantage of a college course find that only a small residue of what they learned adheres to them.

Most text-books on the subject are cast into forms that repel the lay reader. Hence it is not easy for the beginner to acquire the rudiments of the science.

"Rocks and Rock Minerals" is an attempt to present the outlines of petrology in such a way as to give an intelligent idea of the subject to readers quite unacquainted with the microscopic standpoint.

Rocks and rock minerals are dealt with entirely from a megascopic, or practical outdoors, point of view.

The book before us attains the desired object of giving the reader a knowledge of rocks and rock minerals without recourse to the microscope. It is a very fair introduction to the study of geology generally. Part III, in which igneous, stratified, and metamorphic rocks are described, is an excellent treatise in itself. Simplicity is the keynote of the book.

A Guide to Technical Writing.—By T. A. Rickard, 127 pages. Price, $1. Mining and Scientific Press, San Francisco, 1908.

"Rules are useful, but the understanding of the reason on which a rule is based is better. No man can apply a rule intelligently until he understands when to disregard it." Thus writes Mr. Rickard in a prefatory note to this invaluable little volume.

Literary elegance is neither expected nor necessary in a mining engineer's report—and it is rarely discoverable in these documents.

As a record of facts and scientific deductions, engineers' reports and technical press articles are usually clear. But, not infrequently, this species of literature is turgid beyond description. Not only is it turgid, but it is abominably inaccurate and hazy.

One section of Mr. Rickard's book is entitled "Examples of Journalese." Here, clearly and briefly, the author gives instances of some of the most common inaccuracies and errors current in technical literature. We shall quote a few of these.

Lodes are often described to as being "permanent." "Persistent" is meant.

"Extensive" and "inaugurate," because of their mouth-filling qualities, are commonly chosen to replace the unassuming monosyllables "large" or "big" and "start."

"Installation, inaugurate, and prosecute are words that are the stock-in-trade of the boosters of wildcast."

Similarly the author. scores the unnecessary use of quotations from foreign languages. "The use of Greek or Latin, French or German, where Englsh suffices is a mark not of the literate, but of the pseudo-literate man."

That description and useful phrase "carries values" is condemned incontinently. Ores, or veins, do not carry "values;" they carry metals.

The chapter "Hints in Grammar" contains a most lucid explanation of the proper uses of "shall" and "will." Indeed, we cannot recall having read anything so clearly definitive. Particularly useful are the directions as to the correct use of singular verbs with such plural nouns as "500 tons of ore." "The idea is of a quantity of ore as a whole, all of which is treated in a continuous operation."

Among other minor matters the principles of punctuation, that bug-bear of the young writer, are set forth. The functions of the comma, colon, semi-colon, and the period are explained simply and well.

Questions of usage and of taste are not omitted. In this field Mr. Rickard may be followed almost implicitly.

Six maxims are presented as parting advice to the reader. They will bear repetition:

1. Have something to say; then say it.
2. When uncertain as to your grammar or phrasing, re-write the sentence or paragraph.
3. But do not tinker at a doubtful sentence; re-construct it thoroughly.
4. Avoid the use of words the meaning of which is doubtful to you.
5. Make your meaning clear; then consider style.
6. Remember the reader.

EXCHANGES.

The Mining Journal, June 27th, 1908.—Our London contemporary, after due consideration of the Coal Mines Eight Hours Bill, arrives at the conclusion that "the inevitable effect of shortening the hours of work, if the present rate of production is not reduced, must be to accelerate the rate of winding and all other operations underground." In this respect, then, the Eight Hours Bill, if it becomes law, will not improve the Miners' Act. Indeed, it will have a tendency in the opposite direction.

The wild generalizations "of the advocates of the Bill are easily refuted. It is contended by labor members that the death rate among miners is appalling. Statistics prove that as a class colliers are healthier and longer-lived than the average occupied male.

Mr. Walsh, a labor member, threatened that if the Eight Hours Bill were not passed, "trades union methods," which being interpreted means a general strike, would be resorted to.

This is the keynote of the situation. The Journal recognizes the moral certainty of enhanced prices of fuel to consumers, and alludes also to the highly probable increase in wages.

The Mining and Metallurgical Journal (Denver), July 3rd., 1908.—A strong editorial in this number outlines the education that should be acquired by the mining engineer. "The way of the engineering student is hard. A long school and college period is unavoidable; a hard course is his lot in college; his training cannot be confined to books and laboratories, for he must learn many things—such as etiquette and dealings with men—not taught in any schools, but in the walks of life."

Our contemporary predicts that the requirements of modern technical education will lengthen college courses to five and even six years.

PERSONAL AND GENERAL.

Mr. Alex. Gray, of Montreal, passed through Toronto on the 21st July after spending some time in Cobalt.

Dr. T. L. Walker, of Toronto University, is in the Lake of the Wods district searching for rare minerals.

Mr. Frank Loring recently examined and reported upon a deposit of gold-bearing mispickel in the Sudbury region.

Mr. W. F. Jennison, of Sydney, C. B., has been instructed by the Federal Department of Mines to prepare a monograph on the gypsum deposits of the maritime provinces.

Dr. Ells of the Geological Survey has been granted leave of absence on salary to go to Glasgow where he will witness experiments on a shipment of New Brunswick bituminous shale.

Mr. George J. Ross has resigned his position with the Acadia Coal Company of Stellarton, N. S., to become manager and resident engineer of the Lake Copper Mining Company at Copper Lake, N. S.

Mr. Frank J. Nicolas, late editor of the publications of the Geological Survey of Canada, has opened an indexing, cataloging and compiling bureau in Ottawa. Mr. Nicolas' work in compiling the general index for the Survey is evidence of his exceptional aptitude for this work.

INDUSTRIAL SECTION.

THE JEFFREY SHORTWALL COAL CUTTER.

For Room and Pillar Work.

