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Editors:

J. C. MURRAY, B.A., B.Sc. H. MORTIMER-LAMB, Sec. Canadian Mining Institute

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

Asst. Bus. Manager . . D. B. GILLIES, B.A.

Circulation Manager . . . A. P. DONNELLY, B.A.

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WESTERN FUEL SITUATION

As we go to press the reports from the West are disturbing. More than one thousand coal miners are out on strike. The supply of fuel for the railroads is rapidly reaching the vanishing point. A fuel famine threatens the whole West, from Winnipeg to British Columbia. Unless an immediate solution is reached, traffic will be almost altogether stopped, factories closed and smelters shut down.

The president of the United Mine Workers' Union, in responding to an urgent telegram from the Minister of Labour, requesting the miners to await Government investigation, characterized the investigation as a farce, and threatened to "carry this fight to the foot of the throne." The president's intemperate message is the sort of indiscretion that does incalculable injury to the labour cause Instead of attempting in every way to aid the Minister in peacefully solving the difficulty, the miners' representative breathes fire and slaughter. In pursuing this course he antagonizes public sympathy (that most potent factor in deciding any such struggle) and places the body of men whom he represents in a very false position.

Under recent legislation the Minister is endowed with certain powers. We hope that these powers will be used to their utmost in promptly putting an end to this strike. It is iniquitous that the country should be subjected to enormous loss, that many of its most important industries should suffer indefinite suspension merely because the leaders of labour organizations are not amenable to reason.

Whether the fault lies with the operators or with the miners is immaterial. It is an utter anomaly that either corporations or individuals should have it in their power to inflict grave loss and permanent injury upon the country at large. The men, or the corporations, who deliberately tie up traffic and cause a suspension of industrial activity, should be held criminally responsible, and should suffer the full rigor of the law. Canada has had her full share of labour difficulties. It is high time that disturbers of the public peace should be dealt with promptly and severely.

DEVELOPMENT

A new stability is lent to the market for Cobalt ores from the fact that Welsh and German smelting firms are sending inquiries and offers. One mine in Cobalt received an offer of terms as follows: Ore carrying 1,000 ounces silver to the ton, 93 per cent. assay value; ore carrying under 1,000 ounces silver to the ton, 92 per cent. assay value; cobalt under 7 per cent., 20 cents per pound; between 7 per cent. and 10 per cent. and over 10 per cent., from 20 cents per pound to 40 cents per pound. Nickel also is sought at 10 cents per pound on ore carrying over 5 per cent. The opening of a larger market for cobalt and nickel will encourage conservative mining, and will render "gophering" less excusable. Anything that will lead to the sane exploitation and rational development of Cobalt mines at this stage of their history will inevitably lengthen the life of the camp and vastly increase its ultimate value.

CRITICISM

The Mining Journal (London, Eng.), in acknowledging receipt of Vol. I., No. 1, of THE CANADIAN MINING JOURNAL, makes the following comments:—

"We have received from the publishers a copy of the above journal, which, as the reference to an "old series" indicates, is our old friend, the "Canadian Mining Review" masquerading in new clothes. Right here, to adopt the Transatlantic idiom, we desire to make a protest. A journal with a well-recognized name does not change its title without careful consideration, and the choice of a name so similar to our own raises the inference that the proprietors look upon the certainty of confusion as desirable. In fact, they go so far in the first number as to refer to their paper as 'THE MINING JOURNAL,' *sans phrase*. Such action would in this country be preventible by injunction, but, of course, as matters stand we have no remedy. The practice is analogous to the action of the company promoter who, encouraged by the success of a well-known mine, adopts a title which is as close an imitation as he dare, and which is often the only asset of value which the concern possesses. We do our best to avoid inflicting any personal matters upon our readers, but the action of our resuscitated contemporary's proprietors, with the whole English language open to them, of selecting the title they have leaves us no alternative but to protest against what we can only regard as an unfriendly act."

We regret that our respected contemporary has so far forgotten the laws of courtesy as to indulge in this somewhat painfully plain language. We are sure that upon mature reflection it will regret this hasty judgment.

THE CANADIAN MINING JOURNAL at its inception was entirely distinct from "The Canadian Mining Review." The former name was chosen for the new venture for no other reason that that it was conveniently distinctive and short.

The publishers have aimed at producing a sound representative and (so far as may be) attractive technical magazine, with an individuality of its own. The absorption of "The Canadian Mining Review" modified the original plans only in details.

On the other hand, it is difficult to imagine in what possible respect we could be the gainers in designedly stealing our worthy contemporary's title, or, indeed, any other feature. We are publishing a Canadian magazine, dealing with the mining and metallurgical industries of Canada, and our requirements are of a very different nature from those of the London "Mining Journal."

We have made this rather lengthy explanation because we know that our London namesake is neither frivolous nor irresponsible. We are sincerely sorry to have given it offence. That there is, so far as we are concerned, any cause for this offence, we do not admit, and we are sure that our contemporary will willingly withdraw its hasty condemnation when it has had time to reflect.

COBALT LAKE

The Ontario Legislature has passed an Act validating the letters patent which grant to the Cobalt Lake Company the minerals under Cobalt Lake. This Act has been passed, despite the fact that the Florence Mining Company claim to twenty acres of the lake is now *sub judice* .

Concerning the merits of the case, as between the two mining companies, we have nothing to say. The courts will decide this in due time. The action of the Local Government, however, appears to be at least ill-advised. It is highly questionable, indeed, whether the Government is acting within its powers when it arbitrarily decides a case while it is yet in the courts.

BRUCE MINES

The annual report of the Copper Mining & Smelting Company of Ontario, Limited, submitted to shareholders at the recent annual meeting in London makes, on the whole, excellent reading, and many of our readers will be gratified to learn that with good management there is now every prospect that the historic Bruce Mines will ere long be placed on a permanently profitable footing. Actual mining was not commenced before last August, and during the four months following 3,371 tons of ore were raised, and 1,295 tons left in the stopes, the gross profit on which is estimated at $34,000. It is expected that the concentrator will be in operation early in the summer, and that 30,000 tons of ore will be treated, averaging in value $10.50 per ton. The company propose to send their product for treatment to the Sault for the present, but the erection of a smelter on the property is under contemplation. Last autumn a number of important new discoveries were made at the mine, including a lead of bornite, some two miles distant from the main workings. At the conclusion of his speech to the shareholders, the general manager referred to the negotiations that are now proceeding for the extension of the seventeen miles of railway from Bruce to connect with the Grand Trunk Pacific to Hudson's Bay, through an important timber and mineral area. He expressed the opinion that the development of this line would undoubtedly enhance the value of the company's property and tend to make the town of Bruce an important coaling and mining station.

CONSOLIDATED MINING AND SMELTING CO.

The showing made by the Consolidated Mining & Smelting Company of Canada, since the consolidation was effected some two years ago, is eminently satisfactory, and we extend to Mr. W. H. Aldridge and his staff hearty congratulations thereon. The distribution of profits in the form of dividends to shareholders during the period mention has aggregated the large sum of over half a million dollars, and a sixth dividend of 2 1-2 per cent., payable on May 1st, has just been declared, which increases the total to nearly $700,000. While the advance in the price of metals has, of course, largely facilitated the profitable operation of the mines, the result is also in a great measure due to the economies effected by the consolidation and subsequent good management.

EDITORIAL NOTES

A press despatch states that the miners at the Fernie collieries have, by a large majority vote, decided in favor of a strike. This will mean the general suspension of mining activity throughout Southern British Columbia until the dispute is settled. The metalliferous mining industry, which was never in a healthier condition, is thus at the mercy of an aggregation of coal miners, largely foreigners, and dominated by an alien labor organization with headquarters in the United States. Such a state of affairs is altogether intolerable and calls loudly for remedial legislation. The strike is ostensibly based on a number of minor differences, but the real object is to force the owners to recognize the principle of the "closed shop."

Mr. George Otis Smith has been chosen as the new Director of the United States Geological Survey. It is significant that Mr. Smith is but thirty-five years of age. He has, however, served for fourteen years on the Survey. THE CANADIAN MINING JOURNAL wishes Mr. Smith a long and useful tenure of office.

The Premier of British Columbia took a very wise step in announcing the imposition of a tax upon all iron ore exported from the Province. Both this tax and the bounty on native ore smelted will operate to encourage the erection of smelters in the Province. There is no reason why British Columbia should not have a thriving iron industry.

The Atlin Claim of March 30th, in an editorial headed "False Stampedes," condemns the spreading of exaggerated rumors of gold finds. It refers particularly to the report that the richest strike made in Alaska had been discovered on the south fork of the Kuskokwin River. While it does not deny the actual discovery of gold, The Atlin Claim deprecates the overdrawn accounts of the nature of the strike, and predicts hardships and privations for many disappointed prospectors.

THE PRACTICAL MINING MAN

In these degenerate days a trademark, or a catchy phrase, possesses a very positive value. Thus, bad butter, carefully decked and labelled "Fresh Dairy," may command a larger market than the paler, purer article straight from the farm. Patent medicines, concocted of alcohol and incidentals, christened with an attractive name, are eagerly bought.

In the business of mining these snares and delusions have their counterparts. Of the *bona fide* practical man the public hears but seldom, or never When he is heard of, it is mostly in connection with smelter returns, or mine output, or in some such prosaically profitable manner. Like most common mining men, he must earn his living and do a minimum of talking. This is the genuine, undecorated brand.

But there is another brand, a variety that announces to all the world that he is a "practical miner," and that, knowing the business of mining from Alpha to Omega, he is the safest and surest guide for the purchaser of mining stock.

We wish to condemn no one. But it is worth while to observe carefully that the mining man, the practical man, who is following the profession of mining, and who possesses the confidence and respect of his fellows, is, of all men, least given to blatant self-advertisement. The practical man has every right to protest against the sinful misuse of his title.

SINKING THE ALLAN SHAFTS

(H. E. Coll, M.E. Paper read before the Nova Scotia Mining Society.)

DESCRIPTION AND LOCATION.

The Allan Shafts are located in the north end of the town of Stellarton, Pictou County, N.S., and are 1,000 feet from the old Ford Shaft. They were sunk with the idea of cutting the Ford, Cage, Third and McGregor seams on their basin and lowering the north and south coal by means of balances or chutes to the shaft level, thence up the shaft to the surface.

It was decided to make both shafts the same size compartments, guides and timbering, and to place one 350 feet north of the other. In this way whichever shaft proved the most suitable could be utilized as the main hoisting plant.

The size of the shafts is 12 feet 4 inches by 24 feet, outside of timbering. All timbering is of Florida yellow pine, and the dimensions and joints are shown by the accompanying plan. Each shaft is divided into two hoisting compartments, 6 feet 10 inches by 10 feet 4 inches, and one air-way 6 feet 10 inches by 10 feet 4 inches. The air-way is separated from the middle hoisting compartment by two thicknesses of 1 inch yellow pine groove and tongue flooring, having end joints and side joints broken and overlapped.

EQUIPMENT.

Head Frames.—A head frame at each shaft was constructed 44 feet high to a centre of a 5 foot sheave wheel. The details are shown in the accompanying blue print. Instead of a brace leg, the head frame was held by two 3-4 inches rope guys that fastened underneath the rear cap piece, and at the other end were attached to concrete dead men. All hoisting was done in the centre compartments. These head frames were light and easily built, yet answered fully to the rough service given them. In fact, the one at No. 2 shaft is still in use, as by making some changes and adding bracing, we have adapted it to coal hoisting in both compartments.

Across the top and close to the rope line a 10 inch by 12 inch by 18 foot yellow pine cap was placed, with the ends extending out 4 feet on each side. This was for the purpose of hanging a 3-4 inch chain 30 feet long, and which ended in an open hook and was used for swinging the buck out in position to dump into the muck car.

A special hook was used in fastening the muck basket on to the rope. It had a spring latch, which would allow the bale of the bucket to enter and then spring shut. In changing buckets, the operator had to open this latch by hand. The buckets were 3.25 feet diameter, 2.5 feet deep, and had a volume of 20.74 cubic feet. Weight of bucket was 700 lbs., weight of muck contained in bucket, 1,900 lbs.

Compressor.—Compressed air was supplied by one class G. Ing. Sar. machine, having steam cylinder 16 inches by 26 inches by 18 inches, and air cylinders 16 1-4 inches by 26 1-4 inches by 18 inches. This machine being air-governed, worked only as the air was drawn from the mains. The capacity of the machine is 1,327 cubic feet free air per minute, delivered at a pressure of 100 lbs.

Drills.—The drilling was done by 8 Ing. Sar. 3 inch drills of the D 24 auxiliary valve class.

Ventilation was supplied each shaft by a 5 1-2 by 8 1-4 Sturtevant steel place fan having a capacity of 20,000 cubic feet of air. These fans were not required during the sinking, except after shooting, when they were speeded up to their capacity in order to clear the shaft of the dynamite fumes.

Power was supplied by two 200 horse-power Sterling boilers, placed midway between the two shafts.

All the muck coming from both shafts was conveyed by means of a specially built dump car to a ravine just south of No. 1 shaft, which made an ideal dumping place, and at the same time was making room for shops and other buildings.

Hoisting Engines.—Thirty-eight feet from the rope centre of each head frame a pair of Lidgerwood friction drums and brake reversible engines, having 10 inch by 12 inch cylinders, and 5 foot drum, were set up on timber foundations and equipped with a 3-4 inch non-twisting wire rope. These engines were only used for a portion of the sinking, as will be shown later.

Labor.—The work was divided into three eight-hour shifts; each shaft consists of from seven to ten men. The shift bosses worked twelve hour turns, and a walking boss had direct control of the sinking in both shafts, and was liable for duty either night or day.

Sinking Operations.

Having given a description of the equipment, we now come to the actual work of sinking.

Ground was broken on April 26, 1904, in No. 1 Shaft, and on May 2 in No. 2 Shaft. As the operations and rock are identical, we will take No. 1 Shaft until we reach the coal.

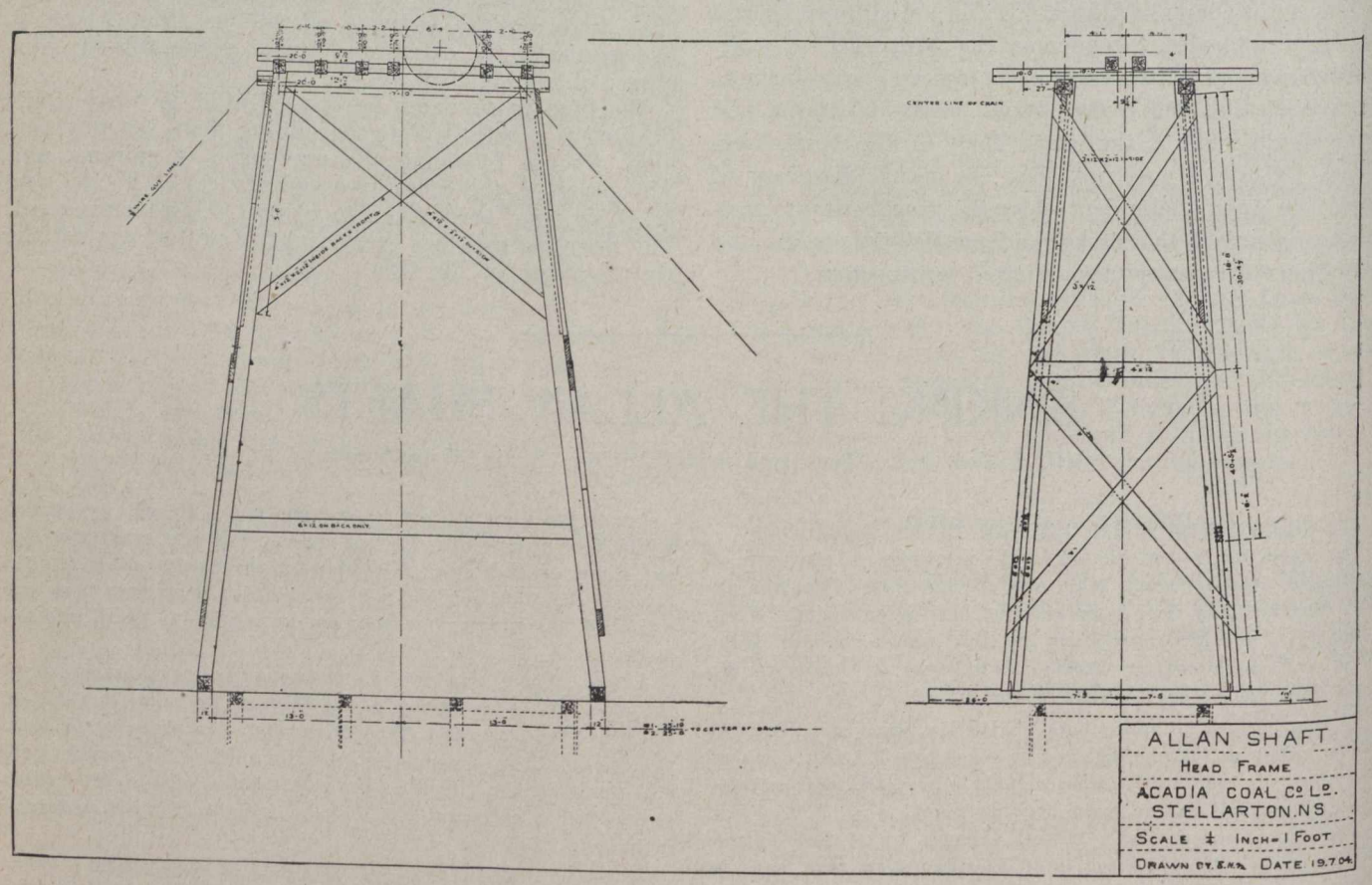
After going a depth of 12 feet in fairly firm top clay, a bed of gravel was met containing considerable water. A delay of two days was occasioned, by which time an injector had been rigged, which soon had the water under control, and sinking recommenced.

After passing through six feet of loose shale and gravel, and having gotten in place five sets of timber, the sinking passed into very fine sand, and this, mixing with the water and clay from above, made very soft mud. At a depth of 23 feet the walls began to give way, and to prevent this a line of poles 4 feet 6 inches long were driven in a lateral direction, but with no avail. The wall on the southeast end began to sink, carrying the timber with it on that side of the shaft.

Skin timbering of spliced sets was immediately commenced, and, after much difficulty and very slow work, twelve sets were secured in place. At this depth a firm blue clay was met, which proved to rest directly on top of the shale at a depth of 43 feet. Three regular sets of timber were then put in, below which the first yellow pine hitches were placed at a depth of 51 feet.

During the entire month of May only 47 feet had been sunk, and of hemlock timber that had been placed not a single set was in proper position. The east side plates were two feet below the level of the west side, and where the spliced plates had been put in the skin timber, eight of the twelve plate had given way at the splices and were closed up to 10 inches towards the centre of the shaft.

On the whole it was a bad start, and it was decided to go on sinking the shafts, leaving the top of No. 1 remain as it was until the sinking operations were finished. Commencing in June, the sinking was in the regular shale formation lying at an angle 30 degrees from north to south. The amount of water was not heavy, but sufficient for the use of the sinking pump. For this purpose a Jeansville sinker, size 5a, 7 inches by 4 inches by 12 inches, operated by compressed air, was used, and gave excellent satisfaction down to 500 feet depth. At this point it was replaced by a Cameron sinking pump, 12 inches by 4 inches by 13 inches.



Two rings were put in this shaft. The first at a depth of 75 feet, and after sinking further it was discovered we were getting a regular stream below this point, whereupon a second ring was cut at a depth of 200 feet. A pump was placed, and the water has been handled from this ever since. These rings were made by cutting into the rock two feet back from timber line all round the shaft. At the south end a sump was cut four feet deep by three feet wide and the whole lined with six inches of concrete.

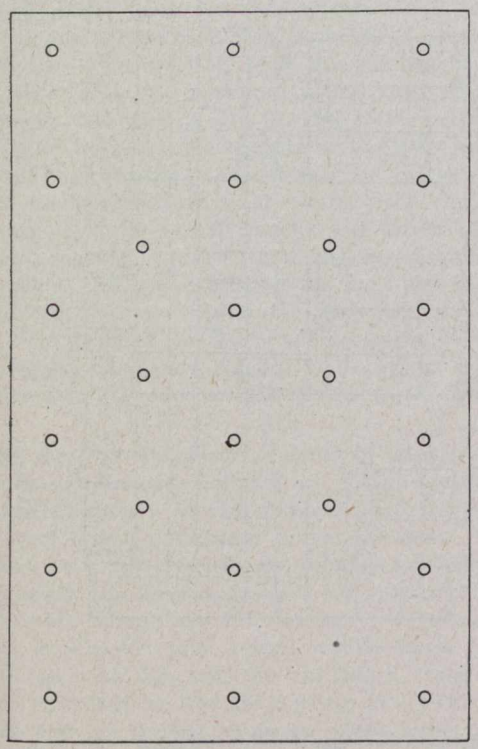
Sinking was continued with very little delay, and very little change in the measures, and at this point we will give an outline of the method used in the sinking operations.

Sinking.—Starting with a clean bottom, two 4 1-2 inch shaft bars 12 feet long would be lowered to the shaft bottom, and set up crossways about 4 feet on each side of the centre line. Four drills were then lowered, one at a time, and two mounted on each bar. The first row of sump holes are started with the machine clamped on the outside of the bar on a slant of about 10 degrees.

All this takes about one hour. The drill steel is handled in big steel cases like large golf bags. Two sets of steel are lowered for the four machines. The air is carried down the shaft in a 2 inch line, with a header on the end having five connections.

While the machines are being mounted, a pair of men take four lengths of 50 foot hose in the bucket and couple them to the header, the drill runner couples on to his machine and is

ARRANGEMENT OF HOLES FOR 1 ROUND OF SHOTS.



AVERAGE CHARGE IS 6 STICKS OF 12" DYNAMITE PER 12" HOLE

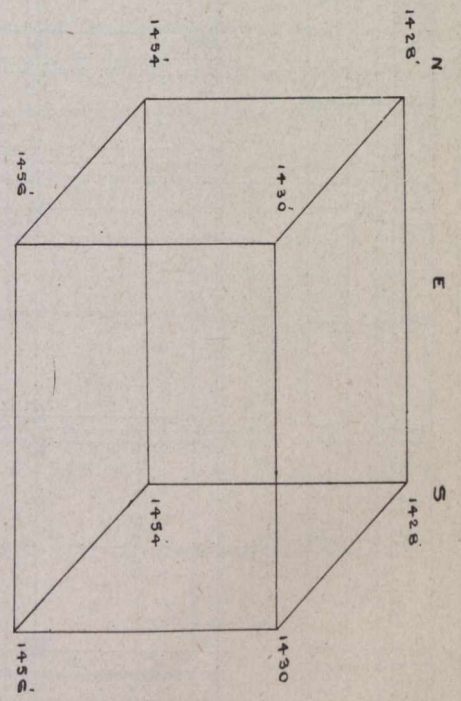
ready to start. It took two men to each machine. The helper mounted the bar and fed the drill, while the drill runner handled the throttle. As soon as the first row of holes were finished the drill was thrown over to the inside of the bar and the second row commenced. There was very rarely over half an hour's difference between the four machines. The average time for drilling a hole was two hours, and for a sump of 12 holes it averaged about 8 hours. As soon as a crew had finished, their machine and gear were hoisted out of the shaft, so that there was little time lost when the last hole was drilled before they were ready to charge and shoot. The average charge was 6 sticks of 12 inch dynamite to each 12 foot hole, or 72 lbs. charge for each sump. Of course there were occasions when more or less dynamite was used, depending upon the area of sump drilled and the quality of the rock as shown in the drilling. The distance from timber, strength of the walls, and the absence or presence of slips, all governed to some extent the placing of the holes and the strength of the shot. All shooting was done from the surface. For this purpose a twin cable wire, mounted on a small reel at the deck head, was provided, and when the holes were loaded this wire was lowered to the bottom and connection made to the connecting wires of the holes. This work was done by two men, all the others being on the surface. As soon as these men came to the surface the battery was connected up and the charge fired. The fan was at once started at its full capacity for about fifteen minutes, when it was reduced to half speed, and the shift boss and one man went down to examine the shaft timbers and remove any loose rock that would be thrown up by the explosion. When the bucket was sent up empty it was a signal all was clear, and the entire shift went to the bottom to muck out.

