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Editor

REGINALD E. HORE

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CIRCULATION.

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CONTENTS.

CALGARY OIL FLOTATIONS

It might have been expected that the men who have so successfully advertised many features of Western Canada would be quite capable of bringing to the attention of the public the mineral possibilities of the Calgary district.

For some reason they have not said very much about the coal resources of Alberta. These they are leaving for the attention of careful experienced operators. Coal mining is considered a very prosaic occupation.

But development of oil fields is a very different business. At least it is being conducted very differently. Possibly one of the chief reasons is that there are known to be very large deposits of coal and no one knows whether there are any large deposits of oil or not.

The lack of knowledge concerning the possibilities of the oil field is being capitalized by companies without number. They are ready to offer you for the small sum of fifty cents one share in a company capitalized at $1,000,000 in 1,000,000 shares of $1 each. Concerning the amount of oil on the properties the companies know nothing. Neither does the public. That apparently is the reason that the price has been fixed at fifty cents. For that small sum you may have one share in a million in a property of doubtful value.

The price having been fixed and a few acres of land somewhere in the vicinity of another company's property having been purchased or leased, the advertising begins. This is where the Westerner shines. Hasn't he sold real estate to hundreds of people who didn't want it? Why shouldn't he be able to sell shares in a company owning several acres located only a few miles away from an oil well of uncertain value? The very uncertainty is the salesman's most valuable asset. Knowing next to nothing about oil wells or the geology of oil fields the salesman is forced to draw largely on his imagination. And if one feature stands out more vividly than any other it is the Western salesman's imagination concerning future possibilities.

All the methods used in advertising real estate are being used in advertising the so-called oil lands. Many newspapers are used to advantage by the companies. Offices are scattered across the country to rake in the subscriptions. Photographs of derricks, bottles of oil and photographs of the Dingman well are considered the proper fittings for an office window. A few telegrams and newspaper clippings are used to advantage. They may be pasted on the window. The telegrams should tell of supposedly important strikes on neighboring properties. The clippings should be from local newspapers if any can be prevailed on to accept the copy.

That many people will buy stock in Calgary oil companies is a foregone conclusion. The seductive adver-

tisements cannot fail entirely. We would urge on those who buy, however, that they use every possible means of determining where the money goes. A large part of it should be spent in actual exploration. If care is not taken the speculator will not even have the chance he might appear to have.

It is evident that the public is willing to bear a share of the expense of exploring the Calgary field. The money is paid in on the assumption that the companies have been formed to raise funds for exploration. To carry on the work of testing large areas thoroughly, considerable sums must be available. Under the circumstances stock companies are very properly formed. By soliciting funds from a large number of people the owners of lands in the more promising section will be enabled to undertake the costly venture. The buyers of shares assume the risks and should share in the profits if there are any.

Criticism of some of the companies is quite unwarranted for there is evidence that an honest effort is being made to raise money for the exploration of their properties. The risks of the venture being great it is well that the expense should be borne by several rather than by a few. Those who assume the risk should be ready to stand the loss of all the money they invest. There is no certainty of oil being found in paying quantities. There is, however, a chance.

But there is evidence also that many companies have been formed to make profits on the selling of shares rather than to raise money for exploration. These are the companies which the public is warned against. These are the companies which make ridiculous statements as to possibilities and give little or no warning of the risk involved. Some of these companies state that oil exists in paying quantities on their property or adjoining property. In view of the facts, such statements are in practically all cases false and are an indication of the character of the companies. To purchase shares of stock in such concerns is mere folly.

The directors of some of the companies state clearly that they know nothing concerning the occurrence of oil in paying quantity on their property and that they regard it as very problematical. They state that they invite the public to pay part of the cost of exploration in the hope that oil may be found. Such directors are to be congratulated on their frankness.

Some of the properties are located where there seems a fair chance of oil being found. Others are located where the chances are very poor. The intending investor should satisfy himself that the property on which he is invited to spend his money is in a good location and that the directors of the company are making an honest effort to explore the property. Further than that it is quite as necessary that the exploration should be carried on economically, the wells drilled in the most favorable places and by experienced drillers. Otherwise even directors with the best of intentions may waste most of the money raised.

COBALT SILVER MINES

The closing down of the Hudson Bay mine last week and the announcement of the fact that the La Rose mine is nearly worked out gives force to the prediction that the production of silver this year will be considerably less than in the past few years. Several other Cobalt mines will make serious inroads on their reserves this year.

There need be no fear, however, that Cobalt will cease to produce silver for some years. One company at least has made a large addition to its known reserves this year. Others have much ore in sight and promising ground still to be explored.

There is still to be mined a very considerable amount of high grade ore and an enormous tonnage of milling ore. Further, it is not unlikely that exploration will result in the discovery of new ore bodies on several properties.

HOLLINGER

The development of the Hollinger mine continues to be very encouraging and gives every day better reason for the statement now being commonly made that Hollinger will be one of the big gold mines of the world.

It is scarcely to be rated as a small mine now, for it is producing ore at the rate of over 500 tons per day and making a profit which allows the company to pay 3 per cent. every four weeks on a capitalization of $3,000,000 and at the same time make substantial increases in surplus cash.

But this is being done with an equipment that is soon to be greatly improved. An enlargement to the mill is nearly completed and a plant that will house three large new compressors is being erected. Part of the new equipment is for the Acme property; but an increase in production at the Hollinger is being provided for.

By the end of the year the Hollinger and Acme should be fairly started on a long and prosperous career. A career which should do much to show the possibilities of Northern Ontario as a mining district. Cobalt has done much to bring the attention of mining men to Canada. Gold mines like the Hollinger and Acme will serve the same purpose.

HILLCREST INQUIRY.

Hillcrest, Alta., July 6.—Daniel Briscoe, fire boss in Hillcrest Mine for three years and a half told the official enquiry Saturday morning that he was in the mine up to ten o'clock of the night previous to the explosion. The mine was not working during the time he was in, but he made an examination of the main roads and found gas in No. 3 South Entry.

The barometer, according to his official report, indicated normal. The amount of gas was not by any means unusual, but, as required, he posted a notice outside the mine on the warning board. The quantity of dust was about normal and the heat was nothing unusual. There was plenty of moisture all over the district he covered.—Journal of Commerce.

THE ROUTES TO MOOSE FACTORY

According to Mr. J. G. McMillan in a bulletin published by the Ontario government railway, power boats cannot be used to advantage on the Mattagami, the Moose or the lower parts of the Abitibi. Transportation must be effected by poling or towing. There are three long stretches of the Upper Abitibi where small motor boats or steamers can be used, when warranted by the amount of traffic. These are from Frederick House River to the carrying place, 13 miles from Island Falls to Lobstick, 28 miles, and from New Post to Otter Falls, 14 miles. For the present the use of canoes only need be considered. These should be of large size and strongly built, to be safe in rough water and to stand considerable hauling over rocks in towing or poling, where there are no portages.

On the Abitibi route, the principal obstacle is the four-mile rapid on the Frederick House. The water in this river is very turbid, rendering it impossible to detect submerged rocks or other obstructions that are even barely covered by water. Great caution must be used to prevent accidents from this cause. Below the long rapids the portages are good and well marked, but the rapids must be carefully approached, especially in high water, as the portages are very close to the head of the falls and the landings are mostly in swift water. Except in very low water, the "Little Lakes Route" should be used in preference to following the river past Lobstick Falls. None of the Indians accustomed to the river use the latter route in high water.

The Driftwood River is easy and safe for canoes to four miles above the crossing. I do not know whether this river can be used up to the T.C.R. If it is navigable, it could be used in preference to the Frederick House. The Mattagami is easily navigated in low water. There are 20 miles of good canoeing on the upper part of the Red Sucker and two miles at its mouth, but the seven miles between these parts are mostly shallow rapids which would be very hard on canoes in low water.

French River can be ascended 80 miles without portaging. Then there are about four miles of rapids and falls. I did not go past these. These falls occur at the junction of the Archean and Palaeozoic rocks, which are here seen in contact. Resting on gneiss or in some cases on diabase, is a layer of sand, or greasy shale, a few inches thick. Then a layer of fragmentary limestone of varying thickness up to five feet, then horizontal layers of limestone that have been subjected to very little disturbance. This limestone strata was not over 50 ft. thick at any point along the river.

The Groundhog or Kapuskasing may be used if desired instead of the upper part of the Mattagami. The Kapuskasing has only two portages and very little rough water.

The Missinabie is probably the safest of all routes to Moose Factory.

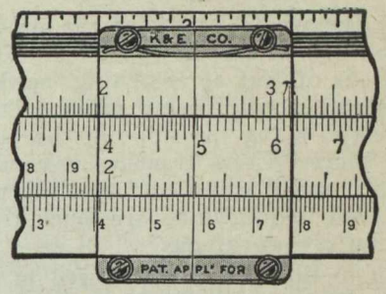
HOLLINGER.

Foundations for the new plant on the shore of Gillies lake are nearly completed and the erection of the steel structure has been commenced. Three large compressors have been ordered.

The twenty stamp addition to the mill is nearly completed and the new tube mills are being placed in position. When this section is ready increased output will be made. Part of the addition is, however, for the use of the Acme Company.

SLIDE RULE IMPROVEMENT.

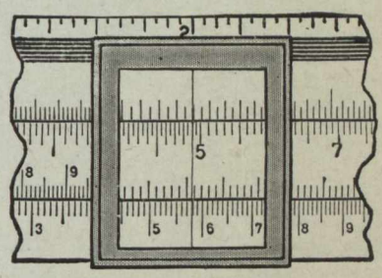
A new patented indicator or runner for slide rules, called the "Frameless" has just been perfected by Keuffel & Esser Co. Every figure on the rule is clearly visible at all times, there being no side pieces to the metal holder of the glass indicator, and, therefore, nothing to hide any of the figures on the rule. This is one of the most important improvements in slide rules—those indispensible instruments for rapid calculations. Often, after setting the old style indicator or runner, the user would find that he could not read



New Style Indicator

the result because important figures were hidden by the frame or holder of the glass. Frequently two, and sometimes four or even six, eight or nine figures would be thus hidden; causing more or less inconvenience and uncertainty in reading the slide rule. The new runner entirely obviates this difficulty.

Thousands of engineers and scientists in every profession and industry, as well as contractors, builders,



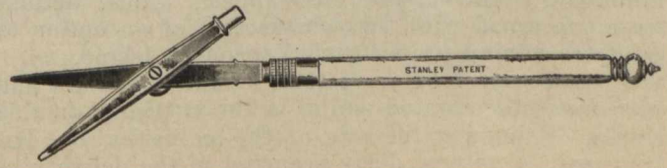
Old Style Indicator

architects and merchants have found the slide rule invaluable as a time and brain saver in quickly and accurately making a great variety of calculations. In its various forms, it has been adapted by Keuffel & Esser Co., to the needs of practically every line of work, including all branches of engineering, as well as chemistry.

A NEW DRAWING PEN.

W. F. Stanley & Co. have placed on the market the new swivel nib drawing pen shown in the accompany-

ing illustration. This pen is easily and quickly cleaned and can be afterwards set back to make a line of exactly the same width as before.

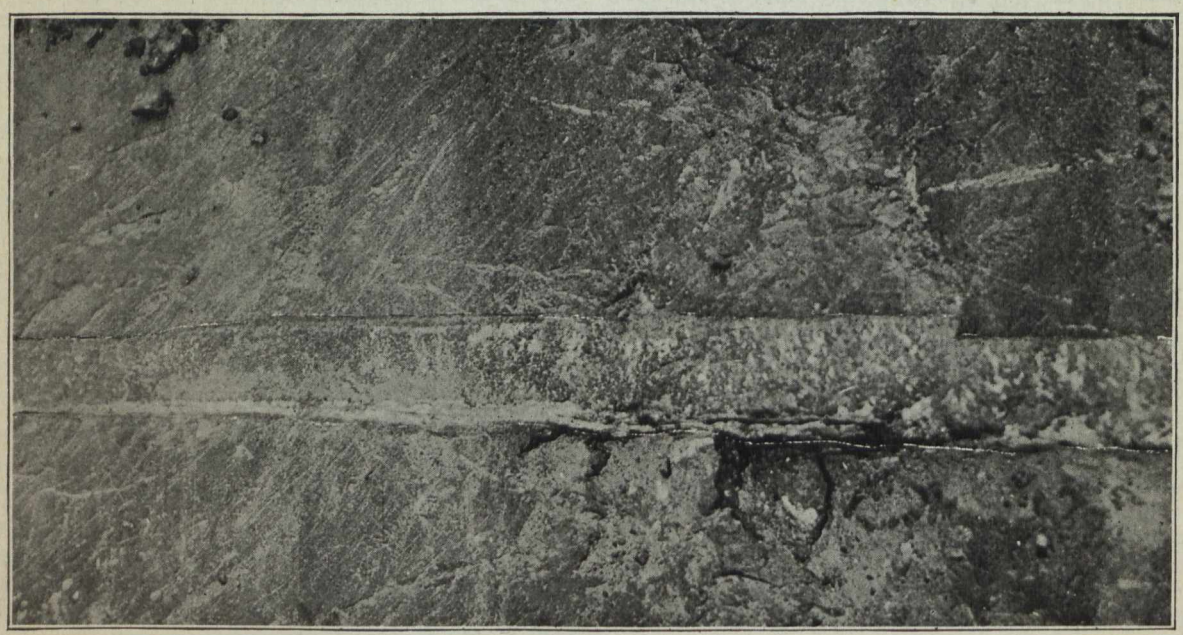


THE DRAINING OF KERR LAKE DISCLOSES RICH ORE.

The water has been completely pumped out of Kerr Lake, and the machinery is now being used to remove the mud from the bottom of the Lake. Already the southern slope of the lake basin has been explored by trenches dug through the mud to the rock bottom. The result of this exploration on the property of the Kerr Lake Mining Company has been the exposure of some of the most remarkable veins yet found in the Cobalt district.

For nearly the whole length of the property there are good showings where the mud has been removed. Of the hundreds of feet of trenching, hardly any has been unsuccessful in uncovering veins. The most important veins run along the slope of the basin, parallel with the shore. Cross trenches were dug at frequent intervals, and it was found that the veins which had been worked underground are much richer at the surface than in the workings.

In addition to the rich ore disclosed in the known veins, some entirely new veins have been discovered. The showings rival anything that has been seen at Cobalt.



A Rich Silver Vein on the Glaciated Rock Bottom of Kerr Lake.

The result of the lowering of the Lake, has been to very materially increase the known reserves of the ore on the Kerr Lake mining property. The adjoining property, that of the Crown Reserve, is still covered by a layer of mud. This mud is being pumped out as quickly as possible by mixing it with water. Up-to-date, however, it has not been possible to prospect the Crown Reserve portion of the lake bed.

COLLIERIES CASE.

The Privy Council to-day allowed the appeal of the Canadian Collieries (Dunsmuir), Limited, vs. Dunsmuir, and dismissed the cross-appeal. These actions were concerned with the construction of an option to purchase mining property on Vancouver Island.

The case involved more than a million dollars and was quite a celebrated action in the British Columbia courts. Following the sale of the collieries by Mr. Dunsmuir, a natural delay occurred in the delivery of the property and both parties laid claim to the receipts during this interval. The buyers also claimed several coal-carrying steamers, which Mr. Dunsmuir alleged were not included in the deal. A question also arose over the current bank account, most of which was exhausted just before the transfer took place by the declaration of a dividend, naturally in favor of the former owner.

THE HOSMER MINE.

It has been announced that the Canadian Pacific Railway Co., which for a number of years has been developing coal measures at Hosmer, in the Crows Nest Pass district of British Columbia, has definitely decided to abandon its coal mines there. That this decision has been arrived at is evident, for the dismantling of the plant has already been commenced. As there is little, if anything, else to support the business of Hosmer, the result will be the practical wiping out of that small town as well. The broken condition of much of the coal in the several seams opened by the Hosmer Mines, Ltd., under which company name the C.P.R. has been operating here, mining coal and making coke, is the chief reason for the final decision to abandon further attempts to continue work there, notwithstanding that a large sum of money has been expended in developing and equipping the mines and coke-making plant. Hosmer is distant from Fernie (the headquarters in British Columbia of the Crow's Nest Pass Coal Co., which has for 16 years operated the Coal Creek and Michel collieries) in one direction eight miles, and from Michel in the other 14 miles. Some years ago the Crow's Nest Pass Coal Co. abandoned its Carbonado colliery, near Morrissey, ten miles south of Fernie and 18 from Hosmer, so the latter is the second place in the district at which important coal-mining operations have proved unprofitable.

McINTYRE.

Foundations for an enlargement to the McIntyre mill are now being constructed. An additional tube mill will be placed in the present building and several tanks will be erected in an adjoining building.

THE VOLCANIC ORIGIN OF PETROLEUM

By Dr. Hans Von Hofer and Eugene Coste

In his paper "The Origin of Petroleum" presented at the New York meeting 1914, of the American Institute of Mining Engineers Dr. Von Hofer discussed at some length the hypothesis of volcanic origin advanced by Mr. Coste. Mr. Coste's reply has been recently published and we reprint here from the bulletins of the Institute, the arguments.

Dr. Von Hofer:

Eugene Coste, of Calgary, seems to be the most zealous American defender of the inorganic origin of petroleum. Three of his papers on the subject lie before me: (1) The Volcanic Origin of Oil (Trans., A.I.M.E., 1904, p. 288); (2) The Volcanic Origin of Natural Gas and Petroleum (Journal of the Canadian Mining Institute, vol. vi, 1903, p. 73), and (3) Petroleums and Coals Compared in Their Nature, Mode of Occurrence and Origin (idem, vol. xii, 1909, p. 273). He sees in petroleum "the product of volcanic solfataric emanation." In the following critical examination of his proofs, I refer chiefly to the interesting paper last named, which is the most recent, and, moreover, takes account of the arguments previously stated in the two others.

I must express in advance my surprise at his statement (p. 275): "The petroleum series includes all the natural hydrocarbons with the exception of the marsh gas." This hydrocarbon is found in every petroleum, though it escapes as a gas very rapidly, as soon as the oil is exposed. Of natural gas, it is generally the essential constituent.

The Proofs Advanced by Coste.

Mr. Coste says in one of his papers: "The vital point is to actually show the carbon and hydro carbon in the igneous rocks, lavas and emanations proceeding from these internal fluid magmas."

As illustrative instances, he cites (on p. 278 and following pages of his latest paper) the following:

1. "Oil in crystalline gneiss: In Placerita Canyon, five miles east of Newhall, Los Angeles county, California, a very light oil, almost naptha, of a gravity between 50° and 60° B., is produced from crystalline gneisses which overlay the San Gabriel granite."

According to the investigations of G. H. Eldridge and Ralph Arnold, this so-called crystalline gneiss is not gneiss at all, but a metamorphic crystalline schist, perhaps Jurassic, and hence by no means an Archaean rock which could possibly be regarded as eruptive. It is a metamorphosed sedimentary, and can give Mr. Coste no help—rather the contrary. The oil of this locality may be in its primary deposit, or, more probably, it may have found its way thither from the neighboring Tertiary oil-feld.

2. "Oil and bitumen in the quicksilver deposits of California."

Being unacquainted with the geological relations of that district, I can offer no suitable explanation of this occurrence, and will only remark that these bitumens may have been extracted and transported from deeper bituminous rocks by the ascending ore-bearing solutions. Spirek ascribes to bituminous rocks the occurrence of bitumen in the Tuscan quicksilver-mines. Since the bitumens occur very seldom in ore-deposits—particularly in deep-seated veins,—they cannot be regarded as a general product of deep volcanic zones. They must have a purely local cause. At all events, such scanty occurrences of bitumen of all sorts prove nothing as to the formation of rich petroleum-deposits. This has been emphasized by Prof. Dr. L. Mrasec, of Bukarest, who is inclined, moreover, not to admit a deep source for the rare occurrences of bitumen in ore-deposits.

3. "Graphite and natural gas in the metalliferous vein of Silver Islet, and graphite in the veins at Cobalt and Ducktown, Tenn."

To these instances also, what I have already said is applicable. No one would dare to infer from the sporadic occurrence of graphite in mineral veins that deposits of graphite are of volcanic origin—still less when (as in the Kaisersberg, Styria) the graphite is accompanied by plant-fossils. It seems to me equally audacious to argue the origin of the great deposits of petroleum found in sedimentary rocks, from the isolated and quite insignificant occurrences of bitumen in veins.

4. "Solid petroleums in pegmatite dykes, and other veins, associated with uranium, radium and vanadium."

We are here concerned, not with "solid petroleum" (a contradiction in terms, since petroleum is a liquid), but with a bituminous mineral, the combustion of which left an ash which, in one locality not named, contained uranium, and in another place, in Peru, contained vanadium. The remarks already made under (2) and (3) are applicable here; and I will only add that petroleum is almost entirely free from ash.

5. "Graphite, diamond and hydrocarbons in meteorites."

This phenomenon bears no relation to the origin of petroleum, nor is it at all surprising, since in the original cosmic material carbon must have been present (probably as carbonic acid), and must have been segregated in the meteoric masses, as in that of the earth.

