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Iron Miners at Play at Ishpeming, Michigan
The Ski Jumper

**The Chrome Deposits
of Bahia, Brazil**

By Horace C. Williams

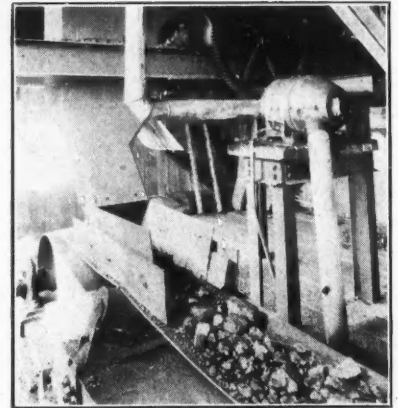
**Recreation in the
Modern
Mining Community**

**Research in Mining
and Metallurgy**

By Samuel H. Dolbear



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Health to the Institute!

ALL IN ALL, the Institute may well be congratulated on the success of its annual winter meeting. It was a success technically and socially. The dominant note was that of virility—the air was humming with entertainment and side shows and outside attractions. The technical sessions on metallurgy, on the technology of drill steel, on electrolytic zinc, on petroleum, on non-metallic minerals, and other subjects were live and interesting. The non-metallic committee is a new one, created by the enthusiasm and push of our non-metallic mining specialists in the Bureau of Mines, Oliver Bowles and Raymond Ladoo; and under the chairmanship of Heinrich Ries, it was evident that an important specialty had been added to the Institute's list.

In the petroleum section, among other live topics, there came up the question of the origin of the salt-sulphur-petroleum domes of the Gulf Coast, and although no even remote agreement on the question has been reached, it was evident that all the ancient diverse theories of origin still flourish, and the discussion was thus illuminating and refreshing. Even as to the origin of petroleum, it appeared that not only the veteran Coste but some of the more recently arrived authorities leaned or inclined more or less cautiously toward the volcanic, as contrasted to the pure organic, theory.

Mining geology was not represented in the convention as strongly as usual. An address by Horace V. Winchell on Pachuca and El Oro, in Mexico, was especially notable for the skill in presenting a geologic problem to his hearers in plain and even picturesque language, so that all comprehended and were interested. We understand that the Society of Economic Geologists will meet with the Institute at Wilkes-Barre, in Pennsylvania, next fall, so that more emphasis on this phase of mining may be expected.

The prestige of Herbert Hoover, of course, was felt in the whole organization; and in spite of the very widespread criticism that was abroad as to the Institute having over-extended itself financially and as a publisher, the impression of progress was strong. Doubtless there has been some over-extension, but that is an ordinary incident attached to any strong move: and it is likely that the Institute has seen this detail and made plans to remedy it. In the last two presidents (to speak only of most recent history), Horace Winchell and Herbert Hoover, the Institute has had two forceful and progressive executives, who have helped especially in the great movement of awakening the citizenship-consciousness in the mining engineer and making it effective.

The social side of the meeting was highly developed: nothing was left undone. There is a feeling that this has also been over-extended; and that so much spoon-feeding in the way of entertainment should not be provided. At the next smoker, for example, the popular

desire is to get back to the old habit of circulating around, meeting, and talking. Also, the ladies were more conspicuous than ever before; possibly in this the good movement has been over-extended. Many were so inclined to think; but as long as the technical sessions are not taken in charge by the Women's Auxiliary (and we believe that is the only thing left) we are not in hearty sympathy with the male grouch. We forgot the smoker—where fumigation was appropriate. The solitary male was quite safe there.

As Hoover pointed out in his address at the banquet, the Institute can confidently look forward to a prosperous year. Its newly elected president, Edwin Ludlow, is a man of poise, force, charm, experience, and friends. The membership is greater than ever before, and the income larger. The internal and external organization has been advanced during the year, and will be further advanced under the presidency of Ludlow during the coming year. The citizenship activities of the engineer have been co-ordinated with those of other engineers in the Federated American Engineering Societies, and with Hoover as president of this society the representation of the engineer of mining among other engineers will not be overlooked. A spirit of co-ordination and co-operation with other organizations, whether in the engineering or in the mining field, prevails more strongly and smoothly than ever before.

Boosting Co-operation

ON THE FRONT COVER of this issue we have reproduced a photograph to which some exception may be taken on the ground that the subject is perhaps a little far-fetched in its relation to mining. We think not, however, and take this occasion to call attention to the fact that there is a real, live association between the work of actual mining and the elements of play, which everyone must obtain in fair measure in order to perform his daily task successfully. The filling in of leisure time with clean amusement, open-air contests wherein a healthy rivalry is introduced, or some other form of attraction which offers a respite from routine occupation, is highly desirable in all industries, many of which have amusements that are characteristic of their particular field.

In northern Michigan and Minnesota, in the iron-mining districts, a great deal of interest is shown each winter in skiing, the season being considerably discounted unless at least one tournament is held in which the contestants can demonstrate their prowess in this exciting snow sport. The occasion is made one of general celebration, and the meets are always well attended. Formerly the ski slides consisted merely of steep snow-covered hills, which were taken as nature provided them, but during recent years an innovation in the form of a steel structure, used to heighten the steepness of the course, has been introduced. It may be added that the

finances for these affairs are contributed largely by the mining companies.

The encouragement of such activities by company officials may be characterized as "welfare work," but we resent the term, on the ground that the idea is more participative than paternalistic. It is the former spirit that secures complete co-operation between the men and their employer, and the realization by the miners that an interest similar to that shown in their work is being displayed in their recreation produces a fine spirit of loyalty.

