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CIRCULATION.

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THE HILLCREST DISASTER

One of the worst accidents in the history of mining in Canada occurred at the Hillcrest colliery in the Crowsnest district on June 19. Two hundred and thirty-seven men went down to work in the mine and only forty-eight returned alive. In spite of the heroic efforts of many willing and experienced workers a very small number were rescued. One hundred and eighty-nine lives were snuffed out.

It is very clear from the reports that have reached us that the rescuing parties did their utmost. In the face of great danger they went into the mine and brought out the unfortunate men. With oxygen breathing apparatus they carried on the work as long as possible and we have every reason to believe that many risked their lives to save their fellows. It requires courage of the highest sort to do such work and the greatest praise is due to the valiant band of men of all stations who so willingly did all they could.

The cause of the disaster is not, as yet, clearly understood. An investigation will doubtless be made to determine the cause, and we can only hope that the investigation will be a rigorous one and that every necessary step will be taken to avoid similar awful accidents in coal mines. There have been recently in coal mines in Great Britain and the United States some equally horrible disasters. While many advances have been made in increasing safety underground it is obvious that there is still necessity of insisting again and again on the investigation and removal of the causes of such accidents.

Unfortunately investigations are never completely satisfactory. There are always many contributing causes and it is difficult for the most experienced coal mining authorities to determine them and analyze them correctly. Nevertheless, every effort should be made and some valuable information is sure to be obtained.

ONTARIO'S SILVER OUTPUT

The report of the Bureau of Mines of Ontario for the first quarter of this year shows a production of 6,519,860 ounces of silver. This is 680,198 ounces less than in the corresponding period last year.

In 1904 the silver mines at Cobalt produced 206,875 ounces of silver. In 1905 they produced 2,451,356 ounces. In the next few years increase was very rapid until in 1910 the production was 30,645,181 ounces. A slight increase was made in 1911 when 31,507,791 ounces was produced.

Since 1911 production has been declining. In 1912 it was 30,719,883 ounces, and in 1913 29,681,975 ounces. A larger decrease is expected in 1914.

Ontario has produced since the Cobalt deposits were discovered in 1903 about 200,000,000 ounces of silver. The Cobalt mines are not expected to make as large annual outputs as in the past few years, but they are expected to make a large production for many years to come.

MINING LAW REVISION.

In a contribution to a discussion of a paper presented at the March meeting of the American Institute of Mining Engineers, Mr. J. B. Tyrrell, of Toronto, says of the attempt made to draft a mining code for the Dominion of Canada:—

"The Dominion of Canada does not own all its wild land. Most of the various Provinces, like many of the States, own their public lands, so that the Dominion only owns a certain proportion of the more distant vacant land. These lands are covered by the Dominion mining law. A few years ago the Canadian Mining Institute suggested to the Dominion Government that it might be allowed to co-operate with the Government in the drafting of a new mining law for the Dominion, in the hope that such a mining law might not only be useful to the Dominion of Canada itself, but might also serve as a model for the various Provinces of Canada, and that sooner or later the Provinces would pass laws which would closely approximate this model law which we were to draw up. The Dominion Government threw the responsibility back on the Canadian Mining Institute and said to it: 'You draw up the Act, and if possible we will pass it for you.' That was under a Government which two years ago went out of power, and since the new Government has come into power, while it has considered our draft sympathetically, it has not passed it into law. We hope it will take that draft into consideration during this year and enact it into law, because it embodies, as closely as we can determine, the kind of law which we think would be best for Canada.

"Now, the constitution of the committee that was appointed to draft this law was about as follows: We chose three or four of those actual mining members of the Canadian Mining Institute whom we thought had most experience and were most competent to express opinions on what a mining law should be. We also added a couple of lawyers to the committee, who were to furnish the legal assistance in doing the work and in putting the drafts into proper legal form. It was not their duty, nor did they assume, to dictate what that law should be, but they were to assist us in framing the law; so that it would be a law which would be considered as being properly drawn by the courts.

"I am not going to give you any synopsis of that draft. It is still a draft, though we hope to have it enacted into law this year. Whether it will be or not, I do not know. But what I have said may give you some idea of the way in which we undertook the preparation of it. We have endeavored to draw up a mining law for the Dominion of Canada, covering the Federal lands, which we hope will serve as a model, and be copied by the Provinces as soon as possible, so that we will have fairly harmonious mining laws throughout the entire Dominion.

"In Canada, we do not sympathize with the apex law, which as I understand it, was a product of an erroneous interpretation of Cordilleran geology. Leaving out the ore-bodies in the Rocky Mountains and considering only those occurring in the Pre-Cambrian and other great formations throughout the eastern portion of the country, I do not think that the apex law would have suggested itself to anybody."

WASHING OIL WELLS.

Mr. Arthur Knapp in a communication to the Secretary of the American Institute of Mining Engineers says: "I believe that the washing of a well with clear water is, in general, a very bad thing. There are probably formations that will stand up after being washed with clear water, but my experience in California and elsewhere has been, that to wash a well with anything but a well-mixed mud would stick the casing before cementing could be accomplished. The mud is the only thing that will wash the oil out of the hole and hold back the gas. Neat cement is heavy enough to displace the mud adhering to the casing and give the desired contact between cement and casing. Further, any well in which the circulation cannot be established in 3 hr. is not in a condition to be cemented. The casing should be removed and the hole reamed. Circulation for a long period of time serves only to cut deeper channels around the casing and does not clear the entire circumference."

GRANBY.

Boston.—President Nichols, of Granby Consolidated, sends this word to stockholders with dividend checks:

"The three furnaces of our new smelter at Anyox are now running. Naturally some time must elapse before the exact amount or cost of our normal output can be known, but no unexpected difficulties have been disclosed either as to mechanical appliances or as to character of the ores. The shipments of copper so far received are of unusual purity and the value of precious metals content exceeds our expectations. Some inconvenience and delay has been suffered through the action of the Canadian Government in restricting immigration, but it is not expected to have any permanent effect on our estimated labor cost. Operations at Grand Forks and Phœnix are proceeding as usual."

It is expected the Millie Mack, situated in the mountains east of Burton, on Arrow lake, will be worked again this season, the owners having recently visited the property.

The total quantity of ore received at the Consolidated Mining and Smelting Co.'s works at Trail during four weeks ended May 28, was 26,583 tons, this consisting of 21,469 tons from the company's own mines and 5,114 tons of custom ores, the latter including 912 tons from the neighboring State of Washington.

The Queen's Head Mining and Milling Co. is having a survey made preparatory to driving an adit at a lower level than any of the existing workings on its Hartney group of mineral claims, situated on the mountain above New Denver, Slocan lake. Mr. J. D. MacMaster, of Rochester, New York, managing director, is in local charge.

The traction rope of the old Last Chance aerial tramway is being replaced by a new steel rope 12,956 ft. in length and weighing 8,555 lb. The tramway is now used for taking up supplies to the Surprise mine, above Cody, Slocan, and for bringing ore down for hauling to the railway at Sandon.

Mr. J. D. Galloway, assistant provincial mineralogist, has gone to Hazelton, Skeena Country, B.C., to make that place his starting point in connection with an investigation into mining properties and conditions along the route of the Grand Trunk Pacific railway thence eastward to the British Columbia-Alberta boundary.

LONGWALL MACHINE MINING*

By J. F. K. Brown.

The greatest modern advance in coal mining of late years has been the introduction of machinery to undertake the work formerly performed by the miner underground. This applies to both longwall and the pillar and room systems; but, as continuance of operation is a large factor in the economical working of machines, longwall systems present the best field for their use. In room and pillar methods, a regular succession of varied operations takes place within a short time and the tonnage in each place is relatively small, whereas in longwall working many tons are handled. This gives the machines a continuous work period and so provides the best conditions under which they could be operated. Machine mining too offers the only antidote to the ever increasing wages cost. There is also the advantage of more systematic working methods, with a consequent increase in safety and efficiency. For these reasons alone it is probable than longwall operation will be the more largely utilized system in the future even under conditions which otherwise might be said to favor the pillar method.

Fundamental Problems

To such an extent has machine mining altered mining conditions that there appears now no special problems limiting its possibilities. But there are two factors that have a very large influence on its success, viz,—the roof and a question of organization. By the roof is meant not the few feet of stone immediately overlying the coal; but the succession of strata within 50 feet or more above.

As an illustration, imagine the conditions in any old hand mined longwall working, set out without regard to the roof. Naturally through various causes certain places fall behind others, some stone pillars are built solid, timber is left standing in the waste. From all these causes troubles arise. One miner says his coal is hard and demands extra rates, another fills nothing but small coal, falls are numerous and seem to occur regularly at one or two points, more timbering is wanted at each road head, at various points the pavement requires to be lifted. In other words, due to the overriding weight of the strata above, lines of force are produced which run anyway, and local pressures come into existence at certain points whose position is determinable by the relationship between the line of the coal face, the distance apart of the roads, and the areas open supported and unsupported. The man in charge of such a section usually blames the roof—quite correctly too. But he should realize that it was his method of working that caused the roof to act in such a manner.

The introduction of machine walls and conveyor operation demands straight lines in the coal face, and that the needed supports be placed at stated intervals running in both directions. Regularity becomes the fashion, with the result that equal pressures, lines—unknown under former conditions—develop parallel or at right angles to the line of the coal, and can be taken advantage of in operation. The power that is in the roof becomes a help instead of a hindrance. Safety is increased: if you know what a roof will do you can within limits prepare for it. No two roofs are alike in the weight exerted, the type and direction of break or the swing of the loosened strata; but once regularity of working is established they may each be expected to exert their several powers in the same way. And to gain the best advantage of this regularity in roof pressure a knowledge of all the underlying principles that cause these phenomena becomes a matter of first importance.

Next to a proper understanding of the roof comes the organization of the underground operations. System in every part of the work is much needed and it must be almost military in its exactitude. Let a man or a machine fall behind in his time for the task allotted and the whole routine becomes disjointed. Should a coal cutter be three hours overdue in finishing its run men have to wait before they are able to turn over their coal. When the end of the shift appears, this coal has still to be loaded, extra men have to be procured and finally the machine starts the next shift again behind time, one loss accumulating on the other.

Coal Cutters

Undercutting by machine has advanced so far as to now allow the mine manager a varied choice of machines, although they can all be related to one of three accepted types, viz,—disc, bar and chain. Details of construction cause variations in the appearacne of the machines of different factories, but the essential features are the same. Each type can be air driven, or electric, and neither on skids or wheels. Haulage along the face is accomplished by a rope and gear passing in most cases under the machines.

Certain special advantages are attached to each machine, which are worth considering. The disc machine is the heaviest and fastest worker. The disc generally makes a better cutting arrangement, and its shape and action produce dross in the cut which is cleaned out by the machine itself.

Against this there is the disadvantage in a soft coal or fireclay of the disc becoming jammed by the coal falling down upon it or the cutter wheel being clogged. In many cases this has caused great delay, as the getting out of blocks of coal hidden behind the machine in a thin 18 in. seam is an awkward task. Many troubles of this character limit the cutting time of a disc. Neither is it adapted to working into the coal by itself at the commencement of either end of the cut, and places have to be specially prepared for it by hand labor.

When using a bar machine, the bar being only 4 in. in diameter, the coal even should it fall on the cutter does not stop the progress of the undercutting. The design of the mechanism places the cutter bar at one end of the machine, and as it has a swivel action through about 180° it is possible for this machine to cut its own way into the coal at the beginning of the cut, and, if turned, at the commencement of the return journey. In working, the bar produces "gum," a very fine powdered coal. Generally bar machines seem to be more dusty than disc cutters although this would depend on the class of coal. The noise of a disc cutting is much the greater and by comparison a bar running often appears quite an "abode of silence," but the claim sometimes made for the bar that it enables the working of the roof to be heard can hardly be considered.

*A paper prepared for the annual meeting of the Mining Society of Nova Scotia, 1914.

The chain cutter occupies a position midway between these two and while supposed to have none of the disadvantages of the other types, appeared in a number of cases in the early days like having very few of their virtues either. Through experience it is not a type that is particularly popular in most coal fields in Britain, but having been better designed has been very successful in the United States. This type of cutter using the travelling chain has one main advantage over the disc, for being narrower in the cut and being able to cut its way into the coal itself in a similar manner to the bar.

Machine mining it is understood has the following general economies:—

(a). A much increased output is obtained from the same area.

(b). The undercutting cost is less, by the large increase of output per man.

(c). Owing to better and advantageous control of the roof, the cost of timbering and explosives are both reduced.

(d). Better coal is produced, less slack being cut by the machine in comparison with hand mining.

(e). There is greater safety at the face.

Changed Conditions in the Mines

The most important point is the recognition by management and men of the changed conditions introduced in the mine. The following remarks, apply equally well to conveyor and loader conditions:

The Workings.—As the conditions which prevail under hand mining are in the majority of cases quite unsuited to machine work, the workings must be properly prepared before commencing. Everything possible to expedite this should be done, for with machines a certain amount of work has to be carried out within a definite time. The men must be well arranged and know exactly what is required of them. The roads should be short and well graded, as about three times the tonnage has to be handled with certainty under the new conditions. If the regularity is not maintained, a loss of a night's cut is the usual penalty, and a succession of such defaults will soon make the machine a costly innovation.

Opening Out Machine Walls.—Opening out machine walls if done by hand is slow and tedious work, and in modern practice the machine itself is frequently used either by running a bar and increasing the face in a semicircular form, or using a disc and carrying a short machine wall direct to the dip. In a face of this character one end of the wall should be in advance of the other so that any water made will gravitate to one point in the workings. By making the machine operate with a deep cut in these short opening out walls, the coal is easily broken down and a considerable tonnage results.

Depth of Undercut.—This is a matter of experience and opinion, and is mainly governed by the best depth at which the coal will break easily yet not too readily, so as to avoid any breakage of the coal in top of the machine. Three feet three inches is a common undercut, but with American chain machines six ft. is more usual.

Holing.—As a rule this is done in the bottom of the seam, for the same reason that the miner undercuts there, taking advantage of the roof weight. Holing in any dirt band that may underlie the coal is not always advisable, as it sometimes leads to trouble in filling; and except in very thin seams where height is much needed, holing is best done in the coal. Certain conditions such as a band of bad coal, a soft clay higher up in the seam, may cause holing to be done there; but care should be taken that the portion below the holing has a good parting from the floor. Otherwise trouble will result in lifting this pavement coal.

Working Operations.—The usual practice is to undercut at night, the coal being filled during the day. Machines can cut two ways: back and forward each alternate night, and a certain length of face; or only in one direction, the machine being run at the end of the shift from one end of the section to the other. This latter part of the work known locally as "flitting the machine" is an awkward and costly operation, and is seldom applied now-a-days unless in thick seams where it takes more than one shift to clear away the coal. In some collieries where conditions are good, as many as five cutters follow each other in regular succession over one long face.

Height.—This condition only applies where thin seams are operated, and when it gets down to 18 and 20 in. sections every inch counts. By using skids a few inches is gained over wheels. With thin sections the cutting must be kept at the pavement since any coal left has to be afterwards lifted in order to maintain the height causing extra work. In using coal cutters in thin seams provision should be made for any likely decrease in section.

Operating.—In getting ready to start cutting, the coal face from end to end should be as straight as possible. Usually, however, a longwall face gradually assumes an almost semi-circular form, and where the outlet road of the section is in the centre this form suits just as well, although it is apt to cause faults in the roads owing to the tendency of the lines of roof pressure to converge. A straight line face permits of the weight being more evenly distributed and brings down the coal in a regular manner. Seams exist where the pressure can be regulated, so as to allow the coal to fall without blasting a few yards behind the machine. Timbering should also be regular, each prop being a measured distance from the coal and from the next in line.

Direction of Working Face.—This is mainly determined by the inclination, except in those cases where the cleat of the coal is extra well developed. As a general rule undercutting by machine is independent of the advantage of cleats owing to the use made of the roof weight. Usually a machine is run on the dip to rise run; but it sometimes happens that, at right angles to this, if not too steep, or any angle between the two, the coal may break out easier in large blocks, and so reduce the small coal to a minimum.

The Length of Face.—The amount of coal to be stripped off chiefly determines the length of the wall, together with the time that can be given to doing it. Where a machine cuts the coal every night, the length must be such that there can be no doubt but that the coal can be cleaned away rapidly in the following day shift. What is called back or after stripping is to be avoided, and sometimes too long a wall leads to the waste of much coal being thrown out of the way to allow the machine to proceed.

Stripping.—Steady men should be employed to work as loaders and provision should be made to always have some reserve of men to draw on. Loading should commence in the road head by a breaking in shot and after that work continues filling out each day. The space allotted to the pair of men should only be

what they can reasonably handle and in thin seams 15 yd. is enough. The success of a machine depends not so much on the length cut, as on the regularity of cutting, hence the importance of the stripping.

Inclination.—The amount of inclination of a seam has so far proved no disadvantage to the coal cutter and machines are at work in seams dipping as high as 40°. Under these conditions working to the dip and rise of the seam is a necessity, while the machine instead of a haulage rope on the down rise will require a brake rope in its place. If working across the inclination is attempted, the machine has to be well propped up to its work, not an easy matter. If cutting down it is apt to be diverted in the cut.

Timbering the Run.—This depends on the nature of the roof, slips, and the strength of the coal. About 5 ft. is needed for the passage of the machine. A line of props outside this is sometimes not sufficient to hold the roof. In that case either a row of props in the path of the machine, to be withdrawn and reset as the cutter passes, or a set of straps will be required.

Working the Machine.—The running of any cutter should be under the care of a careful and steady workman. Probably in the past there has been no type of machine so subject to hard usage. Machinemen must be able to make slight repairs, and keep the cutter in good running order. Their shift should start at least an hour before cutting commences, in order that all details be well overhauled. When running, their duties are to guide and control its movements. The man behind attends to the air connections, the cleaning out of the small coal, and the setting up of the props. Generally speaking it pays to provide men usually known as strappers—whose duty is that of timbering the machine run in advance of the machine, and whose shift should commence at least four hours before the cutter. Where the work of the coal face is divided like this into piece work, men become very expert at the portion of the task assigned to them, and the general efficiency rises, all of which tends to the success of the coal cutter.

Regular reports should be made day by day by the machinemen of progress, time lost, reason of delays, and these form a valuable means of comparison and control.

One of the earliest coal cutting collieries was at Gartness, Lanarkshire, Scotland, in 1880, sixteen years before the bar coal cutter began to come on the market. The seam was 30 in., and the machine a disc operated on compressed air, cutting 150 tons per day. The cutting contractor was paid 7 1-2c per ton, and for this he made ready the machine, drew any wood in front, set up any temporary props, reset wood behind machine, cleaned out the "gum", made holing, put in any spraggs, did the cutting and changed the hose pipe from road to road. Four pipe roads in 16 walls were needed. Filling out the coal was also under contract, and paid at the rate of 10 cents per ton, this including blowing down coal, filling and setting up wood. The capital cost on plant amounted for two cutters—each costing $973.00—to $11,499. In its day, this machine known as the Rigg & Maihlejohn, was a very efficient type and could be bought at a price nearly $730 below the present figures. The price of a modern machine now runs from $1,600.00 to $2,500.00, according to size and type.

Conveyors

The second type of coal mine labor saving device to be developed was the conveyor, which originated in the desire to obtain a better and more economical method of handling the coal produced by the coal cutter. With machine undercutting 30 to 60 per cent. of an increase in output is obtainable from the same area, and in many cases existing methods proved inadequate to the demands made upon them. It is, however, only fair to say that one type of conveyor was in existence before coal cutters were operated.

Conveyors like the coal cutters are mainly of three types: shaking, intermittent and continuous.

Curiously enough the shaking type has mainly developed from Continental practice, the intermittent conveyor is typically Scottish, and the continuous jointly American and English.

The first type is the oldest and in its original form has probably been in use for many years, having probably attained its greatest development in the pitching longwall seams of the Belgian and Calais coal fields. At first the conveyor consisted of a series of plates laid down on the pavement on which the coal slides by its own gravity into the waiting tram in the level below. This properly speaking is only a device to aid the flow of the material; and can hardly be said to convey the coal in the modern sense of the term. The next step was the substitution of trough lengths of semi-circular plates being on chains attached to posts placed alongside. At the bottom a cross bar stood just short of the full swing of the trough which might be say 12 in. This bar acted as a stop or bumping post and so there developed the "bumping" or swaying conveyor, and lengths up to 150 ft. were operated in this manner. Considerable breakage of the coal took place and dust was readily made. Out of this the conveyor or "coulior" of the Belgian fields developed and is largely in use to this day. It is a power driven conveyor built up of plates about 12 ft. long, 13 3-4 in. wide and about 3 in. deep. This type acted in the same manner as a sloping screen and was supported on roller bearings, or rods.

The more modern representation of this type is known under various names and general arrangement operation turns upon the same idea as that employed in horizontal screens of the Baker type. The plates rest on rollers running in turn in semi-circular channel irons on the floor. The conveyor is given a to and fro motion and through that obtains a rapid up and down one not produced by the motor being rigidly attached to the plates, but usually through the operation of a rope. One or two conveyors can be operated by the same engine.

The main advantage of the shaking conveyor is its cheapness in first cost, and the ease with which it can be moved. Its disadvantage is its tendency to produce dust.

Of the intermittent type several examples are in use, all developments of face haulage systems. The simplest of all is a long low car with dropping doors in the bottom. Rails are laid along the face and stretch over the road head, the car being run out by a rope attached to the front and back end, and driven by a small double drum engine in a similar manner to a "main and tail" rope haulage. When driven over the road head the bottom doors swing open, and the coal drops into the box below. Except in thin seams this type has no advantages over any system of face haulage.

An extension of this idea introduces the Thompson, Gibb and Ritchie conveyors. The first two of these consist of a series of low boxes or one long box which is operated by a rope and engine in a similar manner to the single car type already described, but the meth-

od of discharge varies. In the Thompson type the car has only one side and that furthest away from the face. The total height on the coal side is only nine inches from the floor. This long car when drawn over the road head passes under a scraper set at an angle which deflects the coal off the travelling plate and into the box below. A Thompson conveyor usually fills out of two stretches of workings operated by a central road, loading first the one side and then the other.

Within the Gibb conveyor there runs an endless chain which is brought into operation when the conveyor comes against a buffer situated in the road head. The same rope gear that draws the conveyor along the face operates the discharging chain. This conveyor is made with discharging gear at both ends, the chains working either way and so any lengths of face can be worked but two outlet roads are needed.

In the Ritchie conveyor the trough extends the full length of the face being operated, while the discharging arrangement only extends one quarter of this distance. In this case the discharging gear is a wire belt drawn backwards and forwards in the troughs by a rope and which at the discharging end coils itself upon a drum spilling the coal into the boxes.

While these conveyors have the advantage of being more or less independent of an undulating floor, they possess in their turn the disadvantage of only serving one portion of the coal face at a time, and like the system of box loading they were intended to supersede, each miner had to await his turn to handle his coal, more or less time being lost in loading.