Two buckets were used, and they were hoisted as fast as they could be filled by eight or nine men. It took from 12 to 16 hours to muck out a sump. When finished, the bars were lowered and set up at each end for drilling the benches. The bar was set about three feet from the end wall, and the first row of holes was put down almost straight. The angle of the second row depended upon the amount of bench to be lifted. Six holes were drilled in each bench, and the charge in the south end was always heavier than on the north, because, owing to the dip, the north side was easier to pull. The holes were then charged and shot, and the muck hoisted out; thus completing a "round," as it was called. The length of time required to take out a "round" varied from 36 to 42 hours. Besides this amount of muck, there were about 500 gallons of water per hour to handle in No. 1 Shaft; in No. 2 it was about half that amount.

TRAVELLER OR CROSSHEAD.

In order to keep the bucket from swinging while going up and down the shaft, a traveller, or crosshead, was used. This was made of 6 inch yellow pine frame, with cross braces. The shoes were formed by bolting pieces of plate at each corner, which lapped over past the guides 2 inches on each side. This cross-

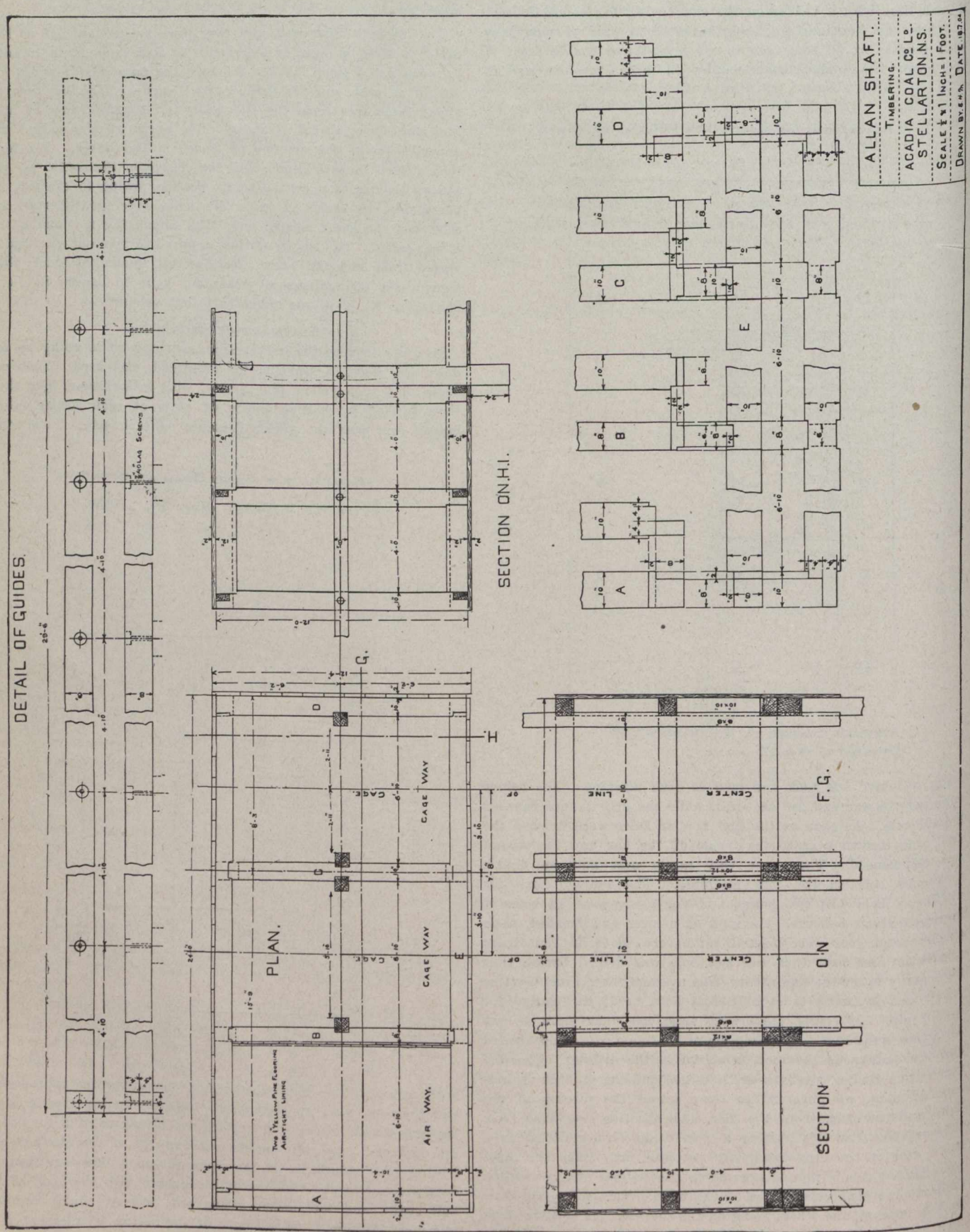
PLAN OF THE CAGE SEAM AS STRUCK IN No. 1 SHAFT NOV 22 1905.



head rested upon a ring which fitted down over the rope socket, and the rope went up through the centre. In the top guide a dog was placed, which could be tripped by means of a rope from the deckhead. As each bucket came up out of the shaft it was hoisted high enough to set the crosshead upon this dog, then the deckman caught the crossbar of the bucket with the hook of the bull chain, and the bucket swung out over the dump car and was upset. Within a guide length of the bottom of the timbering, a par of heavy angle plates were bolted on to the guide, and the descending crosshead would seat itself on those plates and the bucket would be dropped down to the sump. When the loaded

bucket was picked up it was steadied a few seconds, and then hoisted slowly till the crosshead was picked up.

After sinking several hundred feet it was found that the 10 inch by 12 inch hoisting engines were not going to be able to handle the work fast enough from the lower depths. Accordingly, two pairs of engines, 20 inch by 30 inch cylindeers, and having drums 72 inches diameter and 90 inch face, were procured from the Exeter Machine Company, of Pittstown, Pa. These engines were supposed to be good for 4,000 feet maximum speed, but day after day these machines reached a speed of 5,000 feet per minute. This explains why faster sinking was done in the lower and harder measures than during the first half of the work.



Method of Timbering.

When the sinking had been carried down as far as had been considered safe, below the timbering, the distance from the last hitch timber to within about ten feet of the bottom was measured, and hitch holes not less than two feet deep were cut in the walks. When these were ready the hitch timbers were lowered from the surface, placed in position and wedged tight. The two side plates of the first set followed, and then came the end plates and buntons. These came down in rotation, and marked for their respective positions. When all the pieces were in place the set was levelled and then wedged plumb by means of bobs suspended from the last timbering. To facilitate this the centre lines were all scored when the framing was being done. The second set was now lowered, and then plates rested upon the posts until the buntons were in place, when this set was levelled and wedged to place. This was continued till the last, or closing-in, set was reached. In order to get the side plates in position, it was necessary to leave out two buntons of the lower set. These closing-in sets were usually either longer or shorter than the standard, as the measurement could not be made true, and the posts were cut to fit the actual distance and driven home.

The two inch lagging was then placed, and made as near water-tight as possible. All spaces between the walls and the lagging were closed with packing. After the timbering was in place the guides were fastened on the centre compartment, so as to keep the crosshead as near as possible to the sump. The guides were not placed in the other compartment until the sinking was completed.

In sinking the first 500 feet, a number of slips and slickensides were passed through, but not of enough importance to show any radical change. At this depth we find the commencement of a very heavy disturbance in the measures. The rock showed plainly that very severe lateral pressure had been exerted, and at two points the dip was reversed for a distance of 15 to 30 feet. Between 560 feet and 580 feet depth, the measures were vertical, and at 595 feet they become regular again for a distance of 50 feet. At this point we ran into a shale, in which the rock was so broken up that the dip was lost. This was followed by 25 feet of vertical measures, which came down and rested upon the shale, running at its regular dip at a depth of 702 feet. From this the shale become harder and was very regular, with the dip tending toward the southeast. We then met with a well-defined layer of soft shale roof, resting directly on top of the Ford seam. In No. 2 Shaft the measures were harder, and lying about 45 degees dip. Instead of dipping southeast, as in No. 1 Shaft, the rock swung southwest. The slips were more clearly defined and of sharper throw, and it became apparent that we would meet coal much sooner than in No. 1 Shaft.

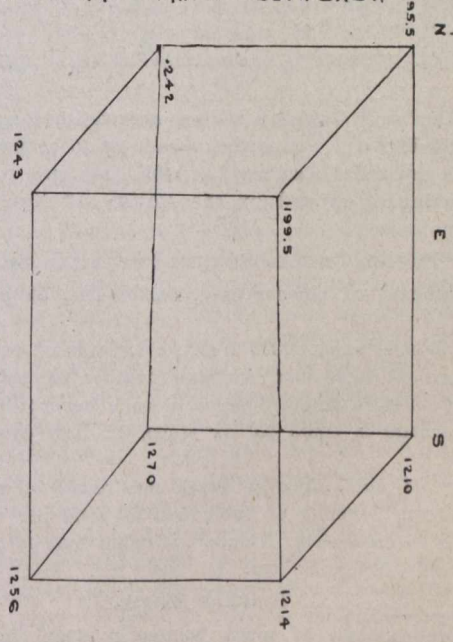
On May 19, 1905, the Ford seam was struck at a depth of 884 feet. The coal entered the northwest corner of the shaft, dipping 50 degrees southeast. The coal was only 6 inches thick on entering, and swelled to 7 feet on the south end. The overlying fault entered on the northwest corner and swung southeast across the shaft, dipping 90 degrees. No water was found with the coal. This is shown by the accompanying cross-section.

Underneath the coal the measures were badly faulted and slipped, and consisted of very tough sandstone, accompanied by several iron bands. As we were not unprepared for this trouble, it was decided to continue sinking to the Cape seam. Deep hitches were placed at the top and bottom of the seam, and work continued. The rock was hard and faulty and difficult to drill; but, on June 27th, coal was again struck at a depth of 977 feet, dipping 45 degrees. This seam showed the same characteristics as the Ford, being pinched to 2 feet in thickness on the north side. A point which greately puzzled us at times, however, was that the coal entered from the northeast side and swung southwest across the shaft; this being opposite from the upper seam, which swung southeast. On the south end of the shaft the coal measured ten feet in thickness, the bottom of the coal in the shaft being 1,005 feet. In order to provide sump room, sinking was continued to a depth of 1,016 feet, which completed No. 2 Shaft on July 17, 1905. Total time occupied in sinking this shaft was fourteen and a half months.

We will now return to Shaft No. 1, which we left at the top of the Ford seam, a depth of 1,195 feet 5 inches. The coal enters from the north side on a dip of 30 degrees, and the bottom of the seam swings southeast. The seam was tapped by the last bench holes on the north end, and it was 16 hours before the drills were again set up, ready to drill the sump. About one foot of coal had been shot out of the north bench; the drills soon reached coal, and the writer can remember some anxious moments, wondering whether we would find nothing but the remnants of the old Ford, as we had in No. 2. The drills fairly raced in the coal, and in one hour they had drilled 12 feet, all in coal. The next round was the same, and for ten days the sinking was carried down in this seam. By that time the anxiety was the other way. At one time as much as 35 feet of untimbered walls of solid coal was standing open to view. The writer believes it safe to say that it was a sight never likely to be seen again. Not a parting band or change of structure in the coal could be found from top to bottom of the seam. Heavy timbers were placed until the rock was reached, when deep hitches were put in. Below the coal there were eight feet of bone and splint, and this rested directly upon the rock. This proved to be different in character than any previously gone through. It was very hard and tough, and had no definite pitch and no limitation, but seemed to split equally in any direction.

PLAN OF THE FORD SEAM AS STRUCK IN No. 1 SHAFT.

THE COAL ENTERS FROM THE NORTH SIDE AT A DIP OF ABOUT 30 DEGREES AND THE BOTTOM OF THE SEAM SWINGS SLIGHTLY SOUTH EAST.

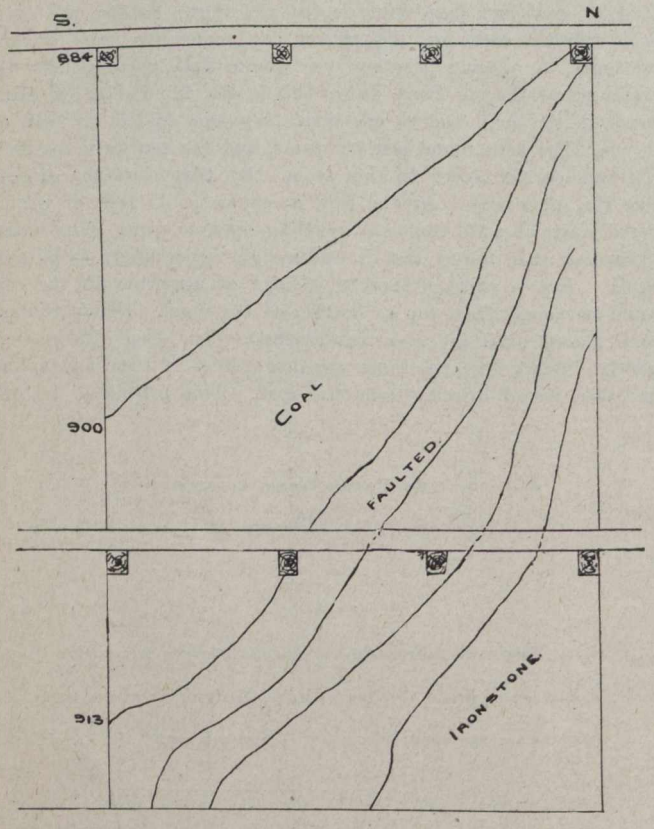


The finish was in sight, however, and it is noticeable that greater speed was made than in the softer measures.

On November 22, 1905, at a depth of 1.428 feet, the Cage seam was struck, with the measures practically flat and about on the axis of the basin. First was a well-defined band of ironstone, 1-2 inch thick, then came 3 feet of clay, 4 inches iron-

stone, 4 feet stone coal, and then the main seam of 22 feet of good coal. As the cross-section shows, the coal has a slight dip towards the east; but this turned out to be only a local condition. Work was continued for 50 feet, in order to get sump room. Rock was hard and lying flat.

CROSS SECTION OF FORD SEAM No 2 SHAFT. MAY 19. 1905.



On December 9, 1905, operations were finished in No. 1 Shaft. The guides in No. 1 compartment had yet to be put on, and this work was finished December 29, 1905, just two years from the first breaking of ground by the Mayors of New Glasgow and Stellarton.

POWDER USED IN SINKING THE ALLAN SHAFT.

Total amount of powder used, 36,950 lbs., 50 per cent. powder.

Total distance sunk, 2,520 feet. An average of powder per foot sunk equal to 14.66 lbs. Average number of holes per round equals 12 holes in sump, 6 holes in each bench; total, 24. The average charge is equal to six sticks 12 inch dynamite per 12 foot hole.

Number of cubic feet of muck per round of powder equals 48 cubic feet. Number of cubic feet of solid per round of powder equals 22 cubic feet. Number of cubic feet of muck per foot sunk equals 726 cubic feet.

TONNAGE RAISED.

The total amount of muck hoisted is equal to 83,790 tons, which meant 88,200 trips landed on deck, or an average of 211 trips per day of 24 hours. In addition to this, there was hoisted 18,315 tons of water, which is equal to an additional 66 hoists for 24 hours; making an average total hoisted out of the shafts of 277 buckets per day of 24 hours.

This makes a total weight hoisted out of the two shafts, of water and muck, amounting to 101,105 tons.

To mine and hoist this tonnage required 5,730 tons of coal, or one ton of coal is equal to mining and raising 17.64 tons per hour, equals 569 cubic feet.

So far as we have been able to find out, this sinking stands as a record, considering the size of shaft, amount of muck to be handled, and depth of sinking, also the timbering occasioned by heavy loss in the actual sinking time. In No. 1 Shaft 137, and in No. 2 Shaft 100 days were occupied in timbering alone.

In both shafts there were placed 476 sets of timber and 56 sets of hitches. In considering the data on the works by months, and the sinking per 24 hours, this loss of time from special timbering should be taken into account.

SHAFT NUMBER ONE.

Month.	Feet sunk.	Feet Timbered.	Buckets.	Total Depth.	Working Days.
May, 1904	47	47	400	47	21
June	48	26	1,681	95	26
July	72	49	2,907	167	26
August	94	62	2,647	261	27
September	69	128	2,269	330	25
October	85	71	3,373	415	24
November	59	47	2,564	474	25
December	52	75	2,006	526	25
January, 1905	53	54	2,198	579	20
February	72	59	2,625	651	24
March	74	84	2,826	725	27
April	77	64	2,949	802	25
May	68	73	2,720	870	27
June	55	68	2,205	925	23
August	128	100	4,014	1,110	27
September	113	146	3,919	1,223	26
October	126	105	3,966	1,349	26
November	132	137	3,947	1,481	26
December 11th	24	49	836	1,505	8
	1,505	1,503	52,436		475

Average buckets per foot, 34.8.
Average sinking, including timbering per working day, 3.17.

SHAFT NUMBER TWO.

Month.	Feet sunk.	Feet Timbered.	Buckets.	Total Depth.	Working Days.
May, 1904	62	40	1,102	62	26
June	70	79	2,448	132	26
July	83	62	3,241	215	26
August	102	56	3,390	317	27
September	43	113	1,885	360	25
October	93	82	2,839	453	24
November	70	55	2,604	523	26
December	77	65	2,477	600	26
January, 1905	36	54	1,929	636	19
February	62	73	2,165	698	23
March	86	67	3,098	784	27
April	57	74	2,099	841	21
May	68	83	2,808	909	27
June	84	60	2,914	993	26
Junly 17th	23	53	851	1,016	13
	1,016	1,016	35,850		362

Average buckets per foot, 35.2.
Average sinking, including timbering per working day, 2.81.

Amung the other uses of aluminium may be mentioned spools and bobbins for textile mill work, household and military utensils, parts of vibrating and reciprocating machines, equipments for railway cars, oil cups on locomotive driving shafts, pigment and foil to replace silver and tin, letter boxes, lithographic plates, alloys, in pyrotechny as a substitute for magnesium, in pattern-making to replace wood, acid carboys, cash checks, bicycle and motor car fittings, chains for hoisting, and jewelry.

Apart from the electrical industry, in which aluminium is gaining favor as a substitute for copper conductors for the transmission of light and power, there has been expansion in other directions. The steel industry is an important consumer of aluminium. Usually from two to five ounces of this metal are employed per ton of open-hearth steel made, and from six to eight ounces for Bessemer steel. The object in adding aluminium in the casting ladle is to reduce the slag or oxide formed while pouring the steel.

Never in the history of the abrasive industry has the time been more opportune for the development of corundum properties than at present.

Black sand obtained from the shallow ravines and gulches is generally the poorest, and when chiefly composed of magnetite and chromite, often practically worthless.

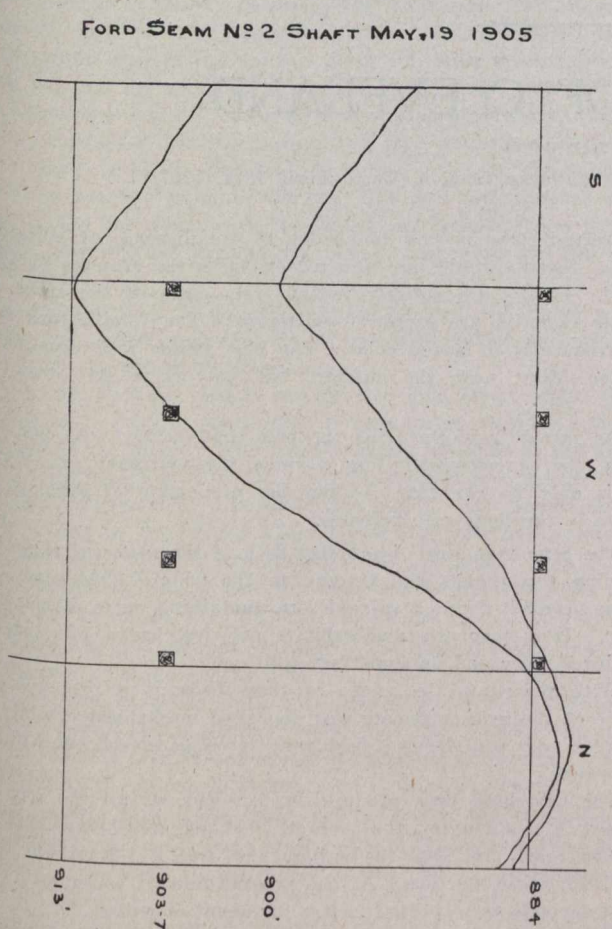
SOME PARADOXES OF MATTE SMELTING

DAVID H. BROWNE, Metallurgist of the Canadian Copper Company.

In working out the problems involved in smelting copper or copper nickel ores, some interesting principles are involved, which, in their practical application, appear to be paradoxes. A study of these shows the importance of looking below the surface of things to find the true relation of the facts involved.

One of the simplest and best-known paradoxes is that a chilled furnace does not alway need more fuel. Take an ore mixture on which the silica is calculated to produce a 33 per cent. silica slag; and suppose 12 per cent. fuel is all that is required to provide heat for the metallurgical reactions.

Suppose now some condition arises, such as a leaky spout. or a delay at the engines, or any minor accident, whereby the blast is cut off for half an hour. On starting the charge may move slowly, and the foreman with good intent may increase the coke, say to 15 per cent. After a few hours the cupola is delivering a wild irony matte low in copper, and a sticky siliceous slag. This slag runs slowly, forms side accretions in the furnace, and narrows



up the smelting zone. In a little while the furnace is delivering very little matte, and the fire has risen to the top of the charge. The furnace is cold below and hot on top. If it could be turned upside down it might shortly recover; but, as it is, the foreman reports it as "badly balled up."

Now what has happened to it? In the first place, there is passing into the cupola fixed amount of air each minute. The pressure of this may vary; but the volume is nearly constant. This air is primarily to oxidize sulphur and iron, secondarily to burn coke. A copper cupola is an oxidizing machine, and exactly reverses the conditions of an iron furnace. The business of the cupola is to send as much sulphur up the stack, and as much iron into the slag as it can economically. Coke has no function, except to produce heat. In fact, if we could furnish heat some other way than by using coke, we would be much better off. The amount of air blown in is always much more than the coke requires; so that the normal atmosphere of the cupola is intensely oxidizing.

Now when the blast stops, the coke in the furnace is still glowing. It absorbs oxygen from the roast ore. It forms CO, and this in turn reduces more of the oxides. The metallic iron formed immediately absorbs sulphur, and the charge gradually changes to a pasty mass of sulphides of iron and copper, and a residue or skeleton of siliceous rock or slag. On starting the furnace we have a lot of high iron matte and a very siliceous slag. The furnace chokes up; the charge cannot pass through, and the action ceases. More coke used at this point simply melts down the sulphide minerals unchanged, increases the silica in the slag, and in general makes a bad matter worse.

What this furnace really needed on starting was, not more fuel, but a few charges of an easily fusible basic mixture, such as couverter slag, or roast ore and limestone, or any material which is easy to meet and is deficient in silica. Such a charge carries the heat down to the hearth, fluxes off the siliceous accretions, and puts the furnace in good condition without any difficulty. Unfortunately, the average foreman at two o'clock in the morning seems to consider no expedient or remedy for a cold furnace except "a little extra coke."

Another paradox is that high silica in the slag often means that the charge needs more instead of less quartz. For example, a cupola is smelting roasted ore and carrying quartz enough to make a 40 per cent. copper matte and a 33 per cent. slica slag. Some poorly roasted ore comes in from the roast yard. The matte shows hot and irony, evidently low in copper, and the slag is siliceous. The foreman gets nervous; waits impatiently for the cent. matte and 36 per cent. slag. He takes off some quartz from next laboratory report, which confirms his fears and shows 30 per the charge, and waits for the furnace to improve. He was wrong. Why?