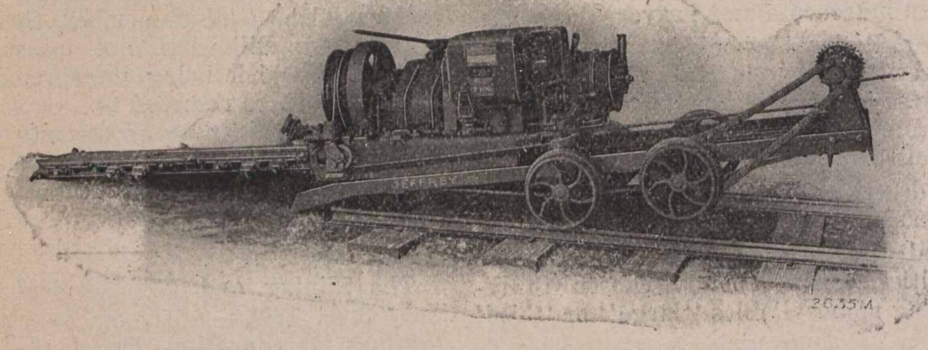
The economy and speed with which coal is mined by longwall machines has given rise to a very large demand for an efficient machine operating on the longwall plan, for room and pillar work. Special interest therefore attaches to an announcement that the Jeffrey Manufacturing Company has added to its line of electric coal cutters, a new room and pillar machine, known as the Jeffrey Shortwall Coal Cutter, 26-B., illustrations of which are here shown.

The difference betwen this and the well-known breast machines built by that company, is largely in the method of cutting. The new type cuts across the face of the coal, starting at one side of the room and not stopping until it finishes the cut at the other side.

A ½-inch steel feed cable wound upon a power driven drum at the front end of the machine pulls it across the face of the coal at a speed dependent upon, and suited to, the hardness of the cutting and the nature of the coal or clay in which the cutting is done. This drum when desired can be disengaged by means of a suitable clutch, so that the machine in finishing its cut at the left hand rib may be angled for the purpose of maintaining a uniform width of room. Another cable, having no connection whatever with the power, is arranged to act as a guide to hold the machine to its work at the proper angle for its greatest cutting efficiency.

Suitable sheave whels are provided at convenient points on the machine to guide the feed cable so that it can be led off in any direction, thereby enabling the machine to be loaded, unloaded, moved about and pulled out from under the coal by its own power,—a very desirable feature, and one which very strongly appeals to the machine runners.

The gearing is arranged so that the feed drum may be operated at a sufficiently high speed to move the machine quickly about the working place.

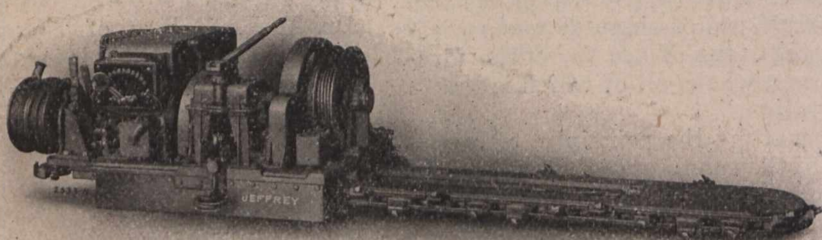


View of Jeffrey Shortwall Coal Cutter being loaded onto truck by its own power.

To take care of the heaviest service, an exceptionally powerful compound wound motor is provided.

The operation of the machine may be briefly described as follows: It is brought into the room on a truck moved by its own power or hauled by a mule, depending on whether or not a self-propelling truck is used.

A pipe jack is placed at the face of the coal at the right hand rib and the feed cable attached. The motor is then started and the machine moved to the face of the coal. A simple guiding device, consisting of a piece of tee rail and one jack, is then set up on the left-hand side of the machine and the sumping cut started, the feed cable pulling the cutting frame in under the coal and the guiding device serving to hold the machine in line.



View of Jeffrey Shortwall Coal Cutter from control side.

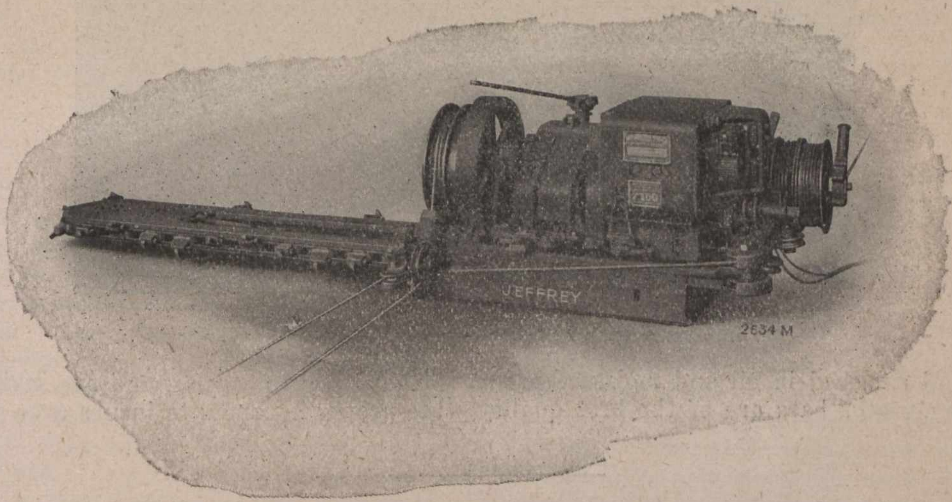
When the sumping cut is completed, a steel anchor hook is secured by a wedge in the left hand rib near the face, to which are hooked one end of both the guide and the feed cables which lead across the face of the coal. The cable is then attached to a jack set up at the right hand rib in line with the rear drums, and the machine started across the room. In operation, the feed cable pulls the machine across the coal face, and the guide cable keeps it at the proper angle to the face of the coal.

A special flexible brand of wire with elliptic stranding is used for the feed and guide cables, eliminating

qualifying it to perform longer and harder service and greatly reducing the danger of breakdown and the cost of up-keep.

2nd. It cuts faster, and less time is consumed preliminary to starting up and in removing the machine after the cut is finished.

3rd. It occupies less space and permits setting the props nearer to the face of the coal.



Jeffrey Shortwall Coal Cutter in position for cutting along face of coal. Note arrangement of feed and guide cables.