Of the continuous types there are three, viz.—the Allardice, Sutcliffe and Blackett. In the Allardice a flat link chain at 9 in. centres equipped with wing scrapers every three feet runs in the usual series of iron plates. This is provided with suitable driving and tension pulleys at either end, and the chain returns overhead being supported on bolts attached to the timber and about 9 ft. apart.

The Sutcliffe represents the application of the conveyor belt to underground use. The belt is either leather, balata or wire cloth, usually the latter, and runs in troughed rollers. A tension gear is used at the top end, and driving gear at lower end.

The last conveyor to be described was brought out simultaneously in America and England, but somehow seems to have found the greater field of its operation in the latter country. A link scraper chain is employed to run in a pan, the return being underneath. This makes the sides of the conveyor higher than most conveyors in operation, usually 15 in. from the floor. The pans are six feet in length easily put together and approximate 8 in. across the mouth, 8 in. sides and 14 in. in the bottom. A tightening gear at the top end of the conveyor is a matter of importance, otherwise the coal gets under the chain, causing it to rise out of the pan, and the coal falls over the side. For this reason all these conveyors are supposed to need a level floor, but the writer has seen a Blackett working through and regularly shifted over a 2 ft. 6 in. fault.

With all these types of machines in operation it is a long task to go over minutely their special advantages. Each like any other class of mining machinery is bound to have its own advocates. Type No. 1 has the advantages of cheapness, and simplicity in construction and operation. No. 2 suits seams with undulating floors, and is very easily moved from position to position, while No. 3 is greater in first cost but produces a steady and regular delivery of the coal at the road head.

All have been designed and operated for the purpose of reducing costs, and do or attempt to do by delivering the coal at one particular point in the workings. This has the following advantages:—

(a). The concentration of the machine output at one point where proper preparations can be made to meet it.

(b). Only one or two roads are needed in each section. This represents in many cases a big saving in costs of building and getting down the roof and repairing, say 10 roads as against two.

(c). The disappearance of lines of roof weakness due to road bushing and consequent continuance of the policy of roof control first introduced with the machine.

(d). The steady systematic timbering giving greater safety.

(e). The increased output per man due to greater care in loading and consequent reduction of costs.

An advantage sometimes claimed is the larger proportion of round coal brought out from the face, but this is doubtful, and likewise the disadvantage often stated of more dust produced in the faces does not seem to be borne out in practice.

Operating Conveyors

In operation a conveyor follows much on the lines of a machine wall. The face must be straight, and with certain types without undulations. When machine and conveyor are both in use regular propping is required as space is needed, for first the machine and then the conveyor.

The main haulage road to deal adequately must be double width to allow of a double track and should be kept in advance of the usual face line a distance of 50 ft. or thereabout. This provides a space in which to manipulate the large number of boxes required for loading. These boxes have to get under the conveyor head so the pavement of the seam is lifted to a depth sufficient to allow this. As a rule this pavement is lifted every third night while the machine is cutting. In order to avoid having to keep a road in advance of the usual face line, a second short conveyor always of the continuous type has sometimes been used. The face conveyor discharges at right angles into the road conveyor, and it in turn raises the coal a sufficient height to reach the boxes. An ingenious turntable has been used with this second conveyor, rotating the tubs from one road to the other in front of the discharge end. It had the advantage of causing no cessation of loading due to shifting and putting in a fresh trip of boxes. With the road conveyor a double road is required just the same, one line being occupied by the conveyor and the other by the empty boxes, and any extra height required is obtained by taking down the roof. Just how essential it is to have a good system at the loading end is at once seen, when it is considered that 400 boxes may have to be dealt with there in one day.

In seams with any inclination, a second bottom road, parallel to the loading road, is good practice. This is due to the tendency of the roof weight to slide down hill, and this second road placed below the loading road acts as a safety valve, into which roof pressure can exhaust itself without causing excessive crush of the working level.

Shifting the conveyor is an operation usually carried out at night while the cutter is running. Six

men on the average are sufficient, depending on the length and type of conveyor, and one or two conveyors may be shifted each night. Sometimes this work is performed on contract.

As with the machines the success of conveyor working depends on the recognition of the principle that the workings must be arranged to suit the conveyor and not vice versa, and system plays a large part in operation. It would be poor policy to concentrate 200 tons at the road head and then have no proper means of taking the quantity to the shaft. The same remark applies to the timbering and loading. Using machines and conveyors, the operation of the roof being steady and continuous, it is possible to set the necessary timber at regular intervals and in line. Such a practice facilitates both the working and shifting of the machines. Where there is much timbering required this is best done by special men who should be attached to the squad detailed to shift the conveyor. In working it is essential that all the coal cut must be filled out to make room for the next machine run, and should any loaders not turn out others must be found to take their place.

While a conveyor is usually considered in conjunction with a coal cutter it is not necessarily so, and there are a number of mines where considerable success has been attained when used alone. The following particulars were taken when mining was conducted with Blackett conveyors only.

The coal seam worked had the following section.

Coal	10 in.
Stone	1 "
Coal	9 "
Stone	12 "
Coal	17 "
Total height	49 "

Coal 36 in.

operated on the longwall principle. Deeps were driven on the straight inclination of 150 and levels broken off every 300 ft.; after a full pillar of 60 ft. was turned each level was connected, and longwall commenced, until operations appeared somewhat as shown on the sketch. One section followed another in regular succession, in all 8 Blackett Conveyors were in use. Faults of 2 ft. 6 in. and 18 in occurred in two sections but presented no difficulty during working. The tonnage per man rose from 3.75 to 6.2 and the advance of the faces from 160 ft. in six months to 260 ft. Only 16 roads all told were maintained for a former 66. The saving in cost amounted to 20c per ton. Working was carried out by contract, contractors having one section apiece, and as each section was an exact replica of the other, a bonus was sometimes paid for highest tonnage produced. Over and above the total reduction in cost actually attained, it is easily seen that there are advantages to the management in this system in the concentration of the output in the one quarter, and the consequent less dead work, and lower supervision cost implied. Ventilation was also simplified.

Generally speaking the saving in cost obtainable using conveyors is variable, and although some figures together with the conditions of working are given in the table attached it is not possible to compare conditions in any way. Every case must be considered on its own merits, measured against some known performance and so the figures given only show what can be accomplished by using this working method.

Loaders

The next type of labor saving device in natural sequence is the underground mechanical loader. So far it has only developed slowly, and it is but little beyond the bare idea. Before describing the machine in existence it may be possible to consider the conditions to which in longwall they would have to comply.

In the first place loaders can only economically be used in conjunction with conveyors, or some system of face haulage. A machine wall may produce from 150 to 300 tons of coal lying in one straight line, so that loading becomes a continuous operation. Considering that filling by hand gives about 6 tons per man, under coal cutter conditions, and the loader can average 20 to 40 tons per hour, the whole face can easily be cleaned up by the one machine and two men instead of 30 to 50 men. Not only this but a machine cleans right from one end to the other, and consequently the coal cutter can immediately follow up the loader. By this means the rate of progress is very nearly doubled, and likewise the output from any one section. It ought therefore to be quite possible to obtain 500 tons per day from a 100 yd. face, and this should be produced by the machine, and a squad of 10 to 12 men, bringing the tonnage per man up to 20. Given an allowance for interest and depreciation on the combinations of machines used, the cost of production cannot help but be low. Further the system has the great advantage of concentration of output, and would help to solve a pressing labor problem. To be successful a loader needs therefore to have sufficient propelling power of its own to give it at least the same progress as the wall cutter, namely something around 15 in. to 20 in per minute. About double this would be better practice, since this would allow for any loss of time due to breakdown, and also give the machine an opportunity to exercise the reciprocating motion essential in the thrust in shovelling.

Neither skids or wheels appear very suitable to a loader; with wheels two tracks will often be needed; with skids progress must be in one direction and the machine cannot back to take a special thrust forward. At best a loader has to travel over a rough floor, and possibly the best arrangement to suit all conditions would be a design using either a caterpillar or endless chain tread. Loading for longwall purposes must be sideways to the passage of the machine, and the machines themselves will require to be built as low in height as the coal cutter has been designed. The thrust forward of the shovel is an important point; this should be as great as possible, and so an engine which provides a large margin of power is much to be preferred. The actual shoveling principle is a matter of choice dictated by the limiting space, and can doubtless be either intermittent or continuous.

So far as the writer knows there is at present only one loading machine being applied to longwall coal mining. This is the Myers-Whaley.

This machine consists essentially of two conveyors, and a revolving shovel, the whole being mounted on a truck. It consists of two parts an inner contained within an outer shovel. The outer shovel fixed on a crank shaft and provided with removable teeth similar to steam shovel practice, in revolving forward, digs into the coal, and as it turns upwards completing the revolution the material slides back into the second or inner shovel. As the revolution continues two cams

on the outer shovel force the inner one to rise and revolve until it in turn discharges on to the first conveyor, hence to the second, and so to the car. The machine is pivoted in two places, the front conveyor and shovels revolving laterally 8 ft., 6 in. to 10 in. on either side of the track, depending on the size of the machine in use. The rear conveyor is also capable of swinging so as to facilitate the loading of cars alongside the machine on a parallel track.

This loader is at work in seams averaging 54 in., 78 in., and 64 in. of coal, and in the latter case in longwall workings. The principal dimensions are:—

Weight, 6,000 to 7,000; track gauge, 24 in.; length, about 19 ft.; over all width, 4 ft., 5 in.; wheel base, 30 in.; reach, 8 ft., 6 in.; maximum height, 38 in.; width of shovel, 28 in.; power consumption, 7 1-2 h.p.; tonnage handled, 1,750 lb. coal per min.; thrust of shovel, 3,000 lb.

The larger sizes are heavier but load correspondingly more material. One of the most interesting things about this loader is the small horsepower as compared with the average of other types of labor saving machines, but this naturally depends on the duty being performed.

In a mine in Virginia the loading machine follows next after blasting, working up a 4 per cent. grade—the cars being dropped down by gravity. On the side next to the working face, the operator sits on the machine and most of the shoveling is done on that side. The cars are brought alongside the machine in trips and loading is practically continuous, any coal which rolls as far as the car track is turned back by hand to allow the cars to run. So far the machine is now loading out about 200 tons a day, which it is expected to increase to over 250 as soon as the men and management can make the necessary arrangements. All this loading is being managed with a crew of four men, and if the results are arranged in the form of a table some striking figures are obtained which bear out the suggestions made earlier in the paper.

	By Hand	By Machine Cutter and loader
Tons per day	80	200
Advance of face per day	1′	6′
Number of men	27	..
Number of men on coal cutter	..	2
Number of men on coal loader	..	4
Number of extra timbermen	..	4
No. of tons per man	3	20
Ratio cost per ton	5	1

From the above table it will be easily seen how the tonnage per man can increase by the use of any properly designed loader, and how complimentary an adjunct they are to machine cutting and conveying. If cutting and loading took 10 hours each and both could be operating at the same time it means that the output can be doubled in the one section with the addition of six men to the operating force.

To the actual cost there is to be added, as in all cases a percentage for depreciation and interest on capital. The purchase price of these machines is somewhat heavy, running from $3,000 to $6,000, depending on the size required.

This practically ends our knowledge of the loader in longwall, but looking to its obvious advantages it is certain that continued efforts will be made along this line to produce and modify a machine suited for this work. Underground loading by machinery constitutes the one large field for mechanical operation as yet practically untouched.

Conclusion

Altogether there can be no doubt but that longwall machine mining will be in the immediate future the greatest factor towards efficiency in underground operations. It offers to managers and owners a dream in the way of decreased costs and ease of production, worth years of experiment and trial. Beyond that statement it is hardly possible to proceed since to each district alone must be left the working out of the lines that will lead to success in the methods indicated in this article.

SMELTING FURNACE FOR CYANIDE PRECIPITATE.

Mr. P. S. Anderson, of Baker, Oregon, in a paper presented at the meeting of the Columbia local section of the American Institute of Mining Engineers, held at the State College of Washington, Pullman, Washington, on May 16, said that his notes were submitted in the belief that they would prove of interest to operators of small cyanide plants where the installation of more expensive tilting furnaces is not practical. The furnace was described as being well adapted to the Taverner lead-smelting process, which Mr. Anderson had used for years with good results. The last furnace was used for nearly four years. It was built in a car-body, dimensions 24 x 42, in., and the brick-work had to be replaced about every twelve months.

Mr. Anderson's notes briefly described construction and operation. As to the latter the furnace is charged with about 100 lb. of cyanide precipitate, litharge and flux, approximately 70 lb. of damp precipitate being used. As this melts down more is added with a scoop shovel until there is about 7 in. of molten material in the furnace. After stirring, and when slag is fluid, the first tapping of slag is taken off, if necessary; otherwise scrap material—old cupels, speiss, etc.—is fed in, and fusion completed. In tapping, about two-thirds of the slag is taken off into the mould and the remainder of the charge is heated until the cupel, on testing with rod, feels smooth, when the entire remainder of the charge is poured by the tilting furnace into another mould. After cooling, slag and speiss is removed and lead bar is placed in the furnace for cupellation.

Although lead is allowed to go to waste, there is a compensating advantage in the fact that slag and bullion are cleaner. Very little gold is found in the flue-dust, although there is considerable silver. Samples give average results of 12.10 oz. gold and 11.40 oz. silver per ton. Slags assay, on an average, two cents per lb. in gold and silver, or $40 to the ton. Gasoline consumption averages one gallon per 18 lb. of precipitate, this including cupellation and resmelting.

A number of employees of the Westinghouse Electric and Manufacturing Company, and the Westinghouse Machine Company went on a strike last month, because the management refused to recognize the demands made by the newly formed labor union, the Allegheny Congenial Industrial Union, and as a result the works of these companies at East Pittsburg are partly shut down. The management of the companies does not believe that the trouble will be of long duration.

OPENING A COAL MINE IN NOVA SCOTIA*

By C. M. Odell.

While but little that is new to members of the society may appear in this paper, the writer's excuse for inflicting it upon the readers of the transactions is that a new generation, which is growing up, may be interested to know of the initial proceedings in opening what is destined to become in the near future one of the largest producing coal centres on the continent.

Before proceeding with the description of the initial work of opening and developing a coal basin it may be well to refer briefly to the field of which the Lingan Basin forms an important part, and to the early operations carried on therein.

The coal fields of Cape Breton, situated on the northeast coast of the island, are largely submarine, and are divided into four basins known locally as the Morien, Glace Bay, Lingan, and Sydney Mines basin, each of these being separated from its neighbor on the land areas by a well-defined anticline. Whether all these basins join into one great one far out at sea, or end as separate individual basins, must be left for future workers to determine, as it is not the purpose of this paper to enter into a discussion on that point. Historical records show that the value of these coal beds was known and some coal exported during the French occupation in the first decades of the eighteenth century.

The earliest mining operations were carried on by driving tunnels into the seams where exposed in the cliffs along the sea coast, or in gullies where the agelong action of streams had cut through the various strata, leaving them exposed on either side. Coal extracted at this time was generally loaded on scows which were towed out to waiting vessels anchored off shore and then transferred to the vessel's hold. In the early sixties of the past century a number of small companies were formed and operations commenced at a number of different points.

The system pursued by the small individual operators of these mines was to select a point as near the sea coast as practicable. There a mine was opened either by shaft or slope as the natural conditions best lent themselves thereto, and on account of the proximity of the shipping pier the coal was conveyed to the point of shipment direct in the mine tub or car in which it was loaded in the mine. The distance in most cases being less than a mile the transportation was effected by horses. Gradually the mining was extended and with increased shipments sinkings were made further back from the coast, machinery for handling coal in larger quantities was installed, short lines of steam railway were built, and the coal at the pit mouth was transferred from the mine tub to larger railway cars and thus carried to a point of shipment. It may be of interest to note the gradual expansion in size of cars used in hauling coal from the mines. Up to the early eighties the four-ton car or wagon was almost universal in Cape Breton. During the next few years cars carrying six tons each were introduced. These in turn gave place to ten-ton cars, which were the standard of the larger collieries only, up to the advent of the Dominion Coal Co. in 1893, when cars carrying fifteen tons each were substituted. These in turn are gradually giving way to steel cars with a carrying capacity of thirty-five tons dead weight of coal. In the same way, the little ten-ton schooner or "hooker" has by successive stages been supplanted by the great ocean freighter of ten thousand tons carrying capacity.

The Dominion Coal Co. controls by lease from the Nova Scotia Government all the coal areas worth considering on the southern side of Sydney Harbor, but has for some years confined its operations to the Glace Bay basin. A royalty of twelve and one-half cents per ton is paid on all coal marketed, and this forms the greater part of the revenue of the province of Nova Scotia. A steadily increasing market has demanded a larger supply, and the company has now turned its attention to the immense reserve fields of Lingan and Morien basins. Both of these areas were worked to a certain extent some years ago. The Morien basin by two companies—the Block House and the Gowrie—while the Lingan basin was opened at three points by the Low Point, Barrasois and Lingan Mining Co.

The Block House Co., with openings close to the shore, shipped direct from mine tubs to the vessel's hold, over a small shipping pier in Morien bay, while the Gowrie Co. sank a shaft about a mile and a half inland, which was connected with a shipping pier by railway. Coal from the Lingan basin was shipped partly in Sydney Harbor, which was reached by four miles of railway, and partly in Lingan basin, where small piers were erected and connected with the mines by a mile of railway.

All of these individual operations were absorbed by the Dominion Coal Co. at its formation in 1893, many of them having been closed down for years before this date, and their piers allowed to fall into decay. The policy pursued by the present operators has been to concentrate their energies on the Glace Bay basin for production, and to confine the shipping mainly to two points, viz.: Sydney and Louisburg harbors, where modern shipping piers capable of handling all the product have been erected. Two points of shipment were necessary for the reason that the magnificent harbor of Sydney, lying within fourteen miles of the mines and offering unsurpassed facilities for shipment, is frozen over during part of the year, while Louisburg harbor, some twenty-five miles distant in the opposite direction, is open the whole year round and furnishes an outlet when Sydney is closed. Another small shipping pier at Glace Bay harbor supplies the smaller vessels frequenting this port. This is maintained more as a convenience to such shipping as discharges cargo in Glace bay and could not at times make Sydney harbor in safety without taking in ballast.

Shipments.—The bulk of the output is shipped at Sydney, where the tonnage during summer months is such that the output is removed as fast as it is sent from the collieries. At Louisburg, which is utilized during winter months, the same regular supply of shipping cannot with certainty be counted on, and consequently a large storage pocket with belt conveyor system is resorted to. Any overplus of coal raised during winter months is stored in coal bank and removed again in summer when the St. Lawrence trade taxes every source of supply to the utmost.

Railway construction.—This involves amongst other expenditures the construction of a branch line of railway, connecting each new colliery with the main line, and a colliery railway yard near the pit mouth for the handling and sorting of the various grades of coal.

*Read at a meeting of the Mining Section Can. Soc. C.E., January 8th, 1914.

The expenditure necessary to place in full operation a colliery in virgin territory is in round numbers about $750,000 per unit, and may be generally divided as follows:

	Per cent.	
Purchase of site	2	$15,000
Prospecting and temporary work	2	15,000
Railway construction	12	90,000
Permanent bankhead, colliery buildings and operating machinery	33	247,500
Lighting	2	15,000
Water supply	5	37,500
Drainage and grading	2	15,000
Housing employees	22	165,000
Fire and life saving stations	2	15,000
Shipping facilities	7	52,500
Underground development including tracks, mine tubs, piping and mine machinery	11	82,500
	100	$750,000

The Coal Seams.—The known coal seams of the Lingan Basin extend from Sydney Harbor on the north to Lingan Bay on the south, a distance of five miles, and extending some two miles inland, embracing an area of ten square miles of land area and about ten square miles of submarine.

The general dip is northeasterly and the angle of dip about 14 degrees in the centre of the basin, decreasing towards the south and increasing as the seams are followed northerly to where they disappear under the waters of Sydney Harbor, where the dip has increased sharply until an angle of 40 degrees has been maintained.

The plans of the company comprise the opening in the near future of eight collieries in this basin, four each on the Victoria and Lingan seams. Four of these, numbered 12, 14, 15 and 16, are now practically complete and producing to their estimated full capacity of 1,200 tons per day, while a fifth is in process of development. Plans are maturing for the opening of two more at the extreme southern limit, and a similar one on the extreme northern limit. This will exhaust the operations on the Victoria and Lingan seams, and leave future enlargement of production to the Barrasois seam, which is the uppermost of the series, and the Mullins seam, which is the lowest of this group and consequently the largest in superficial extent. When these last seams are opened up to their capacity five more mines will have been added to the operations in the Lingan Basin, making thirteen mines in all in an area of ten square miles.

The system of working is to locate the various openings along the outcrop of the seams at intervals of about a mile and a quarter apart. The deep or main slope is then driven on the dip of the seam and from this the levels are broken off at intervals of 500 to 600 ft. These levels will extend half a mile on either side of the slope, at which point a solid barrier of coal extending parallel to the slope will be left. The barriers will extend from the surface to the extreme working length of the collieries, and are designed to separate each mine from the neighboring workings, so that in case of flood or fire each mine can be treated as an independent unit of production, and a stoppage of one mine need not affect the adjoining operations. Only a basin of such marked regularity in slope and position of the various seams comprising it would lend itself to such a system of working, and in this basin nature has left nothing to be desired. The coal collected from the various levels is drawn to the main slope, whence it is carried by a rope haulage system to the bankhead, there to be run over screens and picking belts into the railway cars for transportation to either of the railway terminals.

Company Houses.—Records show an average of about 2.4 tons of coal raised per man employed, and the house record shows about 2.4 working men housed per tenement. Hence a colliery of 1,200 tons daily production requires five hundred men, and they in turn require two hundred tenements. The old time "miners' rows" have been long since tabooed and to-day the company erects neat cottages which are let to the men at reasonable rates. The most suitable style of tenement seems to be a good class of double house, set on a large lot of land, and the grounds around many of the miners' houses to-day present a neat and attractive appearance. These houses are erected and owned by the company. Their cost at present date averages about $1,500 to $2,000 per double block, exclusive of land. As they occupy extra large lots and are built on wide streets, they average but four to an acre, hence about twenty-five acres of land per colliery is required for housing alone. Adding 125 acres for colliery buildings, railways, roads, pole lines, pipe lines, and drainage ditches, we find an average of about 150 acres per colliery required for surface rights, or about 2,000 acres for a layout such as is undertaken here.

The lands surrounding the houses are for the most part owned by the company, and are all laid out and the streets graded by the company's engineers. In quite a few cases the miners buy lands and build their own houses, and this custom will no doubt increase as the whole section becomes more settled. The company encourages the men to become their own landlords, and assists them pecuniarily in many cases.

Railways.—About two-and-one-half miles of standard gauge track is required for colliery yard at each bankhead, with an additional amount of branch line to reach the main railway, making an average of about five miles of track to be laid for each colliery opened. This track is all laid with 60-lb. rails, while the main line, which is subjected to heavier traffic, is laid with 80-lb. rails. All tracks are built in a most thorough and up-to-date manner, as nothing less would suffice for the enormous and ever-increasing traffic.