Here we must consider again the amount of air going into the furnace. This air weighs, say 4 tons to every ton of ore. It is enough under ordinary conditions to oxidize sufficient sulphur and iron to make the proper matte and slag. We strike a lot of high sulphur ore—we need more air, but the blowers are, as a rule, worked to their limit. We cannot blow in more air actually, but we can do so relatively. That is, we can slow the passage of the ore through the furnace, so that each ton of ore is exposed for a longer time than before to the oxidizing blast. This we can do either by decreasing the coke or by increasing the quartz. Either remedy, or both, may be used as local circumstances dictate. The addition of quartz delays the smelting, allows more thorough oxidization of sulphur and iron, and so brings up the grade of the matte, and by burning more iron into the slag actually lowers the percentage of silica in the slag. In this case the remedy is the old one—"a hair of the dog that bit it."

The intelligence of a cupola is at times almost human. A most interesting illustration is the action of a furnace when working pyritically. Here we have no coke to complicate matters. The blast oxidizes iron and sulphur, and the heat thereby generated melts the charge. Suppose such a furnace in proper order making a 40 per cent. silica slag and a 15 per cent. matte, and the amount of quartz in the charge be increased.

The furnace does not produce slag of higher silica content. It simply takes its time to digest this quartz. It burns more iron from the ore, combines this iron with the extra quartz, makes a little better grade of matte for the time, and produces slag of the same silica content as before. Nature can never be forced. All we can do is to find out the conditions under which certain

reactions occur, and, if possible, supply those conditions.

A nice illustration of this parsimony of nature is shown in the selection of siliceous fluxes. The case often happens, where a mine rock consist of natural bisilicates or trisilicates. The ore itself needs silica and we are aiming, for example, to make a mono-silicate slag. The most obvious thing to do would be to smelt these silicate rocks with the ore. On trial, however, it will usually be found cheaper to pick these high silicate minerals out and supply barren quartz in their stead; even where the mine rock carries considerable copper. These high silicate minerals do not readily split up and form new compounds in the cupola. They may meet and dissolve in the slag, but they do not do the desired work. Barren quartz is an active re-agent, while the higher silicate are acid salts which nature has already built up, at much expense of energy, and nature does not like to undo her own work.

Another curious observation in matte smelting is that high sulphur in the charge does not always mean high iron and low copper in the matte. The condition in which this sulphur exists makes a good deal of difference in its action. Thus, a badly roasted ore makes a lower grade matte than a mixture of well roasted ore and unroasted ore, even if this mixture be higher in sulphur. The badly roasted ore consists of a shell of oxides, enclosing a kernel of sulphides. This coating of oxides protects the ore till it gets down to the smelting zone, where it meuts all at once, and the molten sulphides run rapidly down to the hearth. A piece of green ore, surrounded by well roasted ore, is partially roasted in the upper part of the furnace, and when it gets to the smelting zone it has less sulphur than the badly roasted ore. The charge, consisting of a mixture of well roasted and raw ore, remains open and is well acted upon by the blast, where the badly roasted ore escapes action altogether.

These few instances show that in furnace practise we must consider the operation as a whole, and the furnace as an organism containing many parts, each co-related to the other. By the knowledge of underlying principles, we may often discard the evidence of individual analyses and consider a bad slag or low grade matte simply as a symptom of some deeper seated evil.

A matte furnace is not simply a hole surrounded by water jackets. It is a commercial laboratory, in which a great many different and conflicting analyses and syntheses are going on at the same time. The economic conduct of the work depends on our appreciation of this fact and our understanding of the relation of each part to the well-being of the whole.

THE IRONSTONES OF CLEVELAND

By Arthur E. Pratt, Student.

(A paper read before the Institution of Mining and Metallurgy, London, Eng., April 18th, 1907.)

Geology and Mining.—The Cleveland ironstone occurs in large beds in the Middle Lias formation of the North Riding of Yorkshire. The whole of the Middle Lias is more or less ferruginous, but the upper portion is the most productive. The beds cover a total area of about 350 square miles, but cannot be worked profitably for much more than one-fifth of that area. The beds worked extend inland from Redcar through Upleatham and Eston to Normandy, at which places the seam is thickest and best. To the northwest the bed thins rapidly, but to the southeast it thins very gradually, and dips gently about 1 in 15 in this direction. As the bed extends towards the southeast it becomes parted by bands of shale and pyrites. There is no shale band at Brotton, although there is a difference of color in the middle of the seam, but the stone is not affected in quality by it. The shale, however, appears in Kilton, to the south of Brotton, and Loftus, to the east, and develops to such an extent in the southwesterly direction that is 31 feet thick in the valley of the Esk. Where best developed the bed has a total thickness of more than 20 feet.

The upper seam is generally too silicous to be worth working, and practically the whole of the ore is obtained from the middle or main seam. The top seam of ironstone really belongs to the oolite and immediately underlies the freestone, coming between it and the alum shale of the Upper Lias. It was worked for several years at Port Mulgrave and elsewhere, and is still worked at Rosedale.

The average thickness of the main seam is about 10 feet at the northern part—in the neighborhood of Saltburn. Eastward from Saltburn it crops out at Gluntcliff about 300 feet above sea level, and can be traced along the cliffs overlooking the sea in many places, at Loftus, Boulby, and as far as Staithes. At Port Mulgrave it is about 70 feet below sea level. Inland the seam dips and the cover increases, the deepest pit being about 128 fathoms.

The ore is impure clay ironstone, consisting of carbonate of iron with clay, and calcium and magnesium carbonates, also containing about 1.5 per cent to 1.7 per cent. of phosphoric anhydride, or 0.65 per cent. to 0.74 per cent. of phosphorus.

In color the stone is either a greenish grey, such stone having an oolitic structure, or else bluish-grey, in which case it resembles a mudstone and is not oolitic. The characteristic color of the Cleveland stone is said to be due to the presence of silicate of iron. Some varieties are also red owing to the presence of ferric acid. Fossils are entirely absent from some of the stone, but other varieties are highly fossiliferous. The fossiliferous stone is frequently of a red color. The best fossils were obtained at Eston Mine, near the outcrop, but not where the stone was red.

As raised from the mine the ores contain 20 to 33 per cent. iron, the percentage falling towards the southeast (at Whitby it is only 25 per cent.), while the proportion of sulphur and shale in the lump ore increases.

The term "dogger" is applied both to the seams of shale containing ferruginous nodules and to the nodules themselves. In some places it forms a valuable ore, containing up to 50 per cent. iron. It is magnetic and exhibits polarity, has a greenish-blue or black color and an imperfect oolitic structure.

With regard to the origin of these beds, it is probable that some of the iron carbonate was deposited mechanically, while the greater part was formed chemically by replacement of a bed of limestone.

The Cleveland beds produce 40 per cent. of all the iron ore raised in this country, the average yield per acre being 20,000 to 50,000 tons. In 1903 the output was over 5 1-2 million tons; in 1906, 6,100,000 tons. At the present rate of consumption the best deposits are expected to last for about 50 years.

The ore is mined by a system of pillar-working with temporary pillars. Details and dimensions vary somewhat in different mines, but the following may be taken as a typical example.*

*See "Ore and Stone Mining," Sir C. Le Neve Foster and Bennet H. Brough, p. 334.

From the bottom of one of the shafts a "mainway" 5 yards wide is driven out level, or with only a slight incline. At intervals of 20 yards, drivages, also 5 yards wide, are put out at right angles to the mainway. These are known as "bords." At intervals of 30 yards along the bords, cross drivages are made, which are only 4 yards wide, and are known as "walls." Thus the bed is cut up into a series of pillars 30 yards by 20, while a considerable amount of ore has been removed in making the galleries. The pillars are now attacked, beginning with those near

the boundary and working towards the shaft. A "drift" of 2 to 4 yards in width is worked across the pillar from the bord, cutting off one-third.

From the drift this rectangular portion is removed by drivages, known as "lifts," either two or three in number. While these lifts are being worked away, another drift is driven across the remaining two-thirds of the pillar in preparation for another set of lifts. Sometimes a corner or portion of the side of a pillar is left standing during working to keep out the fallen rubbish beyond, or prevent a too sudden fall of roof. During removal of the ironstone the working place is timbered, but this is subsequently taken away and the roof allowed to fall in.

A very good example of a Cleveland ironstone mine is afforded by the Lumpsey Mine, near Brotton, the average output of which is 11,000 to 12,000 tons per week. The ore from here contains about 29 per cent. iron in the raw and 37 per cent. calcined, and is not of very good quality, but the mine has several interesting features which are worthy of notice.

The shaft is 96 fathoms in depth, and the strata passed through in putting it down were first beds of sandstone and shale, then alum shale, then jet shale, then grey shale with dogger, and finally ironstone. From the top of the alum shale to the bottom of the ironstone is about 240 feet. The main seam at Lumpsey is about 50 fathoms below sea level, and is 9 feet 6 inches thick. All the power used in the mine is electrical, with the exception of that required for winding, which is done by steam. There are three Lancashire boilers (one always acting as a stand-by), with Green's economizer for pre-heating the feed water The pressure of steam is 120 to 150 lbs. per square inch. In the engine house there are two separate engines, high and low pressure respectively, the low pressure engine taking the exhaust steam from the high pressure, and each engine being cranked to one end of th drum shaft.

A pleasing feature underground is the general cleanliness and freedom from water, and also the roomy levels, which one would expect from the nature of the seam.

1. *Gravity Inclines* used in one of the main levels where the stone has to be brought down hill. A rope passes round a pulley at the top of the incline. The full trucks are attached at the top, and by their weight pull up the empty ones from the bottom, the speed being regulated by a brake on the pulley. The line of rails is only double in the middle where the trucks pass one another. These self-acting inclines are worked with one rope, which runs backwards and forwards, and the end that lowers full tubs in one run brings up empties the next, and so on.

2. *Electrical Endless-rope Haulage.*—The outbye pulley (which is a clip pulley) is worked by a motor. The full tubs are pulled up on one line of rails, whilst the empties travel in on another, the rope passing round another pulley, the inbye pulley, at the far end. This is used in one of the main levels 1 1-4 miles long, and double track the whole length.

3. *Horse Haulage* is employed for conveying the stone from the working parts to the main levels. There are large stables underground, with stalls for 45 horses at one end of the mine and 30 at the other end.

4. *Electrical Direct Haulage.*—This is used in one of the levels at the dip side, which has a very steep gradient. The motor drives a drum through belt gearing, and on the drum is wound a single rope, by which full trucks are pulled up and then the empty ones let down. The motor is a direct current Westinghouse machine, 200 to 400 amperes, 220 volts, 200 horse-power, speed on full load 550 revolutions. The rails underground are provided at intervals with rotating axle-greasers for the trucks.

For drilling, both rotary, hand and electrical drills are employed. For blasting, gelignite and similar explosives were found to be unsuitable in action, pulverizing the stone without bringing it down, so compressed pellets of black powder, weighing about 2 ounces each, are used. Blasting gives about 2 tons per hole, and costs 1 1-2d. per ton of ore.

Underground surveying is done with the theodolite, as the miner's compass is affected by the doggers.

At the shaft head, the methods of dealing with the ore as it is wound are extremely up-to-date and almost entirely automatic. A full truck, on arriving at the pit head, is pushed out by a man on to an incline, down which it passes to a tippler. There the truck is emptied of its ore, which falls down a grizzley into a railway truck beneath—a branch of the Northeastern Line passes quite close to the mine; in fact, one walks along the rails from Brotton Station to the mine.

On leaving the tippler, the empty truck continues down an incline, and, passing automatic points, reaches a siding which is inclined upwards. At the end of the siding is a powerful spring, which serves to send the truck back again down the siding and past the automatic points. The truck now travels in the reverse direction and parallel to the way along which it came. After passing the points, the truck continues down a short incline until it meets a creep chain which takes it up on to a level, at the end of which it meets a stop. Three or four trucks may remain on this level until required.

On releasing the stop, the truck passes down an incline, past automatic points and past a catch, and travels some way up a second incline . On losing its momentum, it returns and is stopped by the catch, where it waits until required. The automatic points last mentioned are on the opposite side of the pit head to those previously mentioned, so that the truck is now going in the same direction as when it started and is returning to the cage. On releasing the catch, the truck passes down an incline and past points which are arranged to send it to the compartment of the shaft where the empty cage awaits it. The tippler has cog-wheels instead of friction wheels for turning, on account of the heavy weights, and it takes one truck at a time.

As the full truck (or "tub" as it is called locally) pushes the empty one out, the latter catches a lever which puts the tippler into gear. The tippler makes a revolution, and, in coming back to its place, puts itself out of gear again, while the truck just emptied remains in, ready to be pushed out by the next full one. The tippler is capable of dealing with 300 tons per hour.

The only manual labor required with this arrangement, beyond that involved in pulling levers to release catches, etc., is that of pushing the trucks out of the cage to start them on their journey.

Calcination.—Although gas-fired calciners using blast furnace gas are now being introduced, still by far the greater proportion of Cleveland ironstone is calcined in the Gjers or Cleveland kiln, or in modifications thereof. It is a matter of regret that drawings of some modern form of Cleveland kiln have not yet found their way into metallurgical text-books. The old form, discharging on to the ground, continues to be reproduced, together with the earliest type of Whitwell stove, as representative of British ironworks practice. Kilns of this description may still be seen in some of the older works. In one case, not only this early type of kiln, but also U-pipe stoves are to be seen, although it should be added that the works in question have the reputation of turning out some of the best pig iron in Cleveland.

The forms of kiln and the method of work at the Clarence Ironworks, Middlesbro', may be taken as typical examples of modern practice. In this works there are two distinct sets of blast furnaces, kilns, engine houses, etc., known respectively as the Old and New Sides.

On the Old Side the kilns are 16 in number, 15 of them being 37 feet high x 21 feet diameter, inside the lining, which is 18 inches thick. There is also one oval kiln 35 feet high x 35 feet, and 22 feet 6 inches diameter, lining 18 inches thick.

The round kilns have a capacity of 7,600 cubic feet. The gantry on the Old Side is supported by the outside shells of the kilns. The New Side kilns are higher. They are 14 in number, 12 being 21 feet diameter inside the lining (18 inches thick), and 44 feet high, and having a capacity of 10,400 cubic feet. One kiln is 19 feet 9 inches diameter inside the 18 inch lining x 43 feet 3 inches high, with 8,600 cubic feet capacity. This kiln is

drawn at one side only. There is also a rectangular kiln 20 feet 8 inches x 16 feet 10 1-2 inches x 44 feet, 18 inch lining, capacity 10,459 cubic feet.

The New Side kilns have the gantry supported by iron girder work, thus avoiding any strain on the kilns themselves. The burnt stone is drawn through 6 "eyes," or shoots, the lower ends of which are 3 feet 9 inches and 4 feet 6 inches above the ground level for the Old and New Sides respectively.

The cone in the Old Side kilns makes an angle of 55 degrees with the vertical centre line of the kiln.

On the New Side the cone is steeper, making an angle of 45 degrees, except in the case of 2 kilns which were altered to the old angle.

The varieties of ore calcined at the Clarence Works are obtained from the following mines, all owned by Messrs. Bell Bros.:

1. *Huntcliff.*—This ore contains much Fe_2O_3, which gives it its red color. It is also highly fossiliferous.

2. *Park Pit.*—Has the characteristic color of Cleveland ironstone, but is reddish in some parts. It contains much sulphur, both disseminated through the ore and occurring in black bands.

3. *Skeleton.*—Resembles Park Pit, but is somewhat paler. It contains sulphur and also considerable quantities of an oily shale, and weathers when exposed, the shale and sulphur bands breaking up and leaving the ironstone intact. Appreciably less fuel is required in the kiln when Lumpsey stone is calcined, owing to the oil which is present.

The coal used for calcination is obtained from pits in the neighborhood of Durham. After calcination the ore has lost 25—30 per cent. of its weight, and becomes a brick-red color owing to formation of Fe_2O_3. It is also softer.

The ore reaches the works in trains of 30 or more trucks, which are left on the sidings at the end of the gantry until required for tipping. The trucks used are hopper trucks known as "stripes," and hold 10 to 11 tons of ore.

The mode of working a shift at the kilns is as follows:—In the morning at six o'clock the kiln is about "six trucks down" (*i.e.*, it takes six trucks of stone to fill it), since it has been drawn continuously during the greater part of the night but not charged. The fire is well visible and should extend round the circumference and across the centre. The kilns are first coaled where required, the coaler only putting a shovel or two of coal in those places where the stone is "dead" or not fired properly.

Then four trucks of stone are tipped into each kiln, and the kilns again coaled, a thin layer of coal being shovelled all over the surface of the stone, just enough to cover it. Then two more trucks are tipped in each kiln and the kilns again coaled, more coal being put in those places that require it. This finishes the morning shift, and the evening shift is worked in a similar way. The shifts are from 6 a.m. to 2 p.m., or longer, for the morning, and from 4 p.m. to 12 midnight for the evening. The morning shift entails a greater amount of work, owing to the long interval between midnight and six o'clock, during which no charging has been done.

With regard to details of tipping the ore, the engine brings a small train of half a dozen or more trucks to the top end of the gantry and leaves them there. Owing to the incline of the gantry and the hand brakes on the trucks, the men can move the trucks and stop them over any kiln. In the bottom of the trucks are four drop doors held up by catches kept in place by pins.

When tipping, the pressure on the pins is released by a special iron implement and the pin withdrawn. Then the catch is forced back, and the ore drops through the doors into the kiln. More or less ore always remains in the ends of the truck, and this is dragged down by means of iron "hooks."

When the truck is cleared the drop doors are lifted up from the inside by inserting the end of the hook in a small hole, while a man outside replaces the pins. By releasing the brakes and removing the chock of wood from under the wheel, the truck is then readily pushed down the incline to make way for the next full one. Occasionally a truck of fine ore, known as "small stone," comes along for tipping. In this case half a truck is tipped into each kiln, two of the doors only being dropped.

In coaling, trucks of coal come on to the gantry only during the second coaling, *i.e.*, after tipping four trucks of stone into each kiln. Coal is then shovelled into the kilns by men standing in the trucks. The coal is in the form of slack. The men also make small heaps of coal on each side of the kiln and between the two sets of rails in the middle. It is from these heaps that the first and last coaling in the shift is done, the greater part of the coal consumed being shovelled on from the trucks during the middle coaling.

In drawing the kilns, two barrow loads at a time are drawn from each of the six eyes in rotation. Some of the kilns are oval or rectangular in plan, having three eyes together on each side. These are drawn in the same way, but the men prefer the round form to the oval for two reasons, viz.: They claim (1) that the round kilns work more regularly and use less coal, and (2) that they are easier to draw, as the eyes project and are not in a sort of recess. This enables the men to wheel their barrows straight up to them, and straight away again with a minimum amount of exertion.

The supply of ore and check on amount tipped are arranged for as follows: The gantry foreman sends an order each day for the ore he thinks he will require for his next shift to the office in Middlesbro,' whence it goes to the mines. At the mines the full trucks are weighed and the actual weight of ore is entered up in the invoice opposite the number of the truck. Each truck has spaces in which small cards can be slipped. These cards are printed with the number of the truck, the name of the mine, the name of Bell Bros., Clarence Works, etc., and space is provided for entering the weight of ore in the truck. The numbers are entered up in a book, so that the exact weight of ore tipped per shift is obtained. The same system is adopted for the coal.

With regard to the quantity of coal required for calcination, the amount given in text-books is usually 1 ton of coal for 20 to 25 tons of ore. The amount actually used in these works is 0.70 cwt. per ton of raw stone, or about 2 cwt. per ton of pig iron, which works out to 1 ton of coal for 21 to 29 tons of ore. This excellent result is possibly partly due to the oil shale which some of the ore contains, but may also be taken to be very largely due to good management of the kilns. It may be of interest to give a few brief notes on this subject.

1. *Practical Notes on Working the Cleveland Kiln.*—The stone should burn round the circumference and across the centre. As the stone is tipped into the middle of each semi-circle (looking at a plan of the kiln), this ensures that the burning takes place from outwards towards the centre. The fire may be kept in its proper place by judicious coaling.

2. The kiln should be drawn from each eye in rotation. If the men have not a smart foreman they will often draw continuously from the eye nearest the furnace hoist. This causes the fire to be drawn over to that side and is very liable to cause a scar, and also to cause "green" or unburned stone to come through the other eyes when they are drawn. One can see when the men have been drawing from one side only by noticing the line of fire, which should be across the centre of the kiln, is all on one side.

3. Too much small stone stops the draught and tends to cause scars. It is advisable that not much more than half a truck be tipped in each kiln per shift.

4. Scars are large masses of ore which have become fused together owing to excess of heat and are too large to be drawn through the eyes. They have to be broken up by prodding them with iron bars through the eyes. Large scars may give much trouble, first by sticking to the side and causing an irregular descent of material, with liability of green stone coming through, and, second, by stopping the working of the kiln altogether, in which case the fire has to be let out and the scar broken up from the inside. The chief causes of scars are (1) excessive or injudicious coaling, (2) irregular burning, caused by drawing from

one side only, or stoppage of draft by too much small stone, or by the presence of a small scar on the side wall. The effect of irregular burning is that green or unburned stone, together with its unburned coal, makes its way down one side of the kiln, and on reaching the bottom is fired from the other side, which is burning normally. This causes a sudden local increase of temperature, producing a scar.

5. In coaling the kilns, the "dirty" side (that towards which the wind is blowing) should be coaled first, so as to avoid the smoke and fumes when coaling the other side.

6. A new-lined kiln takes appreciably less coal than one with many cavities in the lining.

7. The kilns should be drawn regularly and with fair frequency. This ensures the fire being well down towards the bottom and of a good depth. When the kiln is drawn at long intervals, the fire works its way upwards, getting very shallow and leaving a great depth of burnt stone below it. When this stone is drawn, the fire generally goes out or becomes improperly distributed.

8. More coal is required for the kilns in winter than in summer, on account of the moisture. The average amount works out at 12 tons extra per day per 24 kilns.

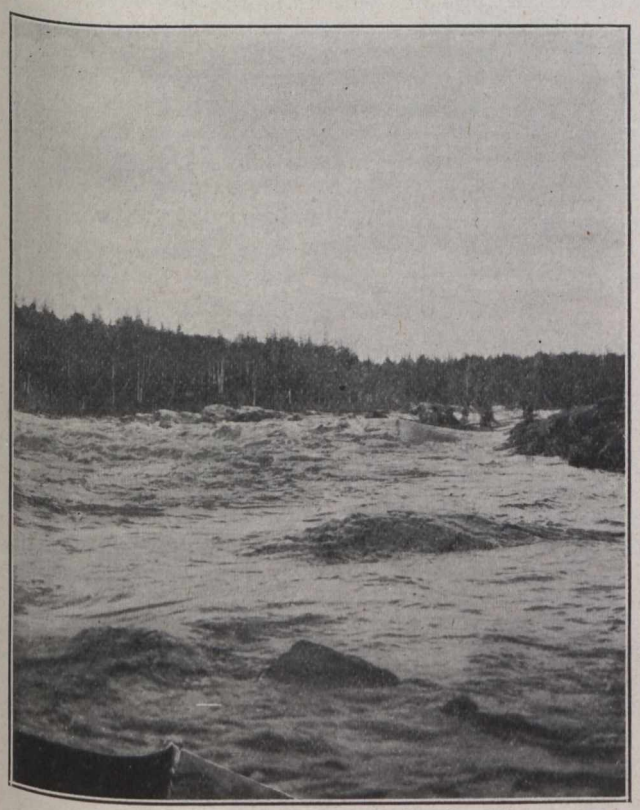
In conclusion, the author desires to express his appreciation of the ample facilities afforded by Messrs. Bell Bros., both to himself and other students of the Royal School of Mines, for obtaining at the Clarence Works a first-hand practical knowledge of blast furnace work. He is also greatly indebted to Mr. Greville Jones, of the Clarence Works, and Mr. D. W. Dixon, of the Lumpsey Mines, for their kindness in revising the proofs of this paper.