This—This Is Hospitality—

"DON'T SHOOT the pianist. He is probably doing his best." This notice, supposed to have been common in the Western saloon at an earlier date, when both the saloon and the West were still distinctive, embodied the spirit of the time and bespoke the charitableness of the miner. Accordingly, only a feeling of warm gratitude can be possible when the member or guest of the Institute considers the entertainment which has been so plenteously provided for him at the stated meetings of the American Institute of Mining and Metallurgical Engineers. The kindly thought, the lavish personal service contributed, the resourceful initiative, can only intensify our love for the genus mining engineer as an all-round man and comrade, and also strengthen our sense of debt to the special committees who have done their durndest to make us happy.

At the same time we have been led to some reflections as to the relation between pugilism and mining engineering. Last summer, when at Hibbing, up on the Mesabi, they provided for us several real fights between professionals; many of us were interested, amused and instructed, just as we were with the Cornish wrestling matches of Houghton. At New York, however, when we were cheered at the smoker by a sham fight, followed by movies representing some dead-and-gone prize fight—was it not Dempsey and some one else?—we did not follow closely—we began to miss anything like a real thrill.

Of course, since Miss Anne Morgan staged a prize fight for sweet charity's sake, and enthusiastically stated thereafter that she had experienced thrills she never had before thrilled, and was going to keep right on, no one can claim that this particular form of contest is not what one looks for in the most refined circles. But it is to be doubted whether mining engineers represent these refined circles. They yawned and gazed—or forgot to gaze—with vast good nature and tolerance; but they did not have the thrills. The thrill presupposes in a certain way a shock—and they were not shocked. One engineer was heard to remark resignedly that if he couldn't hear a symphony he didn't care what they put him up against in the way of an entertainment. Another one remarked that it was all right, but he would not like to bring a guest for fear that the stranger would believe that the entertainment represented the habit and taste of the mining engineering profession.

How could a guest know that the mining engineer and even the prospector is the most balanced man alive, broad in his culture and persistent in his refinement? Let us cite the hell-roaring days of the early placer diggings. We regret that we were not in California in '49 to report the facts, but we were in the Yukon placer diggings in '96, two years before the Klondike rush. Here there was the wild untrammled life—all men—

bearded husky miners of the pick, shovel, and sluice-box, who carried their dust in a moose-skin poke, and weighed out of it on the scales for a drink. We were leaving the country and had some surplus store of blankets, boots and books from which we desired to lighten our load, so we decided to leave them. We were sleeping in the cabin of two revenue officers, the only representatives of the strong arm of the law within a thousand miles; and they offered to auction off our stuff.

The day of the auction we were rather tired, having sat up all night to help the revenue officers stand off the miners from recapturing a keg of whiskey smuggled in from the Canadian side. We beg to apologize, but we were guests. The miners did not fail to attend the auction, however; and bid good gold dust for what was offered. The blankets and boots were disputed for—but the books! They were few and heavy—of the kind that are warranted not to be exhausted in a winter's study—like Darwin's "Origin of Species" and the works of one William Shakespeare. (We kept the Milton ourselves, to read on the way down the river.)

The collection of husky whiskers—even Caribou Bill, we believe—became really excited over these, and the Shakespeare was the culmination of the day. The bidding went by gulches, and when the Hog'em Gulch gang—was it not?—bid in the Shakespeare there was jubilation on their part and disgust remained with the rest of Birch Creek and Forty Mile.

"We shall have a great time this winter" one Hog'em-ite informed us. "We will meet at one of the cabins, and will get Skookum Aleck to read—he is a fine reader—and the rest of us lie around and smoke and see visions."

We record here a fact; we cannot tell a lie, like Jack London and Rex Beach and the rest of the bunch; so our tale is mild and will not be read, or, if read, will be discredited. But the entertainment committees, striving to find a relaxation program for the well-known kind of he-men with hairy chests which are exemplified by the mining engineer, may have this gentle tale as a contribution to the discussion.

Lightening the Copper Market

THE RECENT COUP of the copper producers in floating a \$40,000,000 loan on their surplus copper stocks is one that is worth while examining from many angles. From all of these, let us say from the start, we approve of the move.

Due partly to the overcautious policy of the War Industries Board, which prevented the copper producers from curtailing their production immediately upon the announcing of the armistice; partly to the failure of the great expected buying demand in Europe to materialize, and to other causes, the abnormally great surplus stock of copper metal which accumulated soon after the end of the war has hardly shrunk, in spite of the diversified efforts of the producers to improve the situation.

Drastic cuts in price, long-term financing arrangements with foreign purchasers, the curtailment of production—all seem unable to alter the situation. The lack of gold to buy, and the unfavorable foreign exchange (which has resulted largely from lack of gold and surplus of debt in Europe), have prevented our foreign customers from being able to take even the usual pre-war portion of copper, thus crippling the export trade upon which our great copper-mining industry is built.

Industrial slowing up in this country, due to the normal and necessary deflation, has reduced buying by our own industries. Those who saw in 13c. copper a golden opportunity to lay in a long supply and had the funds to do so, have already bought: but there are many who hesitate to buy anything when it is low, or otherwise than on a rising market. The surplus stocks have become a veritable millstone around the copper producers' necks, an Old Man of the Sea not to be dumped by any known trick.

It was not only an inert burden, but an expensive one to feed. If we reckon say a billion pounds of copper at 15c. a pound, it amounts to the sum of \$150,000,000 of stored up labor and capital, paying no interest. To take the place of this locked-up capital, loans must be had from the banks. But the banks in a period like the present have many uses for their money, which is indeed largely employed in financing the Government and in other matters of prime importance; besides, they are wary of loaning largely or for long terms.