Coal Washers.—As development proceeds and output increases, larger expenditures become necessary for increased screening appliances and picking belts by which the various grades of coal are sorted and impurities removed. More recently a wash plant or coal washery was demanded through which the lower grades of coal are passed to more effectually remove sulphur and other objectionable materials. To this end the company has erected a large coal washer of the Baum type, claimed to be the best in the world, and capable of washing one hundred and twenty tons of coal per hour.

Power.—As a matter of economy the refuse from the picking belts and the slack coal from the screens is used under boilers for power raising. A great change has been effected in recent years by the introduction of electric power in place of steam, and the tendency now is to eliminate all steam around the collieries of the Lingan Basin, except for heating pur-

poses. Up to this year these collieries have been supplied with electric power from a generating station located in the centre of the Glace Bay Basin, some eight miles distant, but as a part of the equipment a larger generating station situated in the heart of the Lingan district is now nearing completion. This station is to be operated by turbine-driven generators of from 2,000 to 4,000 kilowatt capacity. The boiler plant consists of three Bettington boilers, a description of which was published in the special Nova Scotia edition of the Canadian Mining Journal, published in September, 1912. When completed the entire equipment of this district, including air compressors, coal hoists, ventilating fans, bankhead machinery, screening plant and underground pumps will all be electrically operated.

Rescue Apparatus.—In the matter of protection both for men and property underground, the Draeger apparatus has been adopted, and the erection of a life-saving station at each mining centre is deemed a necessary portion of the general equipment.

Water supply is always one of the very first requisites, and at present a temporary pumping plant at Waterford Lake supplies the needs of the community through a main and distributing system. Plans are, however, about perfected for a full and ample supply to the whole community at an estimated cost of $250,000.00.

Lighting, etc.—Surface workings of all collieries are electrically lighted from the company's plant, and some street lighting is also done. At present the townsite known as New Waterford, is unincorporated and practically all street work, drainage and sewerage is undertaken by the company. Mine drainage is effected by pumping plants located near the seashore, water being forced through vertical boreholes by electrically driven underground pumps, and carried by surface ditches direct to the sea.

Transportation.—Shipping piers with all modern appliances are located in Louisburg and Sydney harbors, the average haul from pit mouth to shipping pier being about twenty miles. Locomotives of 120 tons weight, with coal hoppers of two different types, are used on all lines, the two types being wooden hoppers of 15 tons capacity, and steel hoppers of 35 tons capacity. In addition a small percentage of coal which is shipped by rail is carried in box cars. To accommodate these, special box car loaders are installed at some of the collieries, as the loading appliances for hopper cars would not answer for the side doors of the box cars. Present pier loading capacity is about 1,600 tons per hour, but the new pier, which is nearing completion, will greatly increase this.

Coal carrying steamers have been gradually increased in capacity from the 3,000 ton ship, which was looked upon as a leviathan some twenty years ago, to vessels of 10,000 tons capacity in use to-day. These will again be displaced by ships of still greater burden as years go by.

Additional expenditures for equipment.—Even with the colliery fully equipped and producing to its full capacity, expenditure on capital account cannot be said to have ceased entirely, as with the working extending farther and farther to the deep, increased pumping and ventilating capacity becomes necessary, the increased length of mine tracks and air piping add their quota, and additional mine cars and mining machines are required to gather a given quantity of coal over a greater area.

WHEATON DISTRICT, YUKON.

The Geological Survey has issued a memoir, No. 31, on the Wheaton District, by Mr. D. D. Cairnes. The report is accompanied by a geological and a topographical map. Mr. Cairnes gives much useful information concerning the district, its character, general geology and economic geology.

From the standpoint of economic geology, Wheaton district is chiefly of interest for its ore-deposits, but, in addition, some coal-seams have been discovered. The ore-deposits may be considered as belonging to four classes: (1) Gold-silver quartz veins. (2) Antimony-silver veins. (3) Silver-lead veins. (4) Contact-metamorphic deposits.

The gold-silver veins are the most extensive, and are of particular interest in that they contain not only native gold, but various tellurides. The gold content of these ores is generally of considerably greater value than the silver. The antimony-silver veins belong to a rare type of deposit, in that they are antimony deposits the ores of which contain both antimony and silver in economically important amounts. Such deposits are known in only a few localities in the world, and have been named in Germany the 'Mobendorf type.' The silver-lead veins contain silver and lead in important amounts, and are mainly metasomatic replacement deposits. They thus differ considerably from the two types of veins just mentioned, which are prevailingly cavity-fillings. The contact-metamorphic deposits have been discovered on only one claim, but are noteworthy since, although the mineral-combination, the form of occurrence, etc., are those usually encountered in such deposits, the formation in which the ore-materials occur is a calcareous hornblende-gneiss. Limestone is the usual rock in which such secondary ore-materials are produced, and occurrences in quartzite and shales are known, but the occurrence of contact-metamorphic deposits in a gneiss of purely igneous origin is believed to be something new in the history of ore-deposits. Economically the ores are of interest, mainly on account of the copper they contain.

Seams of semi-anthracite coal, from a few inches to several feet in thickness, were discovered by the writer on the eastern face of Mt. Bush; these have not been at all developed so far, but should prove of local value.

Few of the mineral deposits have been at all closely prospected, so that little is really known concerning the mining properties of this district; and the area, as a whole, has been only very superficially looked over by a few men, so that it is improbable that all the better deposits of ore have yet been discovered.

CALIFORNIA OIL.

With the exception of a negligible quantity of oil carrying some paraffine, all of the oil from the California fields has an asphalt base. About 40 per cent. is what is commonly known as heavy or fuel oil, while about 60 per cent. is passed through stills for topping or refining, the residuum being used as fuel. The bulk of the production is, therefore, used for fuel or road dressing, either in its crude state or as residuum. Most of it is utilized in the Pacific States and Canada, but some is exported to the adjacent States to the east, and to Hawaii, Japan, Alaska, Panama, and South America. The output of California in 1913 was valued at $43,500,000.

195 LIVES LOST AT HILLCREST MINE

Calgary, June 20.—Of the 236 men who entered the Hillcrest mine at 7.00 a.m. yesterday only 41 have come out alive. Sixty dead bodies have been recovered, and

A view from Hillcrest towards Crowsnest Pass. Turtle Mt. at left. White rock in middle distance is part of Frank landslide.

135 are still missing. This is the content of the latest official statement issued by Mr. Brown, the general manager of the mine at Hillcrest. Experienced miners at the scene of the disaster state that, considering the violence of the explosion, it is impossible that any of the 135 who have not yet been recovered are still alive. This leaves the number of known dead at 195.

The mine is divided into the north workings and the south workings. The full force of the explosion was felt in the south workings, where over one hundred miners are now entombed, and believed to be dead. Of the 50 workers who entered the north workings, all but nine were taken out alive.

The force of the explosion was so terrific that both the north and south entrances of the mine, two miles away from the occurrence, together with the roof of the engine house outside the south entrance were shattered.

No official statement has been given out as to the cause of the explosion, but the survivors attribute it to the presence of fire damp in the old workings.

This disaster is the worst which has ever occurred in the history of the Canadian mining industry, wiping out as it did, practically the whole male population of Hillcrest. It is the first catastrophe of its kind which has occurred in this particular mine, but four years ago a similar incident occurred at Bellevue mine, about half a mile from this point, resulting in the loss of thirty-three workers.

The rescue work, which was commenced immediately after the explosion, has been pushed forward as fast as possible, and is still going on. However, the progress of this work is necessarily slow, as it is thought that fire is raging in the interior of the mine, and there is fear of another explosion.

Rescue trains were rushed to Hillcrest shortly after the explosion from Lethbridge and Fernie, and six gangs were immediately set to work at clearing away the tons of earth and stone which are blocking the entrance to the mine. Forty bodies were recovered within two hours, and it is estimated that it will take at least a week before the huge mass of debris can be removed and all of the remaining bodies recovered.

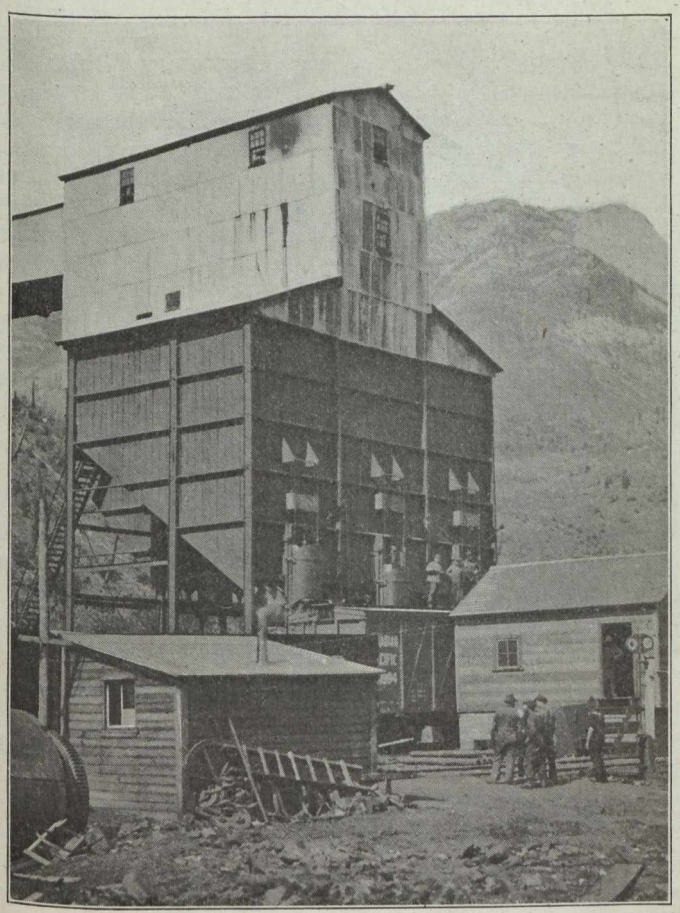
The following statement has been issued by J. M. Mackie, managing director of the Hillcrest Collieries, Limited, regarding the accident:—

"We received a wire yesterday advising us of an explosion in the mine and stating the extent of the damage is unknown at present. We have 377 men on our pay-roll, including office help and outside labor. It is probable that 250 men were in the mine at the time of the explosion. A wire received at the C.P.R. offices here states that 65 men have been taken out alive, but at this writing we have no direct report. Our men are doubtless too busy at rescue work to communicate with us.

Hillcrest station on the C.P.R., Alberta. Geologists returning from visit to Hillcrest Mine, August, 1913.

"In planning our mine we constructed two distinct entries about half a mile apart which are connected underground and great precaution has always been taken in the ventilating of the mine. Our engineer's weekly report just received states ventilation good in all parts. We are at an utter loss to understand how such a tremendous catastrophe could have occurred."

Later in the evening, Mr. Mackie received a wire as follows: "The explosion was in No. 1 mine. This is the mine where most of the men were at work, No. 2 mine is where our new development is going on. Two hundred and thirty-two men went into the mine this morning at 7 o'clock. The explosion occurred at 9.30 o'clock. At 4 o'clock in the afternoon thirty men had been taken out alive and 32 dead bodies recovered.



Tipple, Hillcrest Mine, Alberta.

The missing at present number 170. The work of rescue is progressing steadily and artificial respiration constantly and vigorously applied to those brought up. Excellent order prevails and the best of equipment is available for rescue work."

J. M. Mackie said that the accident to him was a mystery in the absence of more detailed information, for the development work in the mine had been carried out with the idea of giving the maximum of safety. In addition to the two main outlets there was some eight others which were of easy access at the chief points in the workings.

Hillcrest, Alta., June 22.—While rescue work is still being kept up in the Hillcrest mine, it is not with any hope of finding any more men alive, but in the effort to secure the remains of the victims, so that they may be given decent burial.

While men, haggard with lack of sleep and dull eyed from unremitting toil, still dig away the debris in the hope of finding the bodies of all who were entrapped, a community of widows and orphans form funeral processions to the cemetery on the mountain slope. All day yesterday and to-day these tragic little groups have been trudging through the town out to the burying ground. Friends returning from the burial of some member of the family stand aside while the cortege of a neighbor wends slowly by and fall in behind offering such poor comfort as their stunned minds and ravaged hearts can suggest.

In one short street alone, consisting of barely thirty houses, crepe hangs on thirteen doors, and within thirteen widows try in vain to hush the sobbing sorrow of their orphaned children.

Sad as are those who have buried their dead, there is a more tragic group gathered around the mouth of the pit waiting, so far in vain, for the bodies of those who have not yet been recovered. The condition of some of the bodies, torn and shattered by the explosion, has made identification impossible, but still this little group watches, leaving their points of vantage neither to sleep nor eat.

In the face of the stunning effect of the disaster the quick thinking and rapid action of General Manager Brown, who at the moment of hearing of the explosion, reversed the fan which supplied fresh air to shaft, has not been forgotten. Forty-eight miners dashing for the opening and about overcome by the noxious fumes, were refreshed by the draught of fresh air, as the fan began to spin, and those about to drop in their tracks made another effort and escaped.

Manager Brown reported to-day that 181 bodies had been recovered. 48 men were taken out alive, 8 are still unaccounted for.

DOMINION STEEL CO. HAS BIG ORDER.

In reply to a telegram asking for information with regard to the receipt of orders for rails from the Canadian Northern by the Steel Company, President Plummer said to your correspondent: "Yes, we have received a large order from the C. N. R., and our mills are at the moment rolling the rails. No matter how many orders we receive we could not work the plant at any higher pressure than at present. The works will be kept going night and day for the rest of the year."

Your correspondent has it from excellent authority that the Steel Company has a total of seventy thousand tons of 80-lb. rails to roll, before they can go back to work on the South African and Australian orders. Mr. Hawthorne, a Pittsburg expert who visited the plant to-day, said: "The class of rails produced at the Sydney plant of the Dominion Iron and Steel Company are second to none on this continent, and it can be assumed from the fact that orders are received from England, South Africa and the Antipodes, that the rails turned out here are at least equal to, if not better than, those made in Great Britain.

"The immense plant is particularly well equipped for the speedy and efficient output of rails and has a milling capacity of something approaching one thousand tons a day, if necessary. The efficiency system of inspection of all products observed by the corporation's own inspectors besides those on the spot on behalf of the buyers of the materials as they are turned out by the mills, leaves nothing to be desired in the matter of taking precautions against any possibility of material passing out with faults or flaws which might form by any chance in process of manufacturing."

The mills have been working since Monday morning on the C. N. R. order and the first consignment will be ready for shipment by Thursday. It will go by water. —Journal of Commerce.

CANADIAN MINING INSTITUTE—WESTERN BRANCH

The eighteenth general meeting of the Western Branch of The Canadian Mining Institute was held in Nelson, British Columbia, on May 28. Mr. Samuel S. Fowler, general manager for the New Canadian Metal Co., Ltd., presided, and there was a satisfactory attendance of members and visitors at all three sessions morning, afternoon, and evening.

After the chairman had declared the morning session open and had remarked on the benefit such meetings are to those engaged in mining, he recalled that nearly 12 years ago—in September, 1902, he had presided over a similar meeting in Nelson. There was at that time, perhaps, just as much business done, but the feeling of fellowship between mining men now apparent was at that time lacking. The Western Branch of the Institute, organized at Nelson in January, 1908, had done much toward developing the good feeling he had just mentioned, and this truly had been a benefit to all concerned. In addition, the branch had encouraged the contribution of papers, many of which had been of much value.

After the visitors had been welcomed by the Mayor of Nelson and Mr. W. R. Maclean, member for the district in the Legislative Assembly of the province, Mr. Fred A. Starkey, president of the Associated Boards of Trade of Eastern British Columbia, spoke on the importance of the mining industry to Kootenay district and the province as a whole.

On invitation, Prof. Arthur Lakes, addressed the meeting, and in the course of his remarks mentioned that he had been much impressed by the magnitude of some of the mineral veins occurring in British Columbia. He had heard doubt expressed as to whether the ore in such veins "goes down," but, judging by the experience in other countries, it is incredible that it does not. He had confidence that it would be found on development that the ore does continue to great depth. Many of the veins occur in the throat of an ancient volcano, which no doubt goes down to a tolerable depth, so there is no reason to think these veins peter out within the limit of present-day mining. There are other factors in British Columbia of importance to the mining industry, such as the unsurpassed water powers of the province and its magnificent timber. Then there are, for the future, large alluvial deposits suitable for dredging for gold.

The chairman called attention to the fact that, that day in New York, the Columbia School of Mines, of which he was proud to be a graduate, was celebrating the 50th anniversary of its founding. The quality of the work of that institution had not been the result of wealth nor equipment, but rather of the braininess and manhood of the instructors, especially the early ones, and of the braininess of the students they instructed. There are now many other good schools of mining, but all had received benefit from the early efforts of the Columbia instructors, whose graduates had spread all over the country. He could recall the names of many famous men, known by their good work, who were Columbia graduates. Most of those men had come West. The great changes that had taken place during the 30 years since he had graduated were briefly reviewed by Mr. Fowler, who contrasted the many advantages enjoyed by mining men to-day with the few of the earlier period of which he spoke. These changes, though, had led to more and better work in a technical way. Probably the average man around a mine, mill, or smelter to-day does two or three times as much as was accomplished 30 years ago, on account of improved conditions and facilities. Reverting to the Columbia school of mines, Mr. Fowler expressed the opinion that all would recognize the benefits that had resulted from founding the first school of mines in America. Prior to 50 years ago students had to go to European universities, but the training in those institutions was simply a foundation, for students in them were not taught in a manner adapting them for the practical work they had to do in America. A graduate from a European school of mines seldom could carry out the practical work of laboratory or mine. All praise, therefore, should be given to Columbia, and other technical schools since established for the good work they had done and are still doing.

At the suggestion of the branch secretary (E. Jacobs) a resolution was adopted requesting Mr. Fowler to telegraph to the Columbia School of Mines the congratulations of the meeting there assembled. In proposing this resolution, Mr. L. B. Reynolds, M. E., said that his grandfather is the oldest living graduate of Columbia. He was a graduate of the medical faculty of that university in 1842; he is 94 years old and is still practising medicine.

The morning session was closed after Mr. Dudley Michael, first aid instructor of the Provincial Department of Mines, had given a demonstration of the use of a Draeger pulmotor

The afternoon session was occupied in reading and discussing several papers as under:

"Suggestions for Organization and Conduct of Saftey Work in Metal Mines," by Mr. Edwin Higgins, mining engineer. U. S. Bureau of Mines, Washington, D.C.

"The China-clay Deposits of Cornwall, England," by Prof. Arthur Lakes, Denver, Colorado.

"Notes on the Costs and Results of Operations at the Motherlode Mill, Sheep Creek, B. C.," by Mr. W. P. Alderson, general manager Motherlode Sheep Creek Mining Co.

A paper on "The Copper Deposits of East Kootenay, B. C.," by Mr. Stuart J. Schofield, Geological Survey of Canada, Ottawa, was read by title only, Mr. Schofield not having arrived from the East until the evening. Dudley Michael outlined the course he intends to follow in giving first aid instruction. Several of the mine managers present promised their hearty cooperation in this work.

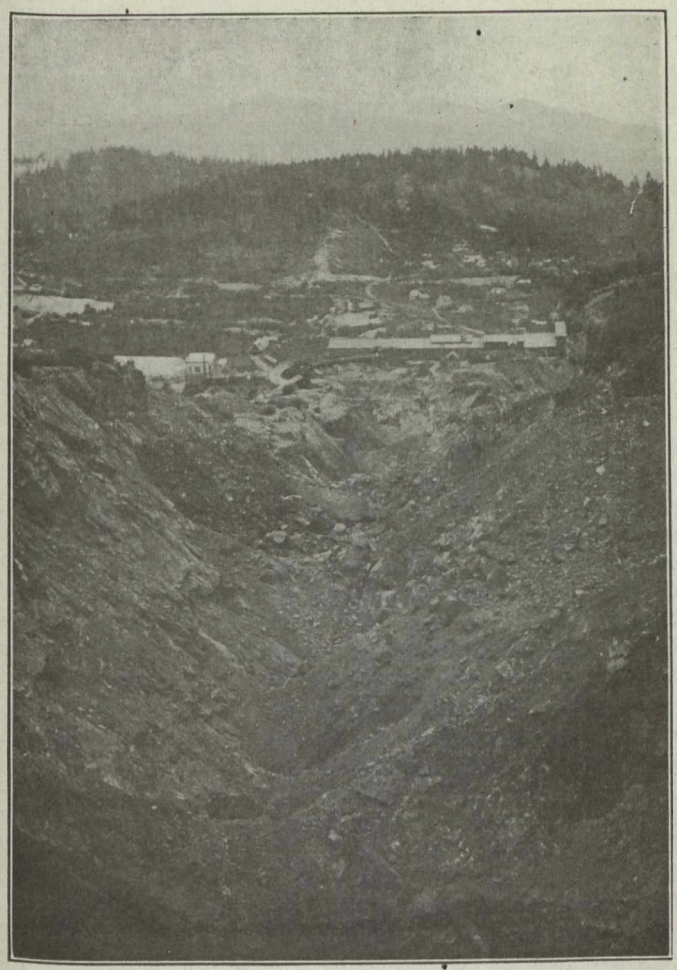
The evening session was opened by a demonstration of the use of the pulmotor. Afterward, the secretary read a contribution by Mr. A. D. Wheeler, of Ainsworth, Kootenay lake, entitled "The Story of Early Kootenay." Following this, the chairman expressed the hope that more of the old-timers would commit to writing their knowledge of the early days. Accurate history is composed largely of an aggregation of many details of personal experiences, the knowledge of which too often died with the men and thus were lost.

An article entitled "The Radium Rage," compiled by Mr. F. A. Ross, consulting engineer, Spokane, Wash., illustrated by lantern-slides of radiographs, was read, and proved of much interest.

Mr. Fowler thanked the members for having elected him chairman of the branch for the ensuing year, and the proceedings then terminated.

GRANBY

Mr. Jay P. Graves, formerly general manager of the Granby Consolidated Smelting and Power Co., Limited, has sent the following statement to the Journal of Commerce:



Granby's Knobhill-Ironside Mine, Phoenix, B.C.

"I tendered my resignation as general manager of the Granby Co., taking effect last October, and F. M. Sylvester, who has been my assistant for about two and one-half years, was elected to fill that position.