6. "Oil and natural gas in volcanic rocks in Europe, Africa and Mexico."

These occurrences, few in number and always very small in extent, may be due to coal-beds or bituminous rocks which the volcanic eruptive broke through, distilling out and absorbing into its own mass some oil and natural gas. This distillation of bituminous material has long been practised in the Scotch shale-oil industry.

7. "Natural gas in serpentine, Asiatic Turkey" (Chimaera).

Alexander von Humboldt suggested long ago that this emission of gas might be connected with petroleum. E. Tietze, who studied the phenomenon on the spot, adopts this view, and calls attention to the neighborhood of the so-called "Flysch" formation, which so frequently carries petroleum.

8. "The occurrence of oil around volcanic necks, Mexico."

This proves nothing, since the mineral oil of Mexico, and especially of the State of Tamaulipas, named by Mr. Coste, is widely distributed, and occurs both near volcanic necks and far from them. Villarello, Division-chief of the Mexican Geological Institute, and one of those best acquainted with the oil-occurrences of Mexico, concludes: (a) that the oil comes from a marine

fauna; and (b) that, in the districts explored hitherto, it is found only in secondary deposits, situated in highly disturbed terrain, connected frequently with basaltic eruptions. Since the volcanic tuffs are highly porous, it is not surprising that the oil, in its migration, should accumulate there in special abundance.

Of all the foregoing proofs of the volcanic origin of petroleum, only two, No. 1 and No. 8, are really pertinent to the question of the genesis of valuable deposits of oil. The rest are so insignificant that they prove nothing as to the production of oil in large quantities, and have for us only a purely scientific interest. And the two exceptions, adducing the occurrence of petroleum in alleged gneiss, and in connection with volcanic necks, have been shown, I think, to be entirely inadequate as proofs.

As a logical consequence of Mr. Coste's view, deposits of petroleum should always be found in the vicinity of volcanic eruptions. But this is not the fact. In the Carpathians, the "outer bend," through Galicia, the Bukowina, and Roumania, is free from eruptives and rich in oil, while the "inner bend" is rich in eruptives and poor in oil. At Baku, in Alsace, and in North Germany, as in Canada, New York, Pennsylvania, Ohio, West Virgina, Louisiana, Texas, etc., there are no eruptives near the rich oil-deposits. In Java, Sumatra, Borneo, and Burmah, the oil fields are far from the regions of eruptive activity.

These weighty facts, completely contradicting the volcanic hypothesis, Mr. Coste seeks to deprive of force by the assumption that oil and gases have ascended from greater depth through fissures, and thus were deposited far from eruptive masses. But it is remarkable that the Hungarian Carpathians are much more disturbed than those of Galicia and Roumania, and are, nevertheless, poorer in oil—indeed, for the most part, contain no oil at all. The most important and profound disturbance of the Galician Carpathians—the so-called Klippenzone—is barren of oil, like its neighbor, the Weichselbruch. The Alps are traversed by deep faults and dislocations, many of which still make themselves disagreeably felt as seismic surfaces; yet no noteworthy oil-deposits have been found among them. At the foot of the Alps on the north, the gas-springs of Wels, in Upper Austria, are found in quietly deposited and undisturbed Miocene strata. In the rich oil-bearing flat anticlinals of Pennsylvania, I sought in vain for any dislocations worthy of mention; and not one of the intelligent "oil-men" whom I met could point me to any such thing. East of that oil-region, we find in the Appalachians mighty disturbances of all kinds—deep fissures, sharply arched anticlinals,—but no oil. At Pechelbronn, in Alsace, the slightly inclined oil-bearing sandstones were formerly mined and thus thoroughly explored, without the discovery of a single dislocation, showing that the oil was occupying its primary place of deposit. K. Kalickij proved the same proposition for the oil-occurrences on the island of Tscheleken. Even the photographs accompanying his paper are conclusive.

The Objections Advanced by Coste.

In order to weaken objections to his own theory, Mr. Coste urges the following objections to the theory of organic origin:

1. "It cannot possibly explain the large petroleum fields below the Carboniferous."

Can the solfataric hypothesis do that? No: Mr. Coste's proofs—except No. 1 and No. 8—rest wholly upon isolated and minute occurrences of bitumen. No one has ever observed at a solfatara any accumulation of petroleum worthy to be mentioned. On the other hand, F. Quenstedt has shown that 1 square mile of the bituminous Posidonia slates of Suabia, rich in animal fossils, contains 200 million hundredweight of oil. In other words, the animal remains of a single sedimentary bed can furnish enormous amounts of oil. What was possible after the Carboniferous era may have been possible before it also. Biological activity on the earth has been immense, continuous, and widespread; whereas volcanic activity has been local, and often but temporary, discharging here and there comparatively insignificant quantities of hydrocarbon gases.

2. "Neither can it explain the petroleums in the volcanic emanations of to-day."

No considerable quantity of hydrocarbon has ever been found in a solfatara. And where only one or a few per cent. have been found, they can be referred to bituminous strata which have been intersected. Moreover, positive reports of hydrocarbons (usually given as methane, CH_4) are to be received with caution. The gases of the Hawaiian volcano Kilauea are often cited as an example. But when collected directly by L. Day and E. S. Shephard they were found to contain no hydrocarbons at all. So this proof also fails. The small quantities of marsh-gas, produced by Brun at Geneva through the heating of certain lavas, may have formed themselves during the process through the decomposition of other gases, for instance, according to the equation

$$4\,CO + 8\,H_2 = 2\,H_2O + CO_2 + 3\,CH_4.$$

3. Nor can the organic theory explain the petroleums "in the volcanic or igneous rocks in all parts of the world."

4. "Nor in crystalline rocks; in California and New Brunswick, for instance."

5. "Nor in meteorites."

6. "Nor in metalliferous veins."

These four points have been already discussed, and shown to be invalid.

7. "It is also at a loss to explain why the petroleum fields in every district are found grouped along certain lines and why the petroleums are found there in many horizons, while outside of the lines in just the same strata and over much larger areas all the horizons are barren."

This raises the comprehensive question of the structure of the petroleum-deposits, which cannot be treated within the limits of this paper. I will only say briefly that the oil is found along certain lines, because it occurs (1) in fissures, (2) in folds, and (3) in long-drawn channels of sand. The fissures are directly connected with the primary deposits. In folds, anticlines, monoclines, etc., the position of the oil is determined by the accompanying natural gas and water. The three substances arrange themselves according to their specific gravity, along the lines and surfaces presented by the shape of the fold. If the oil-bearing sands occur in long, slender bodies, as in Alsace, the grouping of the oil "along certain lines" is not surprising. Since the oil-deposits are coastal formations originating under special conditions, it is comprehensible that they cannot follow throughout the same geological horizon.

8. "It cannot explain how the petroleums can possibly travel out of their supposed organic-remain source in some impervious clay or shale to accumulate in a few porous receptacles far distant laterally and sometimes hundreds and thousands of feet above, or even below as some assert, and this all through most impervious rocks and without any impelling force be-

hind, or any cracks, joints or fissures to follow since the decomposed products of the organisms must naturally be supposed to come from the whole mass of the strata through which the organisms were and there could not be fissures, cracks and joints to all parts of the strata."

If I understand Mr. Coste correctly, this passage is directed, not so much against the theory of organic origin as against the hypothesis, so popular in America, of the regional migration of petroleum. In this respect, I heartily agree with him. I too maintain that the migration of oil can take place only in cracks, joints, and fissures, the source of motive energy being (as has been often demonstrated) the accumulation, in the primary deposit, of natural gas under high pressure.

9. "It cannot possibly explain why the petroleums, although found to-day in their reservoir-rocks under strong pressures, cannot by means of that pressure, return and disperse back to their original sources; they should be able to return the way they came, nothing is to prevent them and there is plenty of pressure for the return voyage if one admits the first voyage from the organic source."

This question might be applied to Coste's hypothesis also. As already remarked, petroleum is driven by gas-pressure to a considerable altitude in fissures; and its removal leaves in the original deposit a space in which the gases collect and keep the oil above them, as, for instance, in the so-called inverted siphon, when partly emptied, the entrance of carbonic acid gas continues to maintain the height of the water in the discharge-pipe.

10. This objection, based on alleged features of the occurrence of petroleum in California, I must leave to my esteemed colleagues, Ralph Arnold, B. Anderson, G. H. Eldridge, and other distinguished investigators of the oil-geology of that State. It will possess for them no difficulty.

11. "It cannot possibly explain again, if the petroleums can travel so freely through the strata as to be able to accumulate under an anticline from organic remains deposited far and wide laterally (at least a mile or two or much more in order to allow for the quantities obtained in many fields), why they did not escape out into the free air only a few hundred or a few thousand feet away at most; the shales above the sands are not any more impervious than the shales below the sands, which on that theory are supposed to be the source of the petroleums, and if they can travel freely through the shales which are the most impervious rocks of the sedimentary series, I repeat, what is to prevent them from getting out into the atmosphere?"

This question properly concerns, not the organic origin of petroleum, but a hypothesis of its migration, advanced to explain the formation of productive deposits—a hypothesis which I reject, holding that petroleum originated in the sands in which it is found, unless it has passed through fissures to other sand-strata.

12. "It cannot account for the continual absence of petroleums in the hard parts of organisms preserved in the sedimentary strata."

Oil can be found from the soft parts of animals under certain conditions only, among which is the exclusion of air. We find on the seashore many hard parts, such as shells and skeletons, of marine animals, from which their organic contents have totally disappeared, having been destroyed by the oxygen of the air. Since this generally finds access to dead animal matter, we find the hard parts without oil very frequently, and oil itself infrequently in comparison, because only under special favoring conditions.

13. "It cannot explain the evident non-connection of petroleum deposits with coal-beds."

Since the latter are land-formations from plants containing cellulose, while the former are marine estuary-formations from animal remains, there can be no connection between the two organic processes or their products.

14. "It cannot account for the continual association of petroleums with strong salt and sulphur waters."

Since the original materials of petroleum accumulated in marine bays, having but limited relations with the ocean, the presence of strong salt water is not surprising, but constitutes, on the contrary, a proof of our theory. Sea-water is known to contain sulphates also, which, in the process of oil-formation, can be reduced to sulphides, or even to sulphur. As a marine formation, petroleum may be accompanied by salt, gypsum, calcite, and dolomite; and this explanation of their presence seems to be more natural than that of a volcanic source.

Further Consideration.

I have thus answered in detail both Mr. Coste's objections to the organic, and his arguments for the inorganic, origin of petroleum. The latter, however, constitute, strictly speaking, an incomplete statement; for he contends only that petroleum was brought by solfataras into the cooler parts of the earth's crust. Concerning the questions, out of what and how it was formed, he is entirely silent. His explanation, even if we were able to accept it as correct, goes only half way, like those of his predecessors, Lenz (1831), Rozet (1835), S. W. Pratt (1846), Choucourtois (1863), Thore (1872), Fuchs and Sarasin. It is at best a plant without a root.

Even if we had proved, or should hereafter prove (as has never yet been done), the presence in solfataras of large quantities of marsh-gas, CH_4, such gas would stream into the air, without forming petroleum. Besides, we know of no process by which CH_4 can be converted into the higher members of the paraffine series, or any member of the naptha series. This circumstance likewise deprives the very rare occurrence of CH_4 in ore-deposits or volcanic rocks, of all significance as to the origin of petroleum.

As a sincere friend of the petroleum industry, I am heartily sorry that I must reject Mr. Coste's emanation-theory; for, if it were true, we might expect our petroleum-supply to prove inexhaustible, new quantities being continually furnished by solfataric activity. Unfortunately, that is not the case.

Mr. Coste mentions an occurrence of hot water with petroleum in Texas. This is a purely accidental phenomenon; since neither in the great Yellowstone region of thermal springs nor in any of the European hot springs has petroleum, or even marsh-gas, been observed.

Why are oil deposits lacking in the highly fissured true Archaean rocks of Scandinavia, Bohemia, the central Alps, the Appalachians, etc.; and why do they appear first in the sedimentaries deposited at a time when the earth had become populated with organisms? This can be construed only as a proof of the organic origin of petroleum.

If this oil had ascended from great depths, it would have impregnated all porous strata. But, on the contrary, we find repeatedly, between two oil-bearing

horizons, porous rocks containing no oil, like, for example, the Jamna sandstone in the Galician Carpathians. Underlying the oil-sands themselves, there are porous, yet barren, rocks.

If petroleum were the product of distillation at high temperature it could not maintain any primary paraffine, and it would be richer in olefins. Neither of these conclusions is confirmed by the facts.

The occurrence of free nitrogen (not in the form of air) in many petroleums and (often in considerable amount) in natural gas, cannot be explained by any volcanic hypothesis, but furnishes another strong proof of organic origin. The same may be said of the optical properties of petroleum, and of the presence of cholesterin, which seems to be a condition of the polarization, and is a special indication of animal origin. Moreover, the high-molecular pyridin bases, observed in many oil-regions (Galicia, Alsace, Baku, Fergana, Roumania, Sumatra, California, Egypt, Algiers) speak conclusively against a volcanic, and in favor of an organic —particularly an animal—origin. The general chemical character of petroleum as an unstable mixture of hydrocarbons bears similar testimony against any supposed pyrogenic process at high temperature.

All geological and chemical facts concerning the occurrence of petroleum bear unanimous witness in favor of its organic origin, and hence conclusively against its production from inorganic substances, and the collateral hypothesis of emanation. The doctrine of the volcanic origin of petroleum deposits must therefore be pronounced to lack scientific foundation.

To demonstrate this fact in a review of the publications of Mr. Coste, one of the most meritorious and zealous representatives of that hypothesis, has been the purpose of the foregoing remarks. Hence I have adduced proofs of organic origin only so far as they contradicted the opposite view. For a detailed exposition and defense of the former theory, I refer to my two books: Das Erdol und seine Verwandten (3d ed., published by Vieweg at Braunschweig in 1912), and Die Geologie, Gewinning und der Transport des Erdols (published by Hirzel of Leipzig in 1909), the latter of which constitutes vol. ii. of the comprehensive monograph issued by Engler and myself under the title, Das Erdol.

Mr. Eugene Coste.—Before answering Dr. v. Hofer's points against the solfataric volcanic origin, I may be permitted to resume what I understand from his paper to be his own views, and what he frankly states as his position on the question. He narrows the origin of petroleums to the direct transformation of animals or fatty plants (such as diatoms) without cellulose; and he considers that the organic matter was originally in the "sands" in which the petroleums are now found, unless in the cases where petroleums have passed afterward through fissures to other sand strata. Dr. v. Hofer also considers these sands to be coastal marine formations, deposited in shallow bays of the sea, where under special favoring conditions, the oxygen of the air did not destroy as usual the animal or fatty plant matter, which was therefore entombed, and afterward through the agency of long time was gradually distilled at low temperature and under high pressure, and became petroleum.

The clear statement of these views forcibly suggests at once the following objections to them:

1. Why is not this process in active operation in the world to-day? Why can we not abundantly verify it, and witness it in numerous cases in some of the millions of shallow bays of the sea teeming with life, where sands are being deposited to-day, and have been deposited in recent ages under similar conditions? It is not enough to cite in support of this hypothesis a very few cases, in which empty shells, or organic matter partly decomposed, were evidently impregnated with petroleums by seepage through fissures or seams from underlying reservoirs.

2. It is also erroneous to say that this hypothesis was accepted by eminent authorities, "mostly in view of the circumstances that the bituminous rocks carry the fossil remains of animals." As a matter of fact, the fossil remains of animals or plants are found mostly in shales which are, as a general rule, absolutely barren of petroleums. It is only very occasionally, surely not in 1 per cent. of the cubic contents of the strata, that bituminous rocks, or rocks (either shales, sands or limestone) containing petroleums, are found; and, as a rule, these spots are comparatively small and are very poor in fossils. The other 99 or more per cent. of the strata really contains the fossil beds; and these fossil beds, as is well known, are barren of petroleums. Although some of these shales may be carbonaceous, they are not bituminous or petroliferous.

3. This brings one to the third serious objection to the view of Dr. v. Hofer, namely, that the "petroliferous sands" are so poor in fossils, and the petroliferous sand-reservoirs are so limited in extent and thickness, with impervious rocks all around them (since we find heavy gas pressures in these reservoirs), that the enormous quantities of petroleums they have produced cannot possibly be accounted for in that way. I will cite only one instance: viz., the example of the small dome of Spindletop at Beaumont, Texas, where from a little over 200 acres, some 50,000,000 barrels of oil have been produced up to date. The oil "sands" under that dome are secondary crystalline limestone or dolomite masses, found only under the dome area of a little over 200 acres, the surrounding strata being impervious clays and sands and "gumbo" beds, with fossils but without oil. The secondary crystalline limestones or dolomites under the dome, containing these enormous quantities of oil, are not fossiliferous; but even if they were, the oil in them could not be indigenous in such quantities, and undoubtedly came up the chimney under the dome from below, since it cannot have come from the impervious sides.

This reasoning from indisputable facts, patent in many fields, long ago forced the American geologists to the conclusion that the petroleums cannot have been produced in the sands they now occupy. On the other hand, most of the American geologists, and many others, conceive a regional migration of oil out of the impervious surrounding sediments into the sands—which, of course, is also impossible. Dr. v. Hofer agrees with me that there is no possible regional migration of oil through the pores of such impervious clays and shales as surround the "sands," and "that the migration of oil can take place only in cracks, joints, and fissures;" but his primary deposits, "the porous sands," are evidently altogether too small in cubic capacity, and too poor in organic contents, to furnish the enormous quantities of petroleum which have actually been produced from them.

Moreover, in the different fields of the world we can trace these primary sand deposits of Dr. v. Hofer lower and lower down in the geological scale, until we find them not only in the Devonian and Silurian but also in the Cambrian (Potsdam sandstone in N. Y. state) and in the crystalline rocks (Newhall, Cal.). This forces us to admit a still lower source, namely, the

volcanic magma; and when these volcanics everywhere give so much evidence of containing large quantities of hydrocarbons either in their associated solfataric gases or in the lavas themselves, why should we reject that source to which we are forcibly led by the full consideration of the geological evidence mentioned above?

4. If the petroleum deposits were coastal marine formations, deposited in shallow bays of the sea, they would be found under geographical alignments entirely different from the straight oil belts in which they are actually being found. The oil belts are evidently connected with the tectonic and orogenic disturbances of each region, and not with the ancient shore lines of the different formations. Moreover, along the same belt we find the petroleums impregnating sands of many different ages. In California, for instance, from and including the crystalline rocks to the Quaternary, there is a thickness of some 30,000 ft. in which productive sands are found. Yet, outside of the productive narrow belts along the Coast Range these 30,000 ft. of strata are barren of petroleum. Surely it cannot be imagined that marine bays of the ancient seas could align themselves in that way along fault lines or straight disturbed zones, and juxtapose themselves, one on top of the other, in formatians of so many different ages, according to just the same tectonic zones of disturbance.

5. In shallow bays of the sea, in which sands are deposited, the organic matter is generally observed to have totally disappeared, having been destroyed by the oxygen of the air. Dr. v. Hofer admits this; but he speaks of vague special favoring conditions which occasionally permitted the preservation and entombment of the organic matter. Would such special favoring conditions explain the enormous quantities of petroleums in the world? And why should these special favoring conditions occur at repeated periods during long ages in the same district along fault lines or disturbed zones; and what are these special conditions, anyhow? If petroleums were deposited in shallow bays, what about the deep vertical chimneys of Texas and Louisiana with several thousand feet of thickness of salt impregnated with petroleums?

6. Admitting, for the sake of argument, that the soft organic tissues of animals, or the fatty tissues of plants, were occasionally entombed, how did the transformation of these into petroleums take place? Dr. v. Hofer says it was by the action of long time, which permitted a slow distillation at low temperature; and, strange to say, as a synthetic proof of that proposition he gives the experiments of Engler, in which oils similar to petroleums were produced from organic fats by heating in a retort at temperatures from 300° to 400° C.—experiments made under conditions of temperatures entirely different from those which obtain in nature, and therefore not in the least to the point. If long time distilled some of the organic matter of the sediments into petroleums, how is it that it did not produce any other effect on these sediments, and on the "coals" contained in them, which are unaltered and undistilled? And if long time could replace temperature in bringing about distillation, should not everything on this earth be in a gaseous state, as there has been all the time imaginable in the eternity behind us to bring about the same effect as the highest imaginable temperature? Phenomena of physical or chemical changes of state in elements require certain temperature points and will not take place at a lower temperature, no matter the length of time. One might as well say that by leaving a turkey long enough in cold storage it would cook itself!

I will now take up in their order Dr. v. Hofer's criticisms of my proofs as contained in his paper.

1. I, of course, never intended to state anywhere in my papers that there was no methane in petroleums; what I did say was, that the marsh gas formed from the decomposition of plants is quite apart and different genetically from the methane of petroleums.