By this clever stroke of issuing bonds, the producers virtually get the public to take off their hands 400,000,000 lb. of copper metal, for a period of several years, and to give them, as partial payment, 10c. a pound on it, or \$40,000,000. Eventually they will sell the metal, and realize the difference between the 10c. and the market price: but in the meantime for some years it is out of the way and not on the domestic market. The market situation is thereby improved by just so much; the producers get ready money and a relief from the financial stringency; and the banks are glad to transfer their burden to the public. And the private investor, who buys the bonds, is also satisfied; for a bond paying 8 per cent or more, and secured by copper metal on a basis of 10c. a pound, is as good as gold.

To the student of organization in business this new move is also of great interest, touching the problems concerning which we have written in recent editorials. The Copper Export Association is legalized to do business only in foreign countries, as a combination of copper producers, under the Webb Act; the activity of this same group in fixing price conditions or combining in restraint of domestic trade is contrary to the Sherman Anti-Trust Act.

Now, the combined domestic financing of the Copper Export Association is designed to lift the copper stocks mainly from the domestic market, and in so far as is a frank attempt to make a combined effort to frustrate the normal workings of the law of supply and demand, and to artificially raise the price of copper metal to the buyer—not perhaps to the ultimate consumer, but to the immediate buyer, at least. Indeed, the immediate effect was a slight rally in the price of the metal. Yet so carefully is the thing done that we have little question as to the legality, or that the legal advisers of the copper producers have so satisfied themselves. And we doubt whether any of our readers will find fault with the expedient which has been adopted to help over a distressing situation: certainly none of our readers who are interested in mining.

As for the ultimate consumer of copper, we have indicated in recent editorials the probability that he is being charged altogether too much, for his own good or that of the copper miners, and that it is the manufacturers of articles containing copper, and other in-between men, who are doing a business profitable and safe for themselves, but expensive to the more essential parties at either end of the chain.

The Heat Treatment of Drill Steel

MORE attention is being paid today to drill steel than formerly, though there is still much that can be done. In most cases this material is no longer looked upon as if its loss or waste were a matter of little moment. Forgotten steel in old working places was once a familiar sight, and it is hardly exaggeration to say that from start to finish steel was often apparently considered as if it were not worth the planning to save. Today in many mines the handling of steel between the face and blacksmith shop is effected with practically maximum efficiency. The underground shop is becoming more common, and machine men as well as shift bosses are coming to realize that steel and its care is one of the most important things they have to study.

Careful use of his steel will do the machine man little good, however, if the matter of heat treatment is neglected in sharpening. In the shop lies the crux of the situation. At the recent A. I. M. E. meeting in New York a representative of a steel company emphasized the importance of selecting a steel of proper quality in the first place and said that in his experience more attention was usually paid to price than to quality. The statement of another speaker, representing a well-known machinery firm, was more to the point. All is not being done by steel manufacturers that can be done, said he, but it is useless for them to attempt to do more when heat treatment is not properly practiced. It is readily seen that a careless or ignorant blacksmith in tempering can completely nullify all efforts made to purchase a steel of superior quality and at the same time defeat those of the management to reduce costs by handling the drill steel properly underground.

Heat treatment, then, is of prime importance, and though strictly a metallurgical subject in its nature it is one which all mine superintendents will do well to study as carefully as local conditions will permit. Research into the causes of the breakage of drill steel was originally undertaken by the U. S. Bureau of Mines, and since then has been taken up vigorously by the Institute committee headed by B. F. Tillson. The subject has been analyzed by Mr. Tillson and his colleagues and is being studied in a systematic manner. The symposium at the recent meeting in New York took up the discussion under certain definite heads. These were: (1) Study of the steels which give the greatest service before failure by breakage; (2) the maximum service which might be expected; (3) the mechanics of failure; (4) the methods and machine development for accelerated tests; (5) the correlation of field tests with accelerated laboratory tests; and (6) the reclamation of depreciated drill steels.

The efforts of this committee have been noteworthy. The subject is one, however, in the study of which all interested technical bodies throughout the country should participate. Van. H. Manning, now the technical director of the American Petroleum Institute, has succeeded in securing the adoption by the drill steel committee of a resolution looking in this direction. This resolution recommended that the A. I. M. E. directors appoint an advisory board on the "investigation of breakage and heat treatment of rock drill steels and other steels or alloys subjected to similar impact stresses" to correlate all co-operative agencies with the Bureau of Mines and the Bureau of Standards. Fourteen national societies and agencies are to be asked to join in this research. With such co-operative research maximum results will be secured with minimum effort.

Chromite Deposits of Bahia, Brazil*

The Mineral Is Found in Gneiss in a District Rich Mineralogically and Under Favorable Climatic Conditions — Large Amounts Were Mined During the War, and Some Chromite Still Awaits Shipment