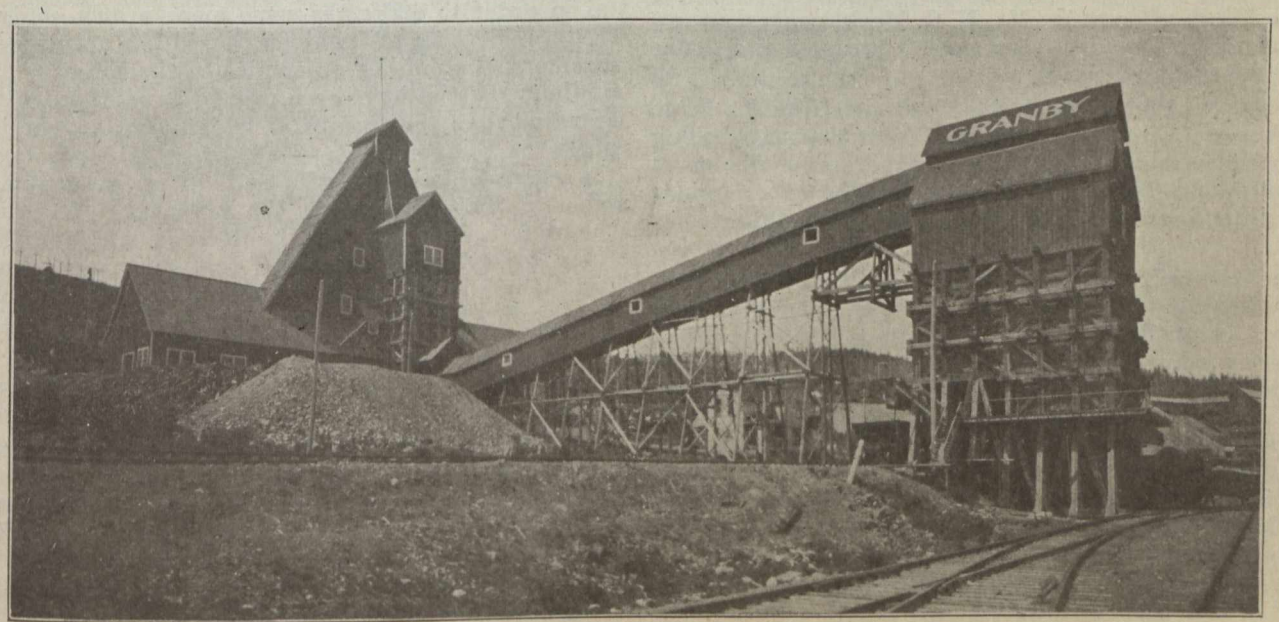
"My reason for making the change was that I had been general manager for about 18 years, having organized the original companies in October, 1895, and had full management of the properties, both in securing the mining properties, in their development and equipment, in the construction of the smelting plants, and their operation, as well as the financing of these companies over this period of time.

"I felt, about four years ago, that I should be relieved of the work, and asked that it be done at that time; but, owing to our considering entering a new field, namely, the Pacific coast, so as to extend our operations, it was deemed inadvisable that my resignation be accepted at that time. So far as I know, that is the only reason connected with the change made, and it was at my solicitation.

"The Granby's mines at Phoenix have very large ore deposits, and development of large ore reserves was made during its early career, and they have gradually depleted ever since the starting of the old smelting plant at Grand Forks, and at the end of each year we have had less ore in sight than the previous year, because of the large tonnage extracted, and it has not been anything new to the eastern directors that this has taken place. If it was new to them, it was because they didn't understand the business with which they were connected.

"The Granby Co. owns a large area of property at Phoenix, nearly four miles in length, and about one mile in width at its widest. Only a small proportion of this area has been prospected. How much additional ore exists in this ground is, of course, not known. This additional ground has been purchased by the company over a period of years, under my direction, believing that it contained ore; and, as the property was purchased at low prices, it was considered to be good business, and a gamble well worth taking.

"We have each year explored a certain amount of the area, some years putting in sight nearly as much ore as we extracted, and other years not any, until the development upon the Hidden Creek mines was undertaken. At that time, it was found that the earnings from the mines at Phoenix were not large enough to



Victoria shaft terminals on C.P. and G.N. Railways—Granby Consolidated, Phoenix, B.C. Over 10,000,000 tons of ore have been shipped from the Granby Mines at Phoenix.

continue our dividends, and to explore further the properties at Phoenix, and also to carry on the exploration work and development upon the new mines at Hidden Creek.

"As the new mines at Hidden Creek showed better grade of ore than at Phoenix, it was deemed good business and more profitable to the company to use all the earnings of the plant at Grand Forks, outside of dividends, for exploration and development at Hidden Creek.

"I think the correctness of this view has been demonstrated by the large tonnage of better grade ore that has been put in sight at Hidden Creek since starting the new smelting plant at Hidden Creek, the ore there being about 2 1-2 per cent. copper, recovering over 40 lb. since its commencement. The Grand Forks plant the past year has recovered between 17 and 18 lb., and that has been about the recovery over a period of two or three years, and not over 20 lb. for several years past.

"We now have a large tonnage of better grade ore in sight at Hidden Creek; hence, more money has been made for the stockholders.

"It was our policy, and probably will be carried out, that as soon as the Hidden Creek smelter was in operation, and the increased earnings were had, we would then have sufficient funds from the earnings of the two plants not only to increase our dividend rate, but to further explore the ore bodies and the land we own at Phoenix, and this undoubtedly will be done.

"I still retain the same interest in the company that I have had for a period of years, and have the same interest in the property and its future. I am going to Hidden Creek in the next two weeks, to go over the property with Mr. Sylvester. Everything is working nicely at both plants. I am pleased to say that both the mining and smelting costs are less than we calculated, so that to-day the future of the properties seems very bright, and the stockholders can be congratulated on the prospects."

DOME.

Timmins, June 18.—as a token of the high esteem in which he was held by the members of the staff at the Dome Mining Company, Mr. H. C. Meek, general superintendent, was tendered a farewell banquet and dance on Wednesday evening.

The event took place at the Dome itself, and a large number of friends and admirers from the neighboring towns of Golden City, Schumacher and Timmins, dropped into South Porcupine to see the ever popular superintendent once more before he made his departure.

The farewell banquet was a most decided success, and after the tables had been cleared, dancing was indulged in until early in the morning. As a last and fond reminder, Mr. Meek was presented with a lovely chest of silver on the part of the staff, who appreciate considerably the benevolent, assiduous and enterprising characteristics which have always prevailed in the various undertakings in which Mr. Meek has taken part.

Prior to coming to Porcupine some four years ago, Mr. Meek was superintendent at Crean Hill, one of the many properties of the Canadian Copper Co. Ltd., at Copper Cliff. Mr. Meek attained this position by sheer hard work. He was previously engaged on the engineering staff and gradually worked his way up. At the time of his arrival in Porcupine, the Dome property was in its infancy, and now after considerable hardships it ranks amongst the foremost mines in the country.

Those who were in the camp at the time of the great fire, will remember the narrow escape Mr. Meek and his family had from being burnt to death. It was due to the timely presence of mind and courage of one of the employees that the whole party was saved. Mr. Meek came from Mandan, Michigan, and is now about to undertake a trip through the West, whilst his wife and family will go to Californa.

All those who have come into contact with Mr. Meek, either in his official capacity or on the street, will regret his departure from the camp and he leaves with the good will of the whole district. Mr. Meek left South Porcupine on the early train on Thursday morning.—Cobalt Nugget.

MOND NICKEL CO.

The directors of the Mond Nickel Company, Limited report that the progress of the company's business during the last financial year has been of a very satisfactory character, and they estimate that the profits made during the year will show an increase over those of the previous year of about £650,000. They expect to be able to place the balance-sheet and accounts before the shareholders as usual during the month of June.

During the course of the last financial year the directors have acquired for the company, on very favorable terms, a number of new mining properties in the Sudbury district, Ontario, Canada, comprising together about 3,200 acres. These include the Worthington and Blezard mines and other mining lands of the Dominion Mineral Co., and also the Levack properties. At Levack No. 1 mine the existence of a large body of nickel-copper ore of excellent grade has been proved by diamond drilling, which circumstance in itself considerably increases the company's ore reserves and assures an ample supply of ore, even at an increased rate of production, for many years.

Having regard to the present position of the company's resources, the directors have decided to recommend a reorganization of the company's nominal capital in order to make the same more nearly equivalent to the real value of its assets, as, in the opinion of the directors, the mining properties of the company in the Sudbury district have been proved to be of much greater value than the figures at which they appear in the books of the company. The directors recommend to the shareholders the adoption of a reconstruction scheme. This scheme has the advantage of abolishing the deferred shares, the holders of which exchange these for ordinary shares, so that the new company's capital will only consist of cumulative and non-cumulative preference and ordinary shares.

BAILEY-COBALT.

Bailey-Cobalt Mines, Limited, a company incorporated under The Ontario Companies Act, having its head office at the City of Windsor, in the Province of Ontario, and carrying on mining operations in the Township of Coleman, District of Nipissing, has made an assignment under the Assignments and Preferences Act of its assets, credits and effects to The Trust & Guarantee Company, Limited, 43-45 King Street West, Toronto, for the general benefit of its creditors.

ORE DEPOSITS OF ATLIN DISTRICT*

By D. D. Cairnes.

Atlin mining district is situated in the northwestern corner of British Columbia north latitudes 59° and 60° (the British Columbia-Yukon boundary), and extends from longitude 132° to 134° 30′ west of Greenwich.

Placer-gold.—Atlin became known as a productive placer-gold camp early in the year 1898, and since then a number of creeks on the east side of Atlin lake, within a radius of 15 or 20 miles from the town of Atlin, have made this one of the more important gold-producing centres in Canada. A number of quartz claims, also, were located during the summer of 1899 and properties of this type have been developed more or less from time to time, and, although the attention and efforts of most persons interested in mining in this district have been mainly directed to the placer deposits, yet a few prospectors and mining-men have continued to prospect for, and develop the non-placer ore deposits, and have succeeded in maintaining a certain amount of interest and hope and even, at times, enthusiasm, concerning lode mining in this district.

Since about 1905 greater attention has been given to the lode-mining industry, partly on account of the promising character of some of the more recent discoveries on Taku arm and also because the Atlin placer deposits are known to be slowly becoming exhausted, and those interested in the welfare of the district are watching more keenly than formerly the development of lode-deposits with the hope that they may continue to foster the mining industry when the gravels no longer are profitably exploitable. In 1899 Prof. J. C. Gwillim reported on Atlin district for the Geological Survey of Canada, and a reconnaissance topographical and geological map accompanies his report. Since the years 1899 and 1900, when the field-work for this report and map was performed, conditions pertaining to placer mining have not materially altered; the geology of the gravels too is fairly well understood, but development has been more rapid in the case of the other mineral deposits of the district.

Accessibility and Transportation.—A rail and steamboat service connects Atlin with the Pacific coast at Skagway. Commodious steamers make regular trips throughout the year between Seattle and Skagway, Alaska, and also between Vancouver and Skagway, distances of 1,000 and 867 miles, respectively. From Skagway the White Pass and Yukon railway has been constructed to Whitehorse, Yukon, a distance of 111 miles. From Caribou, a point on the railway 61 miles from Skagway, a steamer makes two trips a week to Taku Landing, which is about 70 miles from Caribou and is situated at the eastern end of Graham inlet, an arm of Taku arm. A railway 2 miles long extends from Taku Landing to a point on the western shore of Atlin lake, whence a steamer connects with the town of Atlin on the eastern shore about 5 miles distant. All points on Atlin lake and Taku arm are thus directly connected by rail and steamboat service with Skagway.

Wagon-roads have been constructed from Atlin up Pine and Spruce creeks and their more important tributaries, also up Fourth-of-July creek. Roads or trails have been made up Pike river, McKee creek, and other important streams on the east side of Atlin lake. A wagon-road has also been built from Kirtland on the west side of Taku arm to the lode-discoveries on Bighorn creek, and roads have been constructed connecting the workings at the Engineer mines and Gleaner group with the east shore of Taku arm.

During the winter season a stage runs regularly between Carcross and Atlin—a great part of the journey being made on the ice; in the late and early winter, just before navigation is open and after it closes, while the ice is uncertain, dog-teams carry the mail between these points.

Mineral Deposits.—Atlin mining district possesses quite a variety of economically valuable minerals which occur in places in deposits of considerable size. In some of the mineral veins, pockets of exceptionally rich gold ore have been found. Practically all the deposits are readily accessible. The lode-mining industry in the district has made a good beginning and will probably continue to develop in the future. The results up to the present are particularly encouraging when it is remembered that since 1898, when mining commenced in the district, nearly all persons engaged in this industry have devoted practically all their attention to the gold-bearing gravels, and that, until very recently, there has been a relatively slight amount of prospecting for quartz.

Gold-tellurium veins have been found only at the Engineer mines and on adjoining claims which are situated on the west side of Taku arm above Golden Gate, and much the richest ore discovered in Atlin district has been obtained from these properties. The finding at the Engineer mines of pockets of quartz worth from $3 to $5 per pound, caused considerable excitement during the summer of 1910, and has had a decided effect in arousing enthusiasm in quartz-mining.

The gold-silver veins are the most wide-spread type of deposits, and are found in a number of localities distributed over the greater part of the district.

Cupriferous silver-gold veins have been found on Table mountain, where, however, only one deposit of any promise has been discovered.

Silver-lead veins.—A number of strong, well-mineralized veins belonging to the silver-lead division, occur on Crater creek and in that vicinity.

Copper veins have been found on the southern end of Copper island, but those so far discovered do not appear to be of present, economic importance.

One antimony vein is known to occur in the district; it outcrops on the west shore of Taku arm 10 miles below Golden Gate, but as the deposit has been exposed for only about 15 feet, very little is known concerning it.

Contact-metamorphic deposits, so far as is known, occur only on Hoboe creek near the upper end of Torres channel. These possibly should all be considered as belonging to a single ore body since they are situated along the same geological contact, and it seems probable that the ore persists between the points where it outcrops or has been encountered. The ore-material consists largely of magnetite carrying varying amounts of copper, and wherever it has been exposed exceeds 30 ft., and is at one point 150 ft. in thickness. Outcrops have been discovered throughout a distance of at least 3,000 ft.

Coal.—No coal seams have been found in the area, but the Tantalas conglomerate, which is always associated with coals in southern Yukon, occurs at sev-

*Extracts from Memoir No. 37, published by Geological Survey Branch, Department of M ines, Canada.

eral points. Also a considerable amount of float coal has been found to the northeast of the lower end of Sloko lake, and there is every likelihood that the seams from which this is derived will yet be found.

Gold-tellurium Veins.—Gold-tellurium quartz veins have been discovered in Atlin district in only one locality which is situated on the east side of Taku arm above Golden Gate. The greater number of the veins occur at the Engineer mines where the bulk of the rich ore in this type of deposits has been found. Veins containing pockets of good ore, however, have also been discovered on adjoining claims.

The Engineer Mines.—This property is situated on the east side of Taku arm about 10 miles above Golden Gate, and consists of eight connected claims, four of which extend to the water's edge, the other four adjoining these to the east. The group is owned by the Northern Partnership composed of Captain James Alexander, John Dunham, B. G. Nicol, and K. Wawrecka.

The Engineer mines were first located in 1899, and a joint stock company was formed, known as the Engineer Mining Co., who held the property until 1906. The claims are then believed to have lapsed, and were located by Edwin Brown and partners who held the property one year, when it was acquired by the present owners.

The ores at the Engineer mines occur in veins, mainly in Jura-Cretaceous shales and finely-textured greywackes, that vary from dark-greenish and brownish, to almost black in color. The veins range from simple veins a few inches in thickness, to compound veins over 200 ft. thick, and consist largely of quartz, calcite, and intercalated and brecciated wall-rock. The chief metallic mineral is native gold; in addition small particles of tellurides, as well as some pyrite and native antimony, also occur. The veins are thus of value only for their gold content.

It is not known even approximately what average amounts of gold the larger veins contain, but tests so far made have given results ranging from traces to about $10 per ton. Pockets and shoots of remarkably rich ore occur in a number of the narrower veins that have thicknesses of from 6 in. to 4 ft., and it is these that have been mainly prospected and developed.

This group of claims is easily accessible, being situated on the shore of Taku arm, and thus directly connected by navigable water with Caribou on the White Pass and Yukon railway. The property is still in the uncertain, prospect stage, but possesses some promising features.

The Gleaner Group.—The Gleaner group consists of three claims and a fraction that lie to the east of and adjoin the Engineer mines. These claims were located in 1900, and in 1901 the owners formed a joint stock company, known as the Gleaner Mining and Milling Company, who still hold this property. This Company is capitalized at $250,000, the president is Mr. David Stevens, the secretary-treasurer is Mr. P. F. Scharschmidt of Whitehorse, Y.T., and the board of directors include the above named officers and Mr. R. Butler of Atlin, B.C., Dr. Lindsay of Calgary, Mr. D. Von Cramer of Vancouver, Mr. M. H. McCabe of Victoria, and others.

The Kirtland Group.—The Kirtland group is owned by Thos. Kirtland and Captain W. Hawthorn, R.N., and consists of six claims that extend along the east shore of Taku arm from the Engineer group southward to 100 ft. or so across Hale creek, a distance of approximately 8,000 ft. The geological formation on this property is the same as at the Engineer mines and on the Gleaner group, and the veins that have so far been discovered resemble those found on these properties. However, on the Kirtland group, only a slight amount of prospecting has as yet been performed and this has practically all been confined to the Jersey Lily claim which adjoins the Engineer group. Several simple quartz veins a few inches in thickness, and one brecciated vein 2 to 3 ft. thick have been discovered. Two shafts about 10 and 14 ft. deep respectively have been sunk and a few open-cuts and trenches have been dug.

Since this property adjoins the Engineer mines and the formation is apparently identical on the two properties, it is hoped that rich ores will also be discovered on the Kirtland group when the claims have become more thoroughly prospected. So far, only a slight amount of gold has been found.

Gold-Silver Quartz Veins

The White Moose Group.—The White Moose group is situated on the west side of Taku arm opposite the Engineer mines and consists of eight claims which are owned by four persons, three of whom are Dr. H. S. Young, and Messrs. J. Johnson and Robt. Grant. Two veins, distinguished as the North and South veins respectively, have been discovered on this property. Five claims have been located in the valley-bottom along the strike of the North vein, and these extend southward along the shore the length of the five claims from a point about one-half mile above the mouth of Buchan creek. The other three claims have been located along the South vein which strikes in a northwesterly direction; and the most easterly of these claims extends to the shore of Taku arm and adjoins the most northerly of those located on the North vein.

The Rupert Group.—The Rupert group is owned by Messrs. Allan Rupert and James Johnson and consists of 8 claims located on the east face of Whitemoose mountain which is situated on the west side and near the upper (south) end of Taku arm. The property is thus on the lake-front very favorably situated for mining purposes.

The Lawsan Group.—The Lawsan group is owned by Fred Lawsan, Thos. Kirtland, Wm. Powell, Robt. Pelton, Dan Sullivan, and Agnew A. Lawsan, and consists of six claims located on the west side of the valley of Bighorn creek. This property was first staked in 1898, has since this time been owned by several parties, has lapsed twice, and was located by the present owners in 1909. The greater number of the veins that have been discovered are on the Bighorn claim where all the development work has been expended. The British Columbia government during the summer of 1910 constructed a wagon-road from Kirtland on Taku arm up the valley of Fantail river to Bighorn creek, and thence up the valley of this stream to the lower terminal of the aerial tramway on the Lawsan group, a distance of 10 miles, so this property is now readily accessible.

Other Claims on Bighorn Creek.—About 1 1-2 miles north of the Lawsan group, and also on the western slope of the Bighorn valley at a point about opposite Peter's cabin, a fissure-vein outcrops, which is traceable for a distance and is remarkably persistent in dip, strike, thickness, and mineralization. This vein cuts the schistose and gneissoid members of the Mt. Stevens group of rocks, has an average thickness of about 3 1-2 ft., strikes N. 56° E., and has an

almost perpendicular attitude. The fissure-filling consists almost entirely of quartz throughout which are occasional particles of pyrite. This vein is remarkable for its persistency and for the fact that it is the only fissure-vein noted in this locality. The quartz is believed to carry a few dollars per ton in gold, but none of the known assays so far obtained have given more than $10 per ton in gold and silver.

At least two claims, the 'Birdie' and the 'Gold Cup,' owned respectively by Wm. Powell and Fred Lawsan, are located on this vein, and on the Gold Cup two tunnels 35 ft. and 160 ft. in length respectively, have been driven in on the quartz.

The Imperial Mines.—The Imperial mines are owned by Messrs. T. H. Jones, and James Stokes of Atlin, and William A. Moore of Nanaimo, B.C., and consist of four crown-granted claims situated on the south side of Munroe mountain, 5 miles in a northwesterly direction from the town of Atlin to where a good wagon-road has been constructed; the entrance to the lower tunnel is 1,030 ft. in elevation above Atlin wharf. This property was first located in 1899, and in 1900 was bonded to the Nimrod Syndicate of London, England, who surveyed and crown-granted the claims, built a five-stamp mill and bunk house on the property, and did considerable development. At the end of a year this syndicate abandoned the property and Mr. Herbert Pearce obtained an option on it for 2 years, 1901-2. Since this time no work has been performed on the property.

All the work at these mines has been expended in developing a single quartz lode which occurs in a finely-textured rock that ranges from a hornblende-diorite to a hornblende-diorite porphyrite. The lode strikes N. 70° E., and dips at angles of 50° to 60° to the southeast. This deposit includes two or three close, parallel, mineralized fissures which contain an aggregate thickness of 2 to 3 ft. of vein material consisting mainly of quartz, sparsely distributed through which are particles of galena, chalcopyrite, pyrite, malachite, and occasionally, native gold. A considerable portion of the quartz is thought to contain from $10 to $30 per ton in gold and silver, the silver relatively small in amount. Two cross-cut tunnels have been driven, which tapped the vein at 25 and 112 ft. respectively, and from these over 400 ft. of drifts have been driven.

Plenty of water is available at the base of Munroe mountain for crushing and milling requirements, and the falls on Pine creek nearby, would afford ample power for any ordinary mining requirements.

The property thus possesses many natural advantages and contains a considerable tonnage of ore which, although low grade, should prove profitably workable by modern economical methods.

The Beavis Mine.—The Beavis mine is owned by the Gold Group Mining Company, Limited, in which Messrs. H. Maluin and Wynn Johnson are the principal shareholders. This property consists of nine mineral claims three of which are crown-granted, and is situated on the east shore of Atlin lake 1½ miles north of the Atlin post-office.

Several thousand dollars have been expended in the development of these claims, mainly by two shafts which when visited in October 1910, were filled with water, so that no definite information could be obtained concerning their depths or the character of the ore deposit. From the material exposed on the dump, the rock in the shafts appears to be mainly black chert and chert breccia, but a granite-porphyry dyke also cuts the formation in this vicinity. The ore apparently consists of a quartz vein carrying some pyrite and free gold.

Boulder Mountain Claims.—A number of claims have been located on the east slope of Boulder mountain, between Birch and Boulder creeks, about 12 miles in a northwesterly direction from Atlin; of these the White Star Group of three claims owned by Captain Wm. Hawthorne, R. N., and the Lake View group of three claims owned by Jos. Clay have been the most explored. Other claims between and adjoining these groups are also being held, and on some of them the same veins are supposed to outcrop that are found on the Lake View and White Star properties.

A few samples have been obtained from these Boulder mountain deposits that assayed from $100 to $300 per ton and one or two are even claimed to have given higher results, but an average of the veins would probably not exceed $10 and might be somewhat less. From the various tests that have been made, however, it is hoped that some of this quartz will pay for mining when such can be conducted economically. In all probability, numerous other veins will be discovered in this vicinity, as the mountain is in most places covered with a mantle of superficial materials that hide the bed-rock and whatever ores it contains.