PROSPECTING IN UNGAVA

By J. C. Murray.

In the following article very free use has been made of Mr. A. P. Low's reports on the geology of the districts mentioned.

On June 1st, 1901, a party of nine white men and about twenty Indians embarked from Missanabie (a station on the C. P. R. 556 miles west of Ottawa) and started down the lake and river route for Moose Factory, Hudson Bay. On June 17th Moose Factory was reached. The journey had been somewhat trying. The writer was one of the crew of a large rowboat (18 feet over all),

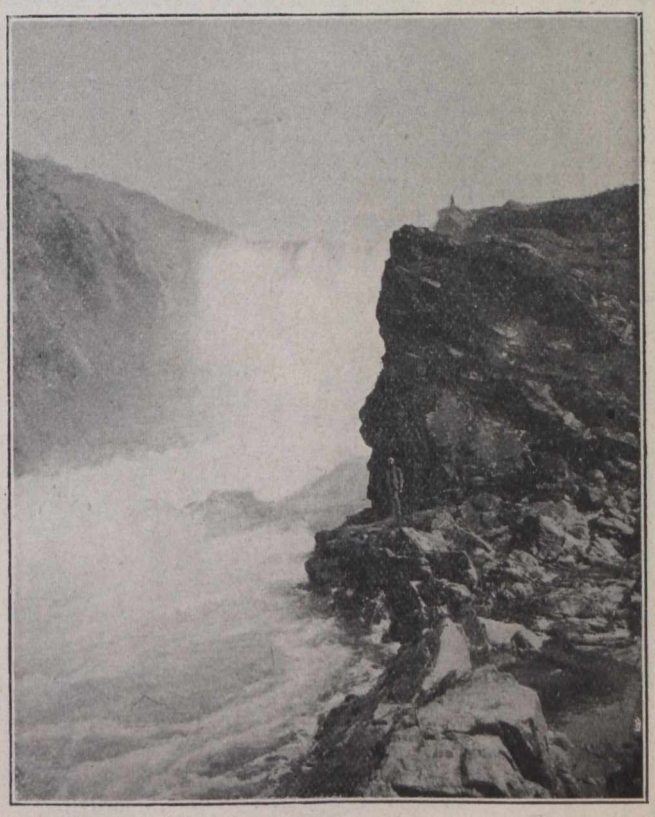


RAPIDS ON MOOSE RIVER

which had to be handled over portage and rapid and river for the long three hundred miles separating Moose Factory from Missanabie. Low water, piratical mosquitoes, malignant black flies, and lazy Indians, all did their best to contribute to our discomfort.

At Moose Factory the Indians were discharged. Four of the nine white men, headed by Mr. D. B. Dowling, of the Geological Survey of Canada, sailed up the west coast of James Bay for a summer's exploration. The remaining five, under the command of Mr. A. P. Low, who had been engaged by a private company to examine and locate mineral claims upon the Nastapoka Islands, left Moose Factory on the yawl-rigged 35-foot sailing yacht "Alle," on Monday, 24th June.

Touching at Charlton and Cape Hope Islands, we made Paint Hills Islands on June 29th. Heavy fog and a thunderstorm gave us a rather difficult run. Ice was encountered several times, and caused us much trouble. On Paint Hills Island a large deposit



NASTAPOKA FALLS

of iron pyrites was examined and staked out. Here also an Indian pilot was picked up, to guide us through the treacherous shoals lying between Paint Hills Bay and Fort George H. B. Post at the mouth of Big River. We made Fort George on July 2nd, in a full gale. The Fort is a consistent Hudson Bay Post, quaintly picturesque, with its stockades and Indian encampments grouped about the Factor's House. It is situated on an island at the mouth of Big River. It is of interest as marking the northerly

limit of land cultivation on the east coast of Hudson Bay. Potatoes and other vegetables are successfully grown here, and the Factor possesses a herd of cattle.

Cape Jones, the northern limit of the east shore of James Bay, loomed in sight on July 7th, and here we engaged three Eskimos, two of whom brought their families along with them. It was

Low cliffs of limestone mark the east side. This Cambrian limestone, overlain by ferriginous cherty beds, which are in turn capped with trap, constitute most of the island. Much iron carbonate was observed here.

With a favorable breeze we logged 57 knots on July 9th, and reached Great Whale River, where is the most northerly Hudson

Drawn for photolithography by O.E. Prud'homme.

To accompany Part D, Vol. XIII.

REPRODUCED FROM GEOLOGICAL SURVEY OF CANADA

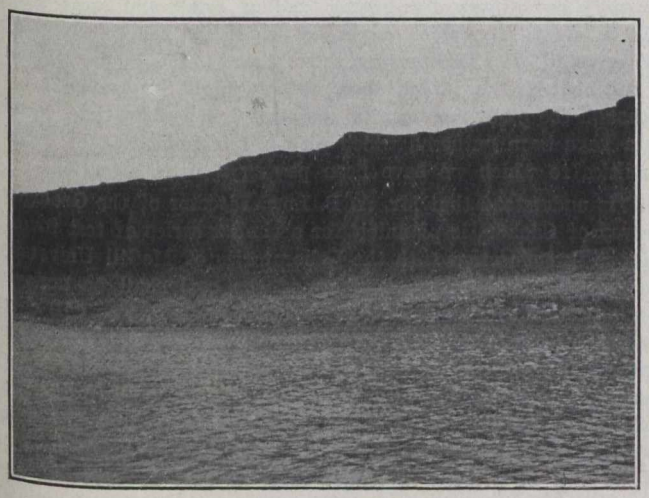
arranged that they should follow us in a sailing boat that had been chartered at Fort George.

Long Island was touched on July 9th. The Island is from one to three miles wide and about twenty-three miles long, and is distant from the mainland not more than five miles.

Bay Post on this shore. A striking change was observable in the appearance of the country in this run. Low, rounded hills of gneiss and granite can be seen a short distance inland. The shore itself is generally low and sandy, and rises in terraces to the granite hills.

Leaving Great Whale on July 11th, Little Whale River was reached during the evening of the same day. Thirty miles of this distance was made in Manitounuk Sound, between Manitounuk Islands and the mainland. Then, striking through a narrow channel between the islands, the remaining miles were run in the open.

Unaltered Cambrian sedimentary rocks, capped with diabase, form the coast from the northern extremity of Manitounuk



CLIFFS OF LIMESTONE AND SANDSTONE ON COTTER ISLAND

Sound northward to Little Whale River. This formation passes south into the Manitounuk Islands.

At Little Whale we found the ruins of an old Company Post. There are two well-defined trap overflows superimposed upon the sedimentary rocks here. The weathering of the under strata of sandstone and limestone has caused the fall of huge pieces of the basaltic trap. Galena, in small pockets, occurs throughout the limestone.

After a day's cruise, stress of weather and the loss of an anchor forced us into the entrance of Richmond Gulf. Almost exactly at this point the small scrub pines disappeared from the coast line, and beyond this no trees whatever were observed.

Iron ore occurs on the southern side of Richmond Gulf and continues north to the Nastapoka Islands.

We had now arrived at our real objective point, and systematic work was at once begun.

Commencing near the mouth of Little Whale River, the Nastapoka Islands extend northward for one hundred and twenty miles. They lie from one to three miles out from the mainland, and, with the exception of the most northerly, Cotter Island, are very close together.

The shoreward faces of the islands are precipitous cliffs, 100 to 350 feet in height, sloping with a dip of from 15 degrees to 5 degrees westward into the sea. Their general appearance roughly suggests an emergence of the edge of the basin which forms the bottom of Hudson Bay. The east shores afford safe anchorages for craft of all sizes; but on the mainland only at the mouths of Nastapoka and Langland Rivers can harbours be found.

The Islands are marked from summit to sea level with old terraces and beaches, evidences of profound uplifting towards the close of the glacial period.

In general, the Nastapoka Islands give a section in descending order, of the follow members:—

1. Rusty weathering, dark gray, siliceous rock containing ankerite and magnetite—20 to 100 feet.
2. Dark gray siliceous rock, containing magnetite with small quantities of ankerite—50 to 250 feet.
3. Red jaspilyte, rich in hematite ore—10 to 100 feet.
4. Red jaspilyte, poor in hematite ore—5 to 20 feet.
5. Purple, or greenish weathering, dark green, graywacké shales—10 to 70 feet.
6. Red jaspilyte, poor in hematite ore—5 feet.
7. Light greenish gray sandstone and shale—10 to 300 feet.
8. Fine grained dolomite—50 feet.

The rocks of the first division are found on all the islands except Cotter, the most northerly. These occur in thin beds, the partings being filled with brownish ankerite, which also occurs in flat lenticular masses enclosed in the cherts. These measures are traceable 150 miles south to Long Island.

The typical rock of the second measure is a dark gray, fine-grained variety of quartzite chert, containing considerable magnetite scattered through it in minute crystals, and small quantities of siderite and ankerite. The mixture of silica and magnetite in the ore is intimate, the silica being usually in a finely divided state. The proportions of rock vary. In some places a lean ferruginous chert is found, and in others a rich sixty per cent. iron ore. In the lower beds, large quantities of the richer ores are found. Similar occurrences in the Lake Superior region have been prescribed by Prof. Van Hise.

On the three southern islands, these measures gradually pass into a brownish-black siliceous shale, rich in iron, and containing considerable carbon and small flakes of graphite.

The typical rock of the third division is fine-grained and very siliceous, with minute particles of silica coated with red oxide of iron, forming a coarse, impure red jasper.

These jasper rocks usually occur in thin broken bands, with the partings between them filled with a finely-divided mixture of hematite, magnetite and jasper. The hematite is greatly in excess of the magnetite. The intimate association of the iron ores and the jasper points to their simultaneous deposition from aqueous solutions, probably leached from the cherty carbonate measures above. Where the ore is poor, the jaspery rock predominates and incloses lenses of hematite, while where the hematite is most plentiful it incloses similar lenses of jasper.

The fourth division, consisting of red jsapilytes, is an arbitrary one, of use only as a sub-division of the iron-bearing rocks.

The rocks of the fifth division differ from those of the rest of the section in that they are of volcanic origin.

GILLIES ISLAND—UPPER IRON BEDS

The dolomites forming the eighth and lowest division are only met with at the eastern point of Belanger Island, the last but one to the extreme south.

From a study made of the southern cliffs of Richmond Gulf, in 1988, by Mr. Low, it is inferred that the Nastapoka group of rocks, with their important iron-bearing measures, belong to the middle portion of the so-called Cambrian formation of the Peninsula of Labrador. Consequently, they are older than the rocks of the coast and underlie them.

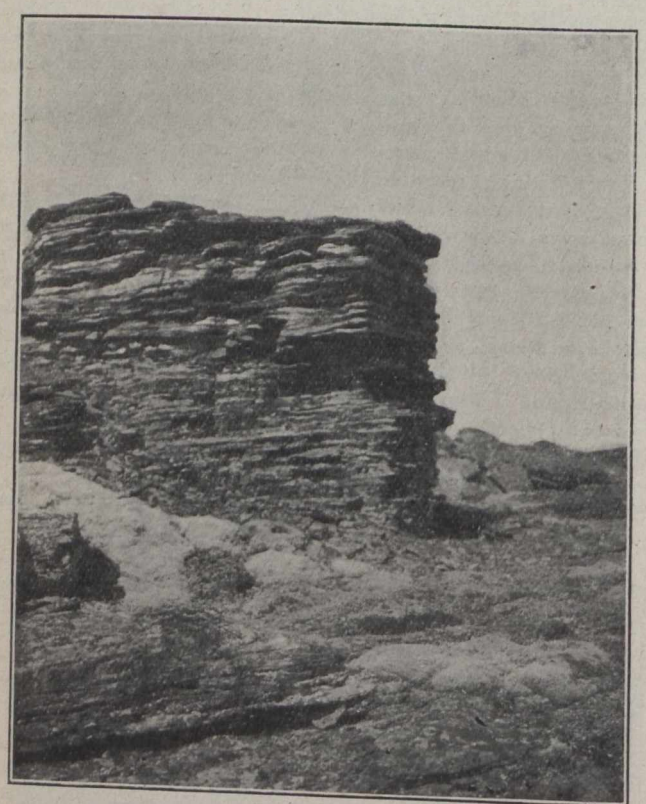
Large areas of similar unaltered sedimentary rocks occur throughout the Peninsula of Labrador, and are probably the

equivalents of certain of the iron-bearing series about Lake Superior and of those to the westward of Hudson Bay.

The southerly islands of the Nastapoka group are richer in iron ore than those towards the north. In Gillies Island (see map), the iron-bearing measures constitute at least four-fifths of its rock areas. At Taylor Island the iron-bearing rocks attain a maximum thickness of nearly 200 feet.

Towards the northern end of Davieau Island the dark gray cherts become thicker, especially in the upper rusty portion carrying ankerite, while the underlying jaspilyte contains less hematite and gradually thins out. The total amount of ore appears to be smaller and to be more evenly disseminated than in the southerly island, so that no part is rich enough for mining.

On the mainland, almost opposite Gordon Island, are the Falls of Nastapoka River. From a photograph only a very meagre idea can be obtained of their splendor. A high perpendicular wall of rock on the north side, and broken, massy crags on the other, form the banks of the river. At the falls the river leaps



WEATHERING EFFECT, NASTAPOKA ISLANDS

splendidly out and drops a sheer 100 feet. The water is shaken into the whitest foam ,but, as a contrast, pure deep green bands of unbroken water are visible behind the white of the foam. The stream then drops farther, down a constricted channel of solid rock, to tide-water. In all, there is a drop of about 170 feet. Almost incalculable power has been wasting itself here for ages.

Langland River, also, has not inconsiderable falls near its mouth. They are not, however, at all to be compared with Nastapoka. At both places, and at Nastapoka particularly, an enormous aggregate of industrial power could be developed.

There is little doubt that in due course of time, when concentrating and smelting methods shall have been improved, the iron deposits on many of these islands will be amenable to reduction upon a commercial scale.

(To be continued.)

Muscovite, the most common of the micas, is named from Muscovy, a part of Eastern Russia. The occurrence of this mica is confined, more or less, to pegmatite dikes, masses, lenses, sheets or veins, which in chaarcter may be called a very coarse granite.

COAL SAMPLING

(Paper read by Dr. J. E. Woodman before the Nova Scotia Mining Society.)

Recent plans of the Director of the Geological Survey of Canada lend especial interest to discussion upon two subjects—namely, the classification of coals and the relative efficiency of various methods of sampling coal.

A few years ago the United States Geological Survey began to carry out a plan for testing coal on small and large scales, and in every way which might be useful for the consumer and the investor. For this purpose they erected at St. Louis, Missouri, a testing plant in which these results might be reached; and, although the plant has been in operation but a short time, certain data have been gathered which give a fair indication of certain qualities to which we have been paying a little attention.

It is understood that Mr. A. P. Low, Director of the Geological Survey of Canada, is planning for a similar series of test investigations in connection with the Laboratories of McGill University. It is intended that the sampling of the coal shall be done by specially designated members of the Survey staff, who will cover the various collieries from the Eastern to the Western extremities of the continent. In addition to the ordinary chemical laboratory analyses and tests, it is intended to subject the coals to practical tests under boilers, and in every other way which will give valuable information regarding all of their fuel properties. The results will be printed in leaflet form as fast as obtained, and distributed quickly to those most interested in that particular coal. These will later be collected into pamphlets, and probably at the end a larger monograph will result. It is important to note that not only is a new departure being made in the type of work done by the Survey, but also in the rapidity with which the results bid fair to reach the public. The distribution of the summary report for 1906 within less than a month after the close of the year is an earnest of what is to come later.

It is an important question, under what conditions coal sampling can be done so as to give results most directly applicable for commercial purposes. I take it for granted that the chief value of sampling and analysing any economic raw material is the discovery of its commercial properties. For surely no merely academic interest would be responsible for the large amount of analytical work that has been done upon various substances. The sources of the material in coal sampling may be quite varied. In the first place, on may sample the coal in process of shipment, secondly, one may sample the coal at point of delivery, or thirdly, the coal may be sampled at the point of consumption, which is nearly the same. As contrasted with these localities, there are the mines and their surroundings. Should the coal be sampled underground, in the seam, or on the rakes or lifts at the bank head, or periodically at the storage piles; or should all of these localities be used in order to check one another? For metallurgical purposes, it seems clear that whatever sampling is done at the mine, there should be careful sampling at the point of discharge of the coal; since it is probable that only a part of the coal mined at any particular colliery will reach a certain metallurgical establishment, and, moreover, it is perfectly conceivable that the coal which is used at such establishment may not always have the same source. Thus we have the two facts to consider, namely, variability in the mine and variability of source of shipment. The present paper aims only to show the results of work done in connection with the United States Geological Survey testing plants at St. Louis, in order to see whether we may get some light upon possible methods to be used later in this country. It makes no claim to originality in any way, being essentially a resume of what has been published on the subject by the United States Geological Survey, and in the Am. Inst. Min., Eng.

In the St. Louis plant, coal was received for testing only in car load lots, and the cars were loaded under the immediate supervision of a member of the Government. As a check upon these results, two mine samples were collected from each colliery;

and these samples, as well as samples taken from each car when received at the testing plant, were analyzed in the chemical laboratory. The dominant idea throughout was that the mine sampling should be so done that the coal should have the same composition as the commercial output of the mine. Before sampling, the mine was examined, and all its peculiarities, or rather the peculiarities of the seam and surrounding rocks, carefully noted. Methods of mining were observed, and note was taken of whatever efforts were made commercially in the mine or at the bank head to free the coal from impurities. Two points were then selected for sampling in widely different parts of the mine, but always in parts then in process of excavation and shipment. After cleaning the floor, an oilcloth blanket was spread to catch the coal, to prevent it from being mixed with dirt, and to avoid absorption of moisture where the floor was wet. A cut was made clear across the face of the coal, about three inches wide and one inch deep. The material from this cut would include the thin partings of shale, clay, or sulphur, such as the loaders would not separate from the coal; but would not include anything that is usually thrown out by the miners. Such a sample, weighing 25 or 30 pounds, was placed in a sack and taken to the Survey, there to be pulverized and quartered. The final result would be about one quart of fine coal. This was placed in a screw top iron sampling case, the cover of which was bound with electric tape. These were mailed directly from the colliery to the laboratory, and the sample was then transferred to a glass jar and sealed.

After securing the sample underground, the inspector went to the surface to observe the loading of a test car. In this loading, such hand picking was allowed as was usually done in preparing coal for the market, and every care was taken to make the car a representative commercial sample. In the case of very soft coals and lignites, such as we have in abundance in our Western Provinces, box cars were used for transportation, in order to keep the coal from disintegrating in transit. Ordinarily, however, the bituminous as well as the anthracite coal was shipped in the usual open cars. As far as possible the shipping was done during the pleasanter seasons of the year. Thus all possible ordinary precautions have been taken to prevent a great change in the moisture contents of the coal between the pit bottom and the testing plant.

Upon arrival, the coal was unloaded and passed at once through rolls which had apertures of 1.5 inches. As the coal was fed to the rolls, samples were taken at regular intervals with a small shovel. Thus a practically continuous sample aggregating 200 or 300 pounds would be obtained from each car. This was taken directly to the chemical laboratory and analyzed. In the laboratory all samples were divided, and part stored in sealed glass jars for future reference. The remainder was subjected to practical analysis. The sample was air dried until it reached a practically constant weight and the loss of moisture was determined. The sample was then analyzed, and its composition was recalculated on the basis of the coal as it was originally received. The two mine samples were always averaged; and the percentages of moisture, sulphur and ash are considered as representing practically the impurities obtained in as careful mine sampling as could be devised. The car samples were also averaged; and the result is regarded as giving the amount of impurities obtained in the commercial conduct of the mine.

Results of these samples, which were taken from fifty mines in fourteen States. are as follows:—

Moisture: (1) Lignite and lignitic coals show higher moisture in the car samples than in the mine samples, but the difference is slight.

(2) Bituminous coals having more than 5 per cent, of moisture usually show less in the car samples than in the mine samples, the loss being about 1.5 per cent.

(3) Bituminous and semi-bituminous coals with less than 5 per cent. moisture usually show a gain in the car sample to the extent of 1.5 per cent.

So few tests were made upon anthracites that they are neglected here.

Sulphur.—The variation between the mine and the car samples is slight. The general average shows an increase in the car samples. This is probably due to more rigid exclusion of impurities in selecting the mine samples than miners ordinarily use in loading commercial coal. The amount of increase is .04, taking into account all the samples made. Hence, at least in the United States, it is probable that in mine sampling it is necessary to multiply the amount of sulphur by 1.04, in order to obtain the actual proportion of sulphur in the working output of the amount. When the percentage of sulphur is small, this increase may be disregarded; but when it is large, as in so many Nova Scotian coals, it becomes an important feature.

Ash.—The greatest and most constant variation is in the ash. Of the 50 analysis, 46 showed a larger percentage and four a smaller percentage in the car sample than in the mine sample. The evidence, then, is overwhelming that in commercial practise more impurity is left in the coal than in any ordinary sampling, or, to put it in other words, that sampling is done so carefully as really to misrepresent the commercial value of the coal. Some of the cars were loaded from run-of-mine coal and others with lump coal, and it was thought at first that this might be responsible for the increase in the percentage of ash. Careful tests, however, showed that this was not the cause. Naturally, also, a certain personal element enters into the question of this class of sampling as into any other; but it appears that, although the percentage of cases of ash obtained by each inspector was different, nevertheless in practically all cases there was an excess in the car sample.

The result of all these tests appeared to show that it is not usual for mine samples to correspond with the commercial output of the mine, and, furthermore, it showed that the personal element must be still further reduced to secure satisfaction. If one man were to do all the sampling, the relative values in the different cars would be correct; but this is practically never possible upon a large scale.

Proposed Method of Mine Sampling.

Quoted, with the exception of geographical references, from Campbell, M. R. Trans. A. I. M. E., XXXVI., 352-353.

1. Select a fresh face of coal, and clean it of all powder stains and other impurities.

2. Cut a channel perpendicularly across the face of the coal from roof to floor, with the exceptions noted in 3, of such a size as to yield at 5 lbs. of coal per foot of thickness of coal bed; that is, 5 lbs. coal for a bed 1 foot thick, 10 lbs. for a bed 2 feet thick, 20 lbs. for a bed 4 feet thick, etc.

3. All material encountered in such a cut should be included in the sample, except partings or binders of more than 0.25 in thickness, and except all lenses or concretions of sulphur or other impurities greater than 2 inches in maximum diameter and 0.5 inches in thickness.

4. The sample may be sent to the laboratory as it is cut, or it may at once be quartered down to about the size of a quart. If it is quartered down, it should be divided into quarters and opposite quarters rejected. The operation of mixing and quartering should be repeated until the desired size of sample is obtained. The operation of pulverizing and quartering should be done as rapidly as possible, so as to prevent a serious change in the moisture content, and then the sample should be sealed in either a glass jar or screw top can, bound with wire tape, and sent to the laboratory for analysis.

5. The analysis of such a sample will show the grade of coal that may be obtained by careful mining and picking. In the majority of cases the sulphur and ash in the commercial output of the mine will exceed the amount obtained from the sample, but this can be approximated by multiplying by certain coefficients. The co-efficients determined in the work of the Geological Survey coal-testing plant last year will not be strictly applic-

able, since the sampling was not done under this system; but they are approximately the same and can be used until more accurate co-efficients are determined. When sufficient data are at hand it seems possible that specific co-efficients may be determined for certain fields; that is, a co-efficient for the Sydney field, another co-efficient for the Western Cape Breton field, etc., and finally, co-efficients may be determined for local sub-divisions of the larger fields, or for certain beds of coal within those fields.

6. All descriptions of samples should state definitely how the samples were obtained, so that the reader may judge for himself the value of the results obtained; and when analyses are recalculated, the co-efficients of increase or decrease should be given, together with the authority for using this co-efficient or the data upon which it was determined.

Mine Pumping with Direct Connected Electrically Driven Turbine Pumps

By P. H. Moore, M.E.