2. Whether the crystalline schists or gneiss, from which a very light gravity oil is produced near Newhall, Los Angeles county, Cal., is a metamorphosed sedimentary or not, and is of Jurassic age or of Archean age, makes absolutely no difference in the point which I raised about this occurrence of petroleum, namely, that the petroleum is found in crystalline rocks and therefore cannot possibly be indigenous, and must come from the San Gabriel granite or the magma below. If these crystallines are ancient sediments, they must certainly have lost all their organic matter during the metamorphosis, and especially such light gravity oil as is found there must have an extraneous origin. To attribute that origin to the neighboring Tertiary oil field is altogether impossible; since light oils of that nature, full of gas, never go down in the strata but always ascend.

3. To suppose that the oil and bitumen in the quicksilver deposits of California and elsewhere may have been extracted and transported from deeper bituminous rocks by the ascending ore-bearing solutions, is to reverse the problem without the shadow of a proof. One might as well suppose that the quicksilver itself in these veins had its origin in the wall rocks, instead of the ascending ore bearing solutions. It is well known to mining geologists that ore-bearing solutions, circulating in veins and fissures, sometimes impregnate the wall rocks and become diffuse in them; but they cannot do the reverse, and receive their contents from these wall rocks.

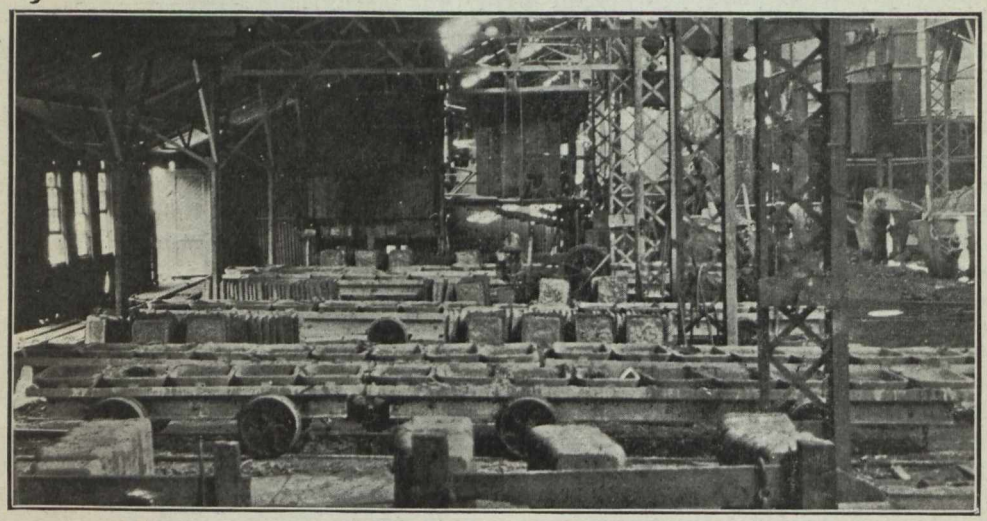
4. I must differ entirely with Dr. v. Hofer when he says that the occurrences of bitumen, petroleums, or graphite in metalliferous veins, pegmatite dikes or volcanic rocks, are scanty or sporadic occurrences. I maintain, on the contrary, that they are frequent all over the world and constitute positive and overwhelming proofs that these products, in all such cases, have an inorganic origin. To suppose that volcanic or eruptive rocks can distill and absorb into their own mass petroleums or natural gas from bituminous materials in the wall rocks, is again to reverse the question without the semblance of a proof, and moreover, involves an impossibility. One cannot look for distillates inside of the hot mass which produces the distillation. The very word "distill" means "driving away."

5. The occurrence of oil around volcanic necks in Mexico is questioned by Dr. v. Hofer, who says that it is widely distributed. From all the records of reputable geologists who have examined the occurrences of oil in that country, and even from the records of Mr. Villarello, quoted by Dr. Hofer, it is quite clear that the petroleum deposits are always intimately connected with the volcanic necks. In fact, this is one of the clearest evidences in the world of the solfataric volcanic origin of oil in enormous quantities.

6. Dr. v. Hofer says that, as a logical consequence of my views, deposits of petroleums should always be found in the vicinity of volcanic eruptions. As we have just seen, when it is found in such vicinity in enormous quantities, as in Mexico, the proximity and connection of the volcanics and the petroleums are

denied. But when the volcanics are not plainly to be seen, then their occurrence in the petroleum fields is demanded. Faulting and fissuring connected with volcanic manifestations take place all over the world, not only in mountainous regions but also in regions of plains, and may be, and are, often accompanied with solfataric emanations, though the lava or volcanic rocks themselves do not appear at the surface. It is clear upon careful consideration of these phenomena that any belt of country very rich in eruptives, such as the "inner bend" of the Carpathians cited by Dr. v. Hofer, might be too much faulted and fissured to permit the storage of the gaseous emanations in the greatly disturbed and broken surrounding sediments, while another belt of the same country such as the "outer bend," which is sufficiently fissured to permit pent-up vapors and gases to force their way through to the porous portions of the sediments, and yet not so much as to permit their complete escape to the surface, would naturally furnish the best and richest petroleum fields. Even in such oil fields as those of Pennsylvania and northwestern Ohio, where the strata are apparently undisturbed, we find such well-marked breaks as the Eureka-Volcano break and the grahamite vein of solid petroleum near Cairo, in West Virginia, and the famous Findlay break in northwestern Ohio, so well described in several of Orton's reports as the most pronounced disturbance in that State. In the greatest number of oil fields, the elongation of the different pools or fields, all in one direction, clearly demonstrates that they are connected with fissuring and faulting.

I believe it is unnecessary to prolong this discussion and to take up Dr. v. Hofer's remarks on the objections advanced by me in my paper, Petroleums and Coals, to the theory of organic origin, as I consider that these objections still stand and have not been sufficiently answered. Most of these points are also covered by my remarks in this discussion, or in my new paper, read at the same meeting of the Institute with Dr. v. Hofer's, and written before I had seen the latter.



Copper Moulds, Granby Smelter, Grand Forks, B.C.

NOTES ON MINING IN WEST KOOTENAY AND BOUNDARY DISTRICTS OF BRITISH COLUMBIA.

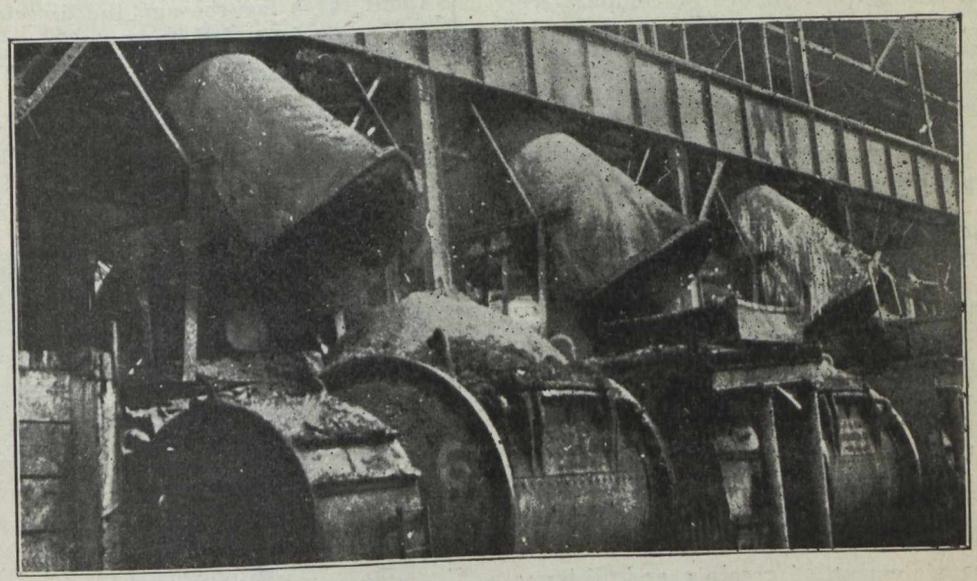
At the end of June, Mr. E. Jacobs returned to Victoria, B.C., after an absence of six weeks, the greater part of which period was spent in West Kootenay and Boundary districts of that Province, visiting mines and reduction works and meeting mining men.

To the representative of a provincial newspaper, Mr. Jacobs stated that, speaking generally, while he found the mining industry progressive in the districts he visited, particularly in connection with the operations of several of the larger and well established companies, some of the statements he had lately seen published in provincial newspapers to the effect that numbers of new properties, or old ones that had lain idle for a long time, were now being worked, or are about to be, are not warranted by the facts of the situation. Further, the assertions relative to a prospective "boom" in mining, at any rate in the districts he visited, were, in his opinion, simply the loose talk of men not well informed on this question. The Slocan district, for instance, has been the subject of much misrepresentation, and one result has been that many men have gone to it expecting to find work at one or other of the mines, but have been sorely disappointed, there having already been more men in the several parts of the district awaiting work than employment was being found for. This is not saying, however, that mining is not progressive in parts of the Slocan, for the position certainly is more satisfactory and promising, on the whole, than in a number of past years. Similarly, in Ymir, Sheep Creek and Rossland camps, not only is there activity at most of the best known mines, but in a number of instances the outlook is decidedly better, owing to development of important ore bodies, and to preparations being made for the mining and reduction of ore on an increased scale.

Leaving Victoria on May 13, Mr. Jacobs went via Seattle to Spokane, and thence to the State College of Washington, Pullman, where he attended a meeting of the Columbia local section of the American Institute of Mining Engineers, and where, as the guest of Prof. F. A. Thomson, he saw much of the mining engineering department of the college, of which Mr. Thomson is the head. Local sections of the electrical and civil engineers of Spokane and district, respectively, also held sessions at Pullman at the same time, so that altogether the gathering was a large and important one.

Going thence to Nelson, B.C., a week was spent in the chief city of the Kootenay, in connection with a meeting of the Western Branch of the Canadian Mining Institute, which was fairly well attended, three sessions having been held and interest in the proceedings maintained throughout.

As to mining in Nelson division—in the near vicinity of the city, several mines that had been worked were idle for the time being, and there was no immediate prospect of a resumption of operations; these were the Granite-Poorman group and two mines that the British Columbia Copper Co. had been working. On the other hand, the Consolidated Mining and Smelting Co. had gradually increased the output of ore from the old Silver King mine, and was just resuming operations at the Molly Gibson, the latter having been closed during several winter months, when the snow at the high altitude of the mine was too deep for safe working. About Ymir, the Wilcox, Dundee and Yankee Girl are all in a better position as regards the quantity of ore developed than for a number of years, so that when finances shall have been arranged they will doubtless be profitably productive for a comparatively long period. Again, in the Salmo-Sheep Creek portion of the Nelson division—lead ore is being shipped in larger quantity from the H. B., Zincton, and Rambler-Cariboo mine and mill, with a two years' ore supply estimated as being available. Ore of good grade and in quantity had been found on the bottom level of the Slocan Star mine and the concentrating mill was being prepared for operation after an idleness of probably eight years; and, as well, ore shoots had been opened on other levels above the tenth. Ore had been found on the Wonderful property, after a year's search for it. The Ruth-Hope and the Richmond-Eureka mines were being worked. Exploratory work at considerable depth was being continued in the Payne mine, though no commercial ore had yet been found. On the Noble Five group, Cody, important development work was in progress, and in the neighboring Surprise mine much ore had been opened and that found suitable for shipment was being sent to the smeltery at Trail. In the vicinity of Silverton, the Standard silver-lead mine looks remarkably well, with large reserves of ore available and mine and concentrating mill being worked to full capacity. The Hew-



Converters, Granby Smelter, Grand Forks, B.C.

Emerald mines, while the Motherlode mill is again at work, on the gold ore mined during the winter, and there has been opened on the 600 level of the Queen mine as unusually large shoot of gold-bearing ore—from 20 to 30 ft. wide along a proved distance of 60 ft.—of good value and which is returning considerable profit to the owning company. In Erie camp, too, there is improvement, for United States men have provided sufficient money to keep the Second Relief going throughout the year.

Ainsworth camp was found to be in a more prosperous state than for a number of years, chiefly as a result of the operations of the Consolidated Mining and Smelting Co., which is operating four mines, while Spokane men are working three properties in the northern end of the camp with good prospects of success. The payroll of this old established camp—it dates back to the eighties of last century—including the Bluebell mine and cencentrator across Kootenay lake from Ainsworth, now numbers more than 300 men and the monthly disbursement of wages is estimated at about $30,000, while the prospects appear favorable for further extension of operations and production.

In the Slocan there was found much indicating substantial progress. Work had been resumed at the itt-Lorna Doone, in the same camp, will shortly join the important producers, for preparations to mill about 150 tons of ore a day are about completed, and there is much ore ready for extraction. Beside these large mines, a number of smaller ones in various parts of the Slocan are also being worked, and these latter contribute in degree to the activity characterizing mining in the district.

At Trail and Rossland, more, perhaps than elsewhere in the Kootenay, is evident the progress that is being made in connection with the mining and smelting of ores. Further important improvements to smelting plant are being made at the Consolidated Co.'s works at Trail, noticeably in new lead and copper blast furnaces of modern design and enlarged smelting capacity, while all through the works betterments are still being made to provide for expeditious and economical handling of ores and smelter products. Near Rossland, the chief mines are known to have large reserves of ore opened, and the prospects for permanence and prosperity are consequently much better now than, say, ten years ago. A ride on an electric locomotive for three-quarters of a mile from the Centre Shaft to one of the working faces of the War Eagle mine, and a sight of the masses of good looking ore at that consid-

erable depth, impress the visitor with the bigness of this mine and make him prepared to believe that there are still millions of dollars worth of ore in Red Mountain mines, even though approximately $60,000,000 worth has already been taken out. Then, when he is taken to another working face, on the War Eagle sixteenth level, nearly 2,000 ft. from the Centre Star shaft, also on an electric locomotive, he begins to be bewildered with the thought of the immense potentialities of these Rossland mines. And these notes leave out of present account the ore bodies opened on the neighboring Le Roi and Le Roi No. 2 mines, both of which have known shoots of ore of good grade opened from the 1,650 ft. level.

In Boundary district, the big copper mines are continuing to produce well on to 5,000 tons of ore a day, and the smelting works of the Granby and British Columbia Copper companies to reduce it and extract its valuable contents. Among the smaller properties, the Jewel gold mine, near Greenwood, continues to do well, making a profit and opening ore at greater depth than was formerly done, while, up the north fork of Kettle river, the Union is a shipper of ore of comparatively high grade, and other properties are being prospected. Space limits prevent more being told of progress, but the foregoing notes will serve to indicate that mining is really progressive in the several districts mentioned.

RAMBLER-CARIBOO MINES, LIMITED.

The annual general meeting of shareholders in the Rambler-Cariboo Mines, Limited, was held at the company's office, near Three Forks, B.C., on June 9. There were represented in person and by proxy 1,007,418 shares out of a total of 1,750,000. Among those present were five directors, namely, Mr. Alfred Coolidge, of Spokane, Washington, vice-president and secretary-treasurer, in the chair; Dr. B. W. McPhee, Spokane; Dr. John Benson, Colfax; Dr. Johnston Armstrong, Tacoma; and Rev. P. F. Hylebos, Tacoma. Dr. J. F. Hall, of Spokane, was also present. Mr. A. E. Cable, in charge of the company's office near Three Forks, assistant secretary, presented a statement of receipts and disbursements during the fiscal year, ended April 30, 1914, and a balance sheet at end of same period. A report of development work done in the mine and of conditions at mine and concentrator, was submitted by Mr. J. E. Rinta, manager.

From the statements of account it was learned that the company's indebtedness on bills and accounts payable, which, on April 30, 1913, was $81,434.04, had been reduced by $55,334.04, and at the end of the fiscal year now under review stood at only $26,100. In addition to this reduction of indebtedness, a liberal amount had been written off mine and mill equipment and aerial tram accounts for depreciation.

Development work done in the mine totalled 669 ft., this consisting of drifting on the 8, 10, 12, 13 and 14 levels, and raising to the 13, 10, and 8 levels. There was shipped to Trail, B.C., 2,508 tons of silver-zinc concentrate. The valuable metal contents of the lead concentrate were 174,799 oz. of silver and 1,706,585 lb. of lead. The zinc concentrate contained 31,066 oz. of silver and 883,018 lb. of zinc.

Mine and mill were closed during the months of February and March; work was resumed in the mine about April 1 and at the mill three weeks later, but no shipments of mine or mill products were made during those three months.

Accounts and report were adopted. The directors were re-elected with the exception that Mr. C. L. MacKenzie was chosen in place of Mr. Harry Cornwell. The board as now constituted consists of the following directors: Mr. A. F. McClaine, Spokane, president; Mr. Alfred Coolidge, Spokane, vice-president and secretary-treasurer; Dr. B. W. McPhee, Spokane; Dr. John Benson, and Mr. C. L. MacKenzie, Colfax; Dr. Johnston Armstrong, and Rev. P. F. Hylebos, Tacoma. Mr. A. E. Cable continues as assistant secretary and Mr. J. A. McPhee as assistant treasurer.

Two of the directors went up to the mine and were shown through it by Manager Rinta. On their return they reported to the shareholders meeting very favorably on what they had seen, and expressed confidence in the profit-earning future of the property. Present force of men on the payroll—mine and mill—numbers about 70. It was mentioned that a Hardinge conical mill had been added to the mill equipment, and that it is intended to put in two more James concentrating tables.

About three months ago the directors issued to the shareholders a printed review of the company's affairs and position at that time. The following are excerpts from it :

"Since the annual report of 1912 we have completed the new concentrator at an additional cost of $35,807.82 and the aerial tramway at $18,073.38, both of which are operating successfully, as shown in the manager's report. Have also built office, assay house, and new boarding and bunk-houses at the mill, and some new houses at the mine. We have purchased additional ground and paid for same to the extent of $11,000. We have store supplies and explosives to the approximate value of $2,200.

"The board expects to carry out the suggestions made by the manager as to careful and economical management, and in this connection we desire to say that there are no salaries paid to any officer or director who is not rendering actual service at the property.

"At the last annual meeting the board authorized a quarterly visit of one of its members to the mine, and since that date two such visits have been made, and brief reports of its condition submitted. We believe that these visits should be continued, as they are productive of good."

Under date, February 15, the manager, Mr. J. E. Rinta, submitted the following report:

"On account of the shortage of water, making it impossible to operate the mine properly, I have decided, as advised you some days ago, to close down until such time as sufficient water shall be available for ample power.

"The development has been continued, and at present we have in our reserves more ore than was shown at the time of my taking charge in June, 1913, and there is now, in my opinion, sufficient ore in sight to keep us continually operating for the next 24 months, and during that time additional ore should be found. I feel certain that the coming year's results will give larger profits than those of last year. The ore bodies in the mine are not large and continuous, but rather small and of higher grade, varying as to size and quality between different levels, and this makes it very difficult to give close estimates as to quantity in sight. When working in swells we are too apt to conclude that we have more than proves out, and again, on lean levels we find the contrary condition. However, it requires at all times careful and economical management

to obtain fair net profits. At the present time we are getting out considerable clean ore from several different places in the mine, and we have every reason to believe that my estimate of better net results for the ensuing year will be verified.

"The mill and the aerial tramway are working satisfactorily, and there does not appear to be any difficulty confronting us other than shortage of power. As soon as there shall be sufficient water available for power purposes we will resume work in the mine and at the mill, and thereafter will push the work as rapidly as shall be consistent with economy."

A BRIEF COMPARISON OF METHODS AND CONDITIONS IN THE WITWATERSRAND AND LAKE SUPERIOR DISTRICTS*

By L. D. Hingle.

The Witswatersrand, commonly called the "Rand," is a ridge projecting slightly from an elevated plateau, 6,000 ft. above the sea level. It consists of several series of conglomerate beds interbedded with quartzite-sandstones and arranged in planes more or less parallel to each other and overlying a huge granite deposit. The term "banket" has been applied to these conglomerates, owing to their similarity in appearance to an almond sweetmeat of that Dutch name.

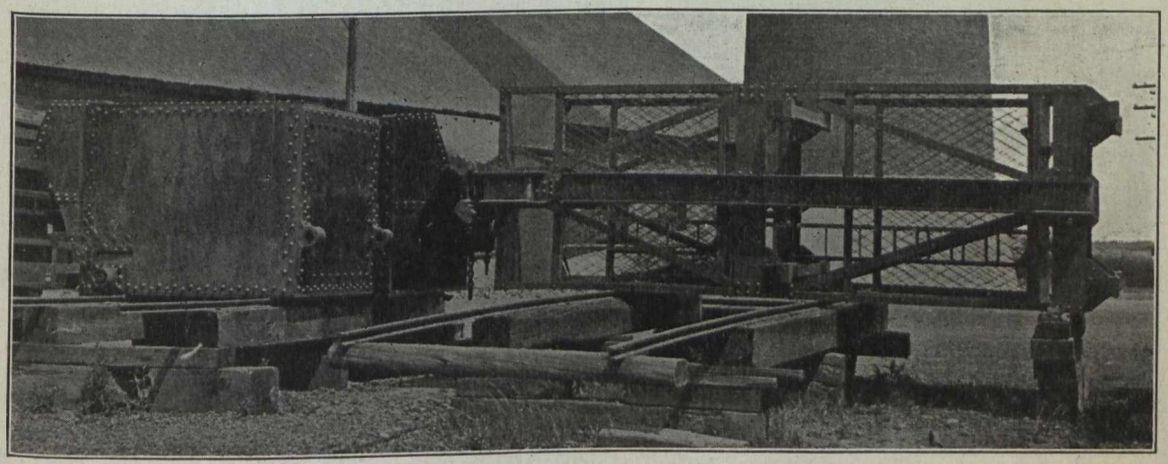
Five series of conglomerate beds are generally distinguished, but up to the present the only one of importance is the Main Reef Series, prospecting on the others having proved that while gold is an essential constituent of all of them, they are generally unpayable. This Main Reef Series, which is near the base of the Witwatersrand beds, produces the great bulk of the gold output of the Transvaal. The Witwatersrand beds appear to form two definite synclines, but mention will be made only of the Witswatersrand or Northern syncline, as this is the important gold carrier.