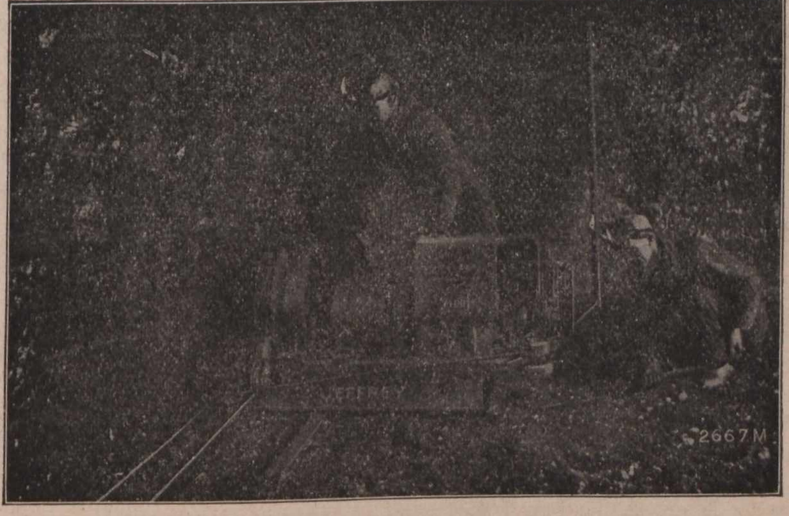
any tendency to kink or curl up when the tension is released, and materially increasing the wearing surfaces of the cable. The elasticity of the cables equalizes the shocks and jars on the machine and gives the motor an even, steady load.

When the machine reaches the left-hand rib, the pipe jack is moved to a position near the truck, the feed cable attached, the machine pulled out from under the

4th. It consumes substantially less power per cubic inch of coal cut.

5th. It is handled by its own power more rapidly and with less exertion on the part of the machine runners.

In addition to the 26-B. machine illustrated, the Jeffrey Manufacturing Company also builds a side cutter for thin vein coal, the construction and operation of



The Jeffrey Shortwall Room and Pillar Machine cutting across face of coal from right to left.

coal and over to the truck where it is loaded by its own power and is ready to move to the next working place.

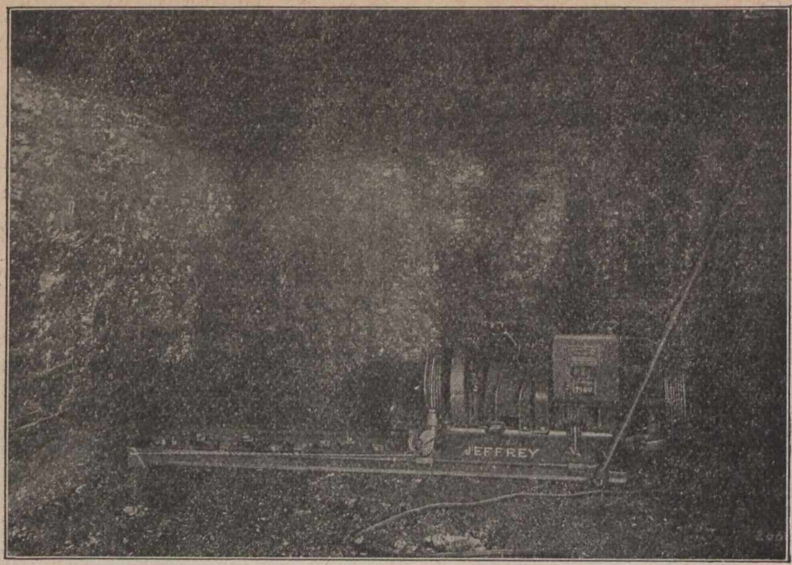
Among the advantages claimed by the Jeffrey Manufacturing Company for this, over any other make of side cutting machine, are:

1st. Its construction is simpler and stronger throughout, and the power of its motor equipment greater,

which is essentially the same, no advantageous features being sacrificed to obtain the reduced height.

Both machines cut directly on the floor of the seam.

The motors furnished with these machines are of the most modern and improved types. The frames are made of cast steel with laminated pole pieces. The armatures are drum wound with form wound coils. The field coils are series wound impregnated with insulat-



Jeffrey Shortwall Coal Cutter beginning first or sumping cut at right hand rib.

ing compound and enclosed in oil and moisture proof covers. The commutator bars are of the best quality of hard drawn copper, and are insulated with mica of the proper hardness to insure even wear and long life.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

Glace Bay.

The Dominion Coal Company's output for the first half of July is about 175,000 tons, which considering that the period includes Dominion Day and the "glorious twelfth," is very good indeed. The outputs are maintaining a steady average of over 14,000 tons a day, and have on several occasions approached the 16,000 mark.

At No. 6 Colliery the work on the new haulage engine is well advanced. This engine is intended to meet the haulage requirements of No. 6 for a good many years. It is a powerful engine, cylinders 26 inches by 48 inches, set on a concrete foundation containing 300 cubic feet of material.

The Walker fan is erected. This fan will have an air capacity of 300,000 cubic feet per minute, and will be more than ample for No. 6 requirements. It is in keeping with the generally heavy and durable class of construction that has been carried on at No. 6 Colliery.

At No. 12 things are moving. The railway will be through and in operation at the end of August. The concrete pedestals for the bankhead are well under way, as is also the construction work on the permanent reservoir. The machine shop, wash-house, warehouse and several other buildings are near completion. The lamphouse is finished and equipped with 120 Ackroyd & Best safety lamps, which will be used in the mine after the 1st of August. The deeps are sunk about 1,350 feet.

At No. 14 the slope sinking is proceeding but is not being pushed. The dip is somewhat steep at the mouth of the slopes, but it is expected to flatten out rapidly as the sinking proceeds. The temporary plant is in course of erection.

The Department of Marine & Fisheries are making improvements in the navigation aids along the Cape Breton coast. They have just installed an acetylene buoy, with whistle and occulting light, in the fairway of Sydney Harbor, and it is understood they will replace the present Low Point Light, which has been in service seventy years, by a modern light, which with its buildings will cost about $16,000. A new fog horn is also being instaled at Cape North. It is being built on a ledge of the cape and will have a sheer cliff, over 1,000 feet high behind it, so that the sound should be well projected to sea. During the summer months the waters between Montreal and Sydney are traversed by an endless procession of coal boats, going and coming, and as there is a good deal of fog along the route every aid to navigation is welcomed.

ONTARIO.

Cobalt.