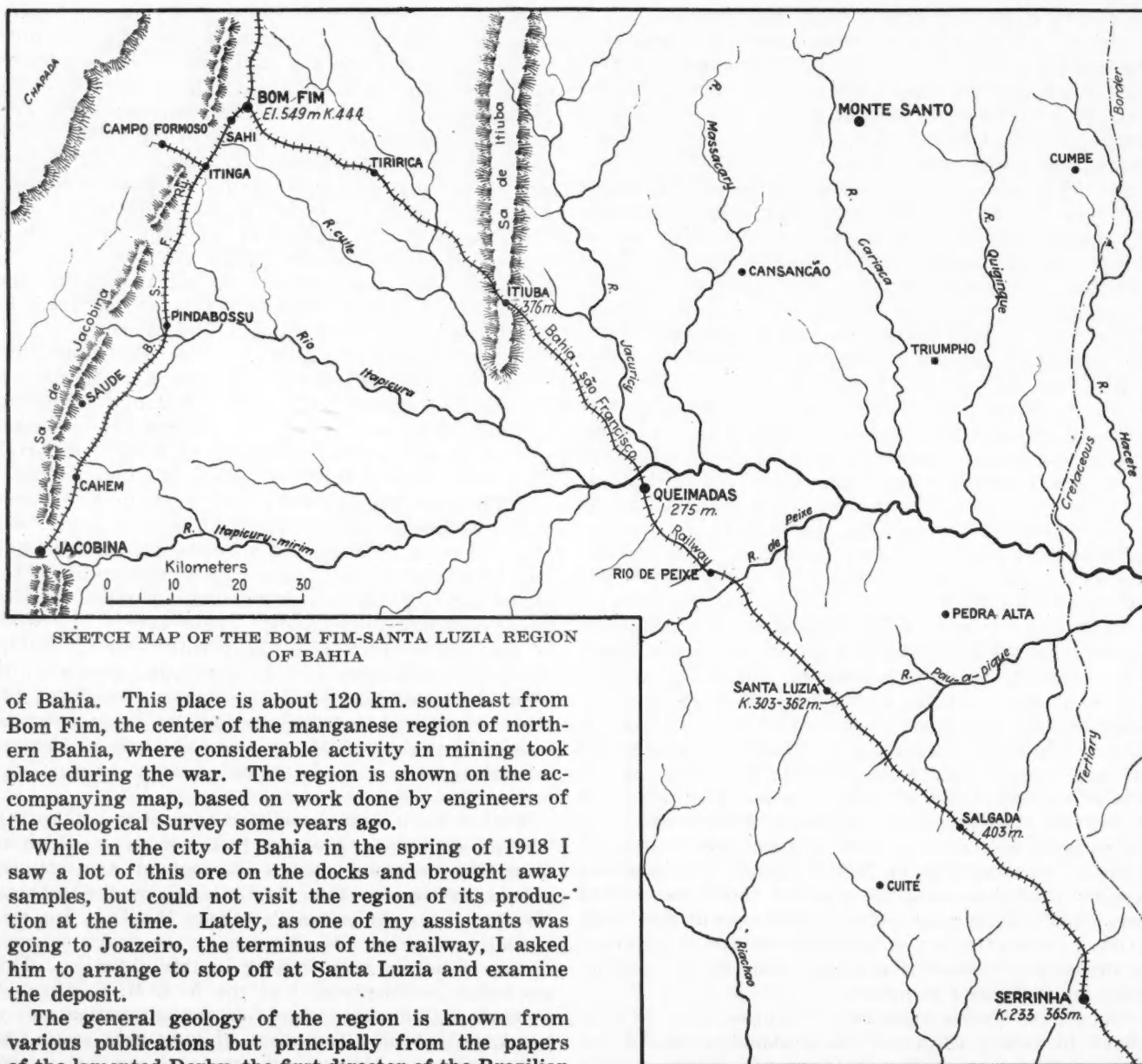
BY HORACE E. WILLIAMS

Geologist, Brazilian Geological Survey

Written for *Engineering and Mining Journal*

SOME years before the war, perhaps in the hunt for manganese or copper, a notable deposit of chromite was discovered near the station of Santa Luzia, on the Bahia-São Francisco Ry., 303 km. by rail and 210 km. in an air line northwest by north from the city

in the *Engineering and Mining Journal* in May, 1909. Another valuable contribution to the geology of this region is the report of Ralph H. Soper, who traveled extensively over the country for the Brazilian Reclamation Service under the direction of Dr. Arrojado Lis-



SKETCH MAP OF THE BOM FIM-SANTA LUZIA REGION OF BAHIA

of Bahia. This place is about 120 km. southeast from Bom Fim, the center of the manganese region of northern Bahia, where considerable activity in mining took place during the war. The region is shown on the accompanying map, based on work done by engineers of the Geological Survey some years ago.

While in the city of Bahia in the spring of 1918 I saw a lot of this ore on the docks and brought away samples, but could not visit the region of its production at the time. Lately, as one of my assistants was going to Joazeiro, the terminus of the railway, I asked him to arrange to stop off at Santa Luzia and examine the deposit.

The general geology of the region is known from various publications but principally from the papers of the lamented Derby, the first director of the Brazilian Geological Survey. Especially complete is the paper on the "Economic Geology of the Diamond Bearing Highlands of Bahia," by Dr. John C. Branner and published

bôa, and which was published in 1914. The first published notice of these chromite deposits which I have seen in English is in a book by Dr. Miller and Dr. Singewald, "Mineral Deposits of South America."

*By permission of the Director of the Brazilian Survey.



OPEN-CUT MINING OF CHROMITE, SANTA LUZIA,
BAHIA, BRAZIL

Santa Luzia is situated in an undulating gneiss peneplain, out of which project, somewhat abruptly, frequent rounded knobs of the more resistant granite which forms the prominent landmarks so characteristic of this region. About 110 km. to the west, across this plain, may be seen the great quartzite ridges of the Serra de Jacobina; to the northwest, about 65 km. away, beyond the shallow valley of the Rio Itapicurú, the lower granite range of the Serra de Itiuba appears. This plain drops somewhat to the east in the valley of the Rio Páo-a-pique, beyond which, approximately 40 km. distant, the flat, low table-lands of the horizontally bedded Cretaceous and Tertiary formations close the horizon.