(Paper read before the Nova Scotia Mining Society.)

Introduction.

Few problems in hydraulics present more interesting possibilities, and at the same time have been more universally neglected, than centrifual pumping.

The development of the centrifugal pump has been analogous to that of the steam turbine, and, although both were pioneers in their respective fields, both were almost entirely abandoned in favor of the reciprocating engine before having been exploited, the centrifugal pump because the principles of its action were not thoroughly understood, and the steam turbine engine because of mechanical difficulties in its construction.

As turbine pumping has been until the last few years absolutely unproven as regards practicability in mine pumping, my experiences with turbines in the Micmac Mines, Leipsigate district, Nova Scotia, may be of some practical service to engineers present.

Description.

The motor driven turbine pump is the exact converse of the waterwheel generator set, that is, instead of the turbine driving the generator, the motor drives the turbine. Both motor and turbine are set upon the same base, and are set as close together as the shaft coupling will permit. This makes a very compact and convenient outfit. In lowering such a pump into the mine, it is only necessary to disconnect the coupling, remove the motor and turbine from the base, and lower the pump in three pieces into the mine.

The only moving part of a single stage turbine pump is the hollow disc, or impeller, which is made of composition or cast iron, and is enclosed in an air-tight pump casing. This impeller has an opening at its axis for the suction, and numerous openings in its circumference for its discharge. Inside the hollow disc, or impeller, are a series of curved spokes or vanes, which serve as partitions between the openings in the circumference. These vanes are placed in the same manner that guide veins are placed in a reaction turbine waterwheel, and are curved so as to form tangential expanding ducts, from which the water emerges at about the velocity existing in the discharge chamber of the pump. The water enters the impeller axially, and issues radially.

Without going into further details as to the numerous designs employed in turbine pumps, I may say that modern ingenuity has so designed high head turbines that there is practically no drag or friction between the periphery of the rapidly revolving impeller and the water in the discharge chamber.

Principle Involved.

The principle of centrifugal force is employed the same in high head turbines as it is in the old-fashioned, low head centrifugal pump, although the mechanical construction is improved to suit the work for which it is built.

A single stage turbine may be designed in such shape and driven in such speed that it may pump against a head of from 50 to 150 feet, with wide variations. Wherever it has been necessary to pump against extremely high heads, the practice until the past few years has been to have the discharge of one turbine led by a pipe directly into the suction of another, and so on, thus multiplying the lifting capacity by multiplying the pumps until the required head was reached. The modern practice, however, has taken advantage of the convenient size and shape of the turbine in a very economical manner. The multi-stage turbine of to-day has a series of impellers mounted upon the same shaft, and all enclosed in the same case, and are arranged in such a way that the speed of the water may be multiplied in proportion to the number of impellers used. The capacity of such a pump is only limited by the number of impellers, and the amount of power necessary to drive them.

Such a pump is to-day pumping water against heads as high as 2,000 feet, and doing it with remarkable economy.

Micmac Pumps.

In the Micmac Mine we have a three-stage, three-inch turbine station pump, with a capacity of 230 gallons per minute against a 300 foot head, driven by a 30 horse-power direct current motor; and a three-stage, two-inch vertical turbine sinking pump of 100 gallons per minute capacity against a 250 foot head, driven by a 10 horse-power direct current motor.

The speed of both the above pumps is controlled by a variable speed resistance coil. The ordinary speed of both pumps is about 1,150 revolutions per minute. The station pump has a three inch discharge pipe and a three inch suction.

Starting the Pump.

There are some peculiar features about starting and running a turbine pump that may be of interest to such of you as have had your troubles with pumps of other descriptions. To start our turbine pump, we first drain all the water out of the discharge pipe through a bipass, leaving the pump and suction full of water. We have a gate valve in our discharge pipe close to the pump. This we close as soon as the pump is primed. We then start our motor with an auto release starter, and get it running up to full speed, still keeping the gate valve in the discharge pipe tightly closed. When the motor is up to speed, we gradually open the discharge pipe until the gate valve is wide open. By that time the pump is throwing at its full capacity. You all know what would happen if we undertook to close the gate valve in a discharge pipe on an ordinary steam or jack head pump while the pump is running, or started the pump with such valve closed when the pump was full of water. At any time while the turbine pump is running we can close the gate valve in the discharge pipe, or the gate valve in the suction, or both, and do the pump no harm in any way. After running a few minutes with the discharge closed, the water in the pump gets hot. I never experimented to see just how hot the water would get if left running any length of time, as it might be an expensive experiment.

The amount of water that a turbine pump throws can be controlled either by the gate valve in the discharge pipe or the gate valve in the suction. The pump will only take power proportionately to the amount of water it is throwing, which is a great convenience in mine pumping.

In case the current is cut off on deck, the auto release starter flies back and the power is automatically shut off from the pump, and it cannot be started again except by the proper manipulation of the auto release starter. This auto release starter pre-

cludes any possibility of the motor being started under full current from the deck.

I wish to particularly call the attention of pump men present to the fact that the Micmac pump is pumping 230 gallons of water per minute against a 300 foot head, through a three inch pipe. There is not another style of pump in existence that will throw that amount of water through so small a pipe and work at anywhere near its economic efficiency.

This turbine takes up about one-third the room of a reciprocating pump of equal capacity, and the cost, including the motor for driving, is only about one-half. The pump runs with practically no noise, the low hum of the motor being hardly noticed. There is no vibration in the discharge pipe, and the flow of water is perfectly steady, there being no throbbing or pulsations in the stream discharged, the water being driven through the pipe at a tremendous speed.

The turbine sinking pump is started in exactly the same way as the station pump. A description of this turbine pump may be interesting. Where the station pump is set upon a horizontal base, and the pump and motor run upon a horizontal axis, the turbine sinker is arranged to run vertically, the motor above the turbine. This vertical sinking pump is arranged in a cast iron water-tight housing, so that in case the shaft fills up with water the pump will run submerged as well as it will out of water. There is a pipe connection in this cast iron housing that a small air pipe may be connected, if necessary, to facilitate the introduction of compressed air into the jacket, and thus keep out all moisture that may accumulate from the sweating of the cast iron while the pump is under water. We have never had our turbine pump submerged long enough to make it necessary to use compressed air. With compressed air the pump may be used submerged for long periods of time.

The only objection to a direct current motor in a sub-aquatic pump of this description is that we are obliged to attend to the brushes and commutator through hand holes cut in the cast iron casing. An induction motor with an alternating current makes a better outfit, and this is the current we are preparing to use in our new electrical installation.

Our sinking pump is throwing 100 gallons of water per minute against a 250 foot head through a two inch pipe. The suction is of the same size as the discharge pipe, owing to the fact that the water is picked up at the same speed that it is thrown out.

Method of Using the Turbine Sinker.

The convenient size and shape, and lack of moving parts make the turbine sinker ideal as a sinking pump. Our sinking pump is hung by chains from differential pulley blocks in any position in the shaft that may be convenient. All pump men know that in using a steam sinker it is necessary to get the pump in such a position that you can connect at least two lines of pipe to it, and sometimes three when the exhaust is carried to the deck, or to some other part of the mine. With a turbine sinker, you have only one line of pipe to connect to your pump.

In order to make our sinking pump more flexible, we use an ordinary rubber fire hose, one end of which is connected to the discharge of the pump, and the other end to the discharge pipe. This gives the pump a chance to be left in any position convenient, and the pump may be lowered without stopping it and without losing its water, and no care need be taken that it is in any particular position. In pumping out a shaft, this style of pump is invaluable, as there is no time lost in pumping while lowering the pump. Owing to its sub-aquatic qualities, we can lower it as far down into the water as the length of the discharge hose will permit. There being no vibration to the pump, a discharge hose will last as long as an iron pipe.

The only objection we have ever found in using our turbine pump, is that in case the turbine loses its water owing to the necessity of moving the discharge hose while the men are working in the bottom, it is necessary to drain the discharge pipe before starting the pump and getting it to take its water again. We have found that gritty water, and any gravel that it large enough to go through the strainer of the suction hose, is handled without injury to the pump.

The small flexible cable that is necessary to carry the current to the pump is covered with a waterproof covering, and has given us no trouble whatsoever.

The auto release starter and variable speed coil are kept in a wooden box at any distance above the pump that is convenient.

Owing to the remarkable fact of having perfect control, by means of the gate valve in the suction or discharge, of the amount of water pumped, the men sinking very learned to adjust the discharge of the pump to the amount of water that the shaft was making, and consequently we have had but little trouble with the sinking pump losing its water.

In case of unexpected springs of water being encountered, the variable speed resistance coil makes it possible to turn the motor up several hundred revolutions per minute above its ordinary speed, so that for some hours a turbine is capable of pumping at least a third over its rated capacity without injury to the motor.

Turbines Compared with Steam and Jack Head Pumps.

We have been running the two turbine pumps mentioned for over a year, and have generated our power to run them in our own shaft house, by driving a 35 killowatt generator with a 75 horse-power engine. We have run a certain number of steam pumps all the time during this year, and have had a splendid chance to compare steam and air pumping with electric turbine pumping.

Where the theoretical power required for a steam pump is about one-third of that actually required by an electrical turbine pump, the enormous losses in steam power through condensation and leaks, the friction in the pump, the numerous delays from breakdowns, the innumerable expenses of packing, oil and attendance, with the nuisances caused by noise and exhaust, more than balance the theoretical power saving in using steam reciprocating pumps over steam generated electrical power for running turbine pumps.

Undoubtedly the old jack head pump run by a Corliss engine is very economical, so far as power is concerned, in mines that have fairly straight shafts, and are not at any great depth, and where there is only a small amount of water to pump, but in deep mines, with large amounts of water to be considered, with more or less irregularity in the dip of the shaft, and where economy in space is to be considered, the turbine pump has proved to be as far ahead of the old jack head pump as the jack head pump is ahead of carrying water in a bucket.

A reciprocating steam pump has innumerable parts that have to be removed and constantly attended. The expenses for packing, and oil, for machines of this description is enormous, compared with turbines. The numerous lines of pipe need continual attendance, and most careful installation; the frictional losses are enormous; the wear and tear of a steam pump in a mine is heart-breaking; the noise is a nuisance; the room it takes up is inconvenient, and the first cost is nearly twice that of a turbine.

In a motor driven turbine there are no valves to pack, no guards or springs, no reciprocating parts, and, most important of all, there is not a contact surface in the entire machine except the shaft and its bearings. The design is such that parts subjected to the action of mine water may be made of acid-resisting metal, and when desired lead-lined pumps can be obtained. The space occupied is less than one-third of that of a reciprocating pump of that capacity. The discharge pipe is much smaller, and there is only one line of pipe. Since there are no rubbing surfaces exposed to the water, the pump will run for years without renewal or repairs, and it will pump anything from thick mud to the cleanest water without injury. In case of accident, the parts are so few, and the construction so simple, that any parts of the machine can be replaced in less than an hour. The cost of attendance is reduced to the minimum, since the only necessary attendance is to see that the pumps and motor are properly lubricated.

Our turbine pump uses about one pint of motor oil in sixty days. All the bearings work in oil, and there is no drip and no waste. The oil is literally worn out.

CONCLUSION.

Our turbine pump in the Micmac Mine has cost just $2.64 for new brushes in the thirteen months that it has been running incessantly. This is the only renewal that has been made on the pump.

With this experience to base my opinion on, I may say that I am convinced that even with steam generated electrical power, a motor driven turbine pump will pump more dirty, gritty water against a high head with less expense per gallon pumped than any other pump ever before invented.

MINERAL PRODUCTION OF BRITISH COLUMBIA

The following information concerning mineral production of British Columbia was given by Mr. E. Jacobs, editor of "The British Columbia Mining Record," in the course of his remarks on this subject at the recenty-held annual meeting of the Canadian Mining Institute:—

British Columbia's total mineral production to the end of 1905 is shown in official publications to have been in value nearly $249,000,000. Adding that for 1906, estimated at rather more than $26,000,000, a grand total to the end of 1906 of, approximately, $275,000,000 is obtained. This production was apportioned in round figures as follows:—

Placer gold—		
Lode metals		$ 58,700,000
Gold	$41,500,000	
Silver	25,900,000	
Lead	17,700,000	
Copper	36,000,000	
Iron and zinc	200,000	
		121,300,000
Total metalliferous		$191,000,000
Coal and Coke—		
Coal	$73,000,000	
Coke	6,500,000	
	$79,500,000	
Building materials, etc	5,500,000	
Total non-metalliferous		85,000,000
Grand total		$275,000,000

Reviewing several periods, its is seen that from the commencement of mining operations in the Province to the end of 1886, the total value of production was $64,246,000, in the following proportions: Placer gold, $53,797,000; coal, $10,449,000. In the ten years, 1887-1896, a total of $37,809,000 was produced, consisting of placer gold, $5,006,000; lode metals, $8,126,000, coal and coke, $23,537,000, and buildings materials, etc., $1,140,000. For the ten years, 1897-1906, the total was $173,000,000, comprising placer gold, $9,889,000; lode metals, $113,299,000; coal and coke, $45,441,000, and building materials, etc., $4,371,000.

Recapitulating, the production of the respective periods above mentioned was as follows:—

To end of 1886	$ 64,246,000
Ten years, 1887-1896	37,809,000
Ten years, 1897-1906	176,000,000
Total production, all years	$275,000,000

The progress of British Columbia's mining industry is further indicated in the following summary:—

COAL AND COKE.

Coal mining appears to have been commenced in 1836, but production must have been small during 30 years to 1865, inclusive, official records showing a total value for the whole of that period of only $666,288. It was not until 1884 that the total for any single year reached $1,000,000, the recorded value for that year having been $1,182,210. As already shown, the total value to the end of 1886 was $10,449,000. During the next period, 1887-1906, the production of $23,537,000 included $7,825 for coke, the manufacture of which was commenced at Union, Vancouver Island, in 1895. Of the total of $45,441,000 for coal and coke during the period 1897-1906, the production of the latter was $6,565,000, chiefly from the collieries of the Crow's Nest Pass Coal Company, at which coke-making was begun in 1898.

PLACER GOLD.

The production of placer gold dates back to 1858, in which year a total value of $705,000 was recovered. The maximum production in any one year was that of 1863, with a value of $3,914,000, followed the next year by a total of $3,736,000. This was when placer mining was at its best in the Cariboo district. In the seventies there was a gradual reduction, while through the eighties the decrease was more marked ,continuing into the early nineties. The minimum yearly total was reached in 1893, the production for that year having been only $356,000. Thenceforward there was a steady increase. The yearly average total recovery during ten years, 1897-1906, was about $988,900. The total production during 49 years has been in round figures:—

In nine years, 1858-1866	$23,675,000
In ten years, 1867-1876	19,790,000
In ten years, 1877-1886	10,340,000
In ten years, 1887-1896	5,006,000
In ten years, 1897-1906	9,889,000
Total	$68,700,000

LODE METALS.

The tables of production of lode mines, published in the "Annual Report of the Minister of Mines for British Columbia," show that a commencement was made in 1887, in which year silver and lead to a total value of $26,500 was produced. The first official record of lode gold was a value of $23,400 for the year 1893, and of copper $16,200 for 1894.

Gold.—Out of a total of about $41,500,000 of lode gold, not quite $2,200,000 was produced during four years, 1893-1896, and yearly production during five years, 1902-1906, has been $4,878,000. In 1906 a total exceeding $5,000,000 was reached, and it is expected that henceforward there will be an annual increase over that amount.

Silver.—Production of silver during ten years, 1887-1896, totalled $4,028,000, of which $2,100,000 was produced in 1896. The yearly average value during the ten years, 1896-906, was $2,187,200, with a maximum of $3,273,000 in 1897 and a minimum of $1,521,000 in 1903.

Lead.—The production of lead was small during the period 1887-1896, having totalled only $1,581,101. During the following ten years an average yearly output of $1,556,706 was maintained, with a maximum value of $2,691,887 in 1900, and a minimum of $689,744 in 1903.

Copper.—No copper was produced until 1894, in which year a beginning was made, with an ouput valued at $16,234. For the three years 1894-6, a total of $254,802 is recorded. Thereafter the average yearly production for ten years was $3,569,321. The output of 1906, estimated at $8,690,000, was by for the highest for any year since production was begun.

PRODUCTION OF 1906.

Turning now to the production of 1906, which was a record year in the history of mining in British Columbia, it is especially noteworthy that this single year's production, estimated at $26,390,000, was not very far short of one-tenth of the total for all years to date (one-tenth would be $27,500,000). While the high prices of silver, lead and copper contributed in large measure to the considerable increase in value of the year's production over that of any other year, there was also an enlarged output of lode gold, silver, copper, coal, and building materials. Copper especially made a substantial gain in quantity—about 7,300,000 lbs. more than was prdouced in 1905. Coal also showed an appreciably large increase over the production of 1905, while the output, estimated at 1,530,000 tons, was the biggest tonnage reached in any single year.

The causes for a decrease in 1906 as compared with 1905 in the production of placer gold, lead, zinc, and coke, respectively, were temporary, and the reasonable expectation is that they will not similarly affect the production of those metals in 1907.

As exhibiting the importance of mining in comparison with other staple industries of British Columbia, the following estimate of production in 1906, made by "The Victoria Colonist," at the close of that year, is submitted:—

Lumbering	$ 9,500,000
Agriculture	8,000,000
Fisheries	8,000,000
Together	$25,500,000
Minerals	26,350,000
Manufactures	11,000,000
Total	$62,850,000

It will be seen that the estimated total value of the mineral production exceeded that of the products of lumbering, agriculture and fisheries combined. While this is a decidedly creditable showing for the mining industry of the Province to have made, the immediate outlook is that when the time shall come for a corresponding comparison for 1907 to be made, the mineral production for that year will be found to have reached a still more favorable relative position.

In general, the auriferous black sands of California may be described as consisting of hard minerals ranging in specific gravity from 3 to 7, mingled with small percentages of metals and metallic minerals reaching from 7 to 20 in specific gravity. Most of the value will be found in the sand below one-eight inch diameter.

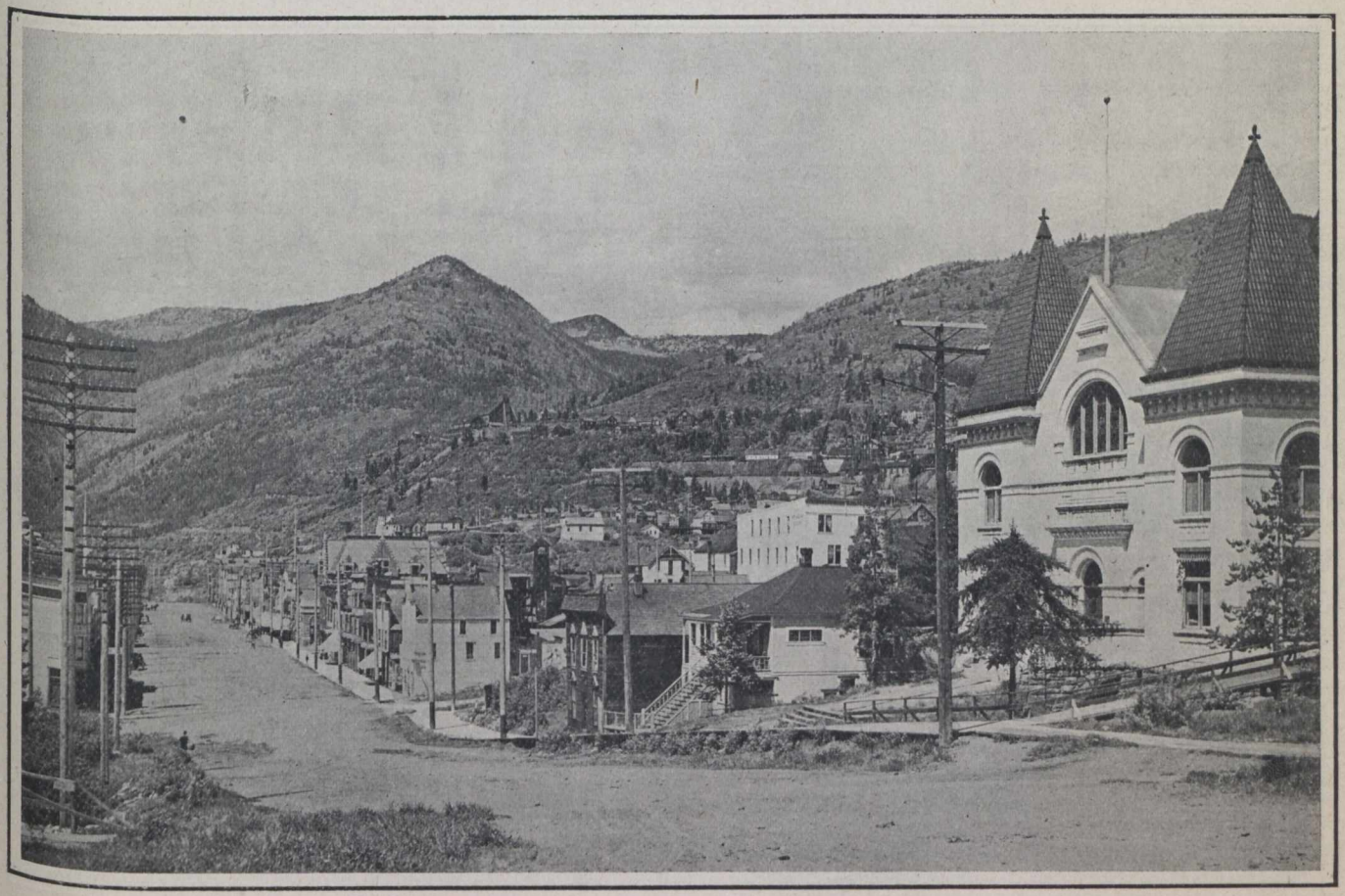
As to the relative value of disseminated and vein graphite, it is held by a Canadian authority, Mr. H. P. H. Brumell, that the advantage lies with the former variety by reason of its uniform character and continuity of deposits.

THE CONSOLIDATED MINING AND SMELTING CO. OF CANADA, LIMITED, ROSSLAND, B.C.

GEO. A. OHREN.

The advent of the Consolidated Mining & Smelting Company of Canada, Limited, into Rossland camp has been an important step towards establishing a prosperous future for this district. The first move in the formation of this country, the consolidating of the War Eagle and Centre Star interests, in the latter part of 1906, was made at a time when mining affairs looked glum, indeed, for the low grade properties of Rossland. It was the general understanding, from reports made by prominent mining men, that there was practically no ore in sight in the mines on Red Mountain, and that the future outlook for these (now prosperous) properties was not assuring by any means.

The amalgamation of the Centre Star and War Eagle holdings



COLUMBIA AVE., ROSSLAND
Consolidated Properties in Red Mountain to Right of Photo. Le Roi Headworks also to right.

being completed, the promoters absorbed the interests of the St. Eugene Mining Company at Moyie, B.C., controlling Canada's premier lead-silver mine, and those of the Rossland Power Company and the Canadian Smelting Works, at Trail, B.C., six miles, as the crow flies, from Rossland; the latter concern being one of the most up-to-date copper smelters and lead and silver refining plants in the West.

One laudable feature of the consolidation was the straining off of a considerable quantity of "water" from the capital of the combined interests over five million dollars having been written off the former capitalization.

The company was capitalized on the following basis:—

St. Eugene Mining Company—Old value, $3,500.00; new value, $2,333,300.00.

Centre Star Mining Company—Old value (estimated cost), $4,666,667.00; new value, $1,555,500.00;.

Trail Smelter—Old value, $1,500,000.00; new value, $750,000.00.

Rossland Power Company—Old value, $600,000.00; new value, $60,000.00.

Total old value, $10,266,667.00. Total new value, $4,698,800.00.