At a meeting of the local branch of the Canadian Mining Institute held at Cobalt on July 17th, a very interesting paper on the origin of the silver in the Montreal River district was read by Dr. A. E. Barlow. Dr. Barlow stated that while he did not make the claim that the development of the James Township area would prove the existence of another Cobalt, yet he believed that the north country would show up a second and possibly a third Cobalt. Dr. Barlow was enthusiastic regarding the future of this new territory and his paper was greatly encouraging to the prospectors who are developing this district. An interesting discussion on the Mines Act was precipitated by a paper read by J. Lorne McDougall, Jr., on the application of the Mines Act. It was proposed that a meeting of the Cobalt branch of the Institute be called for the express purpose of discussing this very important question.

Temiskaming & Hudson's Bay Mine.—On July 14th, the T. & H. B. Mining Company declared a dividend of $6 per share, making a total of $107 per share distributed to the shareholders of this company to date on a par value of $1. This is the eleventh dividend paid by this company and the second paid this year.

Crown Reserve Mining Company.—The foundation for the power plant at this mine has been completed and the boiler and machinery is being installed. The working shaft, which is sunk off the vein, is down 100 feet. A station will be cut at this level and a drift run to the big vein.

The Cobalt Silver Queen Mining Company.—The fire which destroyed the power house at this mine on the morning of July 12th, will not materially affect the operation of the mine. The new 12-drill compressor was, with the exception of one cylinder head and the bearings practically uninjured, the boilers which are bricked in were not damaged. The principal loss will be the building, the repairs to the stack and hoist and the replacing of the lighting plant. The superintendent, Mr. Robert A. Bryce, has the construction of the new power house well under way, and has arranged with the Cleveland Cobalt for air supply until the plant is repaired. A pipe line has been laid from the Cleveland Cobalt and three drills are running at the mine.

Montreal River District.

The diabase area extending south of Silver Lake, through Thompson and Boland Lakes to Hubert Lake, a distance of about seven miles, and the territory surrounding Silver Lake includes some of the most promising prospects in the Montreal River district. A large majority of the claims in this belt upon which any real prospecting has been done, have one or more discoveries of native silver. In the southeast portion of this area adjoining Silver Lake, the Downey claim T. R. 386 has an aplite vein six to eight inches wide which carries high values in native silver and compares favorably in value with the rich bearing veins in the Cobalt camp. This property is tied up in litigation and very little development work has been done. Twenty odd claims to the east of Silver Lake have native silver discoveries of more or less importance, and new discoveries are continually being made.

South of the lake on two claims belonging to Bernard Micmac, good discoveries have recently been made. Cornering on one of these claims and west of Silver Lake is T. R. 224, belonging to Sam Otisse, probably one of the most valuable claims in the Montreal River district. While no sinking and practically no trenching has been done, six important leads showing high values in native silver, have been located. As in the majority of the veins showing native silver in this section of the camp these veins are calcite or aplite, in most cases decomposed on the surface, in which the silver is found freed and lying in a black muck. All of these veins run east and west and average three to four inches in width. The latest discovery on this property made some weeks ago is a vein or dyke of gabbro thirty inches wide, on each side of which is a narrow vein of decomposed calcite one to two inches in width. In these small veins are found nuggets of very pure, white silver and the gabbro is heavily shot with leaf silver. This vein has been uncovered for seventy feet, and wherever opened up shows native silver. It is reported that this property has recently been sold to an English syndicate for a very large sum.

On the five claims belonging to the Clinton & Steindler Syndicate lying west of Silver Lake, a considerable amount of prospecting has been done with very encouraging results. On J. S. 174 a vein of aplite and galena, which assays 37½ per cent. lead and carries small silver values, is being developed. Four out of five of these claims have native silver showings in calcite, cobalt or aplite veins, and with further development, which is now being carried on, these properties should show up well and rank among the best properties in the district.

North of the Clinton & Steindler properties separated by several claims which have not been prospected are the Thompson and Boland properties which include the seven claims in the immediate vicinity of Thompson and Boland Lakes. All of these claims have good discoveries and nine veins have been located which show native silver. North of these claims between Boland Lake and Hubert Lake, the Fisher, Conley and Fraser properties are situated on all of which promising discoveries have been made. In the vicinity of Hubert Lake Otisse has native silver in three veins and several strong leads of smaltite and niccolite. The Doctor Hentchell, and the Currey properties near Hubert Lake, upon which a considerable work has been done, rank with the best properties in the district.

The chief drawback in the development of this section is the difficulty in obtaining funds for prospecting. There is every reason to believe that with proper attention this section will prove up some shipping mines.

ALBERTA.

Strathcona.

What will eventually be one of the largest coal mines in this district has just started sinking operations along side the Edmonton Yukon & Pacific Railway, which connects Edmonton and Strathcona.

The company operating on the property is the Twin City Coal Company with head offices in Toronto. A. Arthur Laurie of Toronto, is president of the company. It has been decided to put down a plant for handling 500 tons of coal per day. Coal cutting machines of the most modern type driven by compressed air, wil be introduced. The seam of coal to be mined is seven-foot cheek, lying about 120 feet below the surface.

District No. 18 of the United Mine Workers of America have decided to appeal to the Supreme Court of Alberta against the decision of Judge Stuart in dismissing the action for $12,000 damages entered by the U. M. W. of A. against the Strathcona Coal Company for a violation of their agreement made under the provisions of the Lemieux Act.

The appeal will be entered on the ground that section 62 of the Lemieux Act provides for the enforcement of an agreement made under that Act, and also that a miner's union has a right to make an agreement collectively and have therefore the right to sue collectively.

The decision to appeal this case was the result of a meeting of the officers of District No. 18 of the United Mine Workers of America, and the various solicitors of that organization held in Calgary recently.

Mr. Frank H. Sherman, President District No. 18, U. M. W. of A., when interviewed in Edmonton on Judge Stuart's decision, said: "We are surprised at the decision given by Judge Stuart. We believed in the Lemieux Act and were under the impression that Judge Stuart believed in it too. Under that Act, Judge Stuart has four times been chairman of conciliation boards in Alberta.