The Laverdiere Group.—The Laverdiere group is owned by three brothers, Messrs, Noel, Frank, and Thomas Laverdiere, and consists of six claims, three of which are crown-granted, and two fractional claims. This property is situated on the west side of Hoboe creek, about 2 miles from where it runs into West bay which forms the upper end of Torres channel, an arm of Atlin lake. The principal ore-body on the Laverdiere group, or at least the one most highly valued and that on which the bulk of the development has been expended, is described under 'contact-metamorphic deposits.' In addition two fissure-veins have been discovered on the Alvine and Brothon claims respectively, that appear from the limited amount of work that has been performed on them, to belong to the 'gold-silver quartz veins' and so will be here described. It is possible, however, that they would be more appropriately classed under 'high-grade silver veins.'

The vein on the Alvine claim strikes approximately N. 30° W., has an average thickness of about 2 ft., and occurs in the Coast Range granitic rocks. This deposit consists almost entirely of a gangue of quartz which is in most places somewhat stained with iron-oxide, and with which is associated a small amount of white calcite. Disseminated through this gangue is nearly everywhere more or less argentiferous tetrahedrite (grey copper containing silver); occasional small particles and flakes of native silver also occur. It is not known what this ore will assay, but its general appearance warrants the expenditure of sufficient work to more thoroughly explore the vein.

On the Brothon claim, another mineralized fissure occurs in the Coast Range granite rocks, strikes N. 25° E., has an almost vertical attitude, and can be traced from near the level of the valley-bottom several hundred feet up the mountain side. In places this fault includes between its walls several inches of quartz which is associated with some calcite, and contains more or less galena and tetrahedrite, and also occasional particles and flakes of native silver. Near the valley this fissure includes only about one-fourth of an inch of decomposed clayey material through which, and the somewhat altered and replaced walls

for 6 and 14 inches on each side of the fault, is a certain amount of disseminated argentiferous tetrahedrite and native silver. Assays of the mineralized wall-rock have been obtained that gave results as high as 600 ounces and it is claimed that a zone 12 to 14 in. in thickness, bordering the fissure, will average from 20 to 30 ounces of silver per ton.

Cupriferous Silver-Gold Veins

The veins considered in this report as belonging to the cupriferous silver-gold class, have been found in Atlin district only on Table mountain which is situated on the north shore of Graham inlet opposite Taku Landing. The only two deposits on this mountain that have been at all developed occur on the Petty and Dundee groups respectively, and occur in granite- porphyry, which is intrusive in Chieftain Hill andesites and andesitic tuffs. The veins consist mainly of quartz, calcite, galena, chalcopyrite, pyrite, malachite, and azurite, which minerals occur also to some extent disseminated through the wall rocks. The Petty vein where exposed is from 6 in. to 2 ft. in thickness and has been traced for over 100 ft.; the Dundee vein has a maximum known thickness of 2 1-2 ft., but has not been followed more than 50 ft.

Silver-Lead Veins

Silver-lead veins are known to occur in Atlin district, only on Mt. Leonard, on the north face of which, in the vicinity of Crater creek, are located the main deposits of this class examined by the writer. When the locality was visited in October, 1910, about a dozen claims were held on Crater creek and in the vicinity; of these, those on which the most development had been performed, and which have the most promising appearance, belong to the Big Canyon group. Two smaller veins on adjoining ground were also seen. A number of other veins are known to occur in the vicinity, but owing to the lateness of the season and stormy weather with considerable snow, these were not examined.

The veins seen are all strikingly similar and vary chiefly only in size and degree of mineralization. The ores all occur in dark-greenish diabase dykes which have invaded the surrounding granitic formation, and the general description given below of the deposits on the Big Canyon group applies to all the veins in the vicinity.

Copper Veins.—Copper veins are known to occur in Atlin district at only one point which is situated on the southwestern corner of Copper island in Atlin lake. Several claims were held there for a number of years by the Laverdiere brothers, but were allowed to lapse during the year 1910.

A number of veins from a fraction of an inch to 6 in. in thickness occur in fissures in basaltic rocks. They consist mainly of calcite; but also, in places, contain particles and masses of native copper, the largest of which known to have been found, is reported to have weighed about 40 lb. A certain amount of malachite (common green copper stain), as well as rare particles of cuprite (red oxide of copper), and tenorite (black oxide of copper) occur as oxidation products of the native copper.

Antimony Veins.

Antimony veins were noted in Atlin district at only one point which is situated on the west shore of Taku arm about 10 miles below (north of) Golden Gate. Two claims, the 'Lake Front' and the 'Antimony,' have been located there by Messrs. James Johnson and C. B. Dickson respectively.

The ore occurs in the form of bedded veins that conform, in a general way, to the stratification planes of the enclosing rocks which lie almost flat and consist mainly of the dark greyish to almost black, finely textured, shales of the Jura-Cretaceous, Laberge series.

Contact-Metamorphic Deposits

Contact-metamorphic deposits of economic interest have been found in Atlin district in only one locality which is situated on Hoboe creek near the upper end of Torres channel, an arm of Atlin lake.

The valley of Hoboe creek has an average width of about one-half mile, is flat, and contains numerous, swampy meadows which are the result, to a great extent, of beaver dams at different points on the stream. Schists, quartzites, limestones, etc., of the lower Paleozoic Mt. Stevens group apparently underlie a considerable portion of this valley and, for a distance of approximately 2 miles from Torres channel, extend up its western slope as well. Adjoining these rocks on the west are the Coast Range granitic intrusives which constitute the high, steep-sided hills to the west and south. The contact-metamorphic ore deposits are included in the Mt. Stevens rocks near their contact with the granitic intrusives.

Along this contact, the Laverdiere and the Callahan groups of claims have been located.

The Laverdiere Group.—The Laverdiere group is owned by three brothers, Messrs. Noel, Frank, and Thomas Laverdiere, and consists of six claims, and two fractions. Three of the fractions were located in 1899 and have since been crown-granted. In addition to the contact deposit which is here described, two mineral veins have been discovered on this property and are described above under 'gold-silver veins.' The main workings on the Laverdiere group are situated on the western edge of the valley of Hoboe creek, 1 1-2 to 2 miles from the mouth of the stream.

The Callahan Group.—The Callahan group, owned by Mrs. Callahan, consists of six claims which adjoin the Laverdiere group on the north and extend in a northerly direction to the upper end of Torres channel, known as West bay. The contact between the Mt. Stevens rocks and the Coast Range intrusives passes through these claims, but is in most places concealed by superficial materials and by forest growth; wherever the contact is exposed, however, ore materials occur in the vicinity much resembling those on the Laverdiere property. These deposits have not been at all developed, the assessment work having been performed on various quartz veins which are generally lens-shaped. These occur mainly in greenish schistose rocks and are prevailingly only a few inches, but in places are as much as 6 ft. in thickness; they show generally only a small amount of pyrite, but are claimed to contain also native gold.

Coal

No coal in place had been discovered in Atlin mining district to October 1, 1910, but a considerable amount of float and wash coal had been found near the summit of Sloko mountains, at a point to the northeast of and overlooking the lower end of Sloko lake, and a number of claims, generally known as the Sloko Lake claims, were located to cover the supposed coal seams presumed to occur in that locality. The nature of the detrital coal shows that it has come only a short distance, and Tantalas conglomerate (which wherever

found in southern Yukon is associated with coal seams), is exposed immediately above the coal float; it, therefore, appears as if a small amount of work should uncover the seams from which the float is derived. As the float and Tantalas conglomerate have been found near the summit of the mountain, the seams when found, unless they can be traced down to lower, more accessible points will not be profitably workable.

Tantalas conglomerate has been found elsewhere in Atlin district, and in all probability coal will yet be found in other places besides in the vicinity of the present Sloko Lake claims.

A seam of coal, 4 ft. thick, is reported to occur on Taku river to the south of Atlin mining district.

STONY CREEK OIL AND GAS FIELD, NEW BRUNSWICK*

By G. A. Young.

The present developments of the Stony Creek field are confined to an area about 2 miles long by 1½ miles broad, fronting on the west bank of Petitcodiac river and lying between Stony creek on the north and Weldon creek on the south. Between the two creeks the land rises rather rapidly from the level of the tidal river to an altitude of 460 ft. Of the 23 wells drilled by the Maritime Oilfields Co., 4 are on the steep east front of the hill and the remaining 19 are scattered over the top of the hill.

Along the river front, strata of the Albert series are visible at low water over a stretch of about 2 miles. At the north end of the section they are overlain by coarse, red conglomerate; proceeding southward, at the first exposures they lie nearly horizontally, beyond this they dip in various directions between south and west, at angles of 10 deg. to 20 deg. The measures consist of thin-bedded limestones and dark shales with sandstone beds which in places are impregnated with hydro-carbons. The measures apparently lie on the crown of an anticline, but there are indications that in places the strata are crumpled and faulted.

The lower slopes of the ridge facing the river to the east and the valley of Weldon creek to the south, are occupied mainly by nearly horizontal coarse red conglomerates and sandstones with some shales. These measures are conformably overlain by the quartz conglomerate and over this, by the light colored sandstone of the Millstone Grit. Possibly the lower, red strata belong to the Millstone Grit, but it may yet be proved that they are considerably older. On the north side of the ridge along the valley of Stony creek, the measures underlying the pale colored Millstone Grit beds consist of red and green shales, and sandstones, with beds of grey sandstone, quartzose conglomerate, etc. Thus the Albert series outcropping along the eastern base of the hill extends westward under it, as shown by the borings, and is overlain by red strata capped by grey beds. The Albert series is of very early carboniferous age, the grey beds of mid-carboniferous age. The exposures indicate, in general, that the measures of all the divisions have relatively gentle dips.

The wells stand at elevations varying between 250 ft. and 460 ft. above sea-level, and in depth they range from 1,200 to 2,060 ft. After passing through a thickness of overlying formations usually amounting to about 350 ft., they enter the Albert series, of which a maximum thickness of 1,800 ft. has been penetrated without encountering any signs indicating the approach of the base of the formation.

The strata of the Albert series, as found in the various wells, consist mainly of thinly bedded, shaly beds, usually black or dark green in color and varying in composition from argillite to limestone. Besides the shaly strata, fine-grained quartzose sandstones are comparatively common, the number of individual sandstone beds in a single well varying between 3 and 15. In thickness the individual sandstone beds vary from a few feet to 100 ft. or more. There is a rather general tendency for the sandstone beds to occur in groups, in a number of instances three such groups separated by intervals of 150 to 350 ft. of shales being encountered in a single well. The aggregate thickness of a single group of sandstones may rise to 180 ft., but more often lies between 3 and 90 ft. The individual beds of a group of sandstones may be separated by shaly layers varying in thickness all the way from a few feet to 30 ft. or more.

Though slight traces of oil or gas have been found in the shaly beds and, in one instance, in strata overlying the Albert series, the oil and gas are confined practically to the sandstone beds in the Albert series. In the case of one well which the drillers recorded as apparently passing through disturbed, broken strata, practically all the sandstones are free from oil or gas. In the producing wells, a small number of sandstone beds do not afford any trace of oil or gas. Usually the number of such dry beds is small in comparison with the total number of sandstone beds in a well; and the dry beds, as a rule, occur towards the top of the well, but such beds are also recorded as occurring beneath others with showings of oil or gas. Usually by far the greater number of the sandstone beds are recorded as at least showing oil or indicating the presence of gas, and in some of the wells, sandstone beds of two different horizons yield large volumes of gas.

In the case of about one-half of the number of the wells, all the sandstone beds (except such as are dry) of each well are recorded on the logs as being either all oil sands or all gas sands. In the remaining cases, oil and gas sands irregularly alternate or they occur in two groups of which, in some wells, the oil sands form the higher group while in others the gas sands form the higher group.

In two wells, strong flows of salt water were recorded. In one case the salt water was struck near the bottom of the well, being first met in a 12 ft. sandstone bed lying 68 ft. below an oil sand that, with other immediately overlying sands, yielded oil at the rate of 5 barrels per day. In the second instance, after having passed through two sands, both giving indications of oil, and one giving a small show of gas, a salt water sand was struck at a depth of about 810 ft. This well was continued to a depth of 1,250 ft., and in the additional distance of 440 ft. passed through four beds of sandstone with an aggregate thickness of 245 ft., but which were barren of oil or gas except in the case of the lowest bed, which was said to give a "show of gas."

From seven of the wells the total calculated yield of gas, as derived from measurements made with a Pitot tube, was nearly 4,000,000 cubic ft. per day, the closed pressure of the individual wells varying from 20 to 200 lb. per square in. From twelve other wells, varying results were obtained. One well had a closed pressure of 525 lb., rising in three days' time to 610 lb., and an

*Extract from Guide Book No. 1, published by the Geological Survey for the Twelfth International Geological Congress, Aug., 1913.

estimated flow of 3,695,000 cubic ft. per day; a second had a closed pressure of 475 lb., and an estimated flow of 8,893,000 cubic ft. per day; and a third had a closed pressure of 560 lb., with an estimated capacity of 6,417,000 cubic feet per day. In these three cases, the volume was estimated from observing the rate of rise of pressure at one minute intervals. As regards oil, in the case of one well, 60 barrels accumulated in 20 hours; from another after an interval of 7 days, 87 barrels were pumped; while a third gave an estimated yield of 40 barrels in 25 hours. The above figures have been taken from records of the Maritime Oilfields Co., who are developing the field.

MUD-LADEN FLUID APPLIED TO WELL DRILLING

In a bulletin issued by the U. S. Bureau of Mines, Messrs. J. A. Pollard and A. G. Heggem say that one of the greatest wastes of natural gas is that which often takes place in drilling oil wells. If a well is being drilled by one of the usual methods, the gas becomes a hindrance to drilling, and the driller regards it as a nuisance; or the gas may be found in a field where it has little or no immediate commercial value, and hence is allowed to escape into the air without restraint. For preventing this waste the usual dry-hole methods of drilling are unsuitable.

When an open hole is bored into a bed containing gas under pressure, the gas flows toward the hole because of the reduction of pressure at the hole. The movement of gas is therefore always from a greater to a lesser pressure. If some means be provided for keeping the pressure within the well greater than the pressure in the gas sand there will be no flow of gas into the well. The requisite pressure may be obtained by a column of water in the well, provided the gas pressure be not greater than that of the water when the well is full. However, the use of clear water is sometimes impracticable and is always undesirable. The action of clear water on the walls of the well causes caving, and an attempt to use clear water in drilling the well invites trouble and may injure the producing sands. By mixing clay with the water the results obtained are entirely different.

The use of clay-laden water, while not new in well drilling, having been used with rotary rigs for years and employed in 1901 for drilling the first successful oil well in the Beaumont (Tex.) field, was not applied previous to 1913 in drilling by the dry-hole method with a cable rig. Already the advantages of the method have been demonstrated, and there can be no question as to its efficiency when properly used. Too much emphasis cannot be placed upon the importance of using it where gas and water are encountered, for it not only greatly reduces the danger to workmen, but effects a great saving in the amount of casing needed and entirely eliminates the waste of gas while drilling is in progress.

In the Mid-Continent field alone during the past year there have been a large number of deaths and serious accidents from blow-outs of gas from wells being drilled. These accidents and the great hazard from fire risk, to say nothing of the great waste of gas, cannot happen if the mud-laden fluid method be properly used.

In one small field as much as 100,000,000 to 150,000,000 cubic feet of gas a day has been wasted in the effort to obtain oil. Such great waste is believed to be altogether unnecessary, for preventive methods have been shown to be entirely practicable. Aside from increasing safety and preventing waste, the methods offer a further advantage in that they absolutely prevent the contents of one bed mingling with those of another; thus water cannot enter the pay sands, neither can oil or salt water contaminate the fresh water of other beds.

The term "mud-laden fluid" is applied to a mixture of water with any clay which will remain suspended in water for a considerable time. The fine sticky clays that in many places are termed "gumbo" are well suited for this purpose.

Some oil workers have thought that "mud-laden fluid" implies the use of any of the drillings from the well; but this is not the case, for if any coarse material in the drillings, such as sand, is used it will settle in the well and prevent the bit from striking the bottom of the hole. The proportion of clay that should be mixed with water to insure the best results is about 20 per cent. by weight. With this proportion of clay in the water it is impossible for the driller, no matter how experienced he may be, to tell whether there is any clay at all in the hole, for the tools work about the same as they would if the hole were filled with clear water. An excellent idea of the consistency required can be obtained by comparing the action of a stream of sand pumpings, or muddy water, running in a ditch with that of clear water. The sand pumpings contain fine material that is deposited on the walls, and especially the bottom of the ditch, where it forms an ever-thickening protective coating; clear water, on the other hand, cuts away the sides and bottom of the ditch and may cause it to cave. Between clear water and water containing more mud than can be held in suspension by the current, it is possible to find a mixture of clay and water that will deposit part of the clay as a fine, protective coating while the rest of the clay remains in suspension and passes through the ditch.

The action of the mud-laden fluid on gas rocks or gas sands, or other porous formations, can be likened to the action of muddy water going through a filter. In any filter that has been used for some time, it will be found that most of the sediment from the water has been deposited on the surface of the filter, but some of it has entered the filter, the proportion diminishing with the distance penetrated.

The distance to which clay from the fluid in a well will penetrate a porous formation depends on the excess of pressure produced by the column of fluid or by the pump, and also on the porosity of the formation but finally no more water will go through.

Some drillers contend that clear water should have the same effect as the mud-laden fluid, but the results of trials have shown that it does not. Many wells can not be filled with clear water, because the water continues to flow into the rock or sand without any clogging effect and in consequence does not rise high enough in the well to give a pressure sufficient to overcome that of the gas. Drillers have attempted this method, using clear water, and have permanently drowned out a gas sand. Further than this, clear water causes the walls of the well to slack and cave and "freeze" the pipe.

The action of the muddy water is entirely dissimilar. The fluid enters the porous stratum for a short distance, and deposits clay that clogs the openings and finally prevents the further inflow of fluid.

In order to save time in preparing the clay and water mixture for a well it is recommended that a slush pit,

about 15 or 20 ft. long, 10 ft. wide and 3 ft. deep, be dug close to the derrick. The place for this pit does not matter much, except that it should be on the lowest side of the derrick, so that when the well is bailed the fluid will run into the pit without trouble. When a well is being drilled through beds of clay the drillings from these beds can be turned into the pit as they come from the well and thus be saved and kept from becoming mixed with sand and shale drillings. Care should be taken not to mix with this fluid any material that will not stay in suspension. Not more than half a day's labor is necessary to prepare the fluid for the well, and the work can be done by ordinary unskilled laborers.

The pump recommended for use in handling the mixture of mud and water is known in the oil business as a "duplex slush pump," fitted with removable liners and rubber valves. These pumps may be obtained in many sizes, some of them weighing about 4,000 lb. Such heavy pumps are costly and are expensive to move from one well to another; consequently the old style 8 in. by 5 in. by 10 in. pump, which weighs less than 2,000 lb., seems best adapted for this work.

There are several methods of introducing the clay and water into a well.

Before gas is encountered in a well that has been drilled in the most advantageous manner, several hundred feet of the hole may be without casing. To prevent the walls from caving, as might happen were the fluid pumped directly into the top of the well, a string of tubing reaching to the bottom of the well should be placed to conduct the fluid. The fluid is then pumped in until the well is filled.

If, after gas has been struck, the well is blowing gas, and the conditions are such that the gas can be shut in, recourse may be had to a method which has been named the "lubricator system," which consists preferably of two joints of 10 in. casing placed above a master valve on the head of the well and having a second gate valve at the top. These valves and casings can be most readily attached to the well by assembling them on the ground and placing them on the well as a unit. It is dangerous to attempt to put a valve or a single fitting on a gas well by handling the valve or fitting in slings.

As soon as the valves and the two joints of casing, which are termed the "lubricator" are in place, the bottom valve is closed. The mud-laden fluid is then pumped into the two joints of casing, and when they are entirely filled the upper valve is closed and the bottom valve is opened. Following the equalization of pressure throughout the device, the mud-laden fluid drops to the bottom of the well. As soon as the fluid has passed the lower gate valve, as shown by the sound when the casing is struck, this valve is closed and the upper valve is opened. The volume of gas that escapes from the hole is equal to the volume of fluid that has been introduced, and therefore the pressure of the gas in the casing is not increased. After a few repetitions of this operation a part of the fluid is forced out of the bore hole into the porous strata. Then the gas remaining in the hole will expand and its pressure will be lowered. The amount the pressure is reduced is an indication of the amount of fluid forced into the porous formations. By repeating the operation described there is finally established in the well a column of fluid sufficient to overcome the gas pressure, and then the remaining space can be filled by pumping directly into the casing.

When gas is blowing from a well and cannot be shut in, perhaps because of the small amount of surface casing in the well or possibly because of the casing not being properly seated, so that gas is forced up outside the casing when the valve is closed, another method is used.

At such a well it becomes necessary to insert a string of tubing, with a back-pressure valve at the bottom, to a point below the gas sand. After the tubing has been lowered to the proper depth it is packed or sealed off with a casing-head tee previously placed on the well. To control the flow of gas a gate valve should be placed on the lateral discharge of this tee. As soon as the mud-laden fluid is started down the well through the tubing, the gate valve on the tee can be partly closed in such a manner as to throttle the outlet and to prevent the mud-laden fluid from being forced out of the well by the gas pressure.

The amount of throttling necessary can be determined only by the man in charge, as similar conditions will not prevail at any two wells. However, it is not difficult to ascertain how much the gas should be throttled to stop the fluid from being thrown out of the well. If a well is emitting water with the gas, the fluid can be put in just as readily in this manner, and a well with a capacity of 40,000,000 cubic ft. of gas and several thousand barrels of water daily can be controlled in 15 or 20 minutes. As is evident, the full rock pressure of the well is not maintained in the casing, and consequently no blow out follows, as would happen were the gas forced to the surface on the outside of the casing.

Sometimes the gas in a sand has a greater pressure than that of the mud-laden fluid in the well. When this happens the fluid is blown out and the well becomes wild. It is then necessary to use a pump to establish a greater pressure in the muddy fluid than that of the gas, in order to force the mud into the sand. A sufficient pump pressure should be allowed to remain on the well for at least two or three hours and then relieved very slowly and carefully. If the pressure is suddenly reduced, not only may the column of fluid be violently ejected and the casings, fittings and derrick wrecked, but the well may cave. If the extra pressure is maintained for several hours and then released slowly, the tools can be put into the well and drilling resumed, because the porous bed is clogged around the tools and also below them to some depth. Great care should be taken, however, not to drill too deep at one time without applying the necessary pump pressure, because the clogged portion is shallow and may be drilled through in a short time. By repeating the procedure just described, the well can be drilled through the formation in which the gas pressure is greater than that exerted by the column of fluid. Each time that pressure is applied by the pump the mud-laden fluid is driven into the bottom and sides of the bore hole, thus excluding the gas from the path of the bit, so that when drilling starts again the tools are drilling in a formation that has been filled with the clay from the fluid.

The presence of the mud-laden fluid within the well does not interfere with drilling. The bailer can be used in the usual way to remove the drillings from the bottom. In the usual dry-hole method of drilling through a formation from which gas is escaping the drillings are blown out of the well and cannot readily be saved for examination, whereas with the mud-laden fluid method samples of the formation are readily obtained.