MANY CLIMATIC ATTRACTIONS IN THE DISTRICT

The rainfall in this region is rather light—about 600 mm., though sometimes less, most of which falls from December to March, though considerable rains occur rarely in other months. The streams are wet-weather courses, drying up after a few weeks of sunshine except in the deeper holes. On account of this light rainfall, the vegetation is not luxuriant. The country is generally covered by an atrophied scrub growth of thorny bush with frequent patches of campo. Many varieties of giant cactus thrive, as well as those of more modest proportions.

Agriculture is practiced only in a small way to supply local needs, though the region is generally very fertile and second only to Cuba for the growing of fine tobacco. The principal interest of the inhabitants is in stock

raising. The climate is exceptional, a few months' residence being sufficient to effect a cure in all light cases of pulmonary troubles. One of the principal drawbacks is that at the height of the dry season water may be at a premium.

To one traveling in this region in season the many wild fruits found by the roadside are very enticing. Among these, the plum-like umbú and mangaba are most delicious when ripe; but if picked too soon the former is acid and the last named reminds one of the green persimmon. The sap of the mangaba tree is a milky substance which on coagulation with alum yields a fair quality of rubber.

Game is not abundant, what there is consisting principally of deer, ant eaters, and the omnipresent armadillo or tatú. In the mountains is found the mocó, a squirrel-like animal living among the rocks.

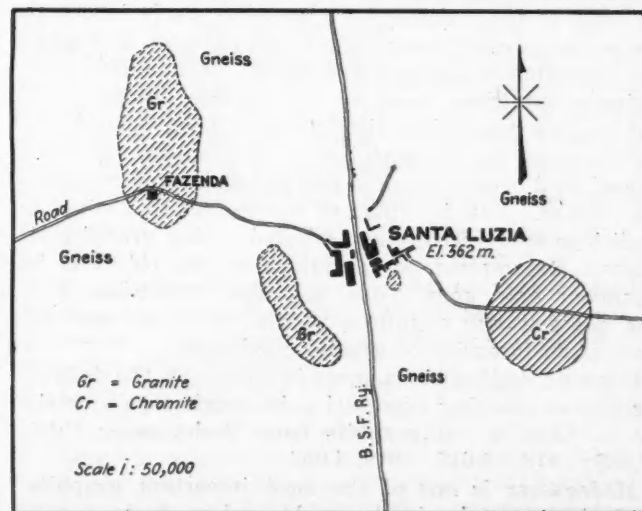
CHROMITE INTERCALATED IN GNEISS

Recently an assistant of the Geological Survey, Dr. Othon H. Leonardos, made a short stop at Santa Luzia to inspect the chromite deposit, and he furnishes the following observations, together with the sketch map and the photograph of the excavations:

"The country rock consists of a fine-grained gneiss, generally light colored and very quartzose. The varying strike of the banding is approximately with the magnetic meridian (about N. 15 deg. W.), with an apparent dip of 55 to 65 deg. W. The gneiss is cut by numerous dikes of pegmatite. A few hundred meters west from the station outcrops of a fine-grained, homogeneous, gray granite are being quarried, the material being shipped to Bahia and elsewhere for paving blocks and other uses, for which it is admirably suited because of its even fracture.

"About 2,000 m. east from the station of Santa Luzia a large deposit of chromite occurs, intercalated in the gneiss. Mining operations have been paralyzed since the close of the war, but it is said that work is to be started up again soon. As may be seen in the photo, mining operations have been by open cut, also by a small inclined gallery over a distance of about 200 m. A large amount of ore was taken out during the war and several thousand tons await shipment. The mineral is very compact, and, mixed with amphibole, occurs in large masses or lenses in the gneiss."

Several other deposits of chromite are known in this



SKETCH MAP OF SANTA LUZIA AND ITS CHROMITE
DEPOSITS

region, some of which may be of importance. One of these is near the village of Campo Formoso, the terminus of a branch line of the railway west of Bomfim, but of this I have no adequate description, nor have I been able thus far to secure samples of the mineral for analysis.

Under the microscope thin slides taken from chance specimens from Santa Luzia show among the abundant crystals of chromite an inconspicuous groundmass, consisting principally of enstatite, with which were recognized a few grains of perovskite, some minute crystals of rutile, some diallage, what appears to be amphibole, perhaps from the alteration of the pyroxene, a small amount reduced to calcite, and a few small nodules of olivine. In places a little serpentine was seen. Many bright fibrous patches of bastite appear on the weathered surface, reminding one of the saxonite of Shasta County, Cal.

DISTRICT CONTAINS OTHER MINERAL DEPOSITS

The region shown on the map is very interesting from a mineralogical point of view. Besides manganese and chromite, already mentioned, deposits of graphite and mica have been worked in a small way. A short distance farther north, in a region not shown on the map, are the extensive copper occurrences of Carahybas. The Serviço Geologico is now conducting surveys to determine the feasibility of taking water from the Rio São Francisco above Joazeiro, across the low plains country to the vicinity of these copper deposits, thus making their development possible, it is hoped, in the near future, and at the same time irrigating a wide extent of otherwise unproductive and possibly potentially valuable country.

Considerable quantities of saltpeter are being produced at present from deposits found in the numerous large caves which abound in the limestone formation of the Chapada, shown on the map a short distance northwest from Campo Formoso. This is the edge or rim of the far-famed Chapada Diamantina of Bahia, and it is needless to say that diamonds are frequently found in the main streams which have their origin in that region.