"Last fall he was chairman of a conciliation board held under the Lemieux Act at Lethbridge. He was on the bench then, and upheld on that as on the other occasions, agreements made under the Act he now finds against, as far as the Strathcona agreement was concerned.

"The judge states now that the men have no right to make an agreement collectively, but the union belives that the Strathcona agreement is the same as those made in the South and that the Lemieux Act is still good.

"The two important sections on which we depend are Nos. 24 and 62. The former says: 'If a settlement of the dispute is arrived at by the parties during the course of its reference to the board, a memorandum of the settlement shall be drawn up by the parties and shall, if the parties so agree, be binding as if made a recommendation by the board under section 62 of this Act, and a copy thereof together with a report of the proceedings shall be forwarded to the Minister.'

"That section provides for the two parties coming to an agreement without waiting for the board's recommendation.

Section 62 governs the recommendation of the board. Here it is: 'Either party to a dispute which may be referred under this Act to the board, may agree in writing at any time, before or after the board has made its report and recommendation, to be bound by the recommendation of the board in the same manner as parties are bound upon an award made pursuant to a reference to arbitration on the order of a Court of Record; every agreement so to be found made by one party, shall be forwarded to the registrar, who shall communicate it to the other party, and if the other party agrees in like manner to be bound by the recommendation of the board, then the recommendation shall be made a rule of the said court on the application of either party, and shall be enforceable in like manner.'

"We believe in the Lemieux Act," repeated Mr. Sherman, "we know it is a power for good where it is a power at all. It makes for peace and good understanding between employers and employed, and we believe those two sections are good law in the Strathcona case and all over Alberta. Anyway we are appealing and will try to get the Act upheld."

BRITISH COLUMBIA.

Rossland.

During the week ending June 20th, 4,685 tons of ore were sent out from Rossland camp, included in this was a car of hand picked galena ore shipped from the Mayflower. This ore was selected with due care and will return the lessees in the neighborhood of $1,000 for the car. The men now working the Mayflower have another car of ore about ready to ship. The extraction of good ore still continues on the Blue Bird.

The shipments of ore from Rossland for the week ended July 2nd, were 5,405 tons; a little heavier than they have been running lately. The Centre Star shipped 3,550; Le Roi 1,470 and the Josie 385 tons.

Considerable interest is being taken in the anticipated visit of the Canadian Mining Institute and their guests and friends to this camp and the surrounding district in September. A meeting of the Western Branch of the C. M. I. was held here recently and arrangements were discussed for the entertainment of this distinguished party. A committee of prominent mining men was appointed to arrange a programme and there is no doubt but this party will enjoy the usual hospitality that is extended to visitors to this section of the country.

The gross value of the output of the Consolidated Mining & Smelting Company of Canada, of Rossland, also operating in Moyie, Phoenix and at Trail, for nine months of the current fiscal year, which ended June 30th, was $4,178,786, which is $100,000 more than for the entire fiscal year of 1907. It is needless to say that the Consolidated Company's report for the year will show a favorable season of operation.

Boundary.

Work is now being energetically prosecuted on four of the Dominion Copper Company's mining properties in this district, the Rawhide, Sunset and Idaho being operated. The large furnace at the Boundary Falls smelter has been put into operation. This machine has a capacity of 650 tons of ore per day and the two smaller ones, which will be blown in just as soon as conditions at the smelter warrant, have a combined capacity of 600 tons.

Mr. W. C. Thomas has returned to the Boundary from Salt Lake City to make a final arrangement of affairs here, as he has resigned as manager of the Dominion Copper Company to take charge on a Newhouse property in Utah,and will be succeeded by Mr. P. F. Roosa, formerly assistant manager. There being a good supply of coke on hand at the smelter, plenty of water, the ore bins full and the stopes in the mines filled with broken ore, conditions were very favorable for a prompt resumption of work at the Dominion Copper Company's properties. The Dominion Copper Company properties appear on the shipping list during the week ending July 2nd for the first time in a long while. The following were the ore shipments for that week:

	Tons.
Granby	20,522
Mother Lode (B. C. C.)	5,840
Oro Denoro	1,190
Rawhide (D. C. Co.)	11,500
Brooklyn (D. C. Co.)	104
Sunset (D. C. Co.)	450
Mountain Rose	45
Total	29,751

The weekly shipments from this district are beginning to exhibit some of their old time weightiness. The total tonnage sent out for the year is 599,768 tons.

Jay P. Graves, general manager of the Granby, paid his properties a visit about a week ago and expressed himself as very well pleased with the way things had been done around the workings. The improvements, which have cost over $500,000, were all in line with his approval and will mean a material reduction in the cost of production of ore and copper matte. The company is realizing a profit, but it is necessary under the circumstances to utilize every possible improvement and money-saving device in order to secure such a profit.

The British Columbia Copper Company has got down to hard work and are turning out about a car of blister copper per day from the convertors at the smelter. They expect to increase their output materially in the near future. The statement following, which gives the operations of the British Columbia Copper Company smelter during the fiscal year ended November 30th, 1907, will give one a reasonable idea of the work done:

	Pro.	Realized.
Refined copper (pounds)	8,643,133	$1,579,907
Silver (ounces)	101,114	67,274
Gold (ounces)	24,967	512,233
Total		$2,159,414

They received an average of 17.52 cents per pound for their copper.

The British Columbia Copper Company is receiving ore at its smelter regularly from the Napoleon and Lone Star mines, controlled by them and situate in the State of Washington, but they have not begun shipments from their holdings near Danville, Wash., so far.

Mining is quite active in the vicinity of Grand Forks and Nelson on the smaller properties. More work is being done in a development way this year than has been done for some years past. This is no doubt in view of the improved condition of the market for small but meritorious mining properties, which is quite noticeable here in the west.

On the C. P. R. Claim in Franklin camp recently an assay was obtained from rock in the bottom of a 20-foot shaft which gave returns of: $380 in gold, $15 in copper and some silver.

A ledge has been located near Nelson carrying native and ruby silver. Ore found on the Mayflower and Hilltop, Sheep Creek district, carries 16 ounces gold, 64 ounces silver and 7 per cent. copper. The Sheep Creek country is presenting a very lively appearance this season and is slowly forging to the front.

GENERAL MINING NEWS.

PRINCE EDWARD ISLAND.