It has been stated by some that in hard limestone too much time would be lost if mud-laden fluid were used, because the tools would not drop readily in the fluid. However, at some wells in the Cushing (Okla.) field as much as 22 ft. has been drilled through the Wheeler limestone in 18 hours, so that apparently the tools work better in the fluid than they would if the gas were blowing, as it often takes from six to eight days to drill through such a gas sand. Not only is less time consumed by the new method, but the risk of fire and danger to workmen from blowouts is obviated. Many instances can be cited of gas pressures so strong that it was impossible to drill through the gas sand into the oil sand below, and consequently the well had to be shut in and called a "gasser," though perhaps there was no market for the gas. In drilling gas wells by the mud-laden fluid method the well can be sealed when gas is struck, thus maintaining the initial rock pressure of the well, so that if it be desired to drill a number of gas wells near each other the rock pressure of the later wells will not be decreased by the drilling of the earlier wells.

In drilling through limestone with the mud-laden fluid in the bore hole great care should be taken not to drill too much hole at one time, as experience has proved that limestone drillings, when too much hole has been made, will settle back around the tools and "freeze" them in the well while the temper screw clamps are being removed and the bull ropes thrown on preparatory to withdrawing the tools.

From observations of engineers of the bureau, it is recommended that not more than 3 ft. of hole should be drilled at one time in limestone with the fluid in the well. If this rule be observed, it is impossible for the drillings to stick the tools. The drillings can be romoved with an ordinary dart-bottom bailer, but it has been found from experience that the patent-bottom bailer is preferable.

Casing a gas well with the fluid in the hole can be accomplished in a few hours without the slightest risk to the workmen. On the other hand, several days have been required to case wells that were blowing and on account of the danger from $7 to $10 a day each had to be paid to men to work in the gas.

Should it become necessary to carry casing while drilling, or, in other words, to allow casing to be put in as drilling proceeds, the mud-laden fluid will be of great assistance. The pressure of the fluid on the walls of the well prevents them from caving and freezing the pipe. Under-reaming can be accomplished in the same manner. It is sometimes possible with this method to carry the casing from 1,000 to 1,200 ft. through a caving, sandy formation, in which a well could not be drilled by other methods.

In drilling a "combination" gas and oil well by the mud-laden fluid method, the fluid is put into the well just before the gas sand is reached, after which drilling proceeds to a point below the gas sand and the next string of casing is inserted. Before this inner string of casing is seated on the bottom (which can be done either with a packer or shoe, as the case may be), the fluid inside the casing is bailed down, allowing that on the outside of the casing to recede at the same time. A Braden head is attached to the next outer string of casing and packed. The gland of the Braden head is prevented from taking a friction hold on the pipe by two or three small blocks of wood; then when the fluid has been removed to such a depth that its hydrostatic head is less than the gas pressure, the remaining fluid can blow out of the well. The casing is then seated on the bottom and the Braden head bolts, already put in place, are tightened. The seating of the casing in this manner will turn the gas up the outside of the inner casing and expel through the Braden head that part of the fluid between the two casings, so that when the well is cleaned, which will not take more than a few minutes, the valves of the Braden head can be closed and drilling can proceed into the oil below in the usual manner.

To place a casing properly, the drill hole must be large enough to allow the couplings to slip freely down the hole. There is therefore a space of an inch or more between the casing and the walls of the hole. This makes a free path around the casing, which allows water, oil or gas to pass from one formation to another. The water may drown out the oil or gas, the gas may escape into porous strata, reducing the pressure below commercial value, and the fresh water in any formation penetrated may be spoiled by salt water.

Such conditions cannot obtain when the mud-laden fluid process is used. The space between the casing and the wall of the hole is filled with the fluid, and all porous formations are sealed with clay, so that oil, water or gas cannot flow from one formation to another.

BOOK REVIEW.

METALLURGY OF COPPER—By H. O. Hofman, Professor of Metallurgy in the Massachusetts Institute of Technology. McGraw-Hill Book Co., 1914. Price $5.00. For sale by book department Canadian Mining Journal.

In this book the author presents an up-to-date treatise on the metallurgy of copper. Present modes of operating are described and principles explained. The examples of practice are mainly from United States metallurgical works.

Several chapters are devoted to description of copper and its alloys and compounds. Physical and chemical properties, impurities, alloys, compounds, and ores are chapter headings.

Chapter VII. entitled "Smelting of Copper" makes up the greater part of the book. This chapter is subdivided into four parts: A, Smelting sulphide copper ores; B, Smelting oxide copper ores; C, smelting native copper ore; D, Fire-refining of impure copper.

Chapter VIII. is devoted to the leaching of copper ore, matte and metallic copper.

Chapter IX. is entitled Electrolysis of Copper.

Dr. Hofman writes with authority and this book has been written after visits to and detailed studies of the leading copper smelteries and refineries of the United States.

CHROME IRON ORE.

It is reported on good authority that Chrome Iron ore has been discovered in the Township of Warden, North of Matheson on the T. & N. O. Ry. The orebody is reported to be 5,000 ft. long and from 150 to 300 ft. wide and occurs in serpentine and peridotite rock.

Chrome ore has been mined in Canada for over 20 years in the Eastern Townships of Quebec, in the vicinity of Black Lake, P.Q. The occurrence of the ore is confined to the southern fringe of the Black Lake-Thetford Serpentine belt, where the Dominion, the Black Lake Chrome and Asbestos and the Canadian Chrome Co. have been operating for a number of years. The ore occurs in the disseminated as well as the crude state, the former being refined in stamp mills and the latter sold after going through a cobbing process. The chief source of supply, according to Fritz Cirkel's "Monograph on Chrome Ore," are the deposits in New Caledonia, and in European and Asiatic Turkey.

THE MINER AS A PIONEER*

By T. A. Rickard

It is a common saying that agriculture and mining are two basic industries. When man rose above the brutish individualism of his primordial state and began to develop the social instinct, he turned to the soil, in order to win food for his family. He paused in his migration, the soil held him; it gave root to his rudimentary community; it gave him the chance to enlarge his energies. His tracks became highways; his rivers, avenues of trade; and as his traffic expanded, so his imagination widened, until, out of the crudities of communal development grew the complexities of civilization.

But the nomadic habit lingered; the spirit of the hunter survived in man; a wanderer and a wonderer he stood beneath the starry dome of the forest arch not knowing whether he were the guest or a captive in the domain of Nature. The hills beckoned; the seas called; the more venturesome left the tents of the tribe in search of material wherewith to fashion their implements. They sought iron for weapons, copper for tools, gold for ornament, and found them in various guise in the earth under their feet. They became miners. To those who delved successfully came power. Throughout the ages the more energetic and adventurous broke from the plough and forsook the cattle in order to explore and to exploit. They brought the metals from which the artificers fashioned engines of power and machines of intelligence. They won the materials for a social structure that, based on stone and built in iron and copper, soared in many-storied tracery of steal to towers radiant with light and vibrant to the sky—towers so far above the common ground that man almost forgot his lowly origin and claimed kinship with the stars.

The story of mineral exploration and racial migration is peculiarly the heritage of our people, the Anglo-Celts. It is the motif that runs through the drama of English and American history, more particularly during the last hundred years. Even in its barest outlines it serves to suggest that the miner is the pioneer of industry and the herald of empire.

The first social organizations around the shores of the Mediterranean sent their prospectors to the hinterlands of Europe, Asia, and Africa. The gold of Ophir, the copper of Sinai, the silver of Laurium were part of the web and woof of these early civilizations. The mines of Iberia gave Hannibal the sinews of war against Rome, and the gold of Davia strengthened the resources of Rome under Trajan. But the greatest adventure was that of the Phoenicians who passed through the Pillars of Hercules into the western ocean in order to reach the far Cassitorides, the tin islands that in turn were to produce those Cornishmen to whom the world is one big mine. After Carthage and Rome, in turn, had been overthrown, the mining industries of the known world were disorganized. Desultory operations persisted in Hungary, Spain, and Saxony, but the Middle Ages to the miner were as dark below ground as above. Even the discovery of America, which marked the beginning of a new world movement, was not connected with a real advance in mineral exploitation, although associated with the winning of gold and silver. It is true, the wave of Spanish conquest broke over the American continent, penetrating the treasure-vaults of Mexico and Peru. But the Spaniard devastated, he did not develop. He gathered the harvest that the patient Indian has sown by the laborious toil of centuries. Cortez and Pizzarro were filibusters not explorers; they were pirates, not miners. The conquistaderes were no pioneers of industry; behind them arose the smoke of ruin and the dust of destruction. Even the great sea-captains of Elizabeth were but the sequel to an epoch of spoilation. After them, and in their wake, across the sea, came the men who from Cornwall and Devon, from Saxony and the Harz, brought the technique of mining to the new world, applying it peacefully to the mineral development of Mexico, Peru, and Chile, all along the regions previously ravaged by European freebooters.

But the great era of mineral exploration came with the discovery of gold in Australia and California. It was the prelude to a worldwide migration, an enormous expansion of trade, a tremendous advance in the arts of life, and the spread of industry to the waste places of the earth.

The color of energy began to tint the blank spaces on the map. The western half of the North American continent, all of Australia, the southern half of Africa, the northern half of Asia, were invaded, penetrated, and explored by those in search of gold, of other metals, and as each successive mineral discovery was made by the miner he called upon his fellows to come and take a hand in the good work. He was the scout far ahead of an army of development. Trade follows the flag, it is true, but the flag follows the pick.

After the prospector has come the mining engineer. The scout has gone in advance of the captain of industry. Those of you that have crossed the range in winter know how the leader breaks the trail by leaving footprints into which his followers tread, step by step, greatly to the safety and ease of their travel. That is what the mineral explorer has done for the mining engineer. That is what the mining engineer has done for those behind him. Some of you have been prospectors as well as engineers.

Again, I ask you to recall how you threaded the pathless forest on your way to examine a new mineral discovery. On the trees at intervals you have seen that the bark was chipped. The trail has been "blazed" by the prospector, making it easy for you and others to follow. That is what the miner has done in a larger way for civilization. He has done it with geographical exuberance and equatorial amplitude. From "the stark and sullen solitudes that sentinel the pole" to the "steaming stillness of the orchid-scented glade" in the Tropics, he has left his mark. You know that. No need for the prospector to complain to you, like Kipling's explorer:

"Well I know who'll take the credit; all the clever chaps that followed—
Came a dozen men together—never knew my desert fears;
Tracked me by the camps I'd quitted, used the water holes I'd hollowed.
They'll go back and do the talking. They'll be called the Pioneers!"

No; not by the men of the Columbia School of Mines, who have shared the prospectors' camp-fire, his blankets, his flapjacks, and his beans. You will give credit to whom it belongs. To the man with the faith of a child and the heart of a viking, to the man who has tramped and toiled until he heard "the mile-wide mutterings of unimagined rivers and beyond the nameless timber saw illimitable plains"; to the miner who has crossed the last range of all and lies in the only prospect-hole he could not dig; to the man who was the herald of empire and the pioneer of industry; to him who blazed the trail.

*Abstract of a speech delivered at the fiftieth anniversary of the School of Mines, Columbia University, May 29, 1914.

ONTARIO MINERAL PRODUCTION IN FIRST QUARTER OF 1914

Returns to the Bureau of Mines, Toronto, made under the Mining Act, show that the output of metalliferous mines and works of Ontario for the first three months of 1914 had a total "spot" value of $9,484,299 as compared with $9,469,938 for the corresponding period of 1913. That the increase was not greater is due to the lessened production of silver from the mines of Cobalt, which fell off by 680,198 ounces. There were also small decreases in iron ore and pig iron, but these were more than offset by a larger output of gold, nickel, copper and cobalt and nickel oxides. Details are given below. The ton is the statutory ton of 2,000 lbs.

The production of non-metallic substances, though steadily growing, amounts in value to less than one-quarter of the whole aggregate output of the mineral industry, and statistics of such materials are collected for the calendar year only.

Gold, fine ounces	61,032	$1,202,502
Silver, ounces	6,519,860	3,549,556
Copper, tons	4,135	591,988
Nickel, tons	6,641	1,446,012
Iron ore, tons	4,536	12,928
Pig iron, tons	184,086	2,503,450
Cobalt, tons	33	8,898
Cobalt and nickel oxides, lb. . .	248,001	168,965
Total		$9,484,299

Gold.—The producing mines were the Hollinger, Dome, McIntyre-Porcupine, Porcupine-Crown, Mines Leasing and Acme, all in the Porcupine district; Tough-Oakes at Kirkland Lake, and Canadian Exploration at Long Lake. None of the other minor fields of eastern or northern Ontario reported any production for the quarter. In all 112,826 tons of ore were crushed, the average yield being $10.65 per ton. The bulk was from Porcupine: 104,880 tons raised from the mines of that camp yielded $1,148,175 or $10.95 per ton.

Hollinger worked steadily and continues to make good profits, the monthly dividend of $90,000 being easily sustained. At 31st March the cash surplus on hand was $753,446.91. The lowest level from which ore is being raised is at a depth of 550 ft.

The annual report of Dome Mines Limited for the year ending 31st March definitely places this large deposit in the low grade class. It is proposed to work the mine on a non-selective policy, to which end the plant is undergoing enlargement from 40 to 80 stamps. The new mill is expected to be in operation in June, 1914, and the total crushing capacity will then be 28,000 tons per month. The ore reserves, wholly or partially developed, above the fifth level (420 feet vertical) stand at 512,600 tons valued at $4.81 per ton, and 2,000,000 tons worth $3.50 per ton. A large amount of diamond drilling has been done below the present development and west of the open pits, which indicates the presence of large bodies of gold-bearing material, but no estimate is made of their magnitude or value. There were milled during 1913, 145,305 tons of ore, which yielded $1,204,598 or $8.29 per ton. Operating costs, excluding all charges against development, averaged $3.08 per ton, a reduction of $1.49 per ton. When the enlarged plant is in operation, it is believed this charge can be reduced to less than $2.50 per ton.

Much interest continues to be taken in the rich narrow veins of Kirkland Lake, where the development is being undertaken chiefly by English capital. It is reported that the Cordova mine in Peterborough county is again about to be worked.

Silver.—It is probable that the crest of production at Cobalt has been reached, and that in all likehood the output will henceforth decline. For the three months, the falling-off is less than half a million dollars in value as compared with the first quarter of last year. As certain of the older mines lower their output, production is kept up by the discovery of new veins in other properties and by a more extensive utilization of low grade material.

In order of production for the quarter the ten leading mines were the Nipissing, Cobalt Townsite, Coniagas, Kerr Lake, La Rose, Seneca-Superior, Crown Reserve, Cobalt Lake, McKinley-Darragh-Savage, O'Brien.

During the quarter there were raised from the mines 155,753 tons of ore of all grades. There were concentrated 163,055 tons, part of which came from the dump heaps. This produced 3,163 tons of concentrates, the average ratio of concentration being 51.5 to 1. The shipments of concentrates were 3,058 tons, the average content of which in silver was 824 ounces.

The number of producing mines was 26. Cobalt proper contributed 94.4 of the output, Gowganda 1.4 per cent., South Lorrain 1.6 per cent., Casey 2.5 per cent., and gold ores .016 per cent.

The silver refineries in operation were three in number—those of the Coniagas Reduction Company at Thorold, the Deloro Mining and Reduction Company's works at Deloro, and The Metals Chemical Company, Limited, at Welland; the last named, a small plant. The recovery of silver by these works amounted to 2,481,493 oz. Adding to this quantity the bullion produced at the mines in Cobalt camp itself, it is found that much more than half the product of the silver mines is now reduced to merchantable bars before leaving the Province.

The refinery at Orillia owned by the Canada Smelting and Refining Company, which was consumed by fire, has been rebuilt and is now about ready for operation.

Nickel and Copper.—The mines of the Sudbury region were actively worked during the quarter, the nickel product being 330 tons greater than for the first three months of 1913, and copper 1,060 tons. The quantity of ore raised was 252,916 tons, and of ore smelted 276,859 tons. The Bessemerized matte product was 13,372 tons, containing 80 per cent. of metal 50 per cent. being nickel and 30 per cent. copper. The Alexo mine in Dundonald Township sent 2,383 tons of ore to the Mond Company's smelter at Coniston.

The Canadian Copper Company and the Mond Nickel Company continue to produce practically all the ore, the British American Nickel Corporation not having as yet reached the producing stage. The first named concern made preparations to work the No. 3 or Frood mine on a large scale, having built a number of dwellings for their workmen and installed a water system for the new town of Frood Mine, etc., when the dia-

mond drill revealed the presence of another large and valuable body of ore in the Creighton mine, which was looked upon as running low in ores. The Creighton mine being richer than the Frood, the Company is again drawing the bulk of its supply from that property, leaving the Frood for future requirements. The developments of the past year or two in relation to ore supplies have been very satisfactory for all three companies, extensive drilling having shown that the reserves of ore are very large.

Iron.—Only the actual shipments of iron ore are included in the production, and these amounted to only 4,536 tons. There was a considerable quantity of ore hoisted at the Helen and Moose Mountain Mines, which will, no doubt, be shipped later in the year. The siderite concentration plant at the Algoma Steel Coroporation's Magpie mine is being enlarged, and the outcome of this experiment in the beneficiation of a large low grade body of ore will be watched with interest, as having an important bearing on future ore supplies for Ontario blast furnaces.

The output of pig iron was larger in quantity than during the first three months of 1913 by 3,044 tons. but the value was less by $2,725—the average price per ton at the furnace having fallen from $13.84 to $13.59. The plants making pig iron were those of the Algoma Steel Corporation at Sault Ste. Marie; Canadian Furnace Company, Port Colborne; Standard Iron Company, Deseronto; Steel Company of Canada, Hamilton. Idle Standard Iron Company, Parry Sound; Canada Iron Corporation, Midland; Atikokan Iron Company, Port Arthur. Of 357,168 tons of iron ore charged into the furnaces 318,577 tons or 89 per cent. was imported from the United States, and 38,591 tons or 11 per cent. was mined in Ontario.

Cobalt and Nickel Oxides.—The manufacture of by-products from the silver-cobalt ores of the Cobalt district is assuming important dimensions. The output of cobalt and nickel oxides was greater in weight than for the same period of last year by 3,905 lbs. and in value by $48,465. It would seem that the world's requirements for cobalt oxide are now practically supplied by the Cobalt mines. Much the larger part of the product is exported to England and Germany for distribution to the potteries and porcelain factories of those countries and Europe generally, but part is also now finding an outlet in other uses, such as in steel alloys, plating, etc. The consumption too, is growing, due no doubt to the reduction in price as compared with former years. The proportion of metallic cobalt in the oxide as exported varies from 60 and 61 per cent. to 74 and 75. The production was 185,078 lb. cobalt oxide 41,252 lb. nickel oxide, and mixed cobalt and nickel oxides 57,671 lb.

The 33 tons of cobalt appearing in the table represents the quantity of ore for which the mine-owners were paid. The price works out at about 13.5 cents per pound.

Chromium and Platinum.—An interesting find, consisting of chrome ore associated with platinum, was made in Reaume Township, Porcupine District, by Mr. Daniel O'Connor, a veteran prospector of Northern Ontario. Little or no development has yet been done, so that nothing can be said as to the extent or general character of the deposit. The discovery is the more noteworthy in that the accompanying rock, a peridotite, is found to carry microscopic diamonds. These, though of little commercial value, are suggestive of important possibilities.

LABOR ORGANIZATIONS IN CANADA, 1913.

The third annual report on Labor Organization in Canada, covering the year 1913, has been issued by the Department of Labor. At the close of 1913 the numerical strength of organized labor in Canada stood approximately at 176,000, an increase of nearly 16,000 over the figures at the close of 1912. The estimated membership for each of the three years during which reports on organized labor in Canada have been issued has been as follows:

1911	133,132
1912	160,120
1913	175,799

These figures show an increase in membership of over forty thousand during the two years 1912 and 1913, and suggest a quite remarkable development during so brief a period. The figures indicate that the growth of union membership has been fairly distributed as between international bodies and those not international in character. The bulk of Canadian trades union membership is attached to international organizations. Of the total numerical strength of organized labor for 1913, the membership owing allegiance to international organizations reached the large proportions of 149,577, leaving for all other organized bodies a membership of 26,222. There were in Canada at the close of 1913, 2,017 local trade union branches of all classes, 1,792 having international affiliation, 199 of a non-international character and 34 independent local bodies. These figures show an increase of 154 in international local union branches, a decrease of 26 in non-international and an increase of six in independent bodies. International organizations having in Canada at the end of 1913 one or more local branches, numbered 101, an increase of two during the year. There are thirteen non-international organizing bodies in the Dominion, an increase of three as compared with 1912.

The total trades union membership of the world for 1912 stood at 12,094,490, a slight increase over the number reported for 1911, which was 11,435,498. The union membership during 1912 increased more rapidly in Great Britain than in Germany, the first named country having an increase of over 800,000 and the latter slightly over 256,000, giving Great Britain nearly a half million more of a trades union membership than Germany. The United States stands third, but especially having regard to its much larger population, considerably below Great Britain and Germany.

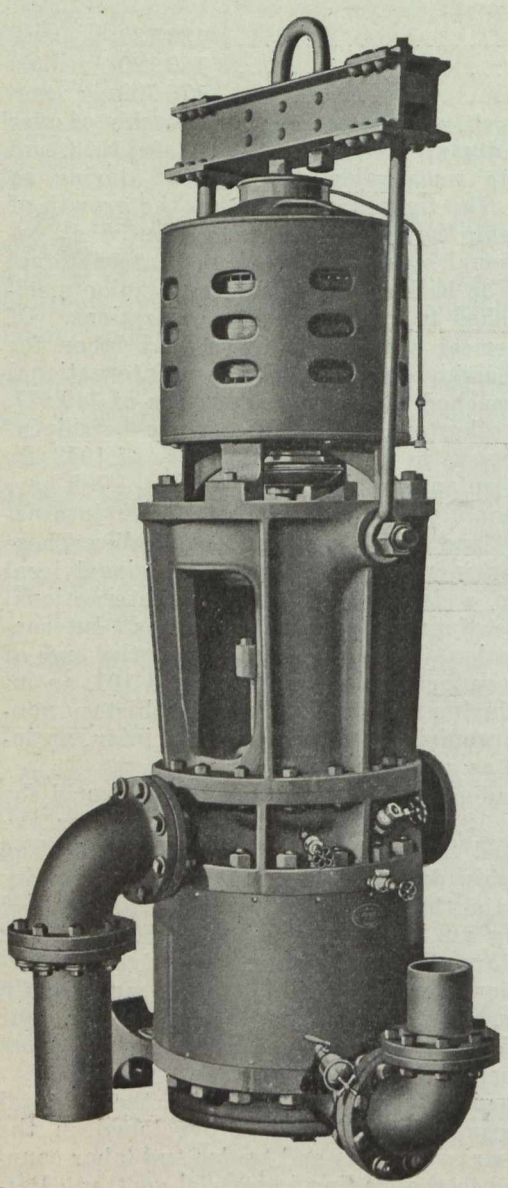
The report gives some attention to the general scheme of organization which has developed in the federations, district councils and trades and labor councils to be found in the leading industrial centres. Particulars of these various bodies are given.