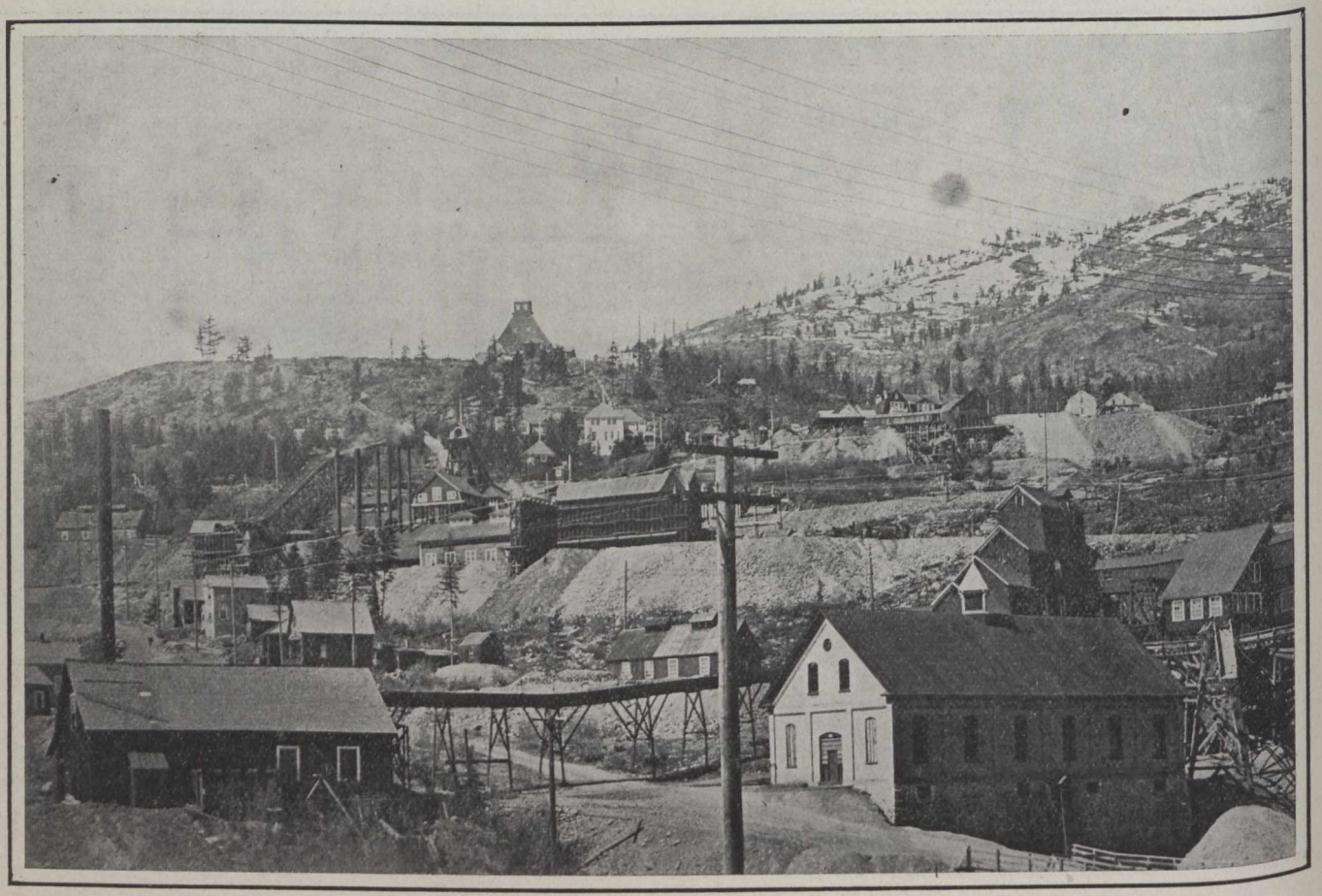
The Consolidated Company has just completed negotiations for the Idaho and Enterprise properties, adjacent to the Centre Star, in this camp. The completion of this transaction gives the Consolidated control over the following group of very valuable mineral claims, which adjoin one another and can be worked on an economical basis: Centre Star, War Eagle, Iron Mask, Idaho, Enterprise, Mugwump, Pilgrim, Monita and Red Mountain. These claims represent the consolidation of five different mining companies' interests, as the Centre Star, War Eagle, Iron Mask, Mugwump and Red Mountain were at one time owned and controlled by five different companies, from whom the Consolidated subsequently acquired them.

Under the direction of Mr. R. H. Stewart, mines manager, more ore has been opened up in the properties and blocked out than ever before in the history of the mines, and there is no doubt but that the Consolidated Company will enjoy a prosperous life for many years to come.

A hundred and one facilities and improvements have been made in the mine and surface workings during the last few months. A large amount of development work and thousands of feet of diamond drill prospecting have been carried on in the mines; new and more commodious buildings have been erected on top; they have installed their own rock crusher and automatic sampler, now doing this work at the mines that previously was done at the smelter, with more or less inconvenience to all concerned. They have greatly augmented their air compressing plant, and at the present time are installing three electric locomotives, for hauling ore underground, and a one thousand horse-power steam hoisting plant. This engine will lift a load of ten tons, including the skip and the heavy 1 1-4 inch cable, at the rate of two thousand feet per minute, and when the installation of this collosal hoist and their air compressing, electrical and other machinery now being put up is completed, many more men will be put to work in and about the mines and shipments of ore largely increased, which will mean more dividends for the shareholders and greater prosperity for this district.

In the report to the shareholders, for the last fiscal year, ended June 30th, 1906, it is shown that after writing off the expenses of incorporation and $45,905.00 as depreciation on plant and equipment, the operating profit was $325,854.93. From this a special reserve of $20,000.00 was provided, and two dividends, amounting to $234,940.00, had been paid, leaving a balance to the credit of the profit and loss account of $70,914.93. Needless to say, the report for the fiscal year ending June 30th, 1907, will surpass the above showing, and it is to be regretted that it is not at hand at the time of this writing, that comparisons might be made.

In addition to the aforementioned properties and interests, the Consolidated Company is operating the Snowshoe Group in Phœnix (Boundary) camp, under a lease from the Snowshoe Company. This group consists of the Snowshoe, Pheasant, Alma Fr., and Fairplay Fr. They are also installing some new machinery and increasing their air compressing plant at that point, and will work the property on an extensive scale in the immediate future.



VIEW OF WORKS CONSOLIDATED MINING AND SMELTING COMPANY, ROSSLAND, B.C

The Centre Star, War Eagle and Idaho claims were among the first located on the southern slope of Red Mountain; the locations being made in July, 1900. The War Eagle group was sold in December, 1896, to the Gooderham Syndicate, of Toronto, Ont., for $700,000.00, after it had paid the former owners $187,500.00 in dividends. Patrick Clark bought the property with another claim and a two-thirds interest in the Iron Mask for $25,000.00, in 1894. The Centre Star was purchased by Oliver Durant and associates in 1891, and in 1897 was bought by Geo. Gooderham, of Toronto, for $2,000,000.00.

Teh Ware Eagle paid $545,250.00 in dividends, and the Centre Star the sum of $210,000.00, before their absorption by the Con-

solidated Company, which has paid quarterly dividends of 2 1-2 per cent. since the declaration of their first division of profits, May 1st, 1906, and to date have paid their shareholders $587,350, including the dividend just declared.

The smelter at Trail was built in 1896 by F. Aug. Heinze, of Butte, Mont., who built the first railway (narrow gauge) into Rossland, from that point. The initial shipments of ore treated at the Trail smelter cost the mine owners around fourteen dollars per ton for freight and treatment. This rate has been reduced step by step during the last few years, until at the present time the smelter is handling low grade Rossland ores for four dollars per ton, and, it is stated, under that, at which treatment rate there are mountains of low grade ore in the hills surrounding Rossland which can, and will, be mined and treated for many years to come.

STATUS OF THE MINING PROFESSION

By J. C. Gwillim, Kingston, Ont.

(Toronto Meeting, 1907.)

At the late meeting of the American Mining Congress, October 16th to 19th, 1906, Governor Pardee, of California, introduced the draft of a bill intended to make the dishonest promoter fear the law. The bill is as follows:—

"An Act to prohibit the making or publishing of false or exaggerated statements or publications of or concerning the affairs, pecuniary condition, or property of any corporation, joint ments of publications are intended to give, or shall have a tendency to give, a less or greater apparent value to the shares, bonds, stock association, co-partnership, or individual, which said state- or property, or any part thereof, of said corporation, joint stock association, co-partnership, or individual, than the said shares, bonds, or property shall really and in fact possess, and providing a penalty therefor.

"Section I. (Enacting Clause).—Any person who knowingly makes or publishes in any way whatever, or permits to be so made or published, any book, prospectus, notice, report, statement, exhibit, or other publication of or concerning the affairs, financial condition, or property of any corporation, joint stock association, co-partnership, or individual which said book, prospectus, notice, report, statement, exhibit, or other publication shall contain any statement which is false or wilfully exaggerate, or which is intended to give, a less or greater apparent value to the shares, bonds, or property of said corporation, joint stock association, co-partnership, or individual, or any part of said shares, bonds, or property, than said shares, bonds, or property, or any part thereof, shall really and in fact possess, shall be deemed guilty of a felony, and upon conviction thereof shall be imprisoned for not more than 10 years, or fined not more than $10,000, or shall suffer both said fine and imprisonment."

The Congress unanimously adopted the bill, and the following resolution:—

"That the officers of the American Mining Congress respectfully suggest to Governors of States and Territories that when in any State which has adopted the law, known as the Pardee resolution, charges of its violation are made, the Governor of the State in which alleged mining properties are claimed to exist, at his discretion may, upon request, authorize the Commissioner of Mines, or other appropriate officials, to examine such alleged mining properties sufficiently to determine and report on their approximate reality, and the State may charge a reasonable fee to cover the cost of such examination and report, this fee to be paid by the parties requesting such examination."

The following resolution was also adopted:—

"That a committee of five members be appointed by the President of this Congress, for the purpose of devising and demonstrating methods for preventing fraudulent mining schemes, and report the same to the Secretary of this Congress eight weeks before the meeting of its next session, who shall mail such report to each member of this Congress at least three weeks before its next session."

There has been some comment upon Mr. Pardee's resolution. Some affirming that so long as a constituency of dupes and gamblers is to be found, so long will the "get-rich-quick" scheme prosper. Others again suggest that all the mining engineers in Denver look up the cases, which should be investigated to prove misrepresentation.

It is argued, moreover, that we now have a law covering the obtaining of money under false pretences, by which men may be found guilty of misdemeanor or felony, according to the magnitude of the offence.

The fact, however, stands, that misleading literature and often absolutely untruthful statements are circulated to a lamentable degree by company promoters, without challenge. Yet the effects thereof are ruinous to legitimate mining.

To the Journal of the Federated Canadian Mining Institute for the year 1897, the late Mr. J. Bawden, barrister, of Kingston, contributed a paper on the subject of "The Economics of Joint Stock Companies," written at the time of the late British Columbit mining speculation.

At the present time, in Ontario, and in many other mining districts of this continent, conditions are not dissimilar to those obtaining in 1897. It may not, therefore, be out of place to call attention to some passages in Mr. Bawden's paper, relating to the promotion of the gambling element in mining. He says: "Let the buyer beware. The law interferes only to protect men's stomachs from adulterated food, not by any preventive process to protect from pickpockets in the guise of vendors of valueless shares. The question whether in the interests of the public it is advisable to interfere with the right to sell valueless shares lest individual liberty and the inalienable rights of British subjects be imprudently invaded, is a question of expediency which those who have at heart the development of mining enterprise may discuss without a tilt with brokers or jurists. The sale of worthless shares injuriously affects the sale of valuable shares. It goes without saying that capital seeking investment in mining shares is a limited quantity; that it is coaxed out of hoards, at the cost of much wind in the form of reports, advertisements, puffs, editorials; and that the characters of many people are staked upon representations, sometimes made in good faith, but too often discredited by adverse results. The argument, therefore, against the legality of worthless shares is founded on the economic ground that the business should be prohibited by legislation because it will work irreparable injury to honest enterprise."

It is often affirmed that mining is, in any case, a gamble; this is not true. There are many mining enterprises carried on in such a way that the gambling element is almost eliminated; but these *bona fide* enterprises cannot operate in a field where properties have been given a fictitious value, due to stock promotion and manipulation. It is said *Chance* is so large a factor in mining that, from the view of the investor, this industry suffers in comparison with other industrial enterprises. But, the writer ventures to assert, if roguery, misrepresentation, and lack of skill were emilinated from mining, to the same degree as they are absent in the operation of railroads, manufactures, and

other industrial undertakings, we might deal successfully with the element of chance, and reduce speculation to investment. Mr. Bawden further remarks: "Industrial stocks cannot be put on the English market without estimates carefully prepared by chartered accountants. The plan of organization of such companies leaves nothing to be desired in the way of reasonable safeguards for the protection of shareholders." And again: "The mining share certificate neither binds nor obliges any. In fact there is not a more innocent, vague, unrepresentative and yet plausible piece of paper in the world than a mining share certificate. It may stand for a share in a mine which has no existence; for a part of the capital of a scheme which never had and never will have a dollar in its treasury; or it may represent the title to a share in a 'bonanza,' honestly administered, paying the largest profits ever realized, and be good documentary evidence of the ownership of value many multiples of the money share stated on its face."

Such a condition is accepted by many of us as inevitable. If, then, mining is so much at the mercy of chance and unscrupulous people, what is the object of educating men to become technical engineers, unless it be to infuse into the industry a higher level of honesty and attainments, which shall do as much for the mining profession as Scientific Medicine has done for sickness, to eliminate "The Act of God" and "Ignorance"? Surely the jeopardy of life is as great as that of mines. Yet medical science has gathered honor and a considerable control of its specialty. Mr. W. R. White, in the discussion following Mr. Bawden's paper, said: "I do not agree with Mr. Bawden's position, when he speaks in regard to the institutions that are turning out young men; I do not think these young men when turned out are competent to do much more than push a barrow in a mine. They may get technical knowledge, but they require the practical experience before they become mining experts or engineers; they are no better than beginners in any other profession in this respect."

A period of probation is certainly necessary to acquire experience and knowledge in all professions. It would be a benefit to mining engineering if all who are training could work for a time as "understudies." A great majority now do this, but there seems to be no good reason why a mining graduate should pass through the mucking, wheelbarrow stage while graduates in civil engineering, law or medicine pass directly into professional work. Surely there are equally wanting in practical experience. Moreover, the graduate of our mining schools is nowadays as well equipped as men graduating into other professions to do efficient service. Give him his place and honor, and he will work as honestly and as well as any other young professional man. The every day accusation against mining is its *Chance* and *Misrepresentation.* Surely the technical graduate has not spent four years in learning how to increase these factors. Mismanagement is not often in his power, and if it is, he has as much at stake as the practical man. Concerning this, Mr. Bawden says: "As a general rule, the so-called mining expert is, in cases of mispresentation, the chief wrong-doer. The evil will, it is hoped, diminish with the increase in numbers and respectability of mining engineers. The director is often the dupe of the expert and prospector as the means of luring ignorant shareholders. The engineering profession owe it to themselves and to the best interests of the country that they shall have a registered membership.

"We shall have ere long a registered body of mining engineers zealous for the reputation and honor of a learned and noble profession, from whose lists will be struck off any guilty of unprofessional conduct." The codes of professional ethics in civil engineering, law and medicine demand the protection of the public in their own interests. In mining, the investor cannot invest because of the speculative and fictitious values of mining property. While, on the other hand, the graduate, or otherwise trained and honest engineer is forced to compete professionally with a host of so-called and self-styled "mining men" who are ready enough to become the tools of the promoter. But the question remains, how to remedy this state of affairs. The channel chiefly used by the promoter to reach the public is the newspaper advertisement, carefully worded and couched in the language of exeggeration, calculated to entrap the unwary. It is well known that it is no difficult matter to secure all the capital necessary to exploit a really meritorious mining property without resource to advertising; and, consequently, the majority of schemes to which the public are invited, by the advertising method, to subscribe, may be regarded with suspicion. The press, meanwhile, disclaims responsibility; the statements, as published, are frequently not even vouched for by a reputable person, much less by a technically qualified man; yet the public speculates, and the mining profession loses both credit and occupation.

Among the purposes for which the Canadian Mining Institute was founded are these: "To take concerted action upon such matters as affect the mining and metallurgical industries of the Dominion of Canada"; and "to encourage and promote these industries by all lawful and honorable means."

Dr. J. Bonsall Porter, discussing Mr. Bawden's paper as above mentioned, remarked: "We engineers cannot, of course, undertake the Herculean task of putting down or even denouncing all of these frauds, but I do think that many of us, and perhaps the Society as a unit, falls short of its real duty'.'

The writer would suggest that the Canadian Mining Institute, which is in part supported by annual grant from the Federal Government, undertake to deal with at least this abuse, namely, the publication of prospectuses of an irresponsible character, the statements in which are not vouched for by some person of recognized standing.

If such advertisements disappear entirely under these restrictions, the loss will fall only on newspaper publishers and on those who prey upon or mine the public. Meanwhile other professions are protected by legislation whereby they are raised above the level of the unscrupulous and incompetent. The Manitoba and Quebec Acts of the Canadian Society of Civil Engineers are for the purpose of the protection of both public and profession. So are the British Columbia Assayers' Act and the Acts which protect the legal and medical fraternities. If any unqualified or irresponsible person were permitted to practice his profession without question, what complications and dangers would ensue! The State interests itself in mining to the extent of taxing, limiting and protecting the prospector, and inspecting his claims, but there is yet no effective law to protect the public from the fraudulent promoter, or to provide for the inspection of so-called mines offered to the public. The press, as an interested party, aids and abets the promoter, whose prospectus is circulated among thousands of readers who know nothing of mining, mining engineers or conservative mining journals.

To remedy this evil, such advertisements should be published subject to restrictions and in fear of penalties, as suggested by the Mining Congress. There might also be stricter regulation governing the issuance of letters patent incorporating companies. Promoters should ,furthermore, be made personally responsible and answerable for their published statements. Again, an incorporated company, before going to the public, should be required to have paid-up capital to a reasonable amount, which would at least be paid in first of all; this would ensure the company having some guarantee of *bona fide* intention. This paid-up capital might be either held as a guarantee fund or used in the company's operations. The company might be made responsible for the statements contained in the prospectus issued, and this fund held available for any loss sustained.

A method which would apparently prove most effective would be to insist that reports for prospectus purposes be prepared and signed by professional men, who would be brought to book professionally for misstatements or misrepresentation.

Mr. George E. Collins, writing in the *Denver Mining Recorder,* anent the "Pardee Resolution," says:—

"The only people competent to say whether a man is qualified to practise as an engineer are his own fellows. I think the time

has come for the American Institute of Mining Engineers to follow the example of its English junior (The Institution of Mining and Metallurgy) and confine its membership to such as have attained a definite standard of qualification and experience. This qualification, in any case, could not mean much, but would be better than nothing. . . Later, State Legislatures could enact that no person should be placed in responsible charge of property employing more than a certain number of men, or should presume to make a written report for money on a mining property unless he were a member of this body."

An editorial leading article in the same journal, October 19th, 1906, contains the following praagraph:—

"Has not the mining industry reached that degree of importance and magnitude when some States, at least, should take steps to discriminate in regard to who shall practise the science and art of mining? It is sometimes said, surely the qualified man can compete successfully; therefore why form a protection for him? The protection as in civil engineering, medicine, and law, is not wanted for merits, but for honest, competent work to replace misrepresentation."

RECENT MINING DEVELOPMENT IN THE SOUTHERN YUKON

By D. D. Cairnes

(*Continued from page 87*).

minerals being galena, with sometimes grey copper, chalcopyrite, pyrite, melaconite, and malachite, and, as a rule, are very persistent and can be traced in some instances for several miles. Outcrops of quartz, very much resembling each other, are seen in almost straight lines, at short intervals, and with the same general strike from the Watson river to about 8 or 10 miles south of the Wheaton river, a distance of nearly 20 miles. Although most of the veins found were in this belt, about 2 miles wide; towards the end of the season Mr. Porter and others discovered some large deposits of quite pure stignite, and other minerals, at a considerable distance west of this belt.

Only a small amount of the rich telluride minerals, which were sylvanite, hessite, and telluric ochre, was found, but no work had been done on any of the claims, when last seen, except a limited amount on the Gold Reef. A government wagon road was built from Robinson to Gold Hill immediately after the discoveries were made. Assays as high as $300.00 and over, in a place or so, and a number of fairly average assays from $20.00 to $60.00 were obtained. Recently the writer has been informed by several disinterested parties that the Tally-ho Mining Company, whose property is situated on the north side of the Wheaton river, in the line of this Gold Hill mineral belt, has over two feet of quartz at the end of a 70 foot tunnel which averages over $200.00. The rest of the vein is lower grade. The property is still working, and the ore is being freighted out to Robinson to ship to the Tacoma Smelting Works.

The copper deposits just west of the town of Whitehorse have been known for some years, and considerable work has been done on some of the properties. However, for several reasons these have not developed as rapidly as might have been expected. Freight rates were high, either for getting in supplies or shipping out ores, and to treat the ore on the ground coke was required, and no coking coal was known to exist in the country; and to bring in coke made treatment very expensive. Also one of the first reports written on the district was one by R. H. Stretch, written for the W. P. & Y. Railway, but which was afterwards published in the *Engineering and Mining Journal*, in September, 1900, and which may also have had a tendency to keep capital out. In this report Mr. Stretch claimed the granites would be found underlying the limestones, felsites, and diabase dykes, and the ore bodies were only superficial and would not extend down more than a few feet. The writer saw no reasons for adopting this theory.

Mr. Wm. M. Brewer, in an article in the *Engineering and Mining Journal* of February 1st, 1902, and also in a paper read before the Canadian Mining Institute in 1905, has given a very concise and clear description of the district and a number of the properties, drawing attention in particular to the striking resemblances between these deposits and those on Texada Island. Recent work in both places has further proved the similarity of the deposits in these two localities; and as those on Texada Island have improved from the surface to their present depths, there is every reason to believe that the Whitehorse deposits will do the same. For recent information regarding the Texada Island deposits the writer is indebted to Mr. O. E. LeRoy, of the Geological Survey, who examined them this last season.

The writer agrees with Mr. Brewer in regard to the Whitehorse deposits, except as regards their origin. Only a very casual examination was made this summer, but from what was seen in the field, and from examinations of specimens since, it seems almost certain that the felsite rocks in which the ore occurs are of secondary contact origin and not intrusives, and that the granites are directly the cause of the deposits and are connected gentically with them. A thin section of a typical specimen of the felsite shows it to be a mosaic of spinel with some pyroxene and to be clearly of secondary contact origin.

This season Byron N. White, of Spokane, has been working the Pueblo nearly all summer, and is still continuing, and when seen in October this property presented an enormous surface showing. A body of ore, approximately 225 feet by 250 feet, was uncovered, and a shaft had been sunk over 100 feet on it, and no walls had as yet been encountered. The ore on the Pueblo is hematite, strongly impregnated with the copper minerals, chalcopyrite, bornite, malachite, cuprite, and even some native copper. Aside from the copper values in the ore, the hematite itself will be valuable for fluxing, when smelting operations commence in this district. On most of the properties magnetite takes the place of the hematite. Ore is at present being shipped from the Pueblo to the Britannia smelter at Crofton, B.C.

The Carlisle shaft has been sunk over 115 feet, and 100 tons of ore were shipped from this property this summer. The Arctic Chief is working at present, and is reported to be steadily improving.

So in this district from the British Columbia and Yukon boundary to Whitehorse, a distance of approximately 100 miles, there are a variety of mineral deposits which extend over a considerable portion of the district, showing how widely mineralized this section is. Added to this is the fact that there is a fair amount of good available coal in the Yukon.

Just south of the Whitehorse copper deposits, and between them and Gold Hill, is a belt of anthracite coal which has been worked to some slight extent about 12 miles in a southwesterly direction from Dugdale on the W. P. & Y. Railway. The general strike of the measures is about true 74 degrees west. A 60 foot tunnel has been run in on one of the seams. Here the strike is true 63 degrees west, with a 42 degree dip to the northeast. Three seams were seen, being respectively 9 feet 6 inches, 10 feet 4 inches, and 2 feet 6 inches wide, and others may be covered by the heavy wash in the valley. The samples tested were surface samples, and consequently ran very high in ash. The coal should make a good fuel, and, as there is a good grade from the railway to the coal claims, and as the coal is close to the copper deposits, the Watson and Wheaton rivers deposits, and the town of Whitehorse, this coal should be of considerable value to the district.