Graphite Production in Madagascar At a Standstill

The French Ministry of the Colonies has furnished the office of the Commercial Attaché at Paris information on the present production of graphite in Madagascar, according to *Commerce Reports*. It is stated that business conditions were so unfavorable during 1920 that no new producing districts have been opened, no new company for the exploitation of graphite has been formed, and operations at a number of the old deposits have ceased. This is explained by the fact that adverse conditions have recently necessitated selling graphite at a loss. Resumption of operations at the old beds is dependent only upon more favorable conditions, and new deposits will doubtless be discovered as soon as there is an incentive to greater production.

Previous decline in business is shown by the following figures covering exportation in metric tons (metric ton = 2,204 lb.) of graphite from Madagascar: 1917, 27,838; 1918, 15,015; 1919, 4,056.

Madagascar is one of the most important graphite producing countries in the world, and produces an excellent quality of flake graphite used in crucible manufacture.

Sand-Filling in Stopes

BY E. D. GARDNER*

THE Ray Consolidated Mining Co. at Ray, Ariz., under normal conditions mines 4,500 tons of copper ore per day from three 500-ft. shafts. The orebody is an enormous low-grade deposit of the porphyry type. It consists of a flat irregular zone, 50 to 500 ft. thick, of impregnated schist enriched by downward leaching from the upper part. In places the belt is leached from the surface to depths of 400 ft., and the minimum cover at No. 3 mine is about 100 ft. Most of the ore comes from No. 1 and No. 2 shafts and is mined by a caving system.

The part of the orebody worked in No. 3 mine is relatively high grade, very irregular, and, as it extends under the creek bed, obviously could not be mined by the caving method. Any settling of the surface would destroy the ore bins at No. 2 mine and open cracks through which the flood waters from the creek would fill the mine. About seventy-five tons per day are produced from No. 3 mine by a square-set and fill method. A section or panel two sets wide and eight sets long is carried up from one level to the next, or to the top of the ore, and then the space is filled with waste. A series of panels in a staggered line may be worked at the same time. Timbers 10 in. x 10 in. in size are used for the square sets and are doubled with round timbers where required. As a rule, sufficient waste to fill the stopes is obtained from development work in the three mines, but if for any reason the supply is short, capping drawn from a finished stope in No. 2 mine is used.

A raise connects each level of No. 3 mine and extends to the surface at the edge of the railroad track. Waste brought from No. 1 and No. 2 mines in railroad cars is dumped into this raise, and then trammed by hand in one-ton cars along the levels to the top of the panel ready to be filled.

The ore and capping are friable and cave readily. To keep the capping from cracking the filling must completely fill the openings. Undue settling of the filling is prevented by flushing sand in at the top of the stope to fill the interstices in the waste. This is done as soon as a panel is finished. Also, sand may be run in while the panel is being filled. The worked-out stopes are carefully watched, and if the filling settles more sand is used at the top to keep the openings tightly packed.

The sand used, which has about the fineness of ordinary building sand, is tailing from the company's concentrator at Hayden, and is brought to the mine in ore cars on the return trip. The dry sand is dumped from the ore cars into a separate raise and trammed by hand in one-ton mine cars to the top of the stopes. After being emptied from the mine cars the sand is flushed into the stopes by means of a hose. Water for this purpose is piped from the pump column in the shaft; the small amount used readily drains through the filling to the level below, and finds its way back to the sump for the mine pump. The water is clear after leaving the stopes. No bulkheads are used at the bottom of the stopes, as not enough water is used at any one time to create a hazard if held back. The mine is divided into sections by concrete bulkheads for protection against flood waters from the surface.

*From "Reports of Investigations" Bureau of Mines, January, 1921.

Recreation in the Modern Mining Community

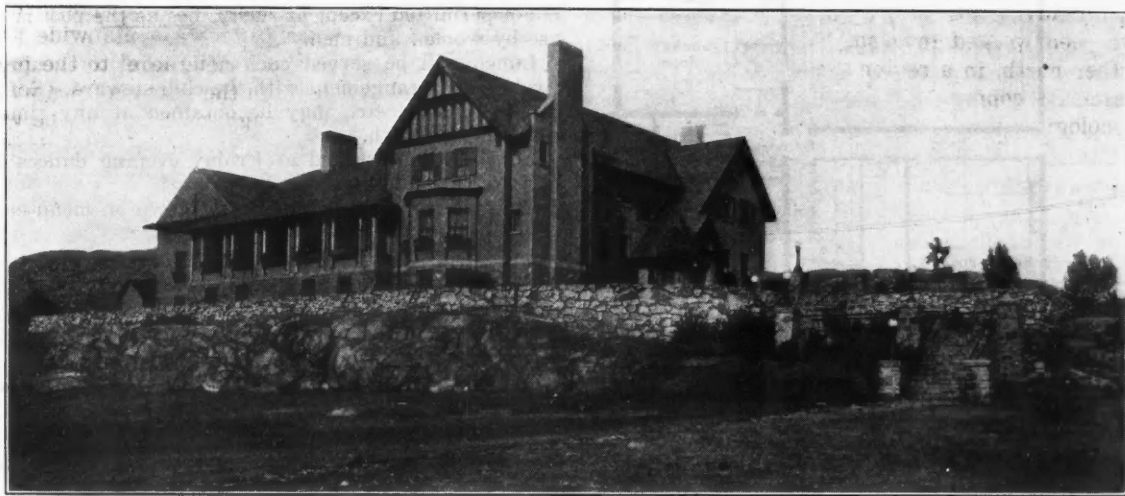
Picturesque Dance-Hall Days Passing—Elaborate Clubhouse of the International Nickel Co. a Model of Its Kind—All the Advantages of Expensive City Clubs at a Cost of \$2 per Month

Written for *Engineering and Mining Journal*

THOSE whose only knowledge of mining camps is gained from fiction, or from an occasional night at the movies, are likely to hold perverted ideas as to the character of entertainment or the class of people which can be found in a modern and thriving mining community. The old saloon and dance-hall days are rapidly passing. Our mines, mills, and smelters are coming more and more to be operated by men who are used to decent living conditions. Comparatively young men they are to a large extent, and most of them married. Even the mucker, the filter man, or the crane-

reading room provided with the current magazines take up the remainder of the first floor. On the second floor are the servants' quarters and two or three bedrooms for company guests.