The feature introduced in the report for 1912 showing disbursements made during the year on account of beneficiary work of central labor organizations operating in Canada is continued in the present report. Of the 101 international organizations having local branches in the Dominion, 72 have benefit features of varying extent. The grand total of the disbursements made on account of benefits by these organizations for the last fiscal year is $14,962,705. Nearly one-half of this amount was expended in death and disability benefits. The payments on this account amounted to $7,556,876. The railway brotherhoods contributed the larger payments for death and disability benefits, the disbursements by the Brotherhood of Railroad Trainmen alone amounting to no less a sum than $2,410,985. These disbursements are, of course, for Canada and the United States taken together, separate figures for Canada alone not being available.

TURBINE PUMPS.

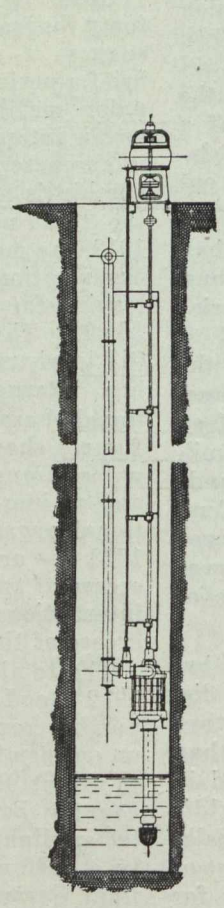
Mining operations afford a wide field for turbine pumps because of the high head against which they can be operated at comparatively low cost, their high speed, which makes them particularly suitable for the advantages of motor drive, the small space which the unit occupies, and the ease with which the unit can be moved. The accompanying illustrations show some applications of turbine pumps, and a 3 stage vertical turbine pump manufactured by Canadian Allis-Chalmers, Ltd.

The modern turbine pump is a more efficient form of the ordinary and well known centrifugal pump for moderate and high lifts, and consists of a revolving wheel or impeller, similar to that of a centrifugal pump, but discharging into one or more correctly designed passages arranged around the circumference, the object of which is to receive the water or liquid delivered at a high speed from the impeller, and gradually to reduce its speed until it is converted into an equivalent pressure head. Those stationary guide passages conduct the water without loss to the delivery outlet, or in the case of a multiple impeller pump, to the eye of the succeeding impeller.



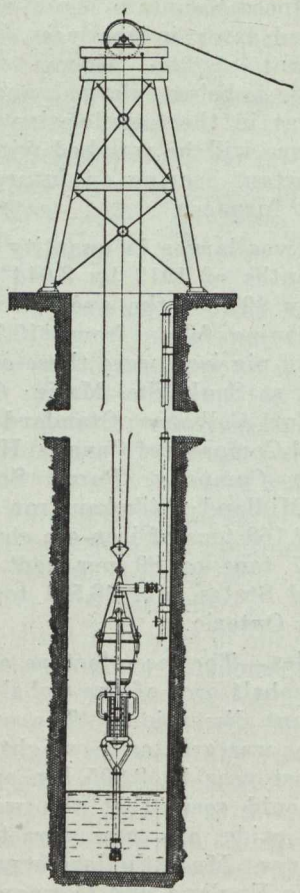
Mine Sinking Pump

Three Stage Vertical Turbine Pump, capacity 250 Imp. g.p.m. against 300 ft. head at 1,800 r.p.m.



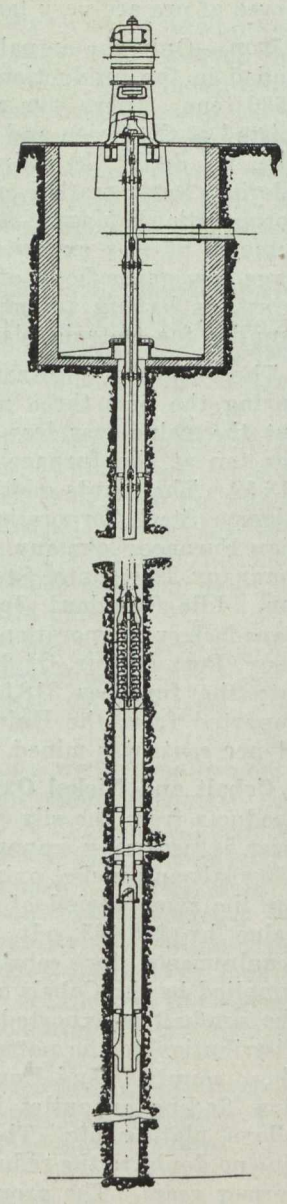
Electrically-driven Pump

with Vertical Shaft sunk in well.



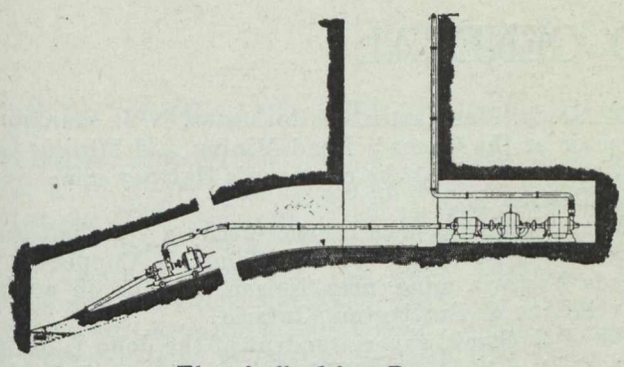
Electrically-driven Sinking or Unwatering Pump

slung in shaft.



Electrically-driven Borehole Pump

Modern turbine pumps are made in single and multiple stage types. In the former the required pressure is obtained by means of a single impeller and guide ring, whilst in the latter, the total pressure is the sum of the pressures obtained by several such units working in series. In single stage pumps the maximum head generated is limited by the strength of materials and by local conditions, as, for instance, a high suction lift. The manufacturers claim to have successfully and continuously generated over 400 ft. head in a single stage pump, and over 300 ft. head per stage in a multistage pump.



Electrically-driven Pump
working in bye and delivering to shaft pump.

The turbine and centrifugal pumps manufactured by Canadian Allis-Chalmers, Ltd., are in accordance with the designs and patents of Mather & Platt, Ltd., Manchester, England.

PROFESSOR RICHARDS OF TECH. RETIRES

With the close of the present term at the Massachusetts Institute of Technology Professor Robert H. Richards will retire from the active work of teaching which he has followed for forty-six years. He is made Professor Emeritus and receives the benefits of the Carnegie Foundation.

Professor Richards has been identified with the Institute since its beginning, for he was a student in the first class, a graduate in the first group to receive the B. S. at Technology, following which he became assistant—1868-1871— and then in 1871 took the chair of Mineralogy, in the department that afterwards developed into that of Mining Engineering and Metallurgy. He it is who developed the splendid laboratories at the institute, and practised himself in the details of the various technical processes; he has been always at the head of his profession, advancing the technique by a number of important inventions.

Professor Richards was born at Gardner, Me., August 26, 1844, but since his schoolday life has been identified with Boston. His activities in any of the directions to which he turned them were always remarkable. In investigation he took up the jet aspirator, looked into amalgamation in the stamp mill, determined the curves of material settling in water, which established the fundamental principles of sorting ore by means of jigs and similar machines. In the same line are the determinations of the settling velocities of quartz and galena, the ground rock being passed into a current of water where the differential settling serves to sort the ore from the worthless rock. The details of various jigs and of the Wilfley table—another sorting device—were investigated by Professor Richards, whose latest work of the kind has been in a variation of the process termed "hindered" settling. Then he has stepped out of the strict province of mining and perfected for civil engineers a prismatic hand telescope for stadia work.

In addition to his work in the class room and laboratory Professor Richards has been in demand as an expert in mining matters and has used his spare time and vacations in professional work of the kind.

In the class room Professor Richards has always been a personality of interest. His lectures have been such as to impress on his hearers the care with which they were prepared, and the teacher has been an example and a stimulus to his students for patient and painstaking work in the interests of accuracy. One of the Tech Alumni, writing on the subject a few years since says, "These personal qualities in a teacher are sometimes of more importance to the future career of the student than are the actual subjects studied, and the successes that have been attained by many of his graduates have, I think, been due in no small part to these qualities of our mentor."

The laboratories of the Institute in the specialties cared for by Professor Richards were the first of their kind in the world and have been the model for many others since established. That their foundations have been solid and their upbuilding philosophical is shown by their success. A part of this has been through the attitude of Technology in giving as freely as possible of its best for the benefit of the world. It was in these laboratories that some of the first investigations were made of the treatment of ores of the Calumet and Hecla, and in return contributions from that mine aided in the equipment of the laboratories.

His writings have been voluminous more than one hundred titles being credited to his name by the bibliographers. These are largely technical, one, a treatise on ore-dressing, has become the standard work in the practice, and has been referred to by one competent to judge as "A valuable work of reference and a monument to his memory."

But best of all Professor Richards has been a man whom instructing staff, students and the outside world which came into his sphere of influence admire. All unite in appreciation of his unselfish and gentle nature, his patience and his forbearance and for the steadfastness with which he has held to his ideals through life. Such is the professor and student whom Technology is to lose as a teacher, but by no means as man. His life has been devoted to the institute, his laboratories are those which he has created within the school, and relieved of the drudgery that is inseparable from the lecture hall, he will be the freer to give to the world the benefits of long experience.

A WAGON LOADER.

A useful machine for loading such material as coal from piles into wagons is shown in the accompanying illustration. This loader is manufactured by the Jeffrey Mfg. Co.

PERSONAL AND GENERAL

Mr. J. B. Tyrrell, who has been visiting mining districts in British Columbia left Prince Rupert last week on his way to Treadwell. He will go to Calgary on his return from Treadwell.

Mr. C. D. Kaeding has been appointed vice-president and manager of Dome Mines Ltd.

Mr. J. Murray Clark, K.C., has gone to Edinburgh, Scotland, on professional business.

W. D. B. Motter, Jr., recently manager of the Canada Iron Mines, Limited, of Trenton, Ontario, was appointed on May 1st as manager of the Benson Mines Company, at Benson Mines, N. Y.

Mr. H. Bradley left Toronto for Calgary last week.

Mr. H. C. Meek has resigned his position as superintendent at the Dome Mine.

Mr. J. C. Murray left Toronto for Calgary last week.

Mr. J. W. Astley has been commissioned by the Provincial Department of Mines to examine and report on a number of mining properties on Texada and Valdes Islands, British Columbia.

Mr. T. Walter Beam, of Denver, Colorado, is again at Hedley, Similkameen, B.C., in the interests of the New York No. 2 Syndicate, which is doing much diamond-drilling near Hedley on a group of mineral claims held under option of purchase.

Messrs. O. E. Cary and W. E. Henry, of Denver, Colorado, each representing a zinc-purchasing company, have been visiting mines in Slocan district, British Columbia, with the object of buying zinc ores there.

Mr. S. H. Conner has returned from Philadelphia to the Lardo river, B.C., to resume work in connection with efforts to recover gold by dredging.

Mr. S. S. Fowler, of Riondel, B.C., general manager for the New Canadian Metal Co., Ltd., on June 16 left Nelson for San Francisco, California, on a business visit.

Mr. W. S. Hawley, of Spokane, Washington, managing director for the Silver Hoard Mines, Ltd., has been spending a week or two at the company's mine in Ainsworth Camp, B. C.

Mr. B. Wallis Knowles, of Hedley, B.C., with the Hedley Gold Mining Co., was married on June 1, at Keremeos, also in Similkameen district, to Miss Ellen Corrigan, of Hope, B.C.

Mr. Andrew G. Larson, of Vancouver, B.C., has been engaged by the Provincial Department of Mines, to examine and report on mining properties in Franklin Camp, north fork of Kettle river, in the northeastern part of Boundary district.

Mr. L. C. Mayer, of New York, consulting engineer for the company recently organized to acquire the mines and reduction works of the British Columbia Copper Co., has returned from a visit to the Boundary district, B.C., whence he went last month in company with the president of the company, Mr. Allen Rogers.

Mr. F. J. Murphy, formerly of Houghton, Michigan, is now assistant to Mr. J. P. McFadden, manager of the Surprise mine, near Cody, Slocan, B.C.

Mr. J. L. Retallack has returned to Kaslo, B.C., from a short visit to Spokane, Washington.

Mr. Wm. Rowe, superintendent of the Jewel Gold mine, in Boundary district, B.C., is convalescent after illness with cerebral hemorrhage.

Mr. F. M. Sylvester, general manager for the Granby Consolidated M. S. and P. Co., has returned to British Columbia from a visit to New York.

Mr. J. D. MacMaster, of Rochester, N.Y., managing director of the Queen's Head Mining and Milling Co., is directing work at the company's Hartney mine, near New Denver, B.C.

Mr. F. L. Smith, who for more than a year had been superintendent of the British Columbia Copper Co's. Queen Victoria mine, near Nelson, B.C., is on a visit to relations at Burlington, Ontario.

Mr. J. J. Streit, superintendent of the John L. Retallack Co.'s mines near Whitewater, Slocan, B.C., has returned from Rochester, N.Y., whence he went to receive special surgical treatment. He is not yet strong enough to resume his mining work.

Mr. Wm. Thomlinson, of New Denver, B.C., is collecting ore samples from mines in the Skeena country, Cassiar district, B.C., for the Canadian exhibit to be made at the Panama Exposition at San Francisco in 1915.

Mr. G. B. Wilson, manager of the marble quarries at Marblehead, north of Kootenay lake, was married recently in the United States, and has returned to British Columbia with his bride.

The Sullivan Machinery Company announces that Mr. J. C. West, hitherto local manager at San Francisco, has been transferred to the general offices at Chicago, in the capacity of general sales engineer. Mr. Ray P. McGrath, for several years associated with the new England sales office of this company, at Boston, has been appointed district manager at San Francisco, to fill the vacancy.

Mr. F. R. Wolfle, of Spokane, Washington, manager for the Florence Mining Co., has been spending a few days at the company's Hope mine, near Ainsworth, B.C.

Mr. H. P. Dickinson, of Vancouver, general sales manager in British Columbia for the Giant Powder Co. Consolidated, was in the Kootenay district lately in connection with changes there. Mr. C. S. Cradock having been promoted to the position of special agent, with headquarters in Vancouver, and Mr. W. S. Rugh, for years office manager for the Le Roi Mining Co., at Rossland, succeeding Mr. Cradock as Interior general agent, with headquarters at Nelson. Mr. R. H. Ley, formerly practising assaying at Nelson, is now the company's resident agent for northern British Columbia, with Prince Rupert as his centre. All these officials are well known in mining districts in British Columbia.

DR. ADAMS HONORED BY TUFTS COLLEGE.

At the recent Commencement of Tufts College, Winston Churchill and Dean Frank D. Adams of McGill University received honorary degrees. Incidentally, Dean Adams was the chief speaker at the annual dinner of the Association of Harvard Engineers and Dr. and Mrs. Adams were also the guests of the Greater Boston geologists at a brilliant dinner at the University club, at which twenty-seven were present.

While not so large as Harvard or Tech, Tufts has many well known men among its faculty and graduates. Among those of most interest to Canadian mining men is perhaps Dr. A. C. Lane, the well known geologist, one of the corresponding members of the Canadian Mining Institute.

One of the most successful graduates of Tufts is Dr. F. S. Pearson, who has been associated with Canadian and English capitalists in many hydro-electric enterprises.

SPECIAL CORRESPONDENCE

PORCUPINE AND KIRKLAND LAKE

Hollinger.—The factor of most importance to the whole of the Pearl Lake section of Porcupine camp, as well as the Hollinger, is the diamond drilling to depth on the Hollinger mine. The greatest care has been taken that the results from this work should not become known and it is not likely that any tabulated statement will be made for some time. But from many indications it is so generally surmised that the cores have given favorable indications that there is a still greater feeling of optimism in regard to the long life of the camp than at any previous period in its history.

Since the results of the diamond drilling became known to the members of the Canadian Mining and Finance, who control the Hollinger, there has been no stay in the pushing forward of the very extensive expenditure on plant and equipment. Every effort is being made to expedite the completion of the big power plant on Gillies lake, which will give the allied properties of the Canadian Mining and Finance syndicate all the power needed for some time. At the same time there is no immediate intention of building another and a larger mill. The addition of twenty stamps to the present mill will be completed without any undue haste and further additions will be made to the present mill as the increased tonnage requires.

The four weekly report ending May 19th shows that gross profits were about the same, total costs perceptibly lower than any previous month and that the net surplus is gradually mounting.

The mill ran 94 per cent. of the possible running time, treating 18,200 tons, of which 831 tons were treated for the Acme Gold Mines. The average value of Hollinger ore treated was $13.10 per ton, approximate extraction 95.7 per cent.

The Dome Lake is having very good fortune at the 300 ft. level. It was not anticipated that they would run into their ore shoot until 150 ft. had been drilled, but as a matter of fact good ore was encountered a little less than 50 ft. from the shaft and 50 ft. of it has been opened up already. About the middle of the month there was 5 ft. of ore of a better grade, considering width, than at any level in the mine, and for the whole of the 50 ft. the stope can be carried right across the drift, giving an average grade of between $15 and $20. The compressor is now being driven by electricity and is working very smoothly. The rule at this mine is a round a shift with the new Leyner drill.

McIntyre.—Following the closing of the New York office and other overhead expenses, the McIntyre Porcupine Gold Mines has decided to instal the continuous decantation process at their present mill and so rearrange the present equipment that it will add 150 tons daily to the capacity, giving, when the plans are complete, 300 tons a day. The manager, Mr. Ennis, wishes to raise the capacity of his mill so that he will be able to get down the cost per ton, which to date does not permit of treating the lower grade ore mined, at a substantial profit. The May report of the McIntyre shows that 4,480 tons was treated, giving an average mill head of $11.10 per ton. The production amounted to $47,184. The station has been cut at the 500 ft. level at the No. 4 shaft, and the campaign of development laid out is being rigidly adhered to.

Dome.—The result of operations at the Dome mines for May was 16,180 tons milled, $62,109 gold recovered. The low amount of production, in spite of the increase in tonnage treated is explained by the fact that the heads in gold recovered only ran $3.83 to the ton.

Eighty stamps are now dropping at the Dome night and day, but the plates in the addition have only just been installed, and until the extra tube mill is running it will not be possible to raise the tonnage very materially. This should be a matter of only a few days now, however. All those who have come in contact with Mr. H. C. Meek, who has been manager of the Dome for the past four years, will learn with extreme regret that he has severed his connection with the company. He arrived at the Dome and took charge when it was merely a spectacular surface showing, and he has been in charge until now, when an eighty stamp mill is running and it has assumed large industrial proportions. In his place is Mr. C. D. Kaeding, who left the Copper Cliff staff to come to the Dome. He has been appointed general manager and managing director. He comes to the Dome with a great reputation for efficiency and his record in many camps will be reassuring to shareholders. He has already taken charge. Mr. Meek left South Porcupine on the 18th. His family goes to live in California, where he will join them after he has spent some time in the East.

Three Nations.—Mr. Laurendeau and his associates in the Hughes Porcupine discharged their underground miners on the Three Nations while a ten day mill run was made. They have had an option on the Three Nations for the past two or three months.

Vipond.—Concrete work on the foundations of the addition to the Vipond mill has been completed, excellent progress having been made since Mr. C. H. Poirier took charge once more. Underground work at the mine should commence very soon.

COBALT, SOUTH LORRAIN, ELK LAKE AND GOWGANDA

The Bailey Cobalt Mines Ltd. has made an assignment. This action was anticipated some weeks ago when under orders from the President Mr. E. F. Benson, all underground men were laid off and development ceased. It is understood that practically the sole creditor is Mr. E. F. Benson, who has been advancing the company money for the past three yeors. The sum that he is now owed by the company amounts to about $90,000. Last year when the Bailey was producing well, Mr. Benson liquidated some of his debt by taking the proceeds from the cars of ore but it was early recognized this year that the only possible way to make a success of the mine was to carry out an expensive scheme of development and Mr. Benson was not prepared to advance any further money for the purpose.

The mine as shown in the annual report has practically no ore reserves, but operations at the 300 ft. level have opened up some ore which would appear to give good hopes for future development.

Casey.—There is considerable activity on the Casey Cobalt range apart from the main operators, the Rose van Cutsen group. The Trethewey Cobalt now has a diamond drill at work on some claims with the hope of discovering favorable conditions for sinking and perhaps of cutting an ore body. On the north half of lot 7, section 5 on the Casey Mountain ridge a number of

men are stripping and trenching and it is understood that the Casey Mountain will start operations again soon.

Nipissing.—During May Nipissing mined ore of an estimated net value of $211,256.

Two new branch veins were found during the month in the Meyer workings. Each has a width of from one to two inches and assays about 1,800 oz. There are now four branch veins being developed by drifts.

The main vein has now been drifted upon for 540 ft. and is being prepared for stoping at the fourth level. The stope can be profitably mined for a width of 12 ft. thus yielding a large tonnage of low grade for the mill.

The hydraulic pump has been moved from the Cobalt Lake basin to Peterson Lake and is now engaged in washing the overburden from R L 486.

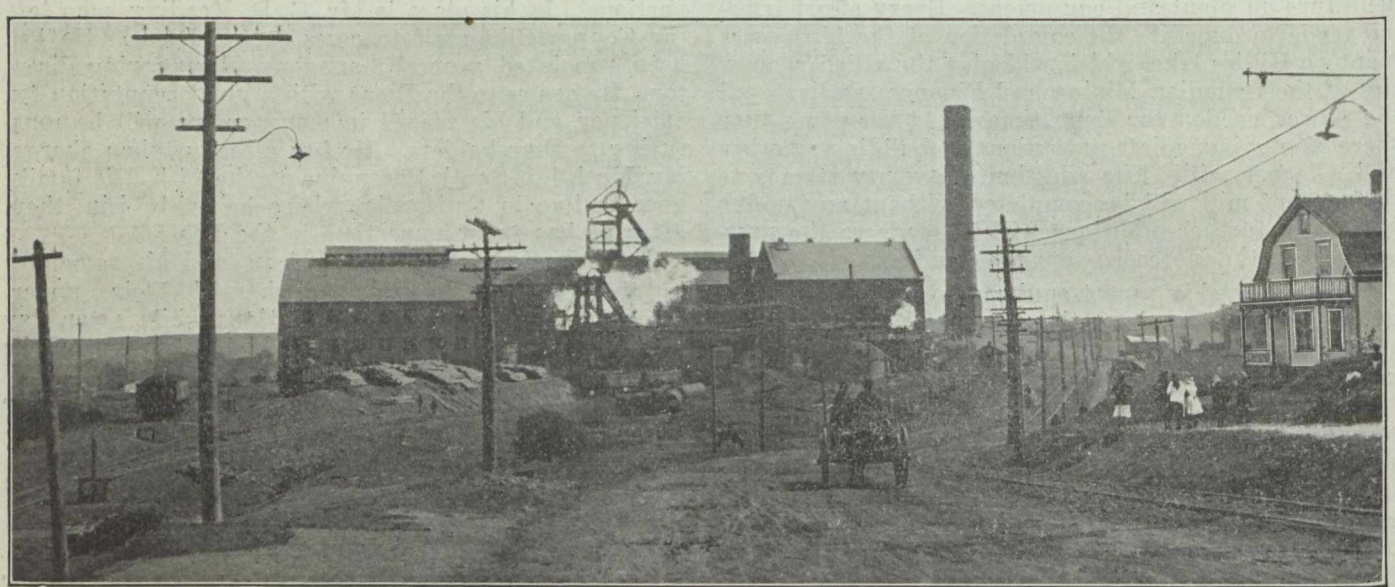
The high grade mill treated 183 tons and shipped 523,320 oz. of silver from Nipissing and customs ore. The low grade mill treated 6,560 tons.