The outcrop of the series takes roughly an elliptical shape, with its major axis extending in a N. E. by E. and S. W. by W. direction, this axis being 130 miles long. The minor axis is practically at right angles to this, and 60 miles long. Most of the gold, however, is obtained in a central portion of the series, 60 miles long extending about 30 miles on each side of Johannesburg.

The gold-bearing beds do not have a uniform outcrop, but dislocations in some localities, and concealment beneath different deposits in others, naturally divide the area into districts.

On the Central Rand the beds dip south, at an average angle of 50 deg. They flatten noticeably with depth, however—at 3,000 or 4,000 ft. often to 30 deg.

On the East Rand, however, the continuity of the beds is hidden by coal measures, and their position complicated by numerous igneous overflows and intrusions. The Main Reef Series has been picked up here after a break of three miles, and the dip is found to be much flatter, getting to 8 deg. in some mines. A great thickness of overlying coal measures in this region causes some companies to sink vertical shafts 3,000 ft. deep before striking the gold-bearing conglomerates.



Skips and Man Car, Calumet and Hecla Mine, Michigan

The West Rand also has been cut off from the Central Rand by means of a huge fault; but here, as at Randfontein, the conglomerate outcrops, and dips at a very steep angle, 80 deg. or over.

Hence it will be seen that the banket is mined on the Rand at practically any angle, which gives rise to vast differences in mining methods employed there.

The ultimate vertical depth to which mining will be carried on the Rand has given rise to much discussion. Those companies mining areas within whose limits the banket outcrops, are known as "outcrop" companies. Companies owning areas to the dip of these "outcrops" are known as the First Rows of Deep Level companies. To the dip of these "Deep Levels" are the Second Row of "Deeps," and so on. At present only one company, the Turf Mines, is operating on the Fourth Row of Deeps, and in consequence in very heavy ground.

Mining engineers on the Rand are now discussing possibilities of working at 8,000 ft. depths and over

*From the M. C. M. Alumnus, April 14.

(vertically), since values found at depth are still most favorable. A typical case is that of the Cinderella Consolidated, which on its fifth level, 4,440 ft. vertical depth, has developed 1,530 ft. along a drift, and obtained an average gold assay of $9 per ton, over a width of 42 in., which is very good. Many other deep-level mines have obtained equivalent or better values at nearly the same depth. The average value of rock hoisted from a good mine on the Rand is $8 a ton.

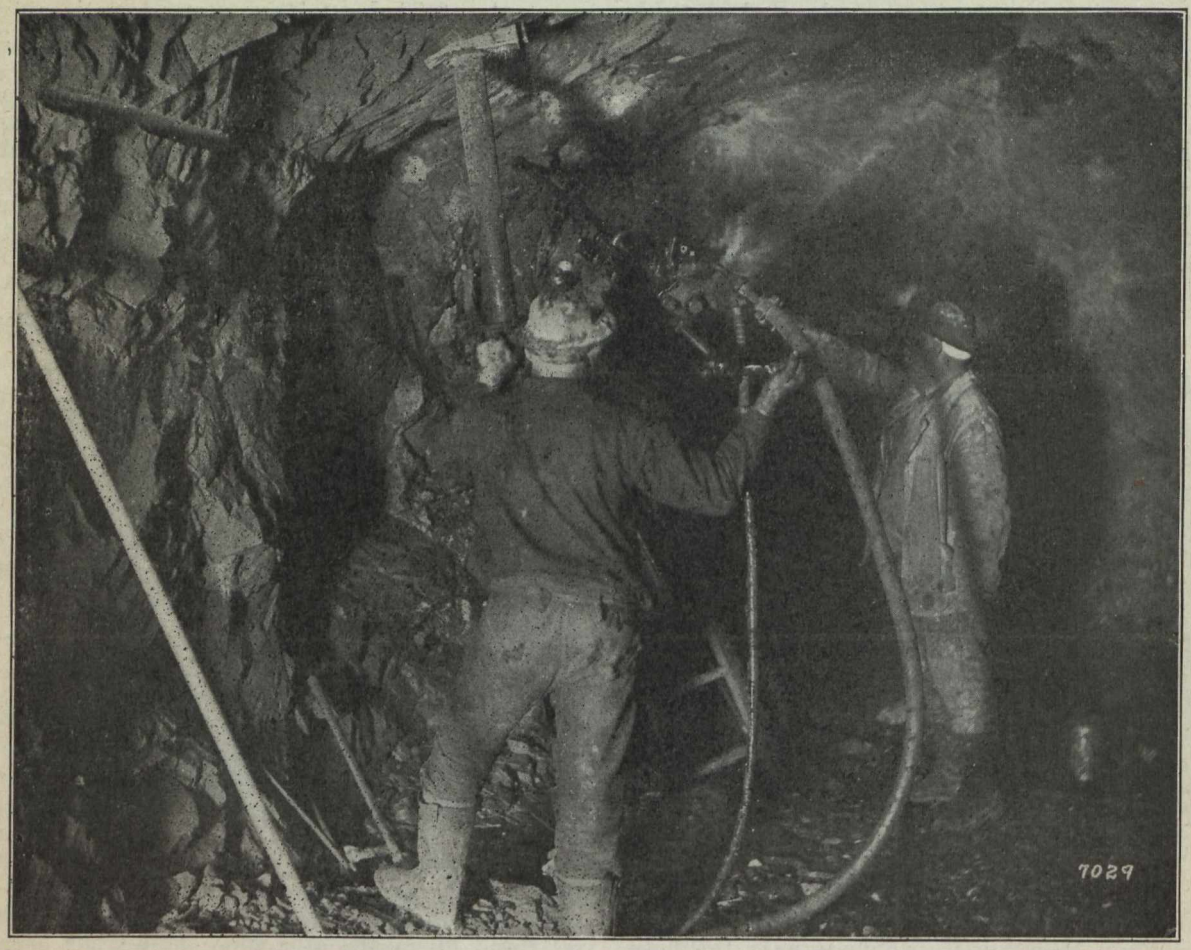
In comparing the Rand banket with the Copper conglomerate in the Superior district, a few prominent points may be mentioned. The dip of the two beds is often alike, but the stoping width in the Rand mines is generally smaller than in the Copper country mines. While the pebbles in the copper conglomerates are mostly reddish or brownish felsites, or sometimes quartz porphyries, those in the gold banket are chiefly of white, sometimes black, quartz. They are also more rounded, smaller and more uniform in size than the pebbles of the copper conglomerate, and lie parallel to the bedding.

The matrix, or cement, binding the gold conglomerate pebbles together is mainly of siliceous and chloritic material, generally containing iron pyrites. The gold is generally found surrounding the pebbles, almost invariably in the matrix, in a manner remarkably similar to the occurrence of the copper in the Lake Superior district, although it is sometimes found along slips and cracks in the pebbles, but rarely visible to the naked eye.

The Witswatersrand appears to be much harder for drilling, and the matrix is not at all loose or friable, as is sometimes the case with the copper conglomerate. The ore of the banket is so hard that lumps of it of suitable size, say roughly 4 in. in diameter, have displaced all flint or other pebbles for grinding the ore in the tube mills, and a piece of banket will take a beautiful polish when ground into a spherical shape, the matrix remaining in position as well as the pebbles.

In connection with shaft sinking on the Rand, it is very rare to find an inclined shaft sunk on the conglomerate bed, unlike the practice in some of the copper mines in this district. Practically all the shafts are sunk in the footwall, and crosscuts driven over to the ore body. In one particular shaft on the East Rand, which has been sunk some 4,000 ft. on the conglomerate, an almost unbelievable warping has taken place, which has resulted in the condemnation of the shaft. Looking up toward the surface from an open skip some distance down the shaft, one sees the track take on the form of an ideal switch-back railway, and all this notwithstanding substantial pillars left on each side of the shaft.

Practically all large mines on the Rand make use of large shaft bins or pockets from which the broken ground is loaded into the skip, and it is very rare to see a car underground being tipped direct into a skip, as in many of the copper mines in this district. The Rand method appears to economize in time of loading skips, and also provides a supply for winding if anything is hung up in the mine workings.



Drilling by Mounted Hammer Drill in a Lake Superior Copper Mine

Photo furnished by P. B. McDonald

Auxiliary shafts are being put down largely on the Rand. An inclined shaft some 4,000 ft. or more in depth may be put down a short distance behind the banket head. A cross cut is then put due south, toward the conglomerate, and a second inclined shaft is started from a point a little above the level of the bottom of the first or main shaft. It will be seen that this auxiliary shaft is also in the footwall, as the bed often flattens out in depth. A chamber is cut out for an electric hoist, which is always put on the footwall side behind the shaft, on solid ground. The auxiliary shaft often has four compartments of exactly the same dimensions as the main shaft, and crosscuts are driven south to tap the conglomerate bed as before. All ground hoisted in the auxiliary shaft is dumped into a chute which leads to a pocket in the main shaft, from which it is hoisted without further handling.

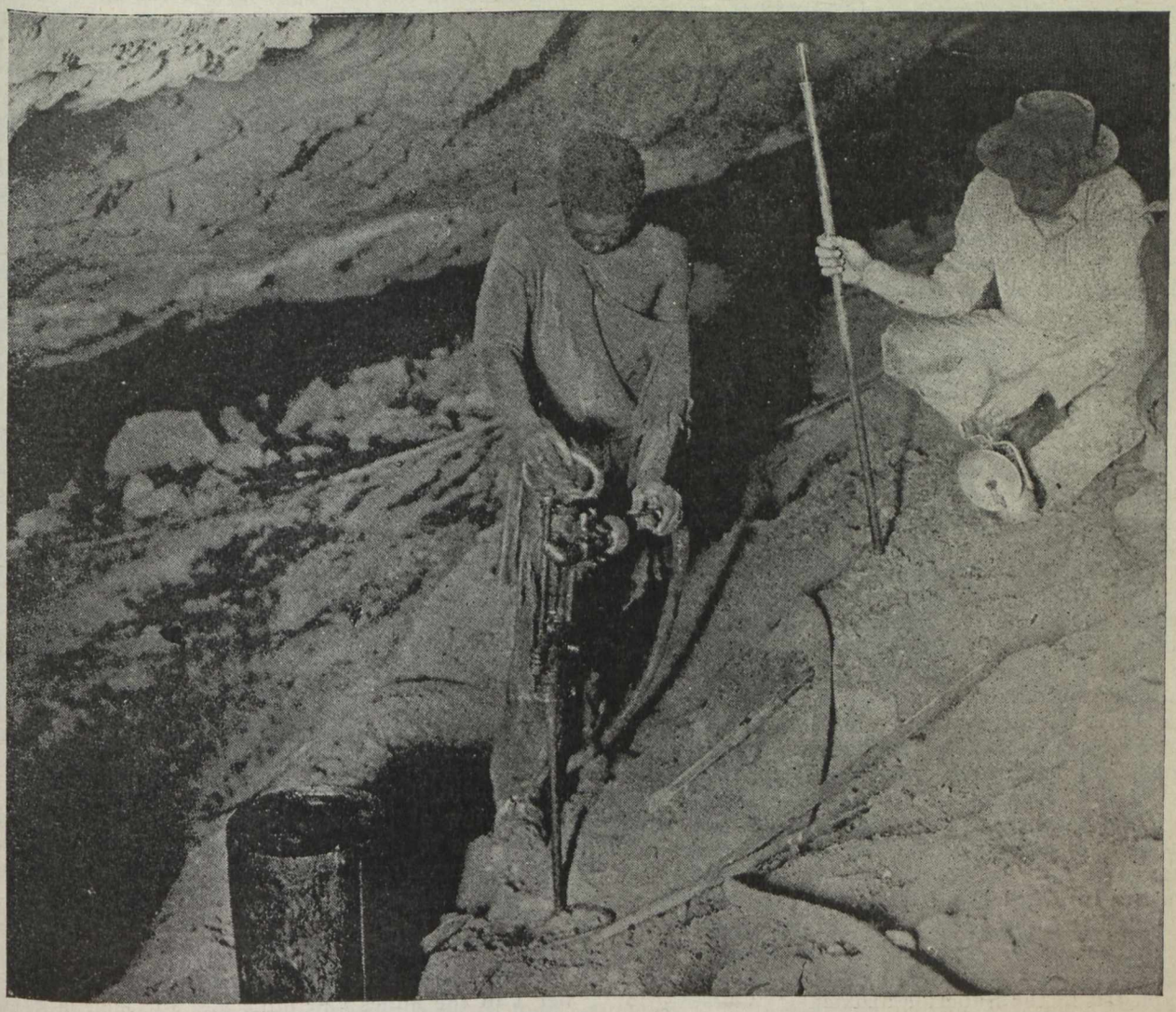
The auxiliary shaft thus serves three chief purposes: It obviates the necessity of having one very deep shaft, when the length of the winding rope would be a source of trouble; it saves money in that short crosscuts are necessary to tap the bed from the auxiliary shaft; and finally, it is unnecessary to change the dip of the main shaft, in order to follow more closely the ore body which is flattening away from the shaft.

While 100 ft. backs are generally carried in the Lake Superior district slopes, most of the mines on the Rand employ 200 ft. or longer backs, and in some of the flatter seams on the East Rand, there may be 1,000 ft. of banket between two adjacent levels.

While the overhead method of stoping is generally employed in the copper mines, both overhand and underhand methods are employed on the Rand, and a third method, known as "cliff" stoping, a combination of the two, is also in use now.

In stopes where the dip is too flat for the ore to gravitate down to the chutes, mechanical shakers are employed in the Witwatersrand mines. These are semicircular steel troughs suspended from the hanging, and reciprocated by means of a small compressed air engine in the stope, the trough being arranged to dip toward the level below. Natives shovel broken ground into this shaker, which transports it direct to cars below, saving much work in the stope.

Comparatively little timber is used to support the hanging on the Rand mines, but a system of sand-filling has been introduced. Damp sand is taken and mixed with water to form a pulp. It is then made alkaline and some permanganate is added to destroy the cyanide remaining in the sand from previous treatment. The pulp is then sent underground through boreholes or old shafts, the boreholes not being lined.



Drilling with Jackhammers, Witwatersrand Mine, Transvaal
—South African Mining Journal.

The pulp is then led along the footwall of old stopes, or along V-shaped launders and distributed to any part of the mine. The launder has a 9 in. side, and the necessary dip is about 15 deg., and such a launder will handle 1,000 tons in 10 hours.

When a worked-out stope is to be filled, the bottom of the stope is boarded off, and the cracks filled with matting or veldt grass. The pulp is led into the stope and water allowed to drain off through bungholes in the barricade into a launder in the level below. The sand then consolidates and forms a rigid support, and two days after filling, it is possible to put a raise up through it; a good native will advance 12 ft. an hour, keeping against the hanging wall.

Sand is not only used for filling old stopes, but also in connection with reclaiming old pillars and bad ground. The workings around the pillars are filled with sand, and the pillars can be removed with safety.

Much trouble has been caused on the Rand by "air blasts," and much debate has arisen regarding their origin. In one particular case in an East Rand mine, a drift 7 ft. high had been driven along the bed at a depth of 3,000 ft. One day, without warning, the drift practically closed up, with the shock of a miniature earthquake. The track was found near the hanging wall, having been elevated 5 ft. or more for quite a distance along the drift. Frequently lumps of conglomerate fly off from the face with considerable velocity, and often cause loss of life; pillars sometimes act similarly. These large "air blasts" have occurred chiefly in zones of known weakness, where considerable faulting has taken place, and the general opinion among engineers on the Rand is that pressure is the sole cause.

The natural ventilation of the mines in the Superior district seems very efficient, as the mine air is undoubtedly good. On the Rand, with its dust problem and high altitude, artificial ventilation generally has to be resorted to, and in most of the big mines powerful fans are installed.

The underground sanitation methods enforced on the Rand by Government regulations are probably more efficient than those found in this district. The Government's regulations as to underground conditions in the gold mines are most complete, and an efficient body of mine inspectors see that the regulations are carried out.

Practically every Rand mine has two distinct systems of electric bell signalling in use, and for very deep shafts electric signalling appears to compare favorably with the methods of hand signalling commonly employed in the Superior district.

The great contrast between the two districts lies in the type of unskilled laborers employed. Practically all unskilled labor on the Rand is performed by the negro, whose average wage is equal to about 50 cents a shift of 8½ hours. The higher rate of wage paid to skilled workmen in the Rand mines, and the expensive amalgamation and cyanidation methods necessary to extract the gold from the banket, bring the working costs on the Rand probably far above those of the Superior district.

As a point of interest in conclusion, it may be mentioned that diamonds have been found in the Rand banket. One company on the West Rand actually started up as a "Gold and Diamond" proposition, but only succeeded in obtaining a few diamonds in the mortar box. One or two diamonds were found on the Central Rand, and recently one was found in the far East Rand.

CALUMET AND HECLA.

President Quincy A. Shaw says of the strike in Michigan which was called off on April 12, 1914:

"The strike was called July 23 last by the Western Federation of Miners, an organization with headquarters in Denver, Colorado. Less than 15 per cent. of the employees joined this union, and many of these were forced to join by intimidation.

"This organization entered the community with a notorious record of brutality, disorder and crime extending over the past twenty years. The strike was inaugurated with the same brutality, disorder and crime and attempts by violence to prevent the great majority of the employees from continuing work. During the strike more than 95 per cent. of the employees, by signed petitions, asked the management not to recognize this organization nor to employ its members.

"The public opinion of 90,000 inhabitants of the copper country, repeatedly expressed in public meetings, representing every class of employment and business, emphatically disapproved the introduction into the community of an organization whose history, principles and recent performances make it a continuous menace to the peace and prosperity of the country. Your management has felt it to be its duty to its loyal employees, to the community and to its stockholders to refuse to have any dealings with this organization and to refuse to employ its members.

"During the strike this company was singled out from among the other companies of the district as the object of attack by the officers of the Federation and other agitators. All sorts of inaccurate and malicious statements as to conditions, wages and hours of work were spread broadcast throughout the country despite the fact that the most casual examination would show that for years the conditions were better and wages higher at this mine than at any other in Michigan. This campaign of misrepresentation was aided and abetted by the officers and leaders of many of the labor organizations throughout the country; by unprincipled politicians and by many newspapers and magazines that have continued to publish sensational articles without reference to the facts.

"In view of the misstatements that have appeared in print as to the wages of underground men and as to the general conditions, the following information may be of interest to stockholders:

"Average net wages for six months prior to strike, miners, $3.59; trammers, $2.97.

"An eight-hour shift has been in force since December 1 in the mines and mills and for men engaged in work that is continuously conducted; a nine-hour day applies to all surface and shop work. The company owns 903 houses, which are rented to employees at about $1.00 per room per month; this includes all repairs and removal of garbage. All houses have running water and the large majority have stone or concrete cellars. The company also leases at $5.00 per year 969 lots on which men have built their own houses. Married men pay $1.00 and single men 50 cents per month to the hospital. This entitles them and their families, without further charge, to medical and surgical attendance and medicines. The company provides pensions for certain of its old employees in consideration of long and faithful service.

"This company has never owned, had any interest in, or operated a 'company store.' This is equally true of all the mining companies in this district in which this company is a stockholder."

THE OCCURRENCE OF PETROLEUM AND NATURAL GAS IN THE MID-CONTINENT FIELD*

By Chas. N. Gould.

The Mid-Continent oil field, as the term is generally used, includes an area approximately 200 miles long from north to south, and 100 miles wide, located in southeastern Kansas and eastern Oklahoma. The limits of the productive field have not yet been sharply determined, and probably will not be for many years. The most northern point at which oil has been found in quantity is near Paola, Kansas, some 50 miles southwest of Kansas City. The most southern point is near Coalgate, Oklahoma. The southeastern part of the Mid-Continent field extends from Oklahoma into the vicinity of Fort Smith, Arkansas. The westernmost limit, as at present developed, is at Blackwell, Kay County, Oklahoma. The area within which oil and gas have been found in commercial quantities contains approximately 20,000 square miles.