A few remarks as to how the club is managed, and concerning its activities, may be of interest and a guidance to those conducting similar organizations. The directors, six in number, who have sole control, are appointed by the International Nickel Co. One member of the board is chairman of the house committee and another of the entertainment committee, these commit-



CLUBHOUSE OF THE INTERNATIONAL NICKEL CO. AT COPPER CLIFF, ONTARIO

chaser may be a college graduate, though wearing dirty overalls. The placid provincial village atmosphere is also absent. Almost every one has traveled widely and is an interesting person to know. Employees of this class, and their wives, demand better conditions than were formerly provided. As a result, the visitor from the city is often surprised to find opportunities for recreation and education comparable with what he can obtain at home.

Possibly no mining company on the continent has provided a finer recreation club for its employees than the International Nickel Co. at Copper Cliff, Ontario, Canada. The building was erected soon after the outbreak of the war, when building costs were considerably lower than at present, but even then it cost, with furnishings, about \$62,000. In the basement are three bowling alleys; a 20 x 40-ft. swimming pool, with a locker room; a gymnasium, complete equipment for which has yet to be installed; a billiard and pool room with four tables; and a refreshment booth. The first floor contains a lounge room, with a high ceiling and fireplace. A pianola and Edison phonograph are provided. A sun parlor opens from this through four double doors, thus making a ballroom floor, 50 ft. square, available. A kitchen, tea room, reception room, and

tees being selected from the membership and carrying on the active work of the club. The club members have no voting power.

Employees of the International Nickel Co. are eligible to membership and non-employees to associate membership. Men must be over eighteen years of age and women over sixteen. The names of applicants are posted before election, and if considered desirable are elected by the board of directors, one vote against the candidate serving to exclude him from membership. Any member may be suspended or expelled for just cause.

The following rules as to dues and club activities have been made:

DUES

Members living within six miles of the club shall pay dues of \$2 per month. No initiation fee is required.

Members living more than six miles from the club shall pay dues of \$1 per month.

Women members shall pay dues of 50c. per month.

Associate members living within six miles of the club shall pay dues of \$2 per month and an initiation fee of \$10.

Associate members living more than six miles from the club shall pay dues of \$1 per month and an initiation fee of \$10.

Women associate members shall pay dues of 50c. per month and initiation fee of \$5.

School teachers residing in company towns shall not be required to pay initiation fees.

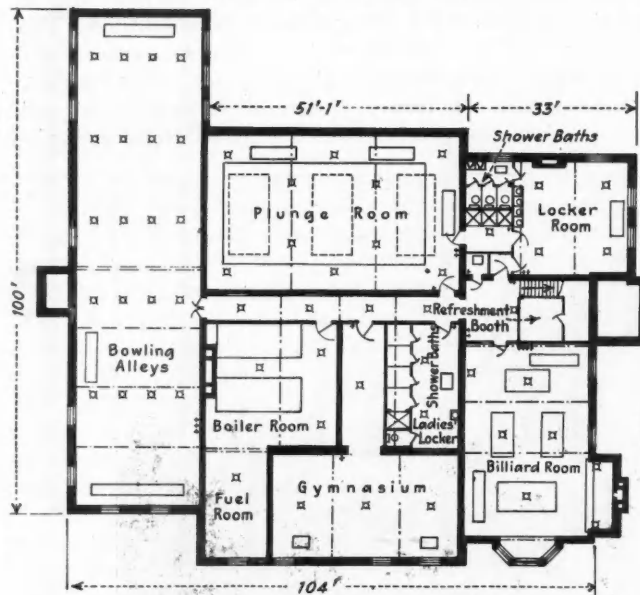
Fees for clergymen shall be \$10 per year. No initiation fee is required.

SWIMMING POOL

Boys and girls whose brothers or fathers are members may use the swimming pool as set out by the house rules. They shall not, however, play any game in the club nor be entitled to other privileges.

VISITORS

Visitors may be introduced into the clubrooms by members in good standing, or any woman holding a privilege card, who shall enter their names, place of residence, date of introduction, and their own name in the visitors' register. Members may obtain for visitors cards good for a period of fifteen days. The member introducing a visitor shall be responsible for any indebtedness of the visitor to the club



BASEMENT PLAN OF THE CLUBHOUSE

during such time. The same person may not obtain another visitor's card within sixty days unless on request of a member of the board, and this visitor's name may not appear on the register more than once within this period.

Minors are not allowed to be visitors.

PAYMENTS

No money shall be paid to employees of the club for the various privileges, but members shall give coupons for the amount of their obligations.

Books of coupons may be obtained by members from the club steward by signing a slip for them, deductions for which will be made from the member's salary or wages in case he is employed by the company, or bills will be mailed otherwise.

Gambling or betting will not be permitted in the club building. No game shall be played in the club building for money, coupons or other stakes.

All entertainments and meetings in the club building must be conducted by the club.

HOUSE RULES

The club will be open for members every day from 9 a.m. to 11 p.m.

Weekly dances will be held Friday evening from 9:15 p.m. to 1 a.m. To help pay for the orchestra, members who attend the dances are expected to deposit with the steward 25c. in coupons.