637,889 oz., surplus $352,810 and ore reserves 2,060,625 oz.

Mr. T. R. Jones, general manager states "the reserves from development of ore during the year are approximately 54,116 tons of a value of about 25 oz. to the ton or 1,352,900 oz. In addition there are approximately 28,309 tons of ore broken in the stopes of about equal value of 707,725 oz."

In addition there are 200,000 tons of sand tailings containing a little more than a million ounces. A small plant has been erected upon the property where tests have been so satisfactory that it has almost been established that they can be treated at a good profit.

The very extensive scheme of development carried on in the search for new ore bodies has been partly successful. Mr. Chas. L. Denison says in this respect "Superintendent Jones' estimate of ore reserves is that they are at least sufficient to supply the mill the coming year. The exploration work has been satisfactory and gives considerable assurance of developing ore ahead of requirements."



Power plant of the Acadia Coal Co., Stellarton, Nova Scotia.

Beaver.—In the last quarterly report of the Beaver Consolidated Mr. F. L. Culver, president, makes the following interesting statement: "We have already commenced sinking the shaft below the 800 ft. level. The object will be to get through the diabase sill and penetrate the Keewatin rock which lies underneath as it is believed that greater values exist below the sill than above." The financial position of the Beaver on May 31st was:

Cash balance	$47,518.93
Due from smelters	71,299.40
Ore bagged at mine and in transit	17,844.77
	$136,663.09
Less accounts payable	13,214.62
Available balance	$123,448.47

The York Ontario intend to start operations as soon as a new compressor can be installed and power obtained from the power company. The capitalization has been increased from $1,000,000 to $1,500,000 and a new board of directors elected. Development will be continued on the upper levels and the shaft taken down to 1,000 ft. and the mill put in shape for crushing ore.

Buffalo.—The annual report of the Buffalo Mines, which has just been issued shows a production of 1,-

The most important discovery is the locating of No. 12 vein on the lower levels. Mr. Denison states "considerable assurance is felt for the future considering what the exploration work has shown and ore likely to be further developed."

Chambers-Ferland.—The bylaw authorizing the transfer of the entire stock and assets of the Chambers-Ferland company for 115,00 £5 shares of the Alladin Cobalt mining company was not passed at the adjourned meeting of the Chambers-Ferland in Cobalt and will come up again at the meeting of the company which will be held in London. Minority shareholders, who were again represented by Mr. Harry Cecil and Mr. A. A. Amos strenuously opposed the deal.

Both these gentlemen gave notice that under the amendment to the companies act they would enter action restraining the company from carrying the deal through.

Hollinger.—General manager P. A. Robbin's report for the four weeks ending May 20, 1914, shows a gross profit of $123,087.67. $13,221 was spent on plant. There was hoisted 14,603 tons of ore which had an average value of $13.10. Mining costs per ton of ore milled amounted to $2.17. Total cost per ton was $4.22. The

mill ran 94 per cent. of the possible running time, treating 15,200 tons, of which 831 tons was treated for the Acme Gold Mines, Limited. Approximate extraction was 95.7 per cent. Milling costs were $1.145 per ton.

NOVA SCOTIA

Dominion Coal Outputs.—To the middle of June the Dominion Coal Company's outputs show an increase of 45,000 tons over the first half of June 1913. For the week ending the 13th a production of 117,000 tons was obtained, and shipments totalling over 145,000 tons were made from the Glace Bay mines, a really notable achievment. The daily outputs for nine days maintained such a sustained high level that it is worth while to give them in detail, as follows:

Some of the members and guests at the annual meeting of the Mining Society of Nova Scotia, Sydney, N.S.

June 4, 19,368 tons; June 5, 19,117 tons; June 6, 8,944 tons; June 8, 19,888 tons; June 9, 19,824 tons; June 10, 20,692 tons; June 11, 19,649 tons; June 12, 19,448 tons, June 13, 17,463 tons.

The reduction on the 8th was caused by a shortage of vessels, occasioned by weather conditions, only about half the mines being at work. For the first time the production crossed the 20,000 tons mark, and, as will be seen, the new record of 20,692 tons was not a chance occurrence, but was obtained in the midst of the largest series of daily outputs yet put out by the company's collieries.

On the 10th inst. the Springhill collieries produced 1,610 tons, making a total production for that day of 22,302 tons.

The shipments from Sydney averaged over 24,000 tons daily throughout the week, and on one day reached the extremely high figure of 28,312 tons. Twenty-two large cargoes were despatched during this week, one cargo exceeding 11,800 tons and another cargo exceeding 10,000 tons, and in addition to this were numerous bunker-boats and schooners, sometimes termed "chicken-feed," but aggregating a respectable tonnage nevertheless.

BRITISH COLUMBIA

After a late spring, with frequent rains, summer weather is being experienced in the Interior mining camps, and mining is generally progressive, though the "mining boom" predicted by those not familiar with conditions is not yet in evidence.

East Kootenay.

During four weeks ended May 28, shipments of lead-silver ore from the Sullivan Group mines, near Marysville, to the Consolidated Mining and Smelting Co.'s smelting works at Trail, totalled 1,215 tons. There are in these mines large bodies of lead-zinc ore, but these are not being mined for the reason that a suitable separation process is not yet available, so this class of ore is left in the mines, in which also occurs much lead ore that is mined and shipped to the smeltery.

A small output of lead-ore is being maintained at the St. Eugene mine, and prospecting for other ore shoots is being continued. Other properties in this neighborhood on which lead ore has also been found are the Society Girl, situated on the same side of Moyie lake as the St. Eugene group, and the Aurora, directly across the lake from the latter mine. No work has been done on the Aurora for a year or more, but prospecting is being done on the Society Girl property, on which ore has been found and mined in past years.

West Kootenay.

Whitewater.

The Echo, above the Jackson mine, in Jackson basin, is again being worked, after having been idle a long time.

Leasers, who have already shipped three cars of high-grade zinc ore from the U. S. mine, in Jackson basin, are now busy taking out more ore.

The dump at the Wellington mine, a mile or so from Whitewater, is being worked under lease. Much fine galena is in the dump, and this is being recovered by hand-jigging.

Work has been resumed at the John L. Retallack & Co. mines, near Whitewater, after several weeks' sus-

pension while melting snow made the workings very wet through seepage of water into them.

Now that supplies can be got to the Eagle Mountain Mining Co.'s Eureka mine, four miles from Sproules, a stopping place on the Kaslo & Slocan railway, the contractors for driving an adit have resumed work, with about 300 ft. to be driven to complete their contract.

Sufficient dry silver ore to fill two railway cars, extracted during the winter months from the Panama mine, situated high up the mountain above Bear lake, is ready for the pack train, which will take it down to the railway as soon as the trail shall be hard enough for the pack animals to travel over it.

Slocan.

The Slocan Star Mines, Ltd., is again operating its concentrating mill, which had been idle for seven or eight years. This mill was remodelled in 1904 so as to provide for recovery of the zinc as well as the lead contained in the ore, approximately $40,000 having been at that time expended on improvements and additions to plant and machinery. In eight years, 1896-1905, concentrates of a gross value of $1,383,702—silver-lead $1,229,641 and zinc $154,061—were shipped from this mill by the Byron N. White Co. of Milwaukee, Wisconsin. During several later years the mill was unworked and little was done in the mine, owing to long-drawn-out litigation over extra-lateral rights. In the latter part of 1911 a settlement was made and the properties affected were merged, and acquired by the Slocan Star Mines, Ltd., which has since done much development work at greater depth than previously had been reached. Now, in addition to occasional shoots of clean ore, suitable for shipment in its crude state to the smeltery, there is enough milling ore opened to keep the concentrating mill supplied for a comparatively long period. It is intended to make both silver-lead and silver-zinc concentrates.

Negotiations are being carried on with a view to using for a while at the Standard Silver-Lead Co.'s concentrator near Silverton, the experimental unit of the Minerals Separation flotation process plant for some time past in use at the mill, on Four-mile creek, of the Silverton Mines, Ltd. At the latter company's mill arrangements are being made to put in two or three more concentrating tables, the crushing capacity of the present plant being about 50 tons a day greater than its tabling capacity. Confidence is felt that the Minerals Separation process will be found successful in saving most of the silver and the zinc that ordinary water-concentration will not recover. Similarly, the Standard Co. hopes to use the process and by it save much of the 8 to 10 oz. of silver now being lost in the slimes, and, as well, to make a higher recovery of zinc.

Developments in levels of the Standard mine above No. 5 adit have led to more work being undertaken in Nos. 4 and 3. A brief review of conditions in the mine early in June is as follows: No. 3 adit was being extended to ascertain whether an ore shoot opened on No. 4, 100 ft. below, continues up to the level of No. 3. Some zinc ore was in the face of the drift, but it was estimated that from 100 to 150 ft. more would have to be driven to reach the silver-lead ore if the shoot extends that high in this part of the mine. On No. 4 the drift had been in ore for 150 ft., but zinc was appearing in the face. This ore shoot was about 40 ft. in width at its widest part, most of it ore suitable for either shipping crude or milling, though some barren ledge matter occurred in places. A raise was being put up from No. 5 to the big ore shoot in No. 4, a distance of 125 ft. There are large bodies of ore on and above No. 5 not yet taken out. Stopes from No. 6 level were still yielding ore. No. 7 was in about 3,500 ft. with an estimated distance of 600 ft. yet to be driven to get under an ore zone that in No. 6 was very productive. Two ore shoots have been passed through on this level, but these are not being worked yet, the intention being to defer opening them until after exploration of the ground ahead of the present face of the adit. No. 8 was in about 1,000 ft. and had passed through zinc ore but no silver-lead. There is a prospect of lead ore being found at 200 to 300 ft. farther in, for this drift will at 1,300 ft. from its portal be under ground that is ore-bearing on No. 7, but the vertical distance between these too levels is too great to allow of full confidence being felt that this will be realized. However, the drift is to be extended to three or four times its present length, so that exploration may be carried on at that depth under parts of the mine that above No. 6 have yielded a large quantity of good ore. Ore bins have been constructed below the portal of No. 7 and a loading station and tramway loader are being put in, connection being made here with the main aerial tramway, the upper terminal of which is below the portal of No. 6. Notwithstanding that a considerable output has been regularly maintained for more than two years, the Standard mine is to-day in excellent condition for production, with large ore reserves opened and reasonable expectation of finding new ore shoots as development shall be farther advanced.

Nelson Division.

Prospects are favorable for increased activity at several mining properties in the neighborhood of Ymir. Much underground development has been done during the last two years at the Ymir-Wilcox, Dundee, and Yankee Girl mines, besides which prospecting on a number of mineral claims has encouraged the holders to continue work. Among the latter are the Jennie Bell, on which Mr. J. J. Hennessy, the lessee, is driving a 200-ft. adit; the Stirling, owned by Phil White, of Vancouver; and the Canadian Pacific, owned by Mr. Ed. Peters, of Nelson, and associates.

The Ymir-Wilcox Development Co., with headquarters at Evanston, Illinois, holds a group of 5 mineral claims, mill site, and tract of timber, situated 7 to 8 miles from Ymir, up the south fork of Wild Horse creek. For two years the work of exploring the ore deposits in the lower levels of the mine, has been in progress under the direction of Mr. Arthur Lakes, Jr., formerly of Denver, Colorado. The chief object in view has been the opening of the mine so that the ore bodies may be handled more economically and effectively, and the general improvement of working conditions and facilities. Ore shoots have been opened to 400 ft. greater depth than under previous ownership. Three more adits have been driven, several intermediate levels opened, and connections made between the various workings by means of shafts and raises. The ore-body gives an average of 30 inches of dry silicious ore, generally quartz with 10 to 15 per cent. sulphide. Sufficient ore has been developed to ensure a continuous supply for the 10-stamp mill that was erected some years ago and which is about 800 ft. lower down the mountain-side than the portal of the lowest adit yet driven on the property. The work of the early future will include the improvement of milling facilities in regard to concentration and cyaniding, so as to provide for gold-

saving by amalgamation, concentration, and cyaniding, the ore having been found amenable to that treatment. As yet the Ymir-Wilcox company has not done much crushing at its mill, but the increase of power is under consideration, with a view to continuous production. The mill plant, compressor, and electric generator have been run by water-power; it is intended to develop the larger power available from the south fork of Wild Horse creek and so make ample provision for requirements of both mine and mill when operations shall be on an extended scale. There is now a transmission line from mill to the compressor in the mine, for power uses, and to mine buildings for lighting purposes. Ore transportation from mine to mill is over aerial tramways, of which there are two. The total value of production by previous owners is estimated at approximately $90,000; ore now available for extraction is estimated to be of a gross value several times greater than that amount. On an average, 12 men have been employed at this mine; with the operation of the mill and the stoping of ore for milling the working force will be proportionately increased.

The prospective development of the Molybdenite group of mineral claims, situated on the northwestern slope of Lost or Stag-leap mountain, above Lost creek, at a distance by wagon-road and trail of about 15 miles from the town of Salmo, in Nelson mining division, has during recent months attracted much attention throughout the district. There are 7 claims in the group, and the owners Messrs. J. Benson and S. N. Ross of Salmo, and H. Bennett of Nelson, have uncovered molybdenite ore in a number of open cuts along a distance of 1,200 ft., the ore having been traced that distance from well down one side of the mountain, some 600 ft. above Lost creek, up over a shoulder of the mountain and down the northeastern slope. The old Dewdney trail, constructed in the sixties of last century, passes nearby, and considerable development work was done in this neighborhood about 20 years ago, the prospectors of those days having seemingly been in search of gold ore under iron cappings. New York men, stated to be acting for German principals, are negotiating for a bond on this molybdenite property, on which in the largest opening there is a good showing of the metal, in places of high-grade ore and, with as well the metal freely disseminated throughout rock to a width of 8 ft. The formation in which the ore occurs in approximately 600 ft. wide and specks of the molybdenite may be seen in the rock right across that width, but so far the ore of commercial value has been found only within the restricted limits first above-mentioned. Under the terms of the bond that the owners have agreed to give, a minimum expenditure of $1,000 a month on development is to be made. Upon acceptance of the bond, those seeking to acquire the property will be required to commence development work without delay.

Last autumn some prospectors found oxidized copper ore and chalcopyrite on Brushy mountain, six miles south of Salmo. The season was then too far advanced for them to do much work on the showing, but as soon as the snow was off the ground in the spring they packed up supplies and are now prospecting the ground.

Another 4-horse team has been obtained for hauling corbonate of lead ore from the H. B. mine, on Deer creek, to Salmo railway station, for shipment thence to the smelting works at Trail. Beyond the H. B., higher up Deer creek, lead ore occurs on the Aspen, a mineral claim on which about $10,000 has already been spent by Mr. H. M. Billings and partners.

SILVER HOARD MINE, AINSWORTH, B. C.

The Silver Hoard mining company operating near Ainsworth, B. C., is putting in additional plant and preparing to mine and ship ore steadily from its mine situated within four miles from the steamer landing at the Highland mill, near Ainsworth. Cement-concrete foundations are in for an Ingersoll-Rand compressor to have a capacity of 327 cu. ft. of air per min. to be driven by a Canadian General Electric 2,200 volt induction motor. A Jenckes Machine Co.'s 6 x 8 double-cylinder single-drum hoist has already been installed. The machinery will be in use before the end of June. Electric current for operating the compressor will be obtained from the Consolidated Mining and Smelting Co's Highland mill, where power is generated for running the machinery of that company's No. 1 mine, situated within three-quarters of a mile of the Silver Hoard. A three-phase transmission line has been constructed from the No. 1 to the Silver Hoard mine, and a telephone wire is strung on the poles of that line. Current for electric lighting of all mine buildings at the Silver Hoard has already been arranged for.

Development work has been continued all through the winter in the Silver Hoard. Forty cars of ore—approximately 1,400 tons—has been mined from on and above the 100-ft. level, chiefly in the course of development. This ore is stated to have averaged 46.7 oz. silver to the ton, 4 per cent. lead, and 9 per cent. zinc. Milling ore mined in addition to that suitable for shipping crude to the smelter is stored on the dumps awaiting the provision of concentrating facilities. Ore is hauled in wagons to the head of the No. 1 mine aerial tramway and and conveyed thence over the tram down to the shipping bins at the lakeside.

Development work is being continued on No. 1 level, by drifting north and south on the big lead occurring here. Similar work is in progress on the 200-ft. level, and the lode is being crosscut as well. Some 53 ft. has already been crosscut without the limits of the orebody having been reached. There are in this big lode three separate shoots of ore of shipping grade—one on the footwall side, a second shoot about 30 ft. from the footwall and a third on the hangingwall side. The last-mentioned varies in width from 2 to 4 ft. The centre shoot is of carbonate ore, while the others are sulphide in a gangue chiefly of quartz. It is not yet intended to open stopes, but to restrict shipments to ore taken out in the course of development.

Ore cars of 16 cu. ft. capacity will be run in the incline shaft on a track with 10-lb. rails. Steel of similar weight is to be laid in main drifts and crosscuts, while in laterals, 12 or 8-lb. will be used. Fifteen men are employed and when the plant is installed two shifts will be worked. It is planned to continue development down to the 600-ft. level, on the slope of the mountain below which is the mill-site, so that all ore will be dropped down on a gravity system.

There are five mineral claims in the Silver Hoard group, all surveyed, and comprising 205 acres, parts of the property are heavily timbered with fine trees—fir, cedar, tamarack, white pine, hemlock, and spruce. A sawmill has been put in to cut lumber for mine buildings and timbering; its capacity is 5000 ft. a day. Buildings are substantially constructed and provide accommodation for 40 men; they include superintendent's cabin, mine and assay offices, bunk and boarding houses, barn, etc. All are lighted by electricity and are supplied with running water. The north fork of Cedar creek crosses the property; its minimum flow is estimated at about 100 h. p.

MARKETS

STOCK QUOTATIONS.

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

June 23, 1914.

New York Curb.

	Bid.	Ask.
American Marconi	3.25	3.75
Alaska Gold	26.62	26.87
British Copper	1.62	2.00
Braden Copper	7.62	7.87
California Oil	322.00	324.00
Chino Copper	41.00	41.25
Giroux Copper	.50	1.00
Green Can.	31.50	33.00
Miami Copper	21.87	22.12
Granby.	....	....
Nevada Copper	13.87	14.00
Ohio Oil	174.00	175.00
Ray Cons. Copper	20.75	21.00
Standard Oil of N. Y.	....	....
Standard Oil of N. J.	....	....
Standard Oil (old)	138.00	....
Standard Oil (subs)	980.00	....
Tonopah Mining	6.75	7.00
Tonopah Belmont	6.75	6.81
Tonopah Merger	.44	.46
Inspiration Copper	17.50	17.75
Goldfield Cons.	1.37	1.50
Yukon Gold	2.50	2.75

Porcupine Stocks.

	Bid.	Ask.
Apex.	.01½	.02½
Dome Extension	.07¼	.07½
Dome Lake	.37	.39
Dome Mines	8.20	8.40
Eldorado.	....	....
Foley O'Brien	.27	.28
Hollinger.	18.75	19.00
Jupiter.	.05	.06
McIntyre.	.25	.26
Moneta.	....	.04
North Dome	....	.05
Northern Exploration	2.00	2.60
Pearl Lake	.03	.03¼
Plenaurum.	....	.50
Porcupine Vipond	.27	.28
Imperial.	.01	.01½
Porcupine Reserve	....	....
Preston East Dome	.01	.01½
Rea.	.10	.20
Standard.	....	....
Swastika.	.01	.01¼
United.	....	....
West Dome	.05	.10
Porcupine Crown	.85	1.00

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.06¾	.01
Beaver.	.30	.30½
Buffalo	.80	1.00
Canadian.	.08	.10
Chambers Ferland	.17½	.18½
City of Cobalt	.40	.45
Cobalt Lake	.37	.45
Coniagas.	7.00	7.40
Crown Reserve	1.01	1.04
Foster.	.04	.06
Gifford.	.01	.02
Gould.	.01	.01½
Great Northern	.06½	.08
Hargraves.	.01	.02
Hudson Bay	65.00	70.00
Kerr Lake	5.00	5.10
La Rose	1.42	1.44
McKinley.	.63	.68
Nipissing.	6.35	6.45
Peterson Lake	.33½	.34
Right of Way	.02	.03
Rochester.	....	....
Leaf.	....	....
Cochrane.	....	....
Silver Queen	....	....
Timiskaming.	.13½	.14
Trethewey.	.20	.23
Wettlaufer.	.05½	.06½
Seneca Superior	2.50	2.70

TORONTO MARKETS.

June 24—(Quotations from Canada Metal Co., Toronto).
Spelter, 5¼ cents per lb.
Lead, 5¼ cents per lb.
Tin, 33½ cents per lb.
Antimony, 8½ cents per lb.
Copper, casting, 15 cents per lb.
Electrolytic, 15 cents per lb.
Ingot brass, yellow 12c., red 13 cents per lb.
June 24—Coal—(Quotations from Elias Rogers Co., Toronto).
Anthracite, $7.50 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

June 22—Connellsville Coke (f.o.b. ovens).
Furnace coke, prompt, $1.75 to $1.80 per ton.
Foundry coke, prompt, $2.35 to $2.50 per ton.
June 22—Tin, straits, 30.65 cents.
Copper, Prime Lake, 14.00 to 14.25 cents.
Electrolytic copper, 13.70 to 13.80 cents.
Copper wire, 14.75 cents.
Lead, 3.90 cents.
Spelter, 5.05 to 5.15 cents.
Sheet zinc (f.o.b. smelter), 7.00 cents.
Antimony, Cookson's, 7.10 to 7.20 cents.
Aluminum, 17.75 to 18.00 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $43.00 to $44.00 per ounce.
Platinum, hard, 10 per cent., $46.00 to $47.50 per ounce.
Platinum, hard, 20 per cent., $49.00 to $51.50 per ounce.
Bismuth, $1.95 to $2.15 per pound.
Quicksilver, $38.00 per 75 lb. flask.

SILVER PRICES.

	New York cents.	London pence.
June 11	56⅞	26⅛
" 12	57¼	26¼
" 13	56¾	26 1/16
" 15	56½	25 15/16
" 16	56½	25 15/16
" 17	56½	25 15/16
" 18	56⅜	25⅞
" 19	55⅞	25 13/16
" 20	55⅞	25 13/16
" 22	56½	26
" 23	56⅜	25 15/16