The rocks in which the hydrocarbons occur throughout the two states, consist entirely of sediments of Pennsylvania age which lie, usually unconformably, above the Boone chert, a limestone of Mississippian age. This limestone, popularly known to the oil men as "the Mississippi Lime," outcrops in the region east of Grand river, in northeastern Oklahoma and southeastern Kansas. The Pennsylvania formations, as exposed in the Mid-Continent field, consist of alternating sandstones, shales and limestones with an occasional bed of coal. Throughout northern Oklahoma and Kansas the Pennsylvanian rocks dip west at rather constant angles, varying from 50 ft. to the mile near their eastern exposure, to less than 20 ft. to the mile in the western part of the area. In the southern part of the Mid-Continent field the rocks have been folded into a series of anticlines and synclines.

Oil Sands.

The petroleum and natural gas found in the Mid-Continent field occur altogether in ledges of sandstone which occur interstratified with shales and limestones. In the great majority of cases the stratum lying above the oil-bearing sand, that is to say, the cap rock which holds the oil down, is shale; but in a few instances it is limestone. All the oil sands in the Mid-Continent field are more or less lenticular. Some of the more persistent of the sands, as for instance the Bartlesville sand, and the Wayside sand are believed to occupy an area of several thousand square miles, while others are but a few square miles in area. Even the most persistent of the sands, however, often vary much in thickness, even in short distances.

Pools.

The term "pool" is applied to a small area from which oil or gas has been produced. The size of a pool in the Mid-Continent field varies from a fraction of a square mile to several square miles. For instance, the Flat Rock pool, near Tulsa, Oklahoma, is two miles long and one mile wide. Glenn pool is twelve miles long and five miles wide. Hamilton Switch pool occupies less than a square mile. The size, shape, and location of the various pools in different parts of the Mid-Continent field differ materially. At the present time there are more than 80 separate pools and new ones are constantly coming to light.

In many of the pools throughout this region, there is but one producing oil sand, while in others there are several sands. For instance, in the vicinity of the world-famous Glenn pool, which during the past six years has produced 120,000,000 barrels of oil, there are four producing sands known as the Red Fork sand, which lies at a depth of 1,300 ft., the Glenn sand at 1,500 ft., the Taneha sand at 1,700 ft., and the Dutcher sand at 2,200 ft. In the Bartlesville field there are eight productive oil sands.

In some parts of the Bartlesville region as many as four sands have been found productive on the same property, and it is a common occurrence for two of them to produce oil. In the Cleveland field there are five producing sands, in the Cushing field five, and in the Ponca City field seven sands that produce oil or gas in commercial quantities.

As has been stated above, all the sands in the Mid-Continent field are more or less lenticular, and often thicken and thin rapidly in short distances. Not enough drilling has yet been done throughout the region to demonstrate with certainty the continuity of the various sands. To cite a specific example, most oil men and most geologists who have studied the conditions now believe that the Bartlesville sand, which has produced such immense quantities of oil in northern Oklahoma, extends uninterruptedly from southern Kansas through Washington and Osage counties, Oklahoma, as far as the Bird creek and Flat Rock fields, near Tulsa. The same sand is also supposed to occur at Cleveland. In other words, the Bartlesville sand is commonly believed to be continuous over more than 5,000 square miles.

In point of fact, however, no one knows with certainty that this is true. It is not possible in the light of present knowledge to either prove or disprove the assertions. No one can be certain that the sand which contains oil or gas at a depth of about 1,100 ft. near Independence, Kansas, is the same sand which contains oil at 1,200 ft. at Bartlesville, at 1,300 ft. in the Flat Rock field, near Tulsa, and at 2,400 ft. at Cleveland. Sufficient investigations have been made, however, to demonstrate with approximate certainty the oil-producing sands in these four widely separated localities, occurring at the depths mentioned, are situated at about the same geological horizon. Taking into account, however, the known lenticular nature of all the Pennsylvania sands in the region, it is as yet too early to make a definite prediction as to the continuity of this or, in fact, of any other sand in the Mid-Continent field. It is quite possible that further development will show that various lenticular sands appear and disappear throughout this region, and that the Bartlesville sand, so-called, is by no means continuous.

Factors Governing Accumulation.

The two dominant factors which appear to govern the accumulation of petroleum and natural gas in the Mid-Continent field are: (1) The thickness of the oil sands, and (2) The structure of the rocks.

It goes without saying that, other things being equal, the thicker the sand, the more oil will be contained

*Extracts from a paper read at the International Geological Congress, Toronto, Aug., 1913.

therein. The Glenn pool, one of the most noted in the world, owes its prominence largely to the fact that the Glenn sand averages from 75 to 100 ft. in thickness at this place, thus providing an immense reservoir for the storage of petroleum. The Bartlesville sand averages from 50 to 60 ft. thick, and scores of millions of barrels of oil have been produced from it. The Cleveland sand, which is also a thick sand, has produced a vast amount of petroleum.

On the other hand, many sands, as for instance the Wayside, Peru, Childers, Alluwe and others, which average 20 to 40 ft. in thickness, have produced smaller amounts of oil. Generally speaking, the wells in the thicker sands have initial productions varying from 100 to 1,500 barrels of oil per day and settle after two to three years to 20 to 100 barrels per day. The wells in the thinner sands usually have initial productions of from 30 to 200 barrels per day, and settle to 5 to 20 barrels per day. Thus it will be seen that, other things being equal, it is very much more profitable to operate the thicker sands. It must be remembered, however, that the thinner sands are often comparatively shallow, occurring at depths of from 300 to 1,000 ft., while the thick sands usually lie at depths varying from 1,200 to 3,000 ft. beneath the surface.

The usual cost of drilling a well to the shallow sands, where an initial production of 50 barrels a day may be expected, varies from $1,000 to $3,000, while wells 2,200 ft. deep in the Cushing field, where the initial production averages 500 barrels per day, cost from $8,000 to $12,000 to drill and equip. It will be understood that in case any considerable number of unproductive wells occur in the region of deep sand the operation may be at a loss, but in case the wells encounter large amounts of oil, the operation is extremely profitable. The general experience throughout the field has been that operation in the thinner sands in the shallow fields is a far safer investment, while the operation of the deep sands is more speculative, but with the possibility of very much larger profits.

A second factor which governs the accumulation of oil in the Mid-Continent field is that of the structure of the rocks. Throughout the greater part of this region the general structure is that of a broad monocline. The normal dip of the rocks is to the west, decreasing from 50 ft. to the mile near the eastern outcrop of the Pennsylvanian series, to 20 or 10 ft. to the mile in the western part of the Mid-Continent field. In many places, however, this western dip of the rocks has been interrupted by local folding. These folds are usually not strongly marked, and in fact are often inconspicuous. In many, perhaps most, cases the folds are in fact nothing but terraces, or "arrested anticlines." That is to say, the rocks in certain localities, instead of having the normal dip to the west, lie nearly level. In comparatively few places throughout the greater part of the field, may well-marked eastern dips be observed.

Careful studies of geological conditions have demonstrated that there is in the Mid-Continent field a rather definite relation between structure of rocks and occurrence of oil and gas. Those who are considered to be the best authorities on the subject do not hesitate to say that, so far as observation goes, practically every oil pool in the Mid-Continent field may be accounted for by structure. It must be admitted, however, that it is not always possible to determine this structure from surface observation, so that a careful study of well records is often necessary to determine it; but, when once understood, the relationships between structure and production are usually obvious.

In the southern part of the area occupied by Pennsylvanian rocks, that is to say, in the region from Muskogee southwest to Atoka, and southeast to Fort Smith, Arkansas, the general western dips noticed farther north give way to a series of alternating anticlines and synclines.

There has been no great amount of drilling in this region, and very little petroleum has so far been found therein. It is, however, a very significant fact that, throughout this region, in practically every known case where drilling has been done along anticline folds, natural gas has been found. The gas fields near Fort Smith and Manfield, Arkansas, and near Poteau, Spiro, Kinto, Red Oak and Wardville, Oklahoma, are located on or near the axis of well-marked anticlines. Up to the present time not enough drilling has been accomplished, throughout this part of the Mid-Continent field, to demonstrate the absence or presence of oil in quantity. It is altogether probable, however, that extensive operations will reveal the presence of considerable amounts of petroleum.

Relation between Sands and Structure.

Within the developed portion of the Mid-Continent field where, as stated above, the anticlines are not so conspicuous as in the regions just discussed, the largest oil pools almost invariably occur where an unusually thick sand underlies an anticlinal fold, or a terrace. The Bartlesville, Glenn, Cleveland, Cushing, and in fact all the larger pools that have produced unusually large amounts of petroleum, contain this very favorable combination of thick sand and structure. In many instances, however, oil has been found in considerable quantities in regions where there is little or no evidence that the normal western dip of the rocks has been interrupted. Under such conditions, however, the drill reveals the fact that the oil sands are unusually thick. Instances of this kind occur in certain parts of the Bartlesville pool, in the Bird Creek pool, in the Shallow field, and in many of the pools in the Osage Nation.

Future of Mid-Continent Field.

There is no means of knowing accurately the possible extent of the Mid-Continent field, but, taking into account all the available data, including the stratigraphy and structure of the rocks, and the known occurrence of oil and gas under existing conditions, it may safely be estimated that, at the present time, not over one fourth of the future available territory in Oklahoma and Kansas has yet been drilled. New fields are constantly coming to light and the limits of old ones are being extended.

Many of the wells now in operation have been producing oil for fifteen years, and are by no means exhausted. At the present rate of development, it will be many years before the productive area of the fields has been determined. It will be many more years before it all will be drilled. There need be no surprise if the Mid-Continent field is producing both oil and gas one hundred years from this date.

COAL CUTTERS.

The Sullivan Machinery Co. has just published a bulletin describing two new machines: the CE-7 Ironclad coal cutter and the CH-8 Longwall coal cutters. Another recent bulletin describes rock drill mountings and equipment. A booklet on "Core Drilling by Contract" has also been recently issued by the Sullivan Company.

BY-PRODUCT COKE OVENS OF THE ALGOMA STEEL COMPANY, SAULT STE. MARIE, ONT.*

By W. J. Dick.

The coal used for making blast furnace coke must be a good coking coal, low in sulphur, and fairly low in ash. The West Virginia and Pennsylvania are the only coals in the middle and eastern states possessing these requisites; consequently these coals are used in all the great iron manufacturing centres east of the Mississippi valley.

The Algoma Steel Company imports coal from two localities, and mixes them prior to coking. The coals are: (1) Cannelton (Kanawha coal, northern West Virginia), a coal containing a high percentage of volatile, combustible constituents and analysing, proximately; Volatile, 34 per cent.; ash, 6-8 per cent; and (2) Pocahontas coal (southern West Virginia), low in volatile, combustible constituents, and analysing, proximately: Volatile, 19 per cent.; ash, 6½ per cent.

The coal is shipped by rail to the Lake Erie ports—Toledo or Sandusky, Ohio; thence by water to the Company's docks at Sault Ste. Marie, Ont.

The coal is unloaded from the vessels by means of two electrically operated steel towers with a capacity of 180 tons per hour each! 9,500 tons have been unloaded from vessels in 34 hours working time. The labor employed on each tower consists of one man to operate the hoist.

The coal is hoisted from the vessel by means of a 3½-ton bucket and is then dumped into an 80-ton hopper situated on the tower. It is discharged from the hopper into an electrically operated 20-ton car, and is then either conveyed, by means of this car, direct to the hopper that supplies the Bradford breaker, thence to the coke ovens, or carried to the stock pile, where it can be dumped on either side of the track by means of the air lift door, depending, of course, on whether it is Pocahontas or Cannelton coal, the two varieties of coal being kept separate on the stock pile. The 6½-ton bucket suspended from the travelling bridge distributes the coal on the pile. About 1,560 tons of coal is used per day to supply the coke ovens.

The coal is loaded from the stock pile, by means of the bucket and bridge mentioned above, and is dumped into a 20-ton electrically driven car which carries the coal to a hopper. From the hopper the coal is then elevated by means of an endless belt to the Bradford breaker. The Bradford breaker consists of a revolving horizontal steel screen, in which the perforations are about 1½ in. in diameter, and which is fitted with radial shelves. These shelves pick up the coal and drop it, crushing it by its own weight. Short deflecting plates cause the oversize to discharge into a 30-ton railway car. The undersize goes to a mixing bin.

The two varieties of coal are kept separate and stored in seperate bins of a capacity of 100 tons each. The coal from the two bins is mixed together in the proper proportion, namely, 60 per cent. Cannelton and 40 per cent. Pocahontas coal, by means of adjustable feed hoppers, situated on the outlets of the bins, and by revolving belts.

From the mixers, the coal passes through two magnetic separators which remove pick-points, or other iron or steel ingredients. It then goes to two Williams disintegraters.

In most by-product plants 75 per cent. of the coal must pass through a ⅛ in. screen. The practice at this plant is to mix the coal so as to give 60 per cent. Cannelton and 40 per cent. Pocahontas coal.

The structure of coke is affected by three factors, viz: The chemical composition of the coal itself; the rapidity of burning; and the fineness of the coal charged into the ovens.

In this plant, all these factors can be adjusted by means of the variable feed, the crushing of the coal, and the firing of the ovens. In general, it may be said that very low volatile coal tends to merely sinter together if heated very slowly; on the other hand, if heated rapidly, fusion is completed.

The degree of the fineness of grinding primarily determines the size of the slate or bone which may be in the coal. After coking, the slate or bone, which keeps its size and shape, causes cross checking; hence, if the grinding is coarse, a friable coke is obtained. Notwithstanding this cross checking, however, the internal structure of the coke is the same, whether the grinding be coarse or fine.

From the crusher, the coal is carried by endless belt to a 2,000-ton storage bin, which is situated over the centre of the two batteries of ovens. The bin is fitted with three sets, of 4 hoppers each, for loading the "lorry car." This car has the same capacity as one oven and discharges into the oven through 4 hoppers. Each oven has 4 charging holes.

The ovens, 110 in number, consist of two batteries of 55 ovens each. They are 21 in. wide, tapering to 17 in. at the ram end, 9 ft. high, and 38 ft. in length. The capacity of an oven is about 12.9 tons of coal or 9.7 tons of blast furnace coke, and the time required for coking is 21 hours. The coke is discharged from the oven into steel cars by means of an electrically operated "pusher." It is then quenched in the car and is hauled by a steam locomotive to the storage bins, which are situated at the blast furnaces.

Regenerative System of Heating Ovens.—After the gas has been deprived of its by-products, it is fed from the distributing main into the gas-distributing channel. This channel is formed of fire brick and is situated beneath the walls of each oven. The gas passes from this channel through orifices, which are each fitted with a gas nozzle, and burns in thirteen vertical flues, built in the wall between a pair of ovens. The gas, after burning in the first thirteen vertical flues, passes into a horizontal flue, down through the remaining thirteen vertical flues in the same wall, thence through a 'checkerwork' or regenerator under the oven chamber, to the main flue, and thence to the stack. The gas and air-supply valves for heating alternate halves of the oven walls are situated at both ends of each wall. These are opened and closed simultaneously by a link. The operation consists in reversing these valves every 30 minutes, so that the gas burns alternately from each end of the oven, and the heated air for combustion is drawn from alternate regenerators. The gas from the distillation of the coal is drawn from each oven through a stand-pipe, passed to the by-product plant, where the necessary suction is furnished by three exhausters.

The Engineering Faculty of the University of Western Australia was established in 1913, and is conducting Degree Courses in Civil, Mining and Electrical and Mechanical Engineering.

*Abstracts from "Conservation of Coal In Canada," by W. J. Dick, published by the Commission of Conservation.

THE COAL MINE DISASTER IN SOUTHWEST ALBERTA

By an explosion which occurred in the mine of the Hillcrest Collieries, Ltd., in the Blairmore-Frank district, southwest Alberta, on the morning of Friday, June 19, 196 lives were lost, the dead including Mr. J. Somerville Quigley, formerly of Nova Scotia, superintendent of the mine. Only 41 escaped of the 237 who entered the mine that morning. The disaster occurred at half-past nine o'clock, about two hours after the men entered the mine to commence their day's work.

Hillcrest is situated about 85 miles west of Lethbridge, Alberta. In the opposite direction, Fernie, British Columbia, is 53 miles west of Hillcrest. From both those cities, each the centre of coal mining activity, men trained in mine rescue work, with their oxygen-breathing apparatus and resuscitating appliances, together with doctors and nurses, were hastily despatched by fast trains as soon as possible after receipt of news of the occurrence. Hosmer and Michel, in British Columbia, and Taber and Macleod, in Alberta, sent helpers. The Alberta Government mine-rescue car was at Blairmore, within half a dozen miles of the scene of the disaster, so was promptly available for rescue purposes, but unfortunately all but the two-score who escaped immediately after the explosion, were past help.

The Hillcrest mines are situated on the southern extension of Turtle mountain, well known as the scene of a tremendous rockslide, which took place on April 29, 1903, causing the loss of about 70 lives, in the town of Frank, together with the destruction of much property, including nearly 7,000 ft. of the Crowsnest Railway.

Brief Description of Hillcrest Collieries.

The following is an excerpt from "Conservation of Coal in Canada," by Mr. W. J. Dick, mining engineer to the Commission of Conservation, Ottawa:

"The mine is situated on a hill, a mile and a half from Hillcrest station, on the Crowsnest branch of the Canadian Pacific Railway. The mine tipple is on the valley level, and is connected with the railway by means of a mine spur seven-eights of a mile in length. The coal is brought from the mine to the tipple by means of a steel rope and disc conveyor.

"The following seams have been prospected on the property:

Coal Seams, Hillcrest Collieries.

Thickness of intermediate strata.	Seam.	Thickness.
No. 1 to No. 2—100 ft.	No. 1	14 ft.
	No. 2	6-8 ft.
No. 2 to No. 3—300 ft.	No. 3	10-12 ft.

Remarks—No. 1, being worked; No. 2, dirty and unworkable; No. 3, dirty and unworkable.

"At present the upper seam only is being worked. The strike of the coal is about northeast and the dip 28 deg. to the west. The seams are badly broken by faults, and the coal is cut off by a fault at the face of the main entry, 4,000 ft. from the entrance.

"**Method of Mining.**—The entrance to the mine is by tunnel, driven on the outcrop, but, as the coal has been mined to the surface above the main entry, the company has driven a cross-cut tunnel and the coal is now being mined to the dip. The system of mining is pillar and stall. Chutes are driven up the pitch to the surface. The chutes are 14 ft. wide and vary in length from 400 to 800 ft. The room pillars are 50 ft. wide and crosscuts are driven in steps on each side of the chute every 50 ft. An extraction of 85 per cent. is obtained. The pillars are removed by slicing on each side of the chute. The roof is sandstone with a 6-in. cap rock.

"Gas has been found in the mine, and Wolf safety lamps are used. Electric light, 250 volts, is used in the main road for a distance of 2,000 ft. from the entrance.

"**Blasting Methods.**—The blasting is done under the supervision of shot-firers. Monobel powder, No. 6 detonators and fuse are used for blasting down the coal. The dynamite used in rockwork is 40 and 60 per cent. The tamping material used for stemming the holes is clay, which has been sent into the mine. The mine is not subject to 'windy' shots, nor has it experienced any explosions.

"The haulage system on the main entry is by horse, while 12 x 15 in. locomotives haul the coal from the entrance to the tipple.

"In timbering, 3 lin. ft. of props is used per ton of coal mined. The mine has a capacity of 2,000 tons a day, but the actual average is about 800 tons. There are 250 men employed underground and 70 above ground.

"The coal is picked on the tipple conveyor and 90 per cent. of the output is shipped as run-of-mine.

"The following machinery has been installed near the entrance of the new rock crosscut:

"Six 150 h.p. r.t. boilers.

"One 3-stage, high-pressure air compressor for locomotive haulage.

"One 105-kw. generator, for lighting and power purposes.

One 250 h.p. hoist for hoisting out of the new 1,800 ft. slope."

A GOOD DIVIDEND RECORD

By reports made to it Mining & Engineering World is able to show that American mines and works during the 6 months of 1914 just ended had one of the most profitable half years in the history of the industry. This, too, despite the fact that the Lake Superior copper companies either largely reduced their disbursements or discontinued them for the time being. Had these companies contributed on the same basis as before the labor troubles in their region, the half-year disbursements would have exceeded those of any similar period by several millions of dollars.

As it was, however, 111 companies divided among shareholders no less than $59,011,077. That these companies have been remarkably successful in the years of their operation is evidenced by their total disbursements, which amount to $860,894,204 on their combined issued capital of $751,531,440. This is a return of approximately $109,000,000 in excess of outstanding capitalization, a record which any industry should be proud of.

Then, when it is understood that the above distributions are participated in only by those companies making disbursements so far in 1914, and making public statements of same, and do not include profits from hundreds of properties privately owned, and still others which make no public reports of earnings, it but adds to the attractiveness of American mining investments.

Then, too, there are the securities-holding corporations whose revenues are derived not only from their holdings in other mining companies but from proper-

ties directly owned, and which are known to add largely to their income. Take for instance Phelps, Dodge & Co., one of whose properties last year yielded profits in excess of $5,000,000.