Charlottetown.—An appropriation of $35,000 has been made by the Dominion Government, most of which is to be spent in boring for coal in this province. The discovery of merchantable coal would be of immense benefit to the island.

ONTARIO.

Ottawa.—The following is the text of the lead bounty extension bill:

An Act respecting the payment of bounties on lead contained in lead-bearing ores mined in Canada.

Whereas under the provisions of an Act passed on the 24th day of October, 1903, being chapter 31 of the Acts of 1903, payment of a bounty on lead contained in lead-bearing ores mined in Canada, not to exceed five hundred thousand dollars in any fiscal year, was authorized to be paid until the thirtieth day of June, 1908; and whereas the total amount of bounty paid thereunder up to the thirty-first day of March, 1908, was six hundred and sixty-six thousand nine hundred and twenty-two dollars, and it is estimated that a further amount of forty-five thousand dollars will be payable on or before the thirtieth day of June, 1908, leaving unexpended about one million seven hundred and eighty-eight thousand and seventy-eight dollars of the total amount authorized to be paid under the provisions of the said chapter 31: Therefore His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

1. The Governor in Council may authorize the payment of a bounty of seventy-five cents per one hundred pounds of lead contained in lead-bearing ores mined in Canada, on and after the first day of July, 1908, such bounty to be paid to the producer or vendor of such ores: Provided that when it appears to the satisfaction of the Minister charged with the administration of this Act that the standard price of pig lead in London, England, exceeds fourteen pounds ten shillings sterling per ton of two thousand and forty pounds, such bounty shall be reduced by the amount of such excess.

The total amount of bounty payable under the provisions of chapter 31 of the Acts of 1903, and of this Act, shall not exceed two million five hundred thousand dollars.

2. Payment of the said bounty may be made from time to time to the extent of sixty per cent. upon smelter returns showing that the ore has been delivered for smelting at a smelter in Canada. The remaining forty per cent. may be paid at the close of the fiscal year, upon evidence that all such ore has been smelted in Canada.

3. If at any time it appears to the satisfaction of the Governor in Council that the charges for transportation and treatment of lead ores in Canada are excessive, or that there is any discrimination which prevents the smelting of such ores in Canada on fair and reasonable terms, the Governor in Council may authorize the payment of bounty, at such reduced rates as he deems just, on the lead contained in such ores mined in Canada and exported for treatment abroad.

4. If at any time it appears to the satisfaction of the Governor in Council that products of lead are manufactured in Canada direct from lead ores mined in Canada without the intervention of the smelting process, the Governor in Council may make such provision as he deems equitable to extend the benefits of this Act to the producers of such ores.

5. The bounties payable under the provisions of this Act shall cease and determine on the thirtieth day of June, one thousand, nine hundred and thirteen.

6. The Governor in Council may make regulations for carrying out the intention of this Act.

Sault Ste. Marie.—The Lepage Gold Mining Company, which is operating the Grace Mine at Michipicoten, held its annual meeting of stockholders at Minneapolis recently, when a new board of directors was elected. The members of the board are: President Dr. D. A. Stewart, Winona, Minn.; M. B. Webber, Winona, Minn.; L. S. Peek, Minneapolis; J. H. Foster, Minneapolis; A. B. Robbins, Elroy, Wis.; N. C. Eklund, Basa, Minn. Mr. Angus Gibson was reappointed general manager of the company, and Mr. Roy Earle will continue as superintendent at the mine. Ten stamps are to be added to the present mill.

Madoc.—The talc-grinding mill is now in operation. An output of from 10 to 12 tons of various grades of ground talc per day is expected. This is an important addition to Madoc's activities.

Cobalt.—The power plant of the Silver Queen was burned to the ground on Sunday morning, July 12. Repairs to the machinery are being rushed with all possible speed. Meanwhile a supply of compressed air is arranged for with the Cleveland-Cobalt Company. The damage is estimated at $5,000, fully covered by insurance.

BRITISH COLUMBIA.

Nelson.—Mr. John L. Retallack, who did excellent work in connection with securing an extension of the lead bounty, has succeeded in organizing a company to take over the Whitewater Deep property.

Rossland.—At the St. Eugene mine at Moyie, several discoveries have been made lately. An extension of the south ledge has been found and it is expected that the ore bodies of the mine will be largely increased thereby.

Nelson.—The Kootenay Development Company has taken a lease on the Silver King mine and Hall Mines smelter, and is erecting a pole line to electrify the property, and will unwater by that means levels to depth of 800 feet. This will mean the employment of over 100 men on the mine before Christmas.

Phoenix.—A new and promising ore body has been struck at the Brooklyn mine of the Dominion Copper Company.

Nelson.—After years of litigation, the Last Chance mine, near Sandon, one of the Slocan's principal silver shippers, will be again operated.

Victoria.—Mr. J. T. Shadforth announces that capital for the erection of a steel plant has been secured. The blast furnaces will be situated near one of the Vancouver Island collieries. Beyond this, no definite announcement has been made.

MINING NEWS OF THE WORLD.

GREAT BRITAIN.

The wages of Northumberland coal miners have been reduced 2½ per cent.

Mr. John Cadman, D. Sc., has been appointed to the chair of Mining at Birmingham University.

The extension of Leeds University including the departments of mining and metallurgy, elaborately equipped, was opened by King Edward on July 7th. The cost was largely met by the Yorkshire coal owners.

The Welsh Navigation Steam Coal Company, who have been sinking in the Eby valley two years, have struck te celebrated No. 3 Rhondda seam of coal at a depth of 1110 feet, proving an area of 3,000 acres of coal.

FRANCE.

Mons. P. Barbier has discovered a new variety of mica at Mesvries, which cannot be classed in the muscovite group, but it is more like paragonite in composition, though it has not the same external characteristics. It is distinguished from muscovite by its percentage of lithia. The discoverer has given it the name of hallerite.

NORWAY.

The Hohenlohe-Werke Company, Oberschlesien, has obtained for one of their subordinate Norwegian companies a concession of extensive zinc claims in Hakedal and Nannestad near Christiania. The concession is for 82 years at the end of which the mines and plant revert to the State. The company will employ from 600 to 700 men.

RUSSIA.