Down the river from Whitehorse, about 190 miles, or somewhat less than half way to Dawson, is the Tantalus Coal Mine. As the coal outcrops here on the river banks, it is well situated to work economically. Most of the river steamers burn this coal, and about 7,000 tons will be loaded this season. There are three workable seams opened up, only the lower two of which are being worked at present. Other seams may be found, as the formation is heavily covered in most places. The coal is worked by the stall and pillar method from two tunnels, which were in about 700 feet

when visited in October. The wages paid was $5.00 per day, with board and lodging for underground and $4.00 for surface work. The measures are quite regular and can be traced over 20 miles down the Nordenskiol river to the south, and for over 10 miles to the north, showing that there is an enormous amount of coal in this district. When the measures have been prospected more closely it is hoped that they may be found in some accessible points much closer to Whitehorse, because, as the coal gives good coking results in the laboratory, it probably will make a metallurgical coke. In that case, a smelter seems a probability in the vicinity of Whitehorse, where there is the ore, flux, and the water power.

The following section was measured near the end of the tunnels at the Tantalus Mine:—

		Feet.	Inches.
	Coal	2	4
	Shale	0	7
Bottom seam	Coal	2	0
	Shale	0	8
	Coal	2	11
	Shale	4	0
	Coal	2	3
	Shale	0	2
	Coal	0	7
Middle seam	Shale	0	2
	Coal	2	0
	Shale	0	2
	Coal	1	8
	Shale	7	0
Top seam	Coal	3	0
	Shale		

Analyses of coal from these three seams are:—

Water	0.75	0.76	0.82
Volatile combustible matter	23.61	24.74	25.12
Fixed carbon	55.21	58.60	66.03
Ash	20.43	15.90	8.03
	100.00	100.00	100.00
Coke per cent	75.64	74.50	74.06

These coals yield in the laboratory a firm coherent coke.

This paper has been intended to give merely a general description of the different classes of mining in the Southern Yukon, rather than to give detailed descriptions of any particular locality, as quartz mining seems to be one of the permanent future industries of the district.

ASBESTOS IN FOREIGN COUNTRIES

By Fritz Cirkel, Mining Engineer, Montreal.

(*Continued from page 55*).

About ten years ago asbestos was discovered in what appeared to be payable quantities in West Griqualand. The asbestos had a peculiar blue color, caused by the large proportion of iron protoxide it contained. It created quite a sensation on the London market. It was generally found in veins seldom less than two and more often four and five inches wide, formed of closely compacted parallel fibres. The output during the year 1898 was, on an average, about 100 tons per month, and the prospects for an increase seemed at times very bright. Very little skilled labor was employed, the mining being mostly surface work, or by shallow adits run in the sides of the hills. The cost of extraction, even with the primitive mining methods employed, was about twenty-five dollars a ton. But with all these advantages the business connected with the mineral has not been prosperous. Although the blue Cape asbestos was claimed to be as good as or superior to the white Canadian asbestos for many special purposes, it was, nevertheless, found that the introduction of this mineral into the trade was not making the rapid progress that was looked for. In 1898 the sales amounted to £9,000. In 1901, according to official reports, the production sank to £1,600, and for 1902 no production was reported. This ended the whole asbestos industry, for the present anyway, in Cape Colony.

Recently, however, information has been received that asbestos has been discovered in the Transvaal in the Carolina District, and it is reported that several companies are already in the field. The extent of the asbestos area is said to be considerable. It is further asserted that the asbestos is of an excellent quality, and so the report goes—can be separated or cleaned without the aid of machinery. (!)

The asbestos occurs in serpentine, cutting a cherty formation with bands of manganiferous earth. The latter, on account of its loose condition, is likely to give considerable trouble in mining. The mode of working the asbestos on a large scale has not been decided upon. Mining and shipping, it is said, may cost as much as £20 per ton, and a profit of from £15 to £20 is anticipated, in view of the excellent market conditions. According to the statement of the miners, the only treatment necessary is "cobbing." This, it is believed, will not cost more than 10s. per ton. No expensive machinery is required. The nearest railway station is Wonderfontein, about fifty miles distant, but the new "Springs Eastward" line will bring the property within half that distance. Native labor is at present scarce. The Carolina asbestos is of abnormal width, according to experts' reports, and equal to the finest in the world.

There are now three companies in the field, viz., The Transvaal Asbestos Syndicate, now absorbed by the Consolidated Gold Fields; The South African Minerals Option Syndicate, a subsidiary of the Bechuanaland Exploration Company, and The Anglo-Swiss Asbestos Company. On one of the properties, that of the Consolidated Gold Fields, it is estimated that there are 150,000 tons of asbestos in sight. This property comprises the Diepgezet farm, in extent about 7,000 acres. Samples of the asbestos from this property were sent to England and America, and replies were received that a ready market existed for the class of material submitted. A ten-ton shipment of almost entirely outcrop stuff, was made to England, and £21 profit realized per long ton. An offer was made for the better class of stuff from Germany at £40 and from England at £45 per long ton.

The South African Minerals Option Syndicate owns the Victoria and Rietfontein farms, and on each of these asbestos has been discovered in several places. The Anglo-Swiss Company are working near Gooderwacht, and it is believed that the mine contains about 200,000 tons of asbestos of No. 1 quality. It must be mentioned that, in view of the small amount of work which has been done on this property, this statement cannot be taken seriously.

A REVIEW OF SOME RECENT SCHEMES FOR CLASSIFICATION OF COAL.

By A. L. MacCallum. Paper read before the Nova Scotia Mining Society.

The classes of coals recognized in this country are various. They depend largely on physical characteristics rather than upon chemical composition, and consequently they cannot be accurately defined.

The divisions into anthracite, semi-anthracite, and semi-bituminous, are fairly satisfactory, but the term bituminous embraces such a variety of coals that it is of little value, and the term lignite is so loosely applied that it has little or no place in a scientific classification.

This classification was based on the fuel ratio which was described as the quotient of the fixed carbon divided by the volatile matter. From this the following classification was adopted:—

Anthracite fuel ratio	100 to 12
Semi-anthracite fuel ratio	12 to 8
Semi-bituminous	8 to 5
Bituminous	5 to 0

The great advantage of this scheme over those previously used is that it is based on certain definite constituents of the coal, and these constiuents in a general way determine the fuel value of the coal, but when an attempt was made to apply this classification to the various coals of the United States it was found to be unsuitable.

By this classification the low grade coals of Iowa and Missouri would be in the same class as the best West Virginia and Pennsylvania coals. Also, there is no provision made for lignites.

In connection with the work done at the coal-testing plant of the United States Geological Survey at St. Louis, the following schemes of classifications were tried:—

I.—Fraser's fuel ratio as above, which proved unsatisfactory, especially in the low grade coals.

II.—*Fixed Carbon.*—This also proved unsatisfactory with low grade coals.

III.—*Calorific Value.*—This is better for low than for high grade coals, as in some cases bituminous coals have a higher calorific value than anthracite.

IV.—*Hydrogen.*—No satisfactory classification could be based on this.

V.—*Carbon.*—This proved fairly satisfactory, but in many cases it is impossible to distinguish between true bituminous coal and lignites.

VI.—*Carbon Hydrogen Ratio.*—These are the two chief fuel elements in coal. In the progressive development of brown lignite to anthracite, the carbon increases (or at least does not diminish), while the hydrogen decreases.

The quotient of the hydrogen into the carbon was found to be a very satisfactory basis for classification, yielding the following distinct classes:—

Group A—Graphite		0	= 0
B, C	Anthracite	30	= 26
D—Semi Anthracite		26	= 23
E—Semi Bituminous		23	= 20
F	Bituminous	20	= 17
G	Bituminous	17	= 14.4
H	Bituminous	14.4	= 12.5
I	Bituminous	12.5	= 11.2
J—Lignite		11.2	= 9.3
K—Peat		9.3	= 7.2
L—Wood		7.2	=

Quite recently this scheme has been rather sharply criticized by Professor Kerr. He suggests a new basis for classification, which seems to be extremely rational.

He bases his systems on two fundamental facts.

I.—The ratio of the total to volatile carbon.

II.—The amount of inert volatile matter.

The volatile matter in coal is often spoken of as volatile combustible matter, which is not absolutely correct, as there is a part which is not combustible, being, in fact, water formed from the oxygen and part of the hydrogen occurring in the coal.

This is the inert volatile matter. It is higher in the lower grade of coals.

The ratio involved is expressed by the formula VC x 100-C, in which VC is the volatile carbon and C the total carbon.

According to this scheme coals are classified as follows:—

Anthracite	$\frac{100}{VC}$ x	=	below 4
Semi Anthracite	"	=	" 4 to 8
Semi Bituminous	"	=	" 10 to 15
Bituminous	A	$\frac{100}{VC}$ C =	20 = 32
		Inert Volatile	5 = 10%
	B	$\frac{100}{VC}$ C =	20 = 27
		Inert Volatile	10 = 15%
	C	$\frac{100}{VC}$ x C	32 = 44
		Inert Volatile	5 = 10%
	D	$\frac{100}{VC}$ x C	27 = 44
		Inert Volatile	10 = 15%
Black Lignites		$\frac{100}{VC}$ C	27% up
		Inert Volatile	16 20
Brown Lignites		$\frac{100}{VC}$ C	24 = up
		Inert Volatile	20 = 30%

The values involved in this table are, of course, calculated from analytical data.

Taken altogether, I think this is the most satisfactory scheme that has yet been proposed. It gives some definite, tangible value to the terms anthracite, bituminous, etc. It is, in addition, based on strictly scientific principles.

I am glad to learn that our own Survey proposes to undertake with our own coals similar work to that which is being carried on at St. Louis. This cannot help being very beneficial if properly carried out. For one thing, it will bring more up-to-date the analytical data appearing in Government reports on coal. Possibly from data obtained they may propose a new and better scheme of classification.

CORRESPONDENCE

THE CANADIAN MINING JOURNAL, while it welcomes letters of criticism or correction, or of general interest, is not responsible for opinions expressed in this column.

To the Editor, CANADIAN MINING JOURNAL:

Dear Sir,—In your last issue, of April 15th, you publish an article on "Graphite in Canada" from the pen of your special correspondent. As one very deeply interested in the future of this industry, I beg to take exception to the article on account of its glaringly apparent intention to advertise certain properties and particular machines manufactured by some of the parties interested in them, and to the statement that it is "specially due to the untiring efforts of some enterprising Americans" that "lately great attention has been paid to Canadian deposits." The entire article is misleading, inasmuch as the reader is led to infer that all the activity in this mineral is confined to the operations of some Americans at the Diamond Graphite Company's works near Buckingham, and at the works of the Calumet Mining & Graphite Company at Calumet. Credit must, of course, be accorded these gentlemen, and is given freely by all of us, but not to the exclusion of a greater number of Canadians who have for years fought the prejudice so commonly held in the United States against our product. No mention is made in the article of the Globe Refining Company at Port Elmsley, the Ontario Graphite Company at Calabogie, the Allan Mine at Allanhurst, all in Ontario, nor of the Buckingham Graphite Company, of Buckingham, Que., nor of the Canada Paint Company, near St. John, N.B., all of which are owned and operated absolutely by Canadians. In addition to these, active work is being prosecuted at the Bell Mine, near Buckingham, by British capital. Your article states that as well as the Diamond Company's mill another is in course of construction. This is certainly news to Buckingham, and those interested in graphite here. Your correspondent is, let us hope, without malice in his mis-information regarding the Diamond Graphite Company. He says the property is "situated five miles north of Buckingham, on the left bank of the Gatineau." It is about six miles north of Buckingham on the right bank of the Lievre, in another county. He states that their graphite area has a triangular shape with certain dimensions, which figures would indicate an area of about two acres. As to his statements relating to the mill, I will take no exception, except to state that I am informed, on the best authority, that the information relating thereto is very inaccurate. The illustration which accompanies the article is labelled Black Lake, Quebec, a somewhat misleading title for a photograph of the Bell Mine in Buckingham Township.

The entire article is full of glaring mis-statements, and it is particularly unfortunate that such should be published at the present time, as every endeavor is now being made to put the industry on a better and more permanent basis. For years we, in Canada, have had to fight prejudice and old-established business connections, and we are only recently getting for our Canadian product the attention of the graphite trade of the world.

If I may criticize the arrangement of your reading matter, I would draw your attention to the fact that you published an editorial on "The Promoter," on page 66, instead of as an introduction to "Graphite in Canada," on page 79.

Yours truly, H. P. H. BRUMELL.

Buckingham, Que., April 22nd, 1907.

SPECIAL CORRESPONDENCE

Nova Scotia.

The long-drawn-out battle, which many surmised was a battle between Nova Scotia's two giant concerns, the Dominion Iron & Steel Company and the Dominion Coal Company, has at last ended. The contest continued over a period of four weeks. The amendments to the Mines Act are now law, but they are not the amendments originally introduced. They have been cut and carved and chopped in a remarkable manner. Both parties profess to be fairly satisfied, so those not directly interested can afford to refrain from criticism. The purpose of the amendments is to afford facilities to owners of submarine areas to obtain access to the same, by going through the lands of other lessees which may intervene. One of the novel features of the bill is that the damages allowed the owners of the intervening areas are not to be allotted by arbitrators, but by the Governor-in-Council. The reason given for this is that the valuation of arbitrators might be appealed from to the courts, and operations delayed for, possibly, five years. To a lay mind it seems peculiar that a clause could not be drafted making appeals and delays impossible. It is now in order for the Dominion Iron & Steel Company to show that they do indeed purpose going into coal mining by proceeding to make arrangements to work the submarine areas at Point Aconi, south side of Sydney Harbor. It is said that the Dominion Iron & Steel Company has met with success in their borings, for coal, at the head of Lingan Bay. About a half mile from the Lingan Beach, outside of the Bridgeport Basin, and adjoining the Dominion Coal Company's areas, a five foot six seam of coal has been discovered. The company has not officially given out the thickness of the seam, but it may turn out that the thickness given is not far wrong. Suppose the Steel Company sets to work on this at once, it will take years before they can produce, in considerable quantity, at Point Aconi, and eighteen months before they can produce in appreciable quantity from the land area, near the head of Lingan Bay.

A new company, that purposes to be a producer on a large scale by 1908, is the North Atlantic Collieries, Limited. The property of this company is situated in what is known as the Cow Bay Basin. The workings will be submarine. It is stated, with a marked degree of confidence, that the coal extends for an almost indefinite distance under the ocean. At first the company proposed to approach their areas from the south side, but as the land areas are held by a party who places their value at a fancy figure, this purpose was abandoned, and instead the company will operate from the north side, and in order to do this will acquire, if they have not already done so, the property of the Gowne and Blockhouse, Limited. The acquisition of this property puts them in possession of a working colliery, not at present a large producer, but which can be made, at a comparatively small expense, capable of producing a thousand tons per day, or 240,000 tons for the year 1908. As the workings underground develope the output will correspondingly increase, and 1909 would likely see an increase of fifty per cent. on the preceding year's output. This company has taken several years to perfect its plans, and therefore there is every reason to believe that the project will be highly successful. There are no fewer than seven seams of coal on the property, the combined thickness of which is thirty-four feet. Henry M. Whitney, of Boston; Geo. E. Drummond, of Montreal, and B. F. Pearson, of Halifax, have consented to become directors. The fact of these well-known men being on the directorate conveys the impression that soon there will be something doing.

Contrary to expectations, the shipments of coal for March do not compare favorably with last year. There are some increases, but the large decrease in shipments of the Dominion Coal Company wipes all of them out. There are several reasons for short shipments, viz., stormy weather, scarcity of cars, and stoppage of work by the workmen. In March Cape Breton had three big storms, which put almost everything out of business. The men of Dominion No. 1 stopped work in an effort to get a number of "outsiders" into the P. W. A. lodge. Having accomplished this, the men signified their readiness to go back to work, but the management told the men as they had stopped work of their own accord they could stop off a while longer, while some repairs were effected in the pit. It was thought that the example set by the men of Dominion No. 1 would be followed by the men of the collieries. The officials of the Coal Company gave intimation that if there were any more of these stoppages the company would discontinue collecting the lodge dues in the pay office. This intimation seems to have had the effect of deterring the men in further attempts after the "closed shop." The coal companies in Nova Scotia have no objections that their workmen should be union men, indeed, they might prefer that all would be such, but if they can prevent it they are determined there shall be no coercion. At the beginning of the month the men at Springhill stopped work until all the men should join the union. They were out four days. Their stoppage was in violation of the new industrial dispute bill. The men claim that they were led to believe that the Act did not apply to the mines of Nova Scotia. The Deputy Minister of Labor informed the men by telegraph that the law was operative in Nova Scotia, but this had seemingly no effect; the men stayed away from work until they had accomplished their purpose. The men are each of them liable to a penalty of from ten to twenty dollars. Proceedings for recovery of penalty are left to private individuals. Will anyone prosecute? Is the law to be a screaming farce?

The Dominion Coal Company are still busy prospecting on their Lingan and Victoria areas. Notwithstanding reports in the press to the contrary, no site for the proposed new colliery has been decided on, nor is a permanent slope being sunk. The company may be bothered from an embarassment of riches. In what is called the Lingan section, there are three known seams, while in the Victoria section no one is prepared to say what the number is. It is claimed by those having knowledge of the locality that there are no fewer than eight workable seams in the Victoria section. If this be so, no wonder the company is perplexed as to which seam to attack. It is possible that the much talked of Mullins seam may be the scene of future extensive operations.

It is believed that the Local Government will assist, pecuniarily, a committee of the Mining Society, appointed to procure information as to the extent and the quality of the fire clays of the Province. In selecting each year a mineral for special consideration, the Society is to be commended.

Cobalt.

A local branch of the Canadian Mining Institute has been formed with Mr. A. A. Cole, M.E., as chairman, and Mr. Geo. Hardy, secretary. There are about fifty members of the Institute residing in Cobalt, and much interest is manifested in the new branch.

Mr. "Nick" Flynn has been appointed manager of the La Rose Mining Company.

Prof. R. W. Brock, of Kingston School of Mining, was in Cobalt for a few days.

Capt. Harris, of the La Rose Mining Company, has resigned.

Mr. T. Herriman is the new manager of the Temiskaming Mining Company.

Mr. Neil McDonald has resigned from the managership of the Beaver, and is now superintending the work at the Prince Rupert and Cobalt Coalition Mining Company's property.

ALGOMA.

The Jury Mining Company, of Dean Lake, are steadily progressing with their development work and preparing for mining on an extensive scale during the summer. A shaft is being sunk on the vein and is now down to the depth of 20 feet, while the appearance of the ore to this depth is extremely satisfactory. A number of prospectors have recently arrived in the neighborhood, but owing to the late spring the snow is as yet too deep to allow of any systematic prospecting being done.

A find of cobalt bloom is reported to have been made in Morin Township, twenty miles north of Bruce Mines, by a farmer, who states that he has discovered a vein extending over a quarter of a mile. This discovery is interesting, inasmuch as it is the first evidence of the existence of this mineral in the neighborhood.

The owners of the Herminia Copper Mine at Massey intend at an early date to erect a smelter at Thessalon for the treatment of their ores.

EAST KOOTENAY.

The Crannbrook Firebrick & Terra Cotta Company, Limited, with a capital of $50,000, in $1 shares, has been incorporated. Among the objects of the company is the manufacture and sale of firebricks and fireclay products for metallurgical, building and other uses.

Preparations are being made for the ensuing season's placer gold mining on both Wild Horse and Perry Creeks, in Fort Steele mining division. On the former the Invicta, Nip and Tuck, and Brown-Larsen properties, among others, will be worked. The heavy snowfall of the 1906-7 winter promises an abundant supply of water for gravel-washing purposes.

An enlarged output of lead-silver ore at the Sullivan Group Company's mine is reported. One recent week's production was about 1,000 tons, which is stated to be an increase of 30 per cent. over the ordinary weekly output for some time past. The ore is all treated at the company's lead smelter at Marysville, a few miles from the mine.

WEST KOOTENAY.

Nelson.—Several mines in the Nelson mining division give promise of making a better showing in 1907 as regards ore production than they did in 1906. These are the Silver King and Eureka, both situated within a few miles of the town of Nelson; the Queen Victoria, a copper property near Beasley siding, about seven miles west of Nelson; the La Plata, formerly known as the Molly Gibson, on Kokanee Creek, east of Nelson; and the well-known Ymir gold mine, in the Ymir section of the division, now under new management and provided with ample funds for further development.

The Silver King is to be worked by the Hall Mining & Smelting Company on its own account, the partnership arrangement between the company and Mr. H. S. Davys having been cancelled. An understanding has been arrived at with the owners of the adjoining Dandy mineral claim, permitting the driving of a tunnel from the Dandy into the Silver King mine, to connect with the workings of the latter at a depth that will drain the mine down to the seventh level without incurring the constant expense of pumping. All ore of payable grade accessible above that level will thereafter be mined and shipped to the smelter.

The Queen Victoria made its first shipments in March, in which month it sent about 400 tons of copper-silver ore of fairly good grade to the smelter at Trail. It is expected that the output for April will be about 1,000 tons, and that production will be gradually increased in later months. The ore is being broken down from a big bluff of mineralized rock, and is roughly sorted before shipment. Mr. N. J. Cavanaugh, formerly at the Slocan Star mine, is in charge of operations, in which 22 men are employed.

Ainsworth.—At the Krao mine the shaft has been deepened to 200 feet, and sinking is being continued, the intention being to go down to the 300 foot level. A station is being cut at the 200 foot level. Further development work is to be done on the 100 foot level, and drifting and cross-cutting at both 200 and 300 foot depth will be undertaken as soon as practicable. Some 20 men are employed at the mine, the work in which is being done under the supervision of Mr. W. E. Zwicky, manager of the Rambler-Cariboo mine in Slocan district.

The long tunnel in the Highlander mine is being extended, Mr. Geo. H. Barnhart, several years ago manager of the Ymir mine, having a contract for driving another 1,000 feet. Mr. Barnhart is also operating the Libby, Spokane and Glengarry properties, all in Ainsworth camp. Mining work in this camp will be much expedited and costs reduced should the owners of the Taylor hydraulic air compressor, installed in a neighboring creek in 1900 by the Kootenay Air Supply Company, Limited, again supply the mines with power. The first drill ever operated by compressed air under the Taylor patents was started in one of the Ainsworth camp miles in April, 1900. The revival of interest in local mines which has taken place during the last year will probably lead to this compressed air supply system being utilized to a greater extent than in former years when previously in operation.

Slocan.—Connection has at last been made between the old workings and the deep level tunnel of the Rambler-Cariboo mine in McGuigan basin. This striking achievement constitutes what is believed to be the most important mine development work ever done in the district. Work on this tunnel was commenced on July 9th, 1904 and continued until May, 1906, an adit having meanwhile been driven 4,600 feet straight into the mountain at a depth of 1,400 feet below the collar of the shaft and 600 feet under the lowest level of the old workings, the heavy cost of keeping which free from water having led to the undertaking of the extensive development work now completed. The face of the tunnel not having reached the vein at the distance above mentioned, it was decided to put up a raise; this entered the vein at 150 feet. Thence up to the bottom of the old shaft the raise was made large enough for after use as a three-compartment main working shaft (12 feet x 4 feet 6 inches in the clear). When this raise was within 17 feet of the 200 foot level above, a drill hole was put through and the large quantity of water filling the old workings up to the 450 foot level drained off through the new tunnel at practically no expense. The raise was then carried through and now the old mine is being cleaned up preparatory to stoping ore of which there was known to be enough to pay the large cost of the adit and raise, leaving out of consideration additional ore that might reasonably be expected to be made accessible by the new workings. Mr. Zwicky, manager of the mine, on whose strong representations this big work was undertaken, has been freely congratulated upon its successful completion. Immediately the roads are in a condition that will admit of hauling to the railway, the shipment of ore will be resumed. Prior to the stoppage of work in the old mine nearly $1,000,000 worth of ore had been shipped from it.