It is little to be wondered at that the copper properties are looked upon as a "good thing" by investors, when 24 of these paid dividends during 1914 of $23,220,406 and since incorporation have paid $418,394,073 on an issued capitalization of $240,051,915. In the lead for the year, naturally, is Anaconda, which has made two declarations of $3,249,573 each, making a total for the year of $6,498,746. Since incorporation it has to its credit $88,506,863. Utah Copper ranks second for the year with $2 373 254 and has made total disbursements of $23,363,184. Calumet & Arizona is third with $1,537,968 and since incorporation, $20,828,617.

The gold-silver-lead-zinc producers, 80 in number, contributed to the half-year's total $14,764,566. This is several million dollars more than was paid out during a similar period in several preceding years. To date these companies have total disbursements of $274,582,603, approximately $40,000,000 in excess of issued capital.

Fifty-six of the above properties are located in the United States. These contributed $8,932,627 to the half-year's total. Since incorporation these companies have paid dividends amounting to $198,069,741 in excess of issued capital. Goldfield Con. leads for the half year with $1,067,744 and has a grand total of $27,398,215. Homestake is second for the year with $950,524 and first in total dividends with $32,664,778 to its credit. Tonopah-Belmont is third with $900,000 and $6,143,000 to date.

Nineteen Canadian companies disbursed $5,084,737 during the half year, with total dividends of $56,099,677. Nipissing retains the lead with $900,000 for the year and $11,790,000 since incorporation. Coniagas is second for the half year with $720,000 and second in total dividends with $6,640,000. Hollinger is third for the half year with $540,000 and to date $2,980,000.

But five Mexican companies have reported dividend payments so far this year, these having disbursed but $747,202.

The metallurgical works had a profitable half year as shown by reports to Mining & Engineering World. Seven of these companies contributed $8,337,426 to the half year's total and since incorporation have divided among shareholders $167,917,528. American Smelting & Refining leads for the year with $2,750,000 and to date with $75,879,719. International Nickel is second for the half year with $2,178,954 and to date has paid out $17,707,761. U. S. Smelting is third for the half year with $1,162,832 and has made a total disbursement of $20,704,601.

Amalgamated is the leader among the securities-holding corporations having divided among its shareholders this year $4,616,636. Since incorporation this company has paid out $86,656,417 in dividends. Phelps, Dodge & Co. are second with $3,600,000, and have to their credit in total dividends paid $33,971,525. American Securities ranks third with $1,260,000 and to date has disbursed $23,055,596.

CALUMET & HECLA.

The estimated copper contents of the mineral produced by the Calumet & Hecla properties for June aggregated 10,472,124 lb., compared with 9,299,507 in May, and 9,743,351 in June, 1913.

IRON ORES OF VANCOUVER ISLAND

Victoria, B.C., July 1.

The British Columbia Government is to be requested to appoint an expert to investigate and report upon the iron resources of Vancouver Island and the establishment of an iron and steel industry on the island. This was the gist of a resolution passed at a public meeting held yesterday afternoon in the Council Chamber at the City Hall. The meeting, attended by representatives of the various public bodies of the city and a large number of citizens in their private capacity, was unanimous in its opinion that the time has arrived when energetic steps towards developing the known immense resources should be taken.

The chief feature of the gathering was the address given by Mr. William Blakemore, setting forth what had been done to date to develop the ore bodies, the success attained and the future possibilities of the industry.

Mayor Stewart presided. Short addresses were also made by Col. the Hon. E. G. Prior, Industrial and Publicity Commissioner Cuthbert and Mr. C. H. Lugrin.

Mr. Blakemore, in the course of his address, frequently cited reports made by the leading experts of this and the Old Country to show the superior quality of the iron ore found on this and adjoining islands, but he confined his attention chiefly to the work of development done on Texada island, one of the few deposits which have, to date, been proven. After outlining the comparatively small amount of work which had been done prior to fifteen years ago, he pointed to the factors which since that time have awakened new interest in the island deposits. The discovery of deposits with a much less percentage of sulphur, the introduction of the open-hearth method of treatment, the great increase in population in the Pacific Coast section and the increased market have brought to hand the time when the manufacture of steel on Vancouver Island is a practical and profitable proposition. Immense sums have been spent by the Provincial and Federal Governments on development plans, especially for transportation purposes, and within the next ten years there would be, he believed, $100,000,000 spent in opening up the country, developing harbor facilities and generally making this section a centre of a world trade.

Mr. Blakemore treated of his subject under the following heads: Has there been found adjacent to this island a sufficient quantity of raw materials to warrant the establishment here of steel manufacturing industries; have actual trade returns shown there is a sufficient demand for the product; can pig iron be produced at a price to show a reasonable margin of profit; what would be the general result of the establishment of such a plant on Vancouver island?

As to the supply of raw materials, Mr. Blakemore stated that the supply in hitherto developed fields was diminishing. Up to date, Canada's production had not exceeded 5,000,000 tons of pig iron, and since 1896 some 6,000,000 tons had been imported for Canadian smelters. While large areas of ore were known to exist in Canada, the low grade thereof and the cost of production had hindered development. Several deposits were known to exist in British Columbia, notably on the Skeena, at Campbell river, at San Juan and on Texada island. With one exception, that on Texada island, the British Columbia deposits had not yet been sufficiently proved to show their commercial importance. Figures were quoted to show the high percentage of the metallic iron and the low percentage of sulphur and phosphates of the ore in the Campbell river

deposits, the former being greater than the average in that of the United States fields. At Texada Island, from where about 20,000 tons of ore have been shipped, excellent results were secured. Experts estimate that from 20,000,000 to 60,000,000 tons of ore is available there. Of the quantity shipped, less than 5 per cent. had to be roasted, indicating the small percentage of sulphur. It has been estimated by experts who examined the Texada island deposits that the ore can be produced for less than 50c. per ton. About 100,000 tons of crude ore will produce 100 tons of pig iron a day for sixty years, indicating that at Texada island there are ample deposits to justify development.

Mr. Blakemore quoted the report of Mr. Horace Winchell, of the United States Government staff, who has stated that the Texada island ores are strictly high grade and compare most favorably with those of the best of other deposits. Another expert has stated that the deposits "are of remarkably pure ore."

Mr. Blakemore went extensively into the question of fuel, pointing to experts' reports to the effect that there is ample coal of sufficient coking qualities and most favorably located as to the iron deposits and the vast deposits of limestone available for flux referred to by Professor William Galloway, the most eminent expert in this line, as "very pure."

Mr. Blakemore believed these reports show that there is available all the required natural resources of a high grade. As regards a market for the product, he pointed to the fact that the local market extends along the entire Pacific Coast and as far east as Winnipeg and within that territory Vancouver island iron should be able to compete with products from other countries, as freight rates would favor the local output. As for the general market outside the above area, the great development on this coast will mean a corresponding development in ocean trade and better rates, while there would be the Oriental market. He believed the home market would consume twice as much as the lowest commercial unit could turn out. At present the cheapest rate on pig iron from the nearest competitor, the Ashland plant in Wisconsin, is $25 per ton. The British Columbia product would be of a much higher quality and closely resemble the Swedish product, which is selling on this coast at $39 per ton. Texada island ore has been manufactured into pig iron at an actual cost of $15.50 per ton, and Professor Galloway has stated that it can be produced at $2.50 per ton less than in England. Professor Galloway had estimated that the cost of installing a plant at Texada island with a capacity of 100 tons of pig iron would be as follows: Blast furnace, £115,000; converting plant, £60,000; rolling mill £95,000; and contingencies, £30,000, a total of £300,000, or approximately $1,500,000.

On the general benefits to be derived from the establishment of steel producing plants on Vancouver island, Mr. Blakemore pointed to the great development in Cape Breton Island following the establishment of the Dominion Iron & Steel Corporation. The experts had united on reporting that from the standpoint of supply of materials, easy means of transportation, ideal climate permitting all-the-year work, and proximity of ore bodies to fuel and transportation, the deposits of Vancouver island and the adjacent islands are unexcelled. Professor Galloway could see nothing in either the improvement of the electrically operated furnace or those using charcoal to interfere with the successful and profitable development of the areas in British Columbia, with the contiguous and ample raw materials available for fuel and flux.

In closing, Mr. Blakemore suggested that an appeal be made to the Provincial Government for the appointment of an expert to make a thorough report upon the whole question as it affects the Province.

Mr. C. H. Lugrin, in moving a vote of thanks to Mr. Blakemore, stated that the data furnished by the latter has established beyond doubt the existence of abundant deposits on Vancouver island and adjacent islands. One of the very finest deposits is on the route of the suggested Seymour Narrows connection. Mr. Lugrin cited the experience of the Irondale plant, which was forced into liquidation by the United States Steel Co., which now controls the deposits, and suggested it would be wise for those seeking to develop the island deposits not to lose sight of the power of the trust. Oriental competition must be expected. He had personally seen a contract between the Irondale concern and Chinese firms for the delivery of pig iron from the latter country. If the idea is to establish a plant here to sell to the Oriental market, the local concern will find itself on very difficult ground. It would be unwise to represent that an Oriental market is expected for the local output of pig iron. The great factor will be the future development of this Coast, a development expected by such large concerns as Yarrows, Limited, which has located here, not for immediate results, but to be in a position to take a share of the great business which will be available as development here increases.

Col. the Hon. E. G. Prior seconded the vote of thanks to Mr. Blakemore, and approved of the appeal to the Government for a thorough and expert investigation and report. He urged that the greatest care must be taken to see that the information given out to the world is, in every respect, correct.

Alderman Cuthbert spoke briefly, urging that the Provincial Government might very properly consider the question of assisting the iron industry.—Daily Colonist.

SUMMARY REPORT OF THE GEOLOGICAL SURVEY FOR 1912.

The Geological Survey has issued a report on the work done during 1912. This includes the reports of the various officials, as follows:

Geology of a portion of the Yukon-Alaska boundary, between Porcupine and Yukon rivers: D. D. Cairnes; a geological reconnaissance on Graham island, Queen Charlotte group, B.C.: Charles H. Clapp; geology of portions of the Sooke and Duncan map-areas, Vancouver island, British Columbia: Charles H. Clapp; geological section along the Grand Trunk Pacific railway, from Prince Rupert to Aldermere, B.C.; R. G. McConnell; Princess Royal island, B. C.: R. G. McConnell; Texada island, B.C.; R. G. McConnell; Groundhog coal field, B.C.; G. S. Malloch; Metalliferous deposits in the vicinity of Hazelton, B.C.: G. S. Malloch; a geological reconnaissance of the Fraser River valley from Lytton to Vancouver, British Columbia: Norman L. Bowen; geology of the Thompson River valley below Kamloops lake, B.C.: Chas. W. Drysdale; Savona map-area, British Columbia: Bruce Rose; geology of the Selkirk and Purcell mountains at the Canadian Pacific railway (main line): Reginald A. Daly; Rocky mountain section between Banff, Alta., and Golden, B.C., along the Canadian Pacific railway: John A. Allan; exploration between Lillooet and Chilko lake, British

Columbia: A. M. Bateman; Lillooet map-area, British Columbia: A. M. Bateman; the geology of certain portions of Yale district, B.C.: Charles Camsell; reconnaissance in East Kootenay, British Columbia: Stuart J. Schofield; Clay investigations in western Canada: Heinrich Ries; Blairmore map-area, Alberta; South Fork coal area, Oldman river, Alberta: John D. Mackenzie; the Silurian and Devonian section of western Manitoba: E. M. Kindle; region east of the south end of Lake Winnipeg: Elwood S. Moore; notes concerning the features of St. Joseph island, Lake Huron, Ontario: Frank Leverett; the Silurian of Manitoulin island and western Ontario: M. Y. Williams; Thedford and vicinity, Ontario: M. Y. Williams; notes on the Oriskany sandstone and the Ohio shale of the Ontario peninsula: E. M. Kindle; Stratigraphy of southwestern Ontario: Clinton R. Stauffer; geology of Lake Simcoe area, Ontario: Beaverton, Sutton, and Barrie sheets: W. A. Johnston; geology of Onaping sheet, Ontario: W. H. Collins; a geological reconnaissance from Lake Kipawa via Grand Lake Victoria, to Kanikawinika island, Bell river, Quebec: M. E. Wilson; exploration of the headwaters of the Broadback or Little Nottaway river, northwestern Quebec: H. C. Cooke; the Trenton group in Ontario and Quebec: P. E. Raymond; investigation of clay resources of Quebec: Joseph Keele; marine shore-lines in southeastern Quebec: J. W. Goldthwait; Joggins Carboniferous section, Nova Scotia: W. A. Bell; Greenfield and Liverpool town map-areas, Nova Scotia: E. R. Faribault; Oldham Gold District, Nova Scotia: E. R. Faribault; clays in Lunenburg county, Nova Scotia: E. R. Faribault; geology of the neighborhood of New Ross, Lunenburg county, Nova Scotia: W. J. Wright; the stratigraphic relations of the Riversdale-Union and Windsor formations of Nova Scotia: Jesse E. Hyde; report of the vertebrate palaeontologist: Lawrence M. Lambe; report of the invertebrate palaeontologist: E. M. Kindle; palaeobotany: W. J. Wilson; mineralogy: Robt. A. A. Johnston; Bore-hole records (water, oil, etc.): E. D. Ingall; Lillooet map-area, British Columbia: W. E. Lawson; Windermere map-area, British Columbia: K. G. Chipman; St. John sheet, New Brunswick: A. C. T. Sheppard; Triangulation work: S. C. McLean; Blairmore map-area, Alberta: B. R. Mackay; Texada Island map-area, British Columbia: D. A. Nichols; spirit levelling, St John sheet, New Brunswick; flathead triagulation, British Columbia and Alberta: S. C. McLean.

There are also reports by the biological, anthropological and draughting divisions.

The report is illustrated by several colored geological and topographical maps, and comprises a volume of 544 pages. It can be obtained on application to the Director of the Geological Survey, Ottawa.

A NEW STADIA CIRCLE.

The subsequent computations necessary to reduce observed stadia distances to the correct horizontal and vertical distances have long been a source of trouble and labor to the surveyor. Many arrangements such as charts, tables and slide rules have been devised to minimize this work, but all have been somewhat complicated and have presented a fruitful source of error. For this reason stadia measurements have not found the universal application which their accuracy and convenience would presuppose.

In the new K. and E. Stadia Circle an arrangement is presented which will undoubtedly stimulate the use of stadia measurements in all branches of surveying. Not only does this arrangement facilitate the taking of field notes but it reduces the calculations of these notes to the simplest arithmetical processes, and, furthermore, the arrangement does not encumber the instrument with complicated and delicate equipment.

The usual method of taking stadia measurements is to observe the interval intercepted on a rod by the stadia hairs and the angle of depression or elevation of the telescope. With this data the observer is then enabled, by using the formulas

$$H = S \cos^2 a \text{ and } V = \frac{S}{2} \sin 2a,$$

to compute the correct horizontal distance and elevation of the point in question. The mechanical means devised for the solution of these formulae have greatly simplified the plotting of notes, but their use still involves considerable labor and necessitates the carrying of extra equipment into the field.

The K. & E. Stadia Circle is a modification of the regular transit circle whereby the degree graduations on two opposite segments are replaced by special graduations which give directly the per cent. of the observed stadia distance represented by the horizontal and vertical components.

Through an arc of approximately 60° at the right and left hand sides of the circle the degree graduations are replaced by the special stadia graduations. At the index marked Hor. is read the percentage factor to be applied to the observed stadia distance to obtain the correct horizontal distance. At the index marked Vert., is read the percentage factor to be applied to the observed stadia distance to obtain the difference in elevation between the rod and instrument. Complication in the calculations is avoided by bringing the centre cross hair of the telescope to a target or mark on the rod which has been placed at instrument height before reading H and V.

Example: Suppose the observed stadia distance to be 480 ft. and the telescope, when sighted on the target, to be inclined at such an angle that the reading at the Hor. index is .97 and at the Vert. index .17. Then the correct horizontal distance would be 480 x .97 = 465.6 ft. and the difference in elevation would be 480 x .17 = 81.6 ft.

The very simplicity of this arrangement would seem to raise doubts as to its accuracy but the position of each special graduation is theoretically correct and exhaustive tests of the instrument throughout the full range of the stadia graduations have proven the device to be practically free from error.

Over a long series of tests by different observers the average error in the reading of the Horizontal correction factor was found to be 0.05 which in a 500 ft. sight would introduce an error of 0.25 ft. in the computed horizontal distance. The same trials applied in the reading of the Vertical correction factor disclosed an average error of 0.02, which in a 500 ft. sight would introduce an error of 0.10 ft.

By the method of least squares the average error in reading was computed to be

Horizontal ± 0.09
Vertical ± 0.07

These larger errors, in a 500 ft. sight would effect the computation of the Horizontal and Vertical distances by ± 0.45 and ± 0.35 ft. respectively, and as the allowable error in stadia work is 1 per cent., it will be readily seen that, in accuracy, the K. & E. Stadia

Circle compares favorably with any method of computation now used.

The greatest advantage of the device, however, lies in the rapidity with which field notes and the subsequent calculations can be made and it is this saving that will do more than anything else to popularize the new device among engineers who are engaged in topographical work.

NINETY POUND DRILLING MACHINE IN MICHIGAN.

One of the favorite fictions of the labor difficulties in the copper country of Michigan was the discussion of the one man drilling machine. In the Western Federation parades they carried banners upon which were painted pictures of this machine with an insignia designating that the drill was the agitator. It was included in the list of complaints which the federation men presented to the managers of the mines. Yet it never was seriously considered, even by the Federation agitators, for the one-man drilling machine was in use in the western camps, dominated by the Federation crowd, long before it was introduced into the Michigan copper mines. And, as a matter of fact there is no objection to it on the part of most of the men.

The one man drill weighs under 150 lbs. The two man machine weighs 290 lbs. The miner operating the one man machine has been able to increase his wages between 20 and 30 per cent. The younger men all clamor for the one man machine. In the Calumet and Hecla mines both kinds are used and will continue to be used for some time to come.

When the old machine, the two man drill, was first introduced there was objection to it. Some men explained that it would throw a lot of miners out of work. Up to that time all drilling was done by machine, one striker or two strikers and one man steering the drill as the parties might be made up. It was all hard hand work, slower than the machines and less satisfactory. When the drilling by machinery commenced it was feared that the result would be to have a lot of idle men on hand. Instead of that and like every other machinery improvement in the history of the country the introduction of the drill gave more miners more work as it resulted in an expansion of general operations on a larger scale than was considered possible at the time. The machine drill worked faster and made more holes than any hand drill ever operated. Now comes the one man machine that takes the place of the old drill that has been operating practically unchanged from the time it was first introduced. The new drill is lighter and works faster.

But another improvement is to be introduced soon. There can be no possible objection to it. A new type of one man machine is now being tried in the Calumet and Hecla and some of the other mines. It is a butterfly drill that weighs 90 lb., 40 lb. lighter than the one man drill now in use. It is claimed that the drill does the work of the heavier one-man machine and does it just as satisfactorily. Extensive experiments will be conducted before it is put into general use in the mines. There are liable to be some defects in the machine which will have to be overcome, following the tests and it may be months before its use becomes at all general. But a 90 lb. machine can be run by a small boy and will require no more attention to operate than an automobile wheel requires when the car is running. Then again, changing positions, taking the machine down and setting it up again, now the most difficult part of the task of running the one man drill, will become a good deal easier with this machine. One mining man told me that he thought the 90 lb. machine particularly applicable to all of the easier amygdaloid mines of this district and is satisfied that within a few years it will be in general use. It will not only make the work easier for the miner, but will make his pay higher. And the company will get a larger tonnage than ever per man.—Homer A. Guck in Mining Gazette.

GOLD OUTPUT OF SOUTH AFRICA.

Editor Mabson of the London Statist has issued his annual compilation for 1914-15 of about 700 pages giving detailed information concerning the mines of Africa with maps and plans.

In his interesting introduction to this, his tenth edition, Mr. Mabson discusses the question of the lives of the producing mines and the outlook as to ability to reduce costs.

Before the Dominion's Royal Commission this year estimates were put forward of producing mines containing still 580,000,000 tons of payable ore and of untouched further area containing a like amount. In other words, after 280,000,000 tons have been mined since the beginning of production on the Rand, there still remains four times as much tonnage as a basis for future production.

The Rand production in 1913 was £35,800,000, or 37¾ per cent. of the world's gold production. The gold mines paid in 1913 £8,000,000 wages to white persons and to natives £5,300,000. The industry annually consumes something like £10,600,000, value of stores and materials.

The policy of the Union Governments in smoothing matters with the white labor party on the Rand by replacing competent colored men with whites has kept costs at a high level. Signs, however, are not wanting that the artificial color bar will soon be swept away and a reduction in working costs per ton will follow.

One shilling per ton on the recent rate of 28,000,000 tons per annum output represents £1,400,000. The total profit of the Rand for 1913 was about £12,000,000 subject to profits taxes.

The total African gold production last year was £41,538,000 in a total world production of £94,720,000. The output of the United States was £18,206,000.—Boston News Bureau.