The yield of asbestos in the Ural has steadily increased from 64,654 poods in 1893, to 571,194 poods in 1907. Owing to the increased prices other areas are being prospected. It is stated that recently large and rich deposits of this mineral have been found in the Altay mining district, a concession for the exploitation of which has been granted.

GREECE.

Large exports of magnesite from the Piraeus district to Britain, Germany and America have laterly been made. The Anglo-Greek Magnesite Company has undertaken the sale of the produce of the Greek Societe des Travaux Public et Communeaux, the latter being bound to deliver annually 42,000 tons, to effect which they will open up new deposits and increase their plant.

Two new companies have been floated for working iron ores in the Pireans district, where large deposits occur. It is reported that extensive quantities of rich iron ore also exist near Karditza Baotia, and a company is being organized to operate them.

AUSTRALASIA.

Production at the tin mines of Tasmania was on a much greater scale during the first three months of 1908 than for the corresponding period last year, the figures being 1,045 tons of black tin, as against 586. Some recently located ore bodies of the Mount Bischoff Company are opening up satisfactorily.

The Zinc Corporation at Broken Hill, New South Wales, has been more successful since adopting the Elmore process of concentration, by which 10,810 tons of tailings were treated during April. Costs have been so reduced that a profit can be realized even at present prices.

The output of gold in New Zealand during June amounted to 47,416 ounces, valued at £190,656, as compared with 26,702 ounces valued at £104,456 in June, 1907.

SOUTH AFRICA.

The Transvaal Government has decided to take over a worked or developed mine in conjunction with the Chamber of Mines and utilize it as a training school for skilled miners.

The Robinson Gold Mining Company of Johannesburg made another record in the reduction of working expenses for May last, bringing the costs down to 12s. 4½d. per ton.

The African Diamonds Corporation and the old Driekopjes Company have been merged and work has been resumed on the Driekopjes property.

UNITED STATES.

There are now twelve shipping mines in the Rawhide, Nev., camp and but one mill in operation, which is being enlarged to a capacity of 120 tons per day. The ore treated yields from $30 to $50 per ton. Several other mills will shortly be started.

The Nova Scotia Steel Corporation having nearly completed stripping at the Norman-Ohio iron property at Virginia on the Mesabi range, Mich., preparations are being made for the extensive mining of the tract.

The Beatson copper mine on Latondie Island, Alaska, isreported to have $10,000,000 worth of copper in sight. The output from the smelter at Tacoma for 1907 was 1,020,000 pounds copper and 9,000 of silver. Production is purposely restricted on account of high transportation and smelter charges.

At the Williamston colliery of the Summit Branch Mining Company, in the lower part of the anthracite coal fields of Pennsylvania, seven miners were killed and ten injured by an explosion of gas on July 15th. The mine was wrecked and set on fire.

COMPANY NOTES.

The Crow's Nest Pass Coal Company on July 16th distributed a stock bonus to its shareholders of 66 2-3 per cent. and later on declared a half-yearly dividend of 3 per cent., payable August 1st, on the basis of the new stock. This is the same as 10 per cent. on the old stock.

In July the following dividends will have been paid by Cobalt companies:

Nipissing, 3 per cent. quarterly	$180,000
McKinley, 3 per cent. quarterly bonus 2	112,346
Kerr Lake, 2 quar., bonus 1	90,000
Crown Reserve, 4 p.m., ½ year	80,000
Temiskaming, 3 per cent., quar.	75,000
Hudson Bay, $6	46,200
Buffalo, 3 per cent., quar.	27,000
City of Cobalt, 3 interim and bonus 2 per cent.	25,000
Total	635,346

STATISTICS AND RETURNS.

NOVA SCOTIA COAL SHIPMENTS.

Outputs of the Dominion Coal Company, July 1st to 15th, 1908:—

No. 1	25,320
No. 2	31,940
No. 3	18,650
No. 4	19,330
No. 5	23,750
No. 6	10,280
No. 7	8,290
No. 8	11,080
No. 9	15,550
No. 10	8,880
Total	173,070

Cumberland Railway & Coal Company.—

Shipments June, 1908	29,411
Shipments June, 1907	34,310
Decrease June, 1908	4,899
Shipments 6 months, 1908	198,279
Shipments 6 months, 1907	176,346
Increase 6 months, 1908	21,933

Inverness Railway & Coal Company—

Shipments June, 1908	30,171
Shipments June, 1907	28,062
Increase June, 1908	2,109
Shipments 6 months, 1908	128,291
Shipments 6 months, 1907	103,037
Increase 6 months, 1908	25,254

Intercolonial Coal Company—

Shipments June, 1908	21,845
Shipments June, 1907	22,374
Decrease June, 1908	471
Shipments 6 months, 1908	134,523
Shipments 6 months, 1907	131,897
Increase 6 months, 1908	2,626

Nova Scotia Steel & Coal Company—

Shipments June, 1908	64,100
Shipments June, 1907	77,055
Decrease June, 1908	12,955
Shipments 6 months, 1908	287,595
Shipments 6 months, 1907	240,682
Increase 6 months, 1908	46,913

Acadia Coal Company—

Shipments June, 1908	30,750
Shipments June, 1907	30,639
Increase June, 1908	111
Shipments 6 months, 1908	162,648
Shipments 6 months, 1907	142,894
Increase 6 months, 1908	19,754

COBALT ORE SHIPMENTS.

Following are the weekly shipments from Cobalt camp, and those from January 1st to date:

	Week end. July 11. Pounds.	Since Jan. 1. Pounds.
Cobalt Lake	95,228	341,683
La Rose	83,100	2,631,662
Kerr Lake	60,674	522,974
Nipissing	127,007	2,283,747
Nancy Helen	187,007	327,427
O'Brien	191,307	3,412,777
Peterson Lake	41,237	41,237
Silver Queen	180,000	814,510

The total shipments for the week were 965,560 pounds, or 483 tons. The total shipments from January 1st to date are 19,048,813 pounds, of 9,524 tons. The total shipments for the year 1907 were 28,081,010 pounds, or 14,040 tons, valued at \$6,000,000. In 1904 the camp produced 158 tons, valued at \$130,217; in 1905, 2,144 tons, valued at \$1,473,196; in 1906, 5,129 tons, valued at \$3,900,000.