Rossland.—The output of ore from Rossland mines for the first quarter of the current year was rather above 62,000 tons. The Rossland Miner has published the following tonnage figures to March 30th:—

Mine.	Tons.
Le Roi	33,551
Centre Star Group	19,842
Le Roi No. 2	4,890
Le Roi No. 2 (concentrated)	2,320
White Bear	255
White Bear (concentrated)	1,200
Total	62,058

The work of sinking the Le Roi main four-compartment shaft below the 1,350 foot level, commenced several months since, is progressing satisfactorily. A depth of 1,650 feet was reached by the end of March, and the contractors were using all expedition in continuing to a deeper level.

The Le Roi Mining Company is operating the Spitzee mine under a working bond with right of purchase. This mine had been idle since 1905, the local company owning it having had no money to pay for further development work. About 6,700 tons of ore in all have been shipped by the Spitzee Mines, Limited.

The 650 horse-power Westinghouse induction motor, installed in the power house of the Consolidated Mining & Smelting Company of Canada's Centre Star mine, to furnish motive power to the 40-drill air compressor instead of steam, was started on April 6th and found to run smoothly. An electric locomotive is now in use at the 350 foot level of the mine, hauling from the War Eagle to the Centre Star main shaft. Goor progress is being made with the installation of the new hoist—a Nordberg engine, cylinders 28 by 60 inches, drums 10 feet, skips 4 1-2 tons—to have a hoisting capacity of 1,350 tons per 10 hours from a depth of 3,000 feet.

BOUNDARY.

The Phœnix Pioneer has published the following ore production statistics for the quarter ended March 31st:—

Month.	Tons.
January	60,003
February	53,965
March	100,219
Total	214,187

The unusual severity of the weather experienced in January and March, and the shortage of railway cars for hauling ore and coke, together with the lack of sufficient fuel for mines and smelters, were accountable for the comparatively small production.

The treatment capacity of the Granby Company's smelter at Grand Forks is now at the maximum the enlargement of its six smaller furnaces was intended to reach. With eight blast furnaces, each having a capacity of about 500 tons per diem, the works are equipped for a larger output of copper than at any previous time since they were established. Should no difficulty arise in connection with labor and fuel supplies, the Granby Company should have a period of renewed profitable operations, mines and smelting works together being equipped for 100,000 to 120,000 tons of ore per month.

At the British Columbia Copper Company's smelter, Greenwood, the third large blast furnace has been completed. Although having a nominal capacity of 600 tons per day, it has been found that the new furnaces will each treat about 700 tons in 24 hours, so that the capacity of the works is fully 2,000 tons of ore per day. At the company's several mines good progress continues to be made. Several levels down to the 400-foot are being extended in the Mother Lode mine. The the Emma, electricity is being supplied for power purposes, the transmission of 40,000 volts from Bomington Falls generating station to the Boundary giving ample power for both mines and smelters of the district. Mr. J. E. McAllister, general manager of the company, has returned from his trip to Europe, his health having been greatly benefitted by the change and rest. Mr. G. F. Beardsley, on the eve of his retiring from temporary charge as acting manager, received from the smelter employees a serviceable gift as a memento of the good feeling existing towards him. Mr. Frederic Keffer, engineer in charge of the company's mines, is also back at his post, after having visited New York at the close of the annual meeting of the Canadian Mining Institute, held early in March.

The Dominion Copper Company is further increasing the equipment of its mines in Phœnix camp. At its smelting works at Boundary Falls the erection of the large blast furnace—the largest copper smelting furnace in Canada—is well forward. The addition of this furnace increases the smelting capacity of these works to between 1,400 and 1,500 tons per day. Mr. Thos. R. Drummond, the company's general manager, has gone to Cobalt in the capacity of assistant general manager of the Nipissing Company's mines. His place in the Boundary has been filled, it is stated, by the appointment of Mr. W. C. Thomas to the charge of the Dominion Copper Company's mines as well as its smelter, of which latter he has been in charge since the inception of operations under the present regime.

GENERAL MINING NEWS

BRITISH COLUMBIA.

The Cariboo-McKinney Mine is being unwatered, preparatory to the resumption of mining operations.

A total of eight furnaces will soon be in blast at the plant of the Granby Consolidated.

In the Ainsworth camp mining is reviving briskly. The Krao main shaft is down 200 feet, and all the workings are reported in good ore.

The Boundary Falls smelter employees, by a new wage scale, will get about $1,000 more per month than hitherto.

The chief demands of the Western coal miners are:. A wage increase of 10 per cent. all around; fortnightly pay. Bank-to-bank eight-hour day for Alberta.

It is probable that a Canadian Mine Workers' Organization will be formed, which will be entirely distinct from the United Mine Workers of the United States.

Large additions are being made to the plant of the Vancouver Portland Cement Company in Tod Inlet, B.C.

At a mass meeting of the miners of Coal Creek and Fernie, held at Fernie on April 11th, it was decided by a referendum vote of 741 to 42 to stop work unless the operators conceded there demands.

At the Cariboo-McKinney, unwatering has been carried on to the 400-foot level.

The smelter of the Dominion Copper Company established a new week's record. For the week ending April 13th it smelted 5,344 tons of ore.

ONTARIO—Cobalt.

The Government has decided to create two new mining divisions. These will be known as the Lady Evelyn Lake and Montreal River district, and the Larder Lake district. Recording offices will be established in each.

The International Coal & Coke Company, of Coleman, Alberta, has declared its second oneper cent. dividend, amounting to about $28,000, payable May 1st.

NEW BRUNSWICK.

A man named Luunder Crossman was killed at the Intercolonial Copper Mines, Dorchester, N.S., by a premature explosion of dynamite.

NOVA SCOTIA.

Torbrook.—The Leckie vein, to recover which systematic prospecting has been carried on for some time by Mr. W. F. C. Parsons, the mining engineer of the Londonderry Iron & Mining Company, was uncovered early in April at a point about 2,200 feet west of the Wheelock shaft. The vein here was 6 1-2 feet wide. It has since been traced east and west of No. 1 pit for a distanc of over one-quarter of a mile. The average width of vein on surface is 6 feet of clean ore between walls. The dip is about 80 degrees. The following is an analysis of an average sample, taken from half a dozen test pits:—Iron, 54.06 per cent.; silica, 13.10 per cent.; phosphorus, 0.86 per cent.; manganese, 0.14 per cent.; sulphur, 0.12 per cent.; alumina, 4.42 per cent.; lime, 1.86 per cent.; magnesia, 0.32 per cent. Assuming that this vein continues to the depth of the present workings, this already proved ground will yield 800,000 tons of ore. The ore can be put on cars at the mine for 75 cents per ton.

Over 4,000 tons of coal was raised in one day, April 12th, at the Reserve Mines Colliery, N.S.

The Dominion Coal Company will this season have the largest fleet of steamers that they have even put into commission. Their total carrying capacity is 106,650 tons.

MEN AND MATTERS

Capt. T. H. Trethewey has retired from the management of The La Plata Mines, B.C. He will remain on the board, however; therefore the company will not be entirely without his services. The Captain has other mining interests that require his personal attention. He has been succeeded by his son, W. J., who assumed charge April 1st. The mine is producing and making regular shipments to the Trail smelter.

Mr. Ralph Stokes, late mining editor of *The Rand Daily Mail*, Johannesburg, is now commencing a tour of the chief mining fields of Canada as the special correspondent of *The Mining World*, Chicago, and *Rand Daily Mail*, Johannesburg, and as an occasional contributor to the London *Financial Times*. His journey will comprise the last section of an extensive tour through the British Empire. Leaving the Rand in January last year, Mr. Stokes has since visited and reported upon the Ceylon (gems and graphite), Indian (mica and manganese), Malay States (tin), Kalgoorlie (gold), Broken Hill (silver, lead, zinc), Bendigo (gold), Mt. Lyell (copper), Tasmanian gold, Mt. Bischoff, Briseis, Anchor, etc. (tin), Zeehan (silver, lead), and Waihi, New Zeland (gold) mining districts. His Canadian journey will include the Rossland, Trail, Sudbury, Cobalt and Thetford fields.

Mr. W. C. Thomas, smelter superintendent of the Dominion Copper Company, has been promoted to the position of general local manager of the company. Mr. Thomas will have charge of both the smelting and the mining operations.

The citizens of Parry Sound have passed a by-law authorizing the giving of a bonus of $100,000 to the Dominion Smelters Limited, to assist in the erection of a $1,500,000 custom smelter. The smelter will have a capacity of 1,000 tons of ore daily.

Mr. Fritz Cirkel, mining engineer, of Montreal, is at present in the asbestos region of the Eastern Townships of Quebec, examining a large tract of recently discovered asbestos ground on behalf of Qeubec capitalists.

Mr. R. R. Hedley, for many years smelter manager of the Holt Mining & Smelting Company at Nelson, B.C., and who recently resigned that post, is at present visiting Montreal and other Eastern cities, renewing old acquaintances formed during his connection with the Orford Copper Company, some twenty years ago.

Dr. A. E. Barlow returned to Ottawa on the 12th inst., after spending a very enjoyable two months on business and pleasure in Europe.

Mr. W. Stanley Lecky, head of Messrs. Mussens Limited mining department, was married on the 3rd inst. to Miss Mary Theresa Perram, of Buffalo, N.Y. Mr. and Mrs. Lecky are spending their honeymoon in England.

Mr. R. A. Daly, who for some years past has been engaged in the survey of the international boundary, along the 49th parallel in Southern British Columbia, in connection with the work of the Geological Survey and the Boundary Commission, has resigned his post and accepted a chair of Geology at Harvard University. Mr. Daly will reside at Cambridge, Mass., in future.

The Cobalt Townsite Company which owns thirty-seven acres directly south of Cobalt, made its first shipment early in April. A six-drill compressor is running on this property.

The Jury Copper Mines, Limited, recently installed a boiler and hoist upon the copper property which they are developing.

The Herminia Copper Mining Company, near Massey Station, are reported to be considering the erection of a copper smelter at Thessalon.

The Ontario Government has received a cheque for about $40,000, being part payment of royalty from the O'Brien mine on nine car loads of ore shipped during the first three months of this year.

Port Arthur.—The prospects of opening up several of the famous old silver mines of this district are good. The West End Silver Mountain is reported to be in satisfactory operation. The Beaver, the Badger, the Porcupine, the Rabbit Mountain, and the Shuniah Wickean or East End Mine, it is stated, will all be reopened. We hope and believe that this will mark an era of added prosperity in Western Ontario.

On or about the first of May the Atikokan mines will commence shipping iron ore to the Port Arthur blast furnace. It is expected that 200 tons per day will be shipped.

It is expected that 100,000 tons of ore will be shipped from the Loon Lake iron mines this season. They have been purchased by the Canadian Bessemer Ore Company. The ore is to be crushed and put over Hancock jigs for concentration.

The merger of La Rose, University and several other mines is reported. Messrs. John W. Martin, Timmins and Dunlop are behind the new promotion. It is announced that the capitalization will be $6,000,000. The new company will take the name of La Rose.

An official report announces that at a depth of 75 feet an eight inch vein of smaltite has been struck in the Foster workings. This is decidedly encouraging. Superintendent Alder is to be congratulated.

Under the recent decision of the Supreme Court, which settles the litigation over the Lawson Mine, Mr. John McMartin becomes owner of three-quarters of the mine. Messrs. Millar and Clarke and their associates get one-quarter.

ALBERTA.

On April 3rd an explosion of gas in the mines of the International Coal & Cofle Company, Coleman, resulted in the death of three men.

Mr. A. B. Willmott has resigned his position with the Lake Superior Corporation and is taking up private practice. He will continue to act as consulting geologist for the above company, and will establish in Sault Ste. Marie, Ont. As a mining geologist, Mr. Willmott has had a long and valuable experience, and has done much towards the development of New Ontario.

Mr. A. A. Hayward, past president of the Nova Scotia Mining Society, is in Toronto. Mr. Hayward is a gold miner of prominence in Nova Scotia. During his term of office as president he infused new life into the Mining Society.

DIVIDENDS

The Consolidated Mining and Smelting Co. of Canada, Limited
Dividend No. 5

Notice is given that a dividend of two and one-half per cent. (2 1-2 per cent.) on the paid-up capital stock of the company for the quarter ending March 31st, 1907, has been declared, payable May 1st, 1907, to holders of full shares of the said company of record on the 22nd day of April instant.

Buffalo, Cobalt—Capital, $1,000,000; last dividend paid April 1st, 1907, $30,000.

Granby Consolidated, B.C.—Capital, $15,000; last dividend paid, March 30th, 1907, $405,000.

McKinley-Darragh, Cobalt—Capital, $2,500,000; last dividend paid, March 1st, 1907, $50,000.

Nipissing, Cobalt—Capital, $6,000,000; last dividend paid, April 20th, 1907, $180,000.

Trethewey, Cobalt—Capital, $1,000,000; last dividend paid, March 31st, 1907, $40,000.

International Nickel—Capital, $12,000,000; last dividend paid, May 1st, 1907, $121,123.

Nova Scotia Steel & Coal—Last dividend paid, April 15th, 1907, $74,555.

The limestones near St. John, N.B., are in places highly serpentinous and have furnished indications of the presence of Eozöon. At Pisarinco, however, serpentine is seen to cut talcose and chloritic rocks, associated with limestones, as a true dyke six feet wide. At the falls of the St. John River, also, deposits of plumbago of large extent are found in the slates and limestones.

BOOK REVIEWS

"Hydro-Metallurgy of Silver," by Ottokar Hofmann, Hill publishing Company, New York and London, 1907, $4.00, postpaid.

Mr. Hofmann's long experience in this branch of metallurgy has amply qualified him to produce an authoritative text-book. Mr. Hofmann was the first to introduce the process of lixiviation with sodium hyposulphite in Mexico (1868). Experience gained with different ores induced him to modify the chloridizing roast with the object of decreasing the loss of silver by volatilization. This was a marked improvement in the treatment of silver ores.

The book is divided into two sections; the first takes up "Chloridizing Roasting of Silver Ores"; the second deals with the "Extraction of the Silver."

There is a popular dictum that a text-book is usually ten years behind modern practice. Mr. Hofmann's book gives the lie to this. "Hydro-Metallurgy of Silver" is well compiled, well illustrated and well printed, and gives us the last word in metallurgical progress.

"The Principles of Copper Smelting," by Edward Dyer Peters, Professor of Metallurgy Harvard University. Pages, 612. Price, $5.00, postpaid. The Hill Publishing Company, 505 Pearl street, New York.

This new book of Professor Peters' is to be distinguished from his standard work on "Modern Copper Smelting." The latter book deals with the methods of smelting, the former is a lucid, exhaustive and reliable exposition of the principles underlying the actual operation. "The book is written, in part, for students," says Professor Peters in his preface, "and, as there are many persons who would like to gain some insight into the smelting of copper, but who have not the training which is requisite for the understanding of ordinary metallurgical treatises, I have tried to write in such a manner that it might be reasonably intelligible to those who have no exact knowledge of chemistry."

In this aim the author has succeeded. The book is clearly written. In style it is clear. In diction it is neither cumbrous nor hyper-technical; and this can be predicated of very few text-books dealing with such subjects. The arrangement is logical. Chapter VIII., on Pyrite Smelting, and Chapter IX., on Slags, are particularly valuable. That our praise may be slightly diluted by the cold water of criticism, we may suggest that a larger number of diagrams and illustrations would not detract from the appearance of the volume. This, however, is incidental. Professor Peters' new book is worthy of immediate adoption by educationists and technical workers. Would that some equally well-equipped writer would give us as full a treatise on the principles of modern iron smelting.

METAL, ORE AND MINERAL MARKET

Aluminium—For No. 1 ingots, 48 to 50 cents per lb.
Antimony.—Market dull; 21 to 21 1-2 cents per lb.
Arsenic, white—7 1-2 to 8 cents per lb.
Barytes, crude—$11.25 to $14.50 per ton.
Bismuth—$1.40 to $1.50 per lb.
Cadmium—$1.40 to $1.46 per lb.
Carbons, for drill—$75.00 to $85.00 per carat.
Carborundum, powdered—8 cents per lb.
Chromium, pure metal—80 cents per lb.
Cobalt—F.o.b. Cobalt, Ont., unrefined, 40 cents per lb.
Corundum—7 cents per lb.
Feldspar—$10.00 per short ton.
Fluorspar, lump—$9.00 per short ton.
Graphite, domestic—$45.00 to $150.00 per short ton.
Gypsum, lump—$4 per ton.
Infusorial earth, ground—$15.00 to $30.00 per ton.
Manganese, pure—75 cents per lb.
Mica, ground—$62.00 to $85.00 per short ton. Scrap—$12.00 to $15.00 per short ton.
Molybdenum, pure—$1.70 per lb.
Molybdenite ore, 95 per cent. pure—21 cents per lb.
Nickel—45 cents to 50 cents per lb.
Platinum, ordinary metal—$33.50 per ounce.
Pyrite, 38 per cent. to 45 per cent. sulphur—11 cents per lb.
Quicksilver—$42 per flask of 75 lbs.
Talc—$17.00 per ton.
Tungsten, pure metal—$1.32 per lb.
Tungsten ore, 60 per cent. pure—$400 per ton.
Tin—40 3-4 cents per lb.
Zinc sheets—$8.60 per 100 lbs.

ENGLISH ORES AND METALS MARKET

Compiled from James Lewis & Son's Monthly Report.

Copper—Standard, per ton, £97; best selected ingots, per ton, £109; ore, per unit (20 cwts.), 19s.

Silver has fallen from 32 1-6d. to 30 1-2d. per ounce; standard.

Quicksilver—£7 per bottle.

Lead is steady at £19 10s. to £19 15s. for English.

Antimony is steady, £98 to £100 per ton.

Nickel—1s. 9d. to 2s. per lb. net.

Cobalt, refined—9s. 9d. per lb.

Tin falls to £185 10s. cash per ton.

Bank rate of discount remains at 5 per cent.

EXCHANGES

The Mining World, April 13th, continues Horace Evans' "Explorations in British Columbia." "Endless Rope Haulage" is an excellent article.

"The Mines of the Fairview District, Nevada," are well described in The Eng. and Min. Journal, **of April 13th.**

The Mining Reporter, April 11th, contains a profitable epitome of chemical literature.

"Gas, Gas Engines, and Gas Producers," is a leading article in The Canadian Electrical News for April.

Cana, for April 6th, has been received. It devotes a page to mining matters.

The Mining and Scientific Press, of April 6th, has a very brisk editorial on "Salting Samples." The third installment of "How the Miner's Dynamite is Made" is eminently worthy of perusal.

South African Mines, March 16th, affords its usual comprehensive summary of mining operations in the Rand, Rhodesia, and other South African mining countries.

In the Journal of the Chemical, Metallurgical and Mining Society of South Africa for February, Dr. James Moir deals somewhat severely with The London Mining Journal. Discussion following the reading of a paper on "Witwatersrand Mine Air" leads to a lively embroglio between Dr. Muir and The Mining Journal—pre-eminently not "*sans phrase.*" Dr. Moir, in terms by no means tender, states that our estimable contemporary is not up-to-date in its technical information.

The Mining Investor, April 15th, compliments the United States Post-office Department upon its good work in suppressing fraudulent mining promotions. It also reprints the abstract of Professor Van Hise's paper on "Cobalt," which appeared in a recent number of THE CANADIAN MINING JOURNAL.

A statistical summary of "The British Open-Hearth Steel Industry in 1906" is given in the April 5th number of The Iron and Coal Trades Review.

In The Mining Journal London, an account of the Royal School of Mines' thirty-fourth annual dinner of old students is illustrated by a full page photogravure. The "Report of the Commission on Gold Stealing in Western Australia" is the subject of the leading editorial.

The Engineering Journal of Canada, April, has been received.

The Colliery Guardian, April 5th, continues "Evidence Taken before the Royal Commission on Mines."

Stone, for April, has been received.

In The Engineering and Mining Journal, April 13th, an electric winding plant at a German colliery is described. A portrait and biographical sketch of Mr. George Otis Smith, the new Director of the United States Geological Survey appears also in this number.

The Mining World, April 20th, gives a very readable account of the "Eocene Gold-bearing Gravels of Colombia."

CATALOGUES AND OTHER PUBLICATIONS

Portable oil well rigs, for drilling deep oil, gas and water wells, are described in a large catalogue (No. 3, 1907, second edition), sent out by the Keystone Driller Company, Beaver Falls, Pa.

Catalogue No. 2, "The Samson Crusher," 1734 Fifteenth street, Denver, Col., illustrates the Samson crusher. This is a uniform crushing type, which will not choke, and is economical of power. From the same address comes a circular giving a description of the Ajax Drill Sharpener, which sharpens 1,200 drills in 24 hours.

The February number of Mine and Quarry has been received. This is a very attractive quarterly bulletin, issued by the Sullivan Machinery Company, Railway Exchange Building, Chicago. The bulletin is published in magazine form, is well illustrated and gives information that is of real value.

A catalogue of coal mining machinery, sent out by the Morgan-Garner Electric Company, of 27th street and Shields avenue, Chicago, gives illustrations of their electric coal cutters, drills, generators, locomotives, etc.

Conveying and Transmission is a monthly publication devoted to methods for the mechanical handling of materials and transmission of power, published by Stephens-Adamson Manufacturing Company, Aurora, Ill. Canadian sales agents, Mussens Limited, Montreal.

From Fried Krupp, Grusonwerk, Magdeburg-Buckau, comes the announcement that a separate metallurgical department has been established at their works for the manufacturing of furnaces, machines and apparatus, as well as complete installations for the recovering of metals from ores and for the designing of plants for metallurgical treatment of lead and zinc dust, waste products, and for the concentration of refractory ores.

We acknowledge receipt of Circulars No. 1028 and No. 1067 from the Canadian Westinghouse Company, Limited. They deal with rotary converters and air blast transformers, respectively.

The "Carbogen" Oil Fuel Burner, manufactured by J. A. Curle, Limited, Homer-road, South Hackney, England, is designed to consume cheap and crude by-products and ordinary heavy oil. The "Carbogen" is lighted with extreme ease, and is an extraordinarily efficient steam raiser. For a full description we would refer our readers to The Engineer of February 15th, 1907. Mr. F. Sturgeon, 32 Church street, Toronto, is the sole agent for Canada. Mr. Sturgeon is also agent for the Anglo-Swedish Steel Company's mining and tool steels.

STATISTICS AND RETURNS

Shipments of ore in various British Columbia mining districts for the week end April 13th were as follows:—

	Tons.
Boundary	29,252
Rossland	4,204
Kootenay-Slocan	2,474
Total	36,530

The smelter receipts for the same period are:—

	Tons.
Granby	17,840
British Columbia Copper Company	5,911
Dominion Copper Company	5,344
Trail smelter	4,790
Hall Mines smelter	138
Le Roi smelter	1,467
Marysville smelter	600
Total	36,090

Cobalt Ore Statement,—Week Ending April 13th, 1907

Kerr Lake shipped 40,000 lbs. to Perth Amboy on April 8th.
Coniagas shipped 42,520 lbs. to Perth Amboy on April 10th.
Coniagas shipped 57,140 lbs. to Copper Cliff on April 10th.
O'Brien shipped 66,000 lbs. to Copper Cliff on April 13th.
Total—245,660 lbs.

The ore shipments through Kaslo for March show a big increase over the previous month and a large gain over the corresponding period of last year. Thirty-four car loads, totalling 632 tons, were shipped during March, against 156 in February. For the corresponding period of last year 401 tons, a gain of 231. This includes silver-lead, carbonates and zinc. The principal shippers were the Whitewater Deep and the Last Chance, as the following table will show:

	Tons.
Last Chance, silver-lead	104
Last Chance, zinc	27
Colonial, carbonates	49
Sunset, silver-lead	43
Whitewater, silver-lead	54
Whitewater Deep, silver-lead	143
Whitewater Deep, zinc	192
Bismarck, carbonates	20
Total tons	632