CONGRESS OF APPLIED CHEMISTRY.

The executive Committee of the Ninth International Congress of Applied Chemistry, to be held in St. Petersburg, Russia, in 1915, has just issued its first Preliminary Announcement.

The Congress will open on July 26-August 8, and close on August 1-14, the second dates in each case being the dates in the new-style calendar. That is, according to the calendar in use in the United States the Congress will be held from August 8 to 14, 1915.

The Emperor of Russia will be the Patron of the Congress. D. P. Konovaloff, Assistant Minister of Trade and Commerce, will be the Honorary President. Professor P. I. Walden will be the President. Major-General Professor W. N. Ipatiew will be the Honorary Secretary.

All letters are to be addressed to the Honorary Secretary, Ninth International Congress of Applied Chemistry, Winter Palace Place 8, St. Petersburg, Russia (cable address Chimicongress, St. Petersburg).

PERSONAL AND GENERAL

Dr. C. P. Berkey, professor of petrography at Columbia University, is at the Porcupine Crown mine, Timmins, Ont.

Mr. R. E. Hore has returned to Toronto after visiting mines at Porcupine and Cobalt.

Mr. D. G. Small, lately in Mexico, is now at the Hollinger mine, Timmins, Ont.

Prof. C. H. E. Wright has returned to Toronto after spending a month in Western Canada.

Prof. E. S. Bruce has resigned as head of the Department of Metallurgy at the Michigan College of Mines and will return to practical metallurgical work.

The sixth semi-annual meeting of the American Institute of Chemical Engineers was held in Troy, N. Y., June 17 to June 20.

Mr. Thos. R. Loudon has been appointed assistant professor of ferro-metallurgy at the University of Toronto.

Mr. J. B. Tyrrell has returned to Toronto after visiting mines in British Columbia.

Mr. H. G. Young, manager of the Trethewey Silver-Cobalt Mine, Ltd., has resigned to take up the position as consulting Engineer to the Algunican Development Co., Ltd., and general manager to its subsidiary companies. Mr. Young will leave Cobalt about August 1st.

Mr. Ed. E. Campbell, of the Granby Consolidated Co.'s mining engineering staff, is now at Valdes, Alaska, in charge of the company's mining operations there, and of its business generally—mining and obtaining custom ore for its smeltery at Anyox, Observatory inlet, B.C., in the Alaskan district around Valdes.

Mr. Geo. H. Dickson, for some time past with Mr. A. G. Larson, of Vancouver, B.C., now makes Calgary, Alberta, his headquarters, chiefly in connection with examinations of lands taken up for oil prospecting purposes.

Mr. W. J. Eaton, formerly on the Granby Consolidated Co.'s laboratory staff, at its smeltery near Grand Forks, B.C., is now superintendent at the Union mining property, in Franklin Camp, north fork of Kettle river, from which ore of comparatively high grade is being shipped to Grand Forks and Trail smelteries.

Mr. Newton W. Emmens, of Vancouver, B.C., has been employed by the British Columbia Department of Mines to investigate and report on gas and oil prospects in the country between Revelstoke and Arrowhead, on Columbia river, B.C.

Mr. F. S. Falconer, of the topographical branch of the Geological Survey of Canada, is in the field obtaining data for use in mapping the topograph of an area of 1,500 square miles in British Columbia, including the portion of Columbia River valley between Revelstoke and Downie creek, as well as the valley of Jordan river.

Mr. Thomas Graham,, of Victoria, chief inspector of mines for the province of British Columbia, has been elected third vice-president of the American Institute of Mine Inspectors, which last month held its annual convention at Pittsburgh, Pennsylvania, U.S.A.

Prof. L. C. Harrington, of Grand Forks, North Dakota, U.S.A., has been in Southwestern Alberta and West Kootenay, B.C., going thence to Western Washington, and afterward to the Coeur d'Alene district of Idaho. A visit to Butte and Anaconda, Montana, was also included in the itinerary of the mining engineering students who travelled with Professor Harrington.

Mr. Frederic Keffer, of Greenwood, B.C., recently paid a visit to the Vancouver Portland Cement Co.'s works at Tod inlet, Vancouver island.

Mr. Lewis A. Levensaler, of Tacoma, Washington, representing the Tacoma Smelting Co., with reduction works on Puget Sound, has been on Moresby island of the Queen Charlotte group, and at Anyox, Observatory inlet also on the British Columbia coast. He afterward went to Ketchikan, Southeastern Alaska.

Mr. R. H. Ley, formerly practising assaying at Nelson, B.C., is now resident agent for Northern British Columbia for the Giant Powder Co. Consolidated. He has his headquarters at Prince Rupert.

Mr. Paul Lincoln, who several months ago arrived in British Columbia from Chihuahua, Mexico, is now manager for the Noble Five Consolidated Mines Co., owning and operating the Noble Five group of mines near Cody, Slocan district, B.C.

Mr. A. W. McCune, of Salt Lake City, Utah, for many years owning mining property in Ainsworth and Slocan mining divisions, British Columbia, has been visiting those districts with a view to resumng work on several of the properties, which have been idle for a number of years.

Mr. J. D. MacKenzie, of the Geological Survey of Canada, Ottawa, has gone to Graham island of the Queen Charlotte group, to complete the geological investigations of the coal deposits there.

Mr. F. S. Norcross, for some time past superintendent of the British Columbia Copper Co.'s Mother Lode mine, and the New Dominion Copper Co.'s Rawhide mine, both in Boundary district of British Columbia, has been appointed general superintendent of the former company's various mines. He has removed from Greenwood to Copper mountain, near Princeton, Similkameen, where the company is developing, under option of purchase, a large group of mineral claims. He has been succeeded at the Mother Lode and Rawhide mines by Mr. P. E. Crane, formerly with the Granby Consolidated Co. at its big copper mines in Phoenix camp.

Mr. J. L. Parker, a mining engineer well known in the Pacific Northwest, is convalescent after a serious illness with pneumonia brought on by exposure when examining mining property at a high altitude in the St. Mary's River district, East Kootenay. After several weeks spent in the St. Eugene Hospital, near Cranbrook, B.C., he has returned to his home in Southwest Alberta.

Mr. R. W. Randall, of San Francisco, California, is superintending hydraulic placer-mining operations on French creek, Big Bend district, north of Revelstoke, B. C.

Prof. Milnor Roberts, dean of the College of Mines, University of Washington, Seattle, Washington, U.S.A., has gone to Graham island of the Queen Charlotte group, to direct operations in connection with boring for coal there.

Mr. Alex. Smith, for nearly 20 years in charge of the development of the Surprise mine, in Slocan district, British Columbia, has returned to New Denver, Slocan lake, after having spent the winter in Ontario.

Mr. N. W. Sweetser, for some time chief assistant to Mr. Chas. M. Campbell, superintendent of the Granby Consolidated Co.'s copper mines at Phoenix, B.C., has been appointed to charge of the company's Mamie mine and other interests on Prince of Wales island,

Southeast Alaska. The Mamie was formerly the property of the Brown-Alaska Co. which several years ago went into liquidation.

Mr. C. E. Bockus, Vice President of the Clinchfield Coal Corporation, Dante, Va., has just placed a contract with the Roberts and Schaefer Company for approximately $50,000 for the designing and installation of a Marcus patent, five-track steel coal tipple with a 600 ft. long inclined car haul, all to be electrically operated, at their mine at Hurricane, Virginia.

The annual meeting of the Lake Superior Mining Institute will be held August 31 to September 3. The first day will be spent at Ishpeming. On September 1 business sessions will be held on the boat en route to Detroit. The last two days will be spent in Detroit.

The Jeffrey Manufacturing Co. has issued a bulletin describing 'Arcwall' coal cutters for the 'overcutting' system of mining.

The Herbert Morris Crane & Hoist Co. has issued a bulletin devoted exclusively to the Morris type SI hand operated overhead traveling crane.

Mr. H. J. Stewart, assistant manager of Crown Reserve Mining Company, Limited, Cobalt, is on a two months trip of inspection to the principal mining camps in the West.

Canadian Allis-Chalmers has issued a bulletin on heavy duty Corliss engines.

OBITUARY

Mr. George Turner, who died at Savona, B.C., on June 17, was born at Oswego, New York, 64 years ago. For nearly 30 years he had been associated with various enterprises in British Columbia, to which province he went in the eighties of the last century. He was resident in Vancouver prior to the destruction of that city by fire in 1886. Ten years later he was engaged in mining in West Kootenay district, in Rossland and Slocan camps, respectively; and, again, a few years ago, when he was manager of a mine near Nelson. Since then he had spent much time on his ranch in San Joaquin valley, California, but each summer he returned to British Columbia. His body was taken to Los Angeles, California, for interment there.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Three metalliferous mining companies operating in British Columbia recently declared their second quarterly dividends. The Consolidated Mining and Smelting Company of Canada, Ltd., on July 1 paid to shareholders of record on June 15, a dividend No. 12, of $2 a share, which is at the rate of eight per cent. per annum; total amount of this distribution of profits, $116,088. The Granby Consolidated M. S. and P. Co., Ltd., on June 15 paid to shareholders of record on May 29, a dividend of $1.50 a share; total amount of this distribution, $224,977.73. The Hedley Gold Mining Co. on June 30 paid to shareholders of record on June 19, a quarterly dividend of three per cent. and an additional dividend of two per cent., together 50 cents a share; amount of this distribution, $60,000. In addition, the Standard Silver-Lead Mining Co. has continued to pay 2 1-2 cents a share monthly on its 2,000,000 shares, or $50,000 a month as a regular dividend, with an occasional extra dividend of a similar amount. The total amount of dividends paid by British Columbia metalliferous mining companies for the first half of 1914 is approximately $1,200,000.

Consolidated M. and S. Co.—While little information has been given out by the Consolidated Mining and Smelting Co. concerning recent developments in its mines in Rossland camp, there is no doubt that these have been important and of such a nature as to assure a long-continued output of ore of good grade, so that the company's operations here may with confidence be regarded as certain to prove profitable, and that to a degree gratifying alike to management and shareholders. This applies to the Le Roi group as well as to the Centre Star-War Eagle mines, all of which are the property of the Consolidated Co.

Le Roi No. 2, Ltd.—In the Le Roi No. 2 Co.'s Josie group, which adjoins the Le Roi group on the west, developments are also satisfactory, especially on the level corresponding to the 1650-ft. level of the Le Roi mine. Some time ago it was made known that the Le Roi No. 2 company had opened at that depth, in the Annie claim which adjoins the Black Bear of the Le Roi group, a shoot of ore which across an average width of 6 ft. gave assay returns of gold 0.25 oz. to the ton and copper 3.3 per cent., also that in the hanging wall of the same drift there had been followed for a distance of 65 ft. two veinlets containing pyrrhotite, in places 24 in. in width, average samples of which assayed 15 dwt. in gold to the ton and 0.8 per cent. copper. Since then a winze sunk from the 1650-ft. level to a depth of 85 ft. has been in ore all the way, with neither wall showing. This ore came in from the Black Bear ground, so that there is good reason to believe it also occurs in considerable quantity in the Consolidated Co.'s property. The Le Roi No. 2 Co. has also met with encouragement in its northern territory, a part of its property not yet extensively developed.

Smeltery at Trail.—Steady and substantial progress has also been made at the Consolidated Co.'s smelting works and electroyltic refinery at Trail. In the copper department, another large blast furnace is being built, this to take the place of the old No. 4 which was of much smaller dimensions and smelting capacity; it is of similar size and style to that of the new furnace put in last year to replace the old No. 2, namely of dimensions 42 in. by 35 ft. at the tuyere level and having 28 standard tuyeres on each side. These larger furnaces have arched tops and flat flues instead of having the old-style goose-neck flue over the furnace, the object of doing away with the goose-neck being to leave clear space for an overhead travelling electric crane for handling purposes on both feeding and tapping floors. Both blowing and crushing capacity have been increased to meet the requirements of the larger furnaces, another of which is to be put in later. In the lead department, additions have also been made; two of the three new lead stacks are in operation, these having dimensions of 45 by 216 in. at the tuyeres. Rearrangement of the Huntington-Heberlein roasting and converting plant has been completed and two Wedge roasters are also in operation. Conveyors now take the "roast" from the roasters to a central bin, and the converters are taken to be filled or dumped by an electric crane. More tanks have been added in the electrolytic refining department. The F. G. Cottrell

system of fume condensation is being tried, and another stack is being built—of reinforced concrete and 250 ft. in height—to dispose of smoke from the works.

Boundary.

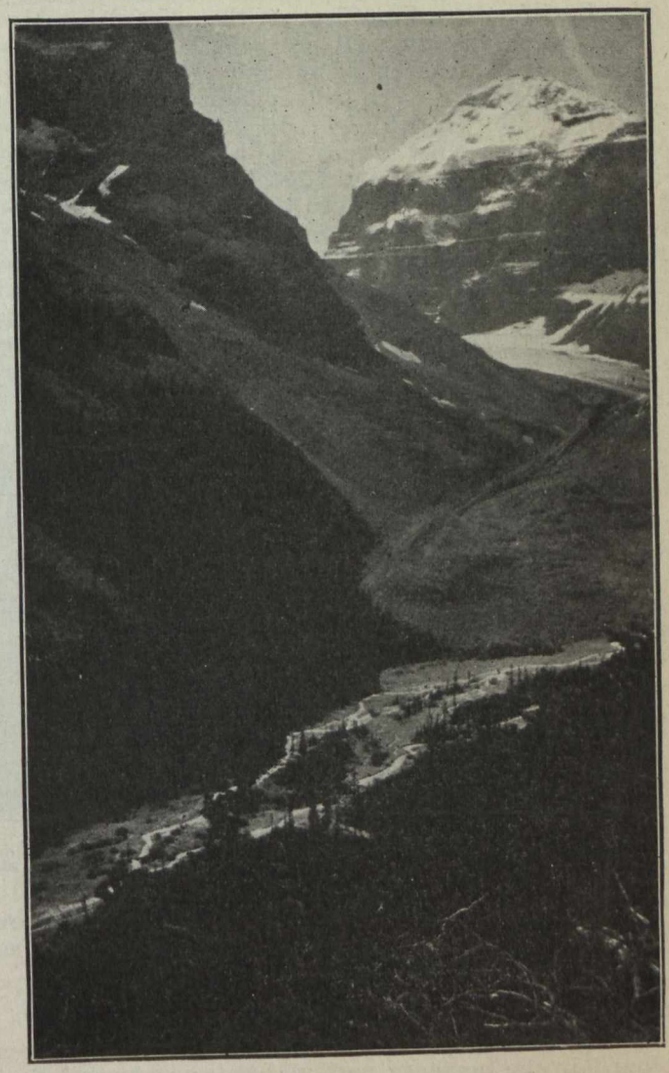
British Columbia Copper Co.—The larger part of the ore being smelted at the company's works at Greenwood is coming from the Mother Lode mine, three or four miles from Greenwood, in Deadwood camp. Following prospecting with a diamond drill, ore of higher grade than that left in the old workings of the mine, has been opened, and this ore is being extracted and smelted. The New Dominion Copper Co.'s Rawhide mine, in Phoenix camp, continues to ship ore to the smeltery at Greenwood, but in smaller quantity than during last year.

Granby Con. M. S. and P. Co.—Shipment of ore from the Snowshoe mine, purchased by this company late last year, has been commenced. The mine is being worked from the Curlew level of the Granby mines, this claim of the Granby group being in close proximity to the Snowshoe. An electrically-operated Bucyrus shovel of the 40R type has been put in at the No. 2 level, which takes in the old "glory-hole" in which steam shovels were worked years ago. The new power shovel has a one-and-a-half-yard dipper. The company has resumed diamond-drilling on the Lame Foot group, situated about 15 miles south of Grand Forks, in the State of Washington.

Camp McKinney.—There is a prospect of a revival of mining in this old camp, which has been practically deserted for seven or eight years, for the tailing dump of the old Cariboo-McKinney gold mine is being sampled with a view to the material being retreated. Some of the mineral claims constituting the Cariboo-McKinney group were staked in 1887, and after sufficient development work had been done a stamp-mill was put in. The aggregate value of gold recovered up to the time operations were suspended on this property in 1903 has been estimated at $1,500,000, and dividends were paid to a total amount of $546,837. Other properties in the camp were worked during several later years, but they did not prove similarly profitable. The Waterloo and Sailor were each equipped with a 10-stamp mill but neither has been worked of late years. In another part of the camp, about two miles from the worked gold belt, copper ore is known to occur; from one of the claims in that neighborhood ore is now hauled to the railway for shipment to a smeltery, the intention being to have a bulk test made of two carloads of this ore.

Quatsino M. ard D. Co.—A recently published report gives information concerning a number of mineral claims situated near Elk lake, about 16 miles from the southeast arm of Quatsino sound, Vancouver island. On one group of these, known as the Old Sport group, work has been done by United States men represented by Mr. M. W. Bacon, of Butte, Montana, manager of the Stewart Mining Co., operating in the Coeur d'Alene district, Idaho, who visited the property late last autumn and shortly afterward arranged for men to do exploratory work throughout the winter. Supplies for the winter's operations, and a diamond drill, were sent in. Now it is stated that drilling has shown the vein to be about 35 ft. in width at a depth of 338 ft., and that there is about 18 ft. in thickness of commercial ore. This report, however, comes from one of the original owners of the property, not from the prospective purchasers. The ore is described as chalcopyrite in a magnetite gangue. It is stated, further, that a compressor, a waterwheel for driving same, and two machine drills have been landed at Quatsino sound and are awaiting provision being made for transporting this plant to the Old Sport group, for which something like eight miles of temporary tramway will have to be constructed, the remaining part of the distance being over three lakes. The syndicate Mr. Bacon represents is called the Quatsino Mining and Development Co.

A second syndicate is developing the Merry Widow group in the same neighborhood, and this is represented by Mr. Conrad Wolfle, of Spokane, Washington, president and general manager of the United Copper Mining Co., operating at Chewelah, Washington. The account given of the lode on this property is that it has been exposed near the surface along a distance of about 600 ft.; that it is a large vein of pyrrhotite, and that assay returns give a value in gold from $4 upward to the ton and 1.5 per cent. in copper. Preparations are being made to do some diamond-drilling on this property.

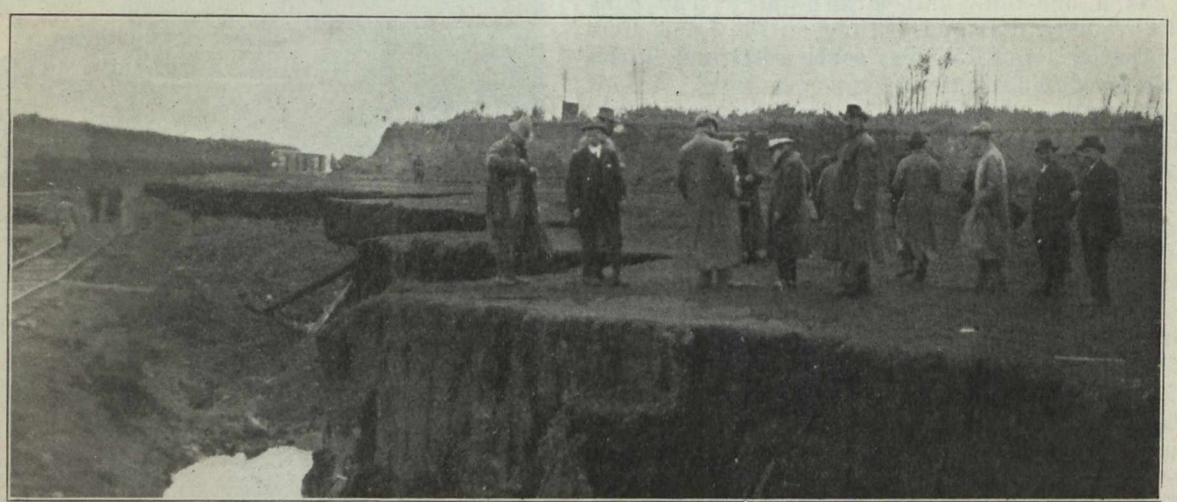


In the Canadian Rockies

There is a good waterpower within a mile of the Old Sport group. There are three routes suitable for transportation facilities; one to the June landing, on southeast arm of Quatsino sound, another to Rupert arm of the sound (which has its outlet on the west coast of the island), and the third to Port McNeill or Hardy bay on the east coast. The distance to the last-

mentioned shipping port is greatest, but construction between it and the mining camps would be less heavy. The transportation problem is now having the attention of those chiefly interested in the syndicates, beside whom there are numbers of individual claim owners also concerned.