Shipments of ore from the Cobalt camp for the week ended July 18 totalled 1,011,000 pounds., or 505 tons, a record output, divided among eight mines. Shipments from January 1st to date total 20,059,813 pounds, or 10,003 tons. Mines and shipments were:

	Week end. July 18. Pounds.	Since Jan. 1. Pounds.
Buffalo	......	696,390
Coniagas	......	631,890
Cobalt Lake	95,228	341,683
Cobalt Lake	......	341,683
Crown Reserve	44,000	128,000
*Cobalt Central	......	210,075
City of Cobalt	......	615,380
Drummond	......	188,600
Foster	......	238,400
Kerr Lake	......	522,974
King Edward	......	127,240
La Rose	362,610	2,994,272
McKinley	......	1,735,280
Nipissing	253,600	1,988,880
Nova Scotia	40,230	311,775
Little Nipising	......	40,110
Nancy Helen	......	327,427
O'Brien	63,870	3,476,647
Peterson Lake	......	41,237
Right of Way	60,050	433,820
Provincial	......	143,210
Silver Leaf	......	196,620
Silver Cliff	......	52,000
Silver Queen	....	879,310
Townsite	......	130,700
Temiskaming	......	545,000
Temis, & H. B.	......	724,000
Tretheway	121,640	1,494,046
Watts	......	306,180

*Concentrates.

The output of the Crow's Nest Pass collieries for the week ending July 10th was 22,261 tons, a daily average of 3,710 tons. Week ending July 13th, 1907, 24,015 tons; daily average, 4,002 tons; wek ending July 13, 1906, 18,108 tons; daily average, 3,018 tons.

The gold production of the Transvaal mines last June was officially placed at 574,973 fine ounces. This was a loss of 7,000 ounces from May, but an increase on last Saturday's estimates of 5,000. The value of the month's output was $12,-200,000.

BRITISH COLUMBIA ORE SHIPMENTS.

Nelson, July 11.—The following were the ore shipments from the mines and the receipts at the smelters of the districts of Southeatsern British Columbia for the past week and year to date:

Ore Shipments.

	Week.	Year.
Boundary—		
Granby	17,399	560,744
Mother Lode	8,944	49,114
Oro Denoro	1,980	15,646
Rawhide	1,360	2,860
Brooklyn	1,066	1,170
Sunset	582	1,032
Mountain Rose	60	105
Sally	19	86
Curley	7	7
Other mines	.....	455
Total	31,417	631,219
Rossland—		
Centre Star	2,633	88,102
Le Roi	1,420	41,398
Le Roi No. 2	721	15,820
Other mines	.....	552
Total	4,774	145,872
East of Columbia River—		
St. Engene	424	10,799
Whitewater (miled)	280	7,700
Poorman (mileld)	250	6,100
Queen (milled)	185	4,985
North Star	199	1,627
Fern (milled)	150	350
Blue Bell	129	221
Whitewater	95	707
Richmond	45	1,002
Arlington Erie	22	832
Standard	55	717
Rambler Caribou	22	710
Sunset	21	187
Fern	17	17
Bluebird	15	60
Ottawa	24	24
Other mines	....	15,405
Total	1,933	51,410
Grand Total	38,124	812,996

Smelter Receipts.

	Week.	Year.
Smelter—		
Grand Forks	17,399	560,744
Greenwood	10,924	66,680
Boundary Falls	3,068	5,167
Trail	6,467	145,572
Northport (Le Roi)	1,545	44,615
Marysville	.....	5,730
Total	39,403	828,508

COBALT ORE STATEMENT FOR THE MONTH OF JUNE, 1903.

	Pounds.
O'Brien Mine—	
June 3rd., Am. Smelting Co., Denever, Col.	58,200
June 4th, Deloro M. & R. Co., Deloro, Ont.	54,500
June 6th, Am. Smelting & R. Co., Denver, Col.	84,500
June 10th, Deloro M. & R. Co., Deloro, Ont.	63,300
June 13th, Am. Smelting & R. Co., Denver, Col.	62,100
June 13th, Am. Smelting & R. Co., Denver	61,500
June 15th, Am. Smelting & R. Co., Denver	63,900
June 18th, Am. Smelting & R. Co., Denver	62,600
June 20th, Am. Smelting & R. Co., Denver	63,320
	573,920
Nipissing Mine—	
June 4th, Nipissing Mine, New York, N. Y.	58,560
June 5th, Nipissing Mine, New York	49,660
June 15th, Nipissing Mine, New York	55,200
June 15th, Nipissing Mine, New York	54,000
June 17th, Nipissing Mine, New York	63,160
June 19th, Newark, N. J.	67,400
June 24th, Newark, N. J.	62,400
June 27th, Newark, N. J.	61,320
	471,700
La Rose Mines—	
June 3rd, La Rose Mines, Denver Col.	59,960
June 5th, New York, N. Y.	46,620
June 20th, Denver, Col.	64,200
June 20th, Perth Amboy, N. J.	43,800
June 29th, Anglo French Nickel Co., Swansea, Wales	62,240
June 29th, La Rose Mines, Denver, Col.	80,000
	356,820
Buffalo Mines—	
June 4th, Buffalo Mines, Copper Cliff, Ont.	42,900
June 24th, Buffalo Mines, Copper Cliff, Ont.	41,500
	84,400
Grand Total	1,486,840

MARKET REPORTS.

Coke.

July 20.—Connellsville coke, f.o.b. ovens—
- Furnace coke, prompt, $1.60.
- Foundry coke, prompt, $2.00.

Other Metals.

July 20.—
- Tin, Straits, 29.30 cents.
- Copper, prime lake, 12.85 to 13 cents.
- Lake, arsenical brands, 12.80 cents.
- Electrolytic copper, 12.75 to 12.85 cents.
- Sheet copper, 17 cents.
- Copper wire, 14.75 cents.
- Lead, 4.45 cents.
- Spelter, 4.45 cents.
- Sheet zinc, 7.50 cents.
- Antimony, Cookson's, 8.50 cents.
- Aluminium, 32 cents.
- Nickel, 45 to 47 cents.
- Platinum, $23.50 per ounce.
- Bismuth, $1.75 per pound.
- Quicksilver, $43 per 75 pound flask.