Coal Strike Still On.—A published report of a mass meeting of coal-miners on strike at Nanaimo and neighborhood gives the information that the strikers were addressed by Mr. Robert Foster, president of the local district of the United Mine Workers of America, who stated that it would not be surprising if the allowances to strikers were soon stopped, the funds of the organization having been much depleted. The U. M. W. of A. was said to be more than $500,000 behind, owing to its having paid out $15,000 weekly to the strikers on Vancouver island, and $36,000 to men on strike in Colorado. The further information was given that by reason of lack of funds, it had not been practicable to give relief to men who had been two months on strike in Ohio. Notwithstanding this announcement, on a vote being taken on a proposal to call off the strike on Vancouver island, 1,467 voted for its continuance and only 274 votes were cast in favor of calling it off. Meanwhile all the coal mines in Nanaimo district are being worked full-handed, and there are beside many names on a list of those waiting for employment to be found for them.



A Coal Seam at Tofield, Alberta

General Notes.

It has been reported that tin-bearing ore has been found in the northern part of Lardeau county, about 20 miles up Fish river from Camborne. Mr. Stuart J. Schofield is going in to investigate, for the Dominion Department of Mines, and Mr. Newton W. Emmens for the Provincial Bureau of Mines.

Some time ago it was reported that ore containing gold had been found in the Coquihalla river, Hope mountains. A district newspaper has recently published news to the effect that development of the claims on which the find was made is resulting satisfactorily and that gold-quartz is now known to occur along a distance of two miles.

Mr. Geo. A. Clothier and associates have leased the Silver Cup group in the Hazelton district, Skeena country, and are preparing to operate the property. Work on the American Boy, owned by the Harris Mines, Ltd., also situated in Hazelton district, is to be operated along lines advised by Mr. T. J. Vaughan-Rhys, who recently examined the mine.

The Black Diamond, a mining property situated in the neighborhood of Toby creek, East Kootenay, has been acquired by United States men who have already prospected it and found on it galena ore of good grade. More development work is to be done preparatory to getting out ore for shipment to a smelter.

Mr. A. Robinson and associates are preparing to operate the Carmi mine, on the west fork of Kettle river. The Carmi ore contains gold and silver. Ten or twelve years ago nearly 1,000 tons was sent to a Boundary smeltery, but a 50-mile wagon haul was too costly to leave any profit for the shippers. Afterward a stamp-mill was put in, but neither mine nor mill has been worked during recent years. Now that a railway has been constructed past Carmi, the transportation difficulty has been overcome.

On one day about the middle of June all previous records for quantity of coal hoisted in one day at the Western Fuel Co.'s No. 1 shaft, Esplanade, Nanaimo, Vancouver island, were exceeded, the total for that day having been 1,121 tons. All this coal came from the north side of the mine, the south side having been flooded when, last year, the United Mine Workers of America, after having declared a strike, refused to permit the miners to wall off that part of the mine, which was on fire so it had to be flooded.

NOVA SCOTIA

June Outputs—Dominion Coal Company.—The output of the Cape Breton mines in June totalled 452,083 tons, exceeding by about 14,000 tons the greatest previous monthly production from these mines. This large quantity does not, however, represent the capacity of the mines, as owing to the decided slackness in trade which has now developed, the output was necessarily restricted by idle time at the collieries. Had it been possible to work the mines to their full capacity, and output of 490,000 tons would have been with ease obtained. The largest previous monthly production was got in October 1913, but in that month the mines worked to full capacity. A comparison between October 1913, and June 1914, is therefore of interest, and is as follows:

	June 1914. tons	October 1913. tons
Colliery 1	44,350	48,180
" 2	72,885	73,611
" 3	7,505	10,867
" 4	39,182	34,825
" 5	16,373	19,406
" 6	25,127	25,680
" 7	19,313	21,327
" 8	4,716	6,482
" 9	37,782	35,468
" 10	15,930	16,471
" 11	8,180	7,165
" 12	41,251	33,523
" 14	40,700	37,440
" 15	23,139	20,649
" 16	26,547	26,343
" 17	1,620	.....
" 21	13,701	13,449
" 22	13,782	7,386
Total number tons ..	452,083	438,272

As before stated, if the mines had worked every day in June the output would have reached 490,000 tons, an advance on the largest previous production of almost 50,000 tons per month. It may also be pointed out that this production is possible on single-shift, and could therefore be greatly augmented if the mines were worked double-shift as they were some years ago.

It is probable that June is the last month in which any appreciable output will show to the credit of No. 8 colliery. This mine, which has been continuously operated by the Dominion Coal Company and its predecessors since 1863, is exhausted, and all the remaining coal will be extracted by about the middle of July. The closing of this colliery will entail very little dislocation of employment or residence among the men who have worked there, as the process has been a very gradual one and the men have found employment at the other collieries of the company. Nevertheless there is always a feeling of regret and loss at the closing of an old-established colliery. Those whose working life is spent on the surface cannot realize the attachment of the miner to the underground scenes which he has visited possibly every working day for many years. The underground streets and landmarks of a mine are as familiar to the miner as the streets and views among which overground workers pursue their daily work, for although the working face is constantly advancing and changing, the main approaches of an old colliery have a permanence that even many towns and cities do not possess in this rapidly growing country. The opening of International Colliery took place ten years before the incorporation of the City of Winnipeg, and it is probable that the pit-bottom and the main approaches of this mine changed very little between 1863 and to-day. The uninitiated may smile at the idea of the miner feeling an affection for the scenes which accompany what they are pleased to term his "daily toil in the bowels of the earth," a piece of "journalese" that is often encountered in the daily newspapers, but those who are miners will appreciate the point of view.

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

Sesekinika.—The discovery on the La Bine and Smith claims near Sesekinika still continues to attract attention. The quartz vein in its size and apparent richness resembles that of the Tough-Oakes as seen on the surface, very closely. It is from two to six or eight in. wide in an altered Keewatin rock. It is most persistent in its strike. It has been uncovered now for several hundred feet and it holds good at both ends. No work beyond trenching has been done on this vein yet, but in several places samples remarkable in gold and telluride ore have been taken out.

Miracle.—A mill is being erected on the claims of the Porcupine Miracle Mining Co. in the township of Langmuir. It is expected to have the plant running some time in the month of August, the crushing being done in Hardinge mill and the recovery made by straight amalgamation. A shaft has been sunk 105 ft. and a drift has been run for 40 ft.

Hunton.—Diamond drilling on the Hunton claims in Kirkland Lake are reported to be quite encouraging. The drill has now reached a depth of 250 ft. It has passed through 75 ft. of mineralized rock and the assays from the cores give good hopes for future development.

In Grenville township, about two and a half miles from Kenogami station, a good find is reported on the Stitt claims. Between 125 and 130 ft. of stripping has been done and the vein shows an average width of about 3 ft.

Radium.—Mr. Stopford Brunton, a McGill graduate, has been deputed by the Canadian Geological Survey to spend several months in Northern Ontario making examination of ore with a view of discovery if any possess radio activity. This is intended as an assistance to the search for radium in the Province, which has been quickened by the promise of a bounty of $25,000. Mr. Brunton has with him a simple apparatus for testing minerals for radio activity, and he will be most pleased to see all prospectors and test (quite free of charge) any specimens they may bring him. He is now in Cobalt and has had quite a number of specimens submitted to him already. The close analogy of the Cobalt fields to those of Saxony lead to some little hope that radio active minerals will be found in Northern Ontario. Mr. Brunton will proceed north to Kirkland Lake and Porcupine when he has been for some time in Cobalt, and he will make examination for radio active minerals as well as making tests of all specimens brought to him.

COBALT, GOWGANDA AND ELK LAKE

Nipissing has cut its vein 64 at a level of 900 ft. in a crosscut. The vein itself is a foot wide of calcite, but values are not such as to give great encouragement of further exploration in the Keewatin under the conglomerate in this portion of the camp. Nothing has so far been found in the Keewatin under the conglomerate, and the work was undertaken purely from an exploration standpoint, the management not having any great belief that results would pay for development. The drift on the vein will be continued in the hope of picking up an ore shoot. This is, by at least 100 ft., the deepest working in the camp.

Cochrane.—A small shoot of ore has been opened up on the Cochrane Cobalt mine at the 100 ft. level. The vein is from 3 to 5 in. wide, of remarkably high grade ore. A raise has been put up on it for 10 ft. and here it holds good, but below the same vein does not give encouraging assays.

The White Reserve mine in the Maple Mountain district is again being worked by a Toronto and London syndicate. A good deal of leaf silver occurs in the wall rock, and this has been taken out and sacked. The Rubicon is also working the same section of the country.

Penn-Canadian development is still most promising. Both on the fourth level in the slates and the fifth in the conglomerate the spur of the Big Pete vein which has given this company most of its ore is looking very well. The average will probably be 2 in. of high grade with a good milling width. Diamond drilling under the 210 ft. level under Glen lake. Soundings were taken by the company last fall.

Scorodite.—According to a bulletin of the Royal Society of Canada, Mr. J. B. Tyrrell has found another new mineral on the Nipissing. This is known as scorodite, and it was discovered in vein 49 of the Nipissing mine. The mineral has a coffee brown color, and is occasionally banded in different shades. Together with a paler yellow ocherous substance it encrusts massive nickeliferous smaltite and there are also associated with it erythrite, and on one of the specimens a few minute crystals of scorodite.

The Hudson Bay mill has closed down and only a few men are left in the mine cleaning up. Work is still proceeding at the No. 2 camp, where exploration work along the Cobalt Lake fault is proceeding.

The last monthly mill run resulted in the production of 25,000 to 30,000 oz. The company is now bending

On a Nipissing Canoe Route, Northern Ontario

the lake has shown the existence of promising stringers, which may be crosscut for and developed later.

The Bailey has gone into the hands of the permanent liquidator on the application of the former president, Mr. E. A. Benson, to whom, it is stated, the company owes over $90,000.

The mine has probably never given better indications of paying back the money put into it than to-day, and in the three years when it has been systematically and scientifically developed it has paid back all charges and given a working balance of some few thousand dollars to the good. But the litigation with the old Cobalt Central was very costly, it having been fought in almost every court in Canada and the United States. The mine is shut down and the course of events appears to indicate that it will remain so for some little time to come.

The Foster Leasing Co. is pumping out the old Foster mine, with the intention of driving a crosscut from its energies to develop the Dome Lake mine at Porcupine, in which property it has a controlling interest. It also owns some claims at Hangingstone Lake, near Gowganda, but it has abandoned them after finding and taking out some very rich but very short ore shoots.

Since it issued its 7,460 shares of stock in 1903 this company has paid $1,940,250, or 25,000 per cent. on its issued capital. Nine thousand per cent. of this came from the sale of the Silver Queen claim in 1906, for which $810,000 was paid. The big find on the company's property adjoining the Trethewey was made in 1907, and mine and mill have been producing steadily ever since.

The pumping out of Cobalt lake will not commence until October. By that time all preliminary work will have been completed. The dam at the foot of Short lake, near the south end of Cobalt lake, is making good progress. This work is 260 ft. long and will cost $35,000. Another and much smaller dam is being built at

the south end of Pickerel lake. Excavations are being made for the pipe lines between Pickerel and Bass lake and also between the various mills which will be affected.

The big pumps are on the ground and can be installed at any time. In another five weeks further rock excavation will be made at the outlet and the level of the lake lowered 6 ft. and a half.

Timiskaming Mining Co. shipped two cars of ore in the week ending July 4th, and one in the week following. Nearly all the drills are now on development work.

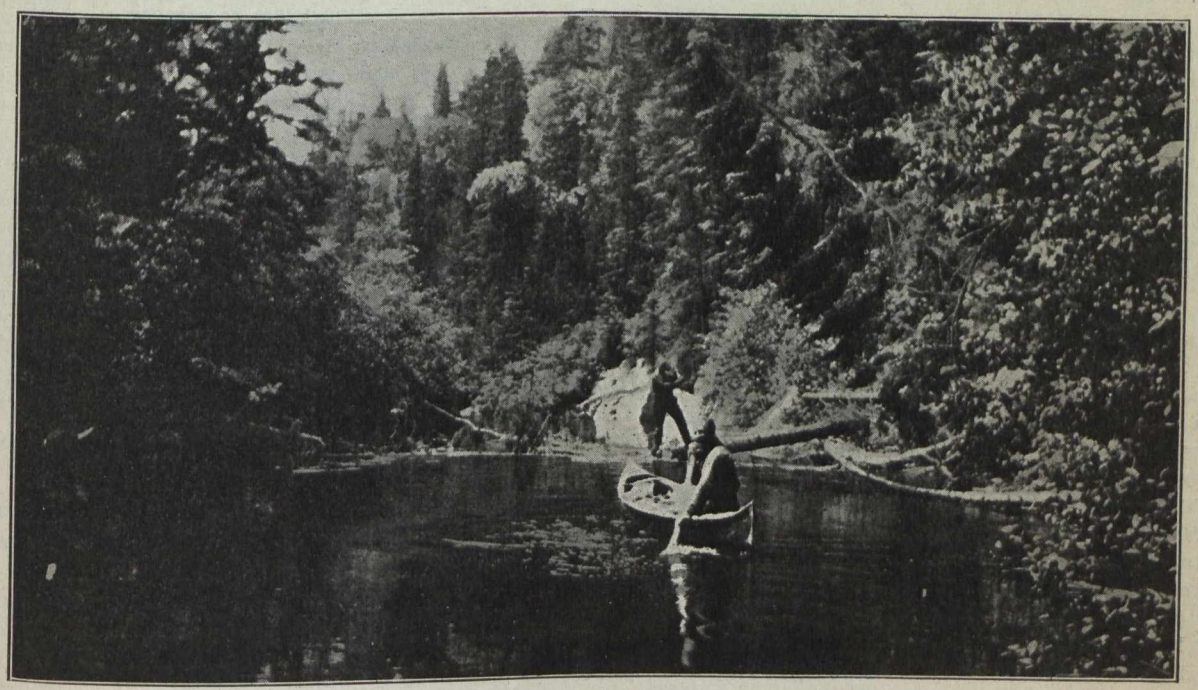
Buffalo.—In the month of May the Buffalo mill run was as follows: Mill ran 634 hours; ore milled, 6,307 tons; average assay per ton before milling, 18.66 oz.; oz. silver recovered, $93,326; silver paid for during the month, 173,747 oz.

Trethewey.—To the regret of the camp Mr. Horace Young is severing his connection with the Trethewey and the Cobalt camp at the same time on August 1st. Mr. Young came to the Trethewey two years ago as manager from the Hudson Bay mine. He has paid dividends and put as much ore in sight as he has taken out. Mr. Young leaves the Trethewey to go as consulting engineer with the Alquinican Development Co., Ltd., and general manager to the subsidiary companies of this holding syndicate. So far these consist of two properties—the Renfrew Molybdenum mines in eastern Ontario and the Julian Alaska Gold Mines in Alaska. The Alquinican is a Canadian company financed in Belgium.

Gowganda.—One of the most promising discoveries ever made on the Miller-Lake O'Brien mine has recently resulted in the opening up of an entirely new ore body at the 250 ft. level. Drifting on the cross vein, a vein which will average 3 in. of high grade ore, has been cut. It is running parallel to the main vein, but 600 ft. from it. It is in the diabase, whereas on the surface, where it was not of any particular importance, it was in the Keewatin.

Trethewey Silver Cobalt Mining Co. has declared a 5 per cent. dividend, payable July 15. This, the first mine to be actively worked in the Cobalt camp, has now returned to shareholders $1,061,998, or 108 per cent.

Gould.—A shipment of seven tons of high grade ore was made this month from the Gould Consolidated lease on Cart Lake. The ore was taken from the extension of the Seneca-Superior vein. The winze has now been sunk 135 ft. below the 200 ft. level. Three big drills and one hammer drill are at work on the lease.



On a Nipissing Canoe Route, Northern Ontario

LONGWALL MINING IN ILLINOIS.

Nearly all of the coal produced in the United States is mined by the room-and-pillar system or some modification of it. The longwall method of mining, so well adapted to many thin seams, is neither understood nor appreciated in the United States. The only field where longwall mining produces any considerable tonnage is in northern Illinois in Will, Woodford, Putnam Marshall, La Salle, Grundy, and Bureau Counties. Bulletin 5, Coal Mining Practice in District 1 (longwall), by S. O. Andros issued by the Illinois Coal Mining Investigations describes in detail this method of mining. Longwall mines in this district produce over five million tons of coal annually or about 9 per cent. of the producton of Illinois. The production of this tonnage is attended by 24.5 per cent. of the non-fatal accidents in coal mines in the state. The per capita production per employee is only 2.1 tons as compared with 4.5 tons for the state as a whole.

The longwall method of mining makes an almost complete extraction of the coal in the bed and produces about 15 per cent. more lump coal over 1 1-4 in. than is produced in Illinois room-and-pillar mines.

The bulletin is illustrated by 25 sketches and flashlight photographs which show every phase of this method of mining coal. Copies may be obtained upon request from the Illinois Coal Mining Investigations, Urbana, Illinois.

MARKETS

STOCK QUOTATIONS.

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

New York Curb.	July 13.	
	Bid.	Asked
American Marconi	2.87	2.37
Alaska Gold	27.37	27.75
British Copper	2.00	2.25
Braden Copper	7.62	7.87
California Oil	321.00	324.00
Chino Copper	40.37	40.75
Giroux Copper	.50	1.00
Green Can.	28.00	30.00
Granby.	75.00	85.00
Miami Copper	22.00	22.50
Nevada Copper	13.62	13.81
Ohio Oil	178.00	180.00
Rays Cons. Copper	21.00	21.37
Sandard Oil of N. Y.	214.00	216.00
Standard Oil of N. J.	405.00	408.00
Standard Oil (old)	138.00	.....
Standard Oil (subs)	975.00	.....
Tonopah Mining	6.62	6.87
Tonopah Belmont	6.75	7.00
Tonopah Merger	.38	.40
Inspiration Copper	18.00	18.50
Goldfield Cons	1.37	1.43
Yukon Gold	2.25	2.37

Porcupine Stocks.	Bid.	Asked
Apex.	.01½	.02½
Dome Extension	.08	.08½
Dome Lake	.38	.38½
Dome Mines	9.10	9.35
Eldorado.	.....	.....
Foley O'Brien	.25	.27
Hollinger.	18.75	19.00
Jupiter.	.07	.08
McIntyre.	.25	.27
Moneta.	.....	.04
North Dome	.....	.05
Northern Exploration	1.00	2.50
Pearl Lake	.03	.03½
Plenaurum.	.....	.40
Porcupine Vipond	.27½	.28½
Imperial.	.01	.01½
Porcupine Reserve	.....	.....
Preston East Dome	.01¼	.06¾
Rea.	.13	.20
Standard.	.00½	.01
Swastika	.01¼	.01½
United.	.....	.....
West Dome	.06	.09
Porcupine Crown	.85	.95
Teck Hughes	.....	.....

Cobalt Stocks.	Bid.	Asked
Bailey.	.00½	.01
Beaver.	.24	.25
Buffalo.	.90	1.00
Canadian.	.08	.10
Chambers Ferland	.17	.17½
City of Cobalt	.39	.45
Cobalt Lake	.44	.47
Coniagas.	7.00	7.40
Crown Reserve	1.15	1.18
Foster.	.04	.06
Gifford.	.....	.01
Gould.	.....	.....
Great Northern	.06½	.07½
Hargraves.	.....	.02
Hudson Bay	57.00	58.00
Kerr Lake	5.10	5.20
La Rose	.90	.98
McKinley.	.54	.57
Nipissing.	5.70	5.75
Peterson Lake	.34	.34½
Right of Way	.02	.03
Rochester.	.....	.....
Leaf.	.....	.....
Cochrane.	.20	.24
Silver Queen	.....	.....
Timiskaming.	.12	.14
Trethewey.	.12	.17
Wettlaufer.	.05½	.06
Seneca Superior	2.25	2.50

TORONTO MARKETS.

July 10—(Quotations from Canada Metal Co., Toronto):
Spelter, 5¼ cents per lb.
Lead, 5¼ cents per lb.
Tin, 34 cents per lb.
Antimony, 8½ cents per lb.
Copper, casting, 15 cents per lb.
Electrolytic, 15 cents per lb.
Ingot brass, yellow 10 cents per lb.
Ingot brass, red, 11 to 13 cents per lb.

July 10—Coal—(Quotations from Elias Rogers Co., Toronto):
Anthracite, $7.50 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

July 8—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.

July 8—Tin, straits, 32.10.
Copper, Prime Lake, 14.00 to 14.25 cents.
Electrolytic copper, 13.70 to 13.80 cents.
Copper wire, 14.87½ to 15.12½ cents.
Lead, 3.90 cents.
Spelter, 4.95 to 5.00 cents.
Sheet zinc, (f.o.b smelter), 7.00 cents.
Antimony, Cookson's, 7.05 to 7.15 cents.
Aluminum, 17.50 to 17.75 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.

SILVER PRICES.

	New York cents.	London pence.
June 24.	56¼	25⅞
" 25.	56⅜	25 13/16
" 26.	56¾	26⅛
" 27.	56½	26
" 29.	56⅝	26 1/16
" 30.	56½	26
July 1.	56¾	26⅛
" 2.	56⅝	26 1/16
" 3.	56⅝	26 1/16
" 4.	Holiday	26
" 6.	56¼	25⅞
" 7.	56⅜	25 13/16
" 8.	56¼	25⅞