Dancing will be permitted on Monday evening from 8 p.m. to 11 p.m. No orchestra will be provided. Dancing will also be permitted any afternoon except Sunday.

Members may bring women guests to the weekly dances.

The billiard room will be open to men only each day except Sunday. Wednesday afternoon and Saturday morning it will be reserved for the use of women.

A charge of 15c. per hour will be made for a pool table and 10c. per hour for a billiard table.

The bowling alleys will be open each day except Sunday for men only, except on Wednesday afternoon and Saturday morning, when they will be reserved for women.

A charge will be made for bowling as follows:

10c. per game for two men;

20c. per game for three or four men;

30c. per game for five or six men.

Pin boys will be paid by the club.

The swimming pool will be open daily for men except at the following hours: Saturday, 9 to 10 a.m.—Members' boys when accompanied by a guardian. Saturday, 10 a.m. to 12 noon—Women and members' girls when accompanied by a guardian. Wednesday, 1 p.m. to 4 p.m.—Women. Monday, 7 p.m. to 11 p.m.—Members accompanied by women, and women holding cards.

Towels will be provided at a charge of 5c.

Members are requested to take a shower bath before entering the pool.

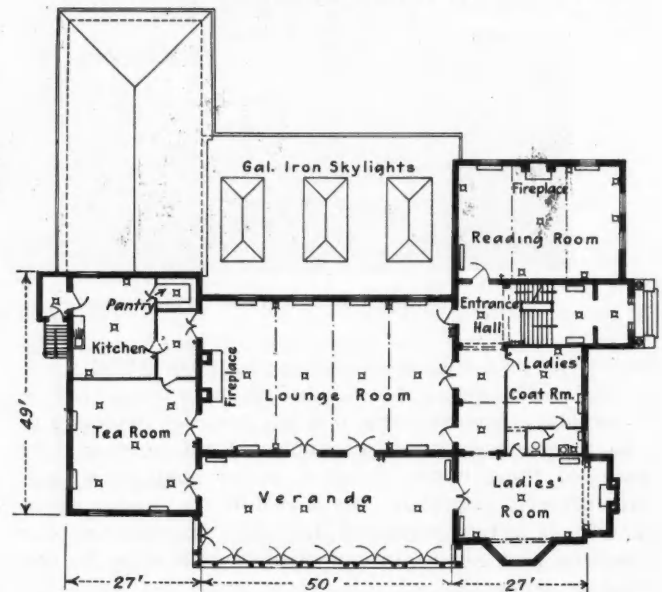
No towels, baseball or football uniforms are to be left in the lockers.

The wearing of trunks or bathing suits in the pool by men is not permitted except at such times as the pool is open for use by women and men.

Lunch will be served each afternoon or evening except Friday, on arrangement with the club steward. Soft drinks, candy, tobacco, etc., may be obtained at any time at the refreshment booth.

Lunch will be served at Friday evening dances from 10 p.m. to 12 midnight.

Charges for lunches will be as shown on menu cards.



PLAN OF THE FIRST FLOOR

At present the club boasts a membership of four hundred. Varied entertainment is provided. The weekly Friday night dances attract a large number, and three or four special dances are also customarily given during the year. Special instructors in the latest dance steps have been engaged from Toronto. Concert and lecture courses are offered and occasional smokers are given. The club rooms afford an ideal spot for the frequent afternoon tea parties given by the women. A card tournament continuing over several evenings is a regular annual feature. Over one hundred members are interested in bowling, and frequent tournaments and matches with outside teams are held. Swimming is popular, mixed bathing being allowed one night a week.

Special instructors have been engaged for this sport at various times.

The membership, it will be noted, is open to all respectable members of the community. The foreign element, however, so far has shown little tendency to apply for admission, seemingly preferring the other entertainment which the town offers. When the club was first organized it was feared that the members would tend to divide into cliques, but happily no trouble has been experienced, and the atmosphere is decidedly democratic.

In addition to this recreation club the company has erected a large building devoted to the Scotch game of curling. The rink is built on the slag dump, which affords an ideal foundation for the ice. The membership is large and enthusiastic. Five clay tennis courts are maintained by the company, members in the tennis club being assessed about \$3 per year. This amount would just about pay for two or three hours' play on city courts. Before the war tournaments were held with near-by towns, such as Cobalt, North Bay, and "the Soo." An excellent baseball field and grandstand have been built and two four-club leagues flourish. College players of standing are often secured for the summer. Hockey, lawn bowling, and the "movies" attract their clientele. Even golf has been played amidst the rugged Archæan rocks.

This is only a sample of what one modern mining community can provide in the way of recreation. Many others scattered about the country are not far behind. Often the more remote the place the more elaborate the facilities for enjoying life. Oases are growing in those "abominations of desolation" which formerly characterized most mining camps.

Measuring Icy Torrents

To determine the value of a river as a source of power, or the extent to which it may be utilized for irrigation, navigation, or other purposes, it is first necessary to measure accurately the volume of its flow. For this purpose the U. S. Geological Survey maintains many stream-gaging stations, and its hydrographic engineers are continually traveling from station to station to determine the flow of the rivers when the water is at different heights.

Several methods are employed to find the exact flow of a river. The engineer can sometimes wade across the river, dropping into it his electric current meter every foot or two in water at different depths, and thus determining almost exactly its flow. As the records should be kept throughout the year, many of these measurements can be made only through holes chopped in thick ice.

The hydrographer who is measuring the flow of a stream wears high rubber boots, which may reach up to his shoulders, but though he may keep dry he is naturally likely to get rather cold. For measuring a deeper river a cable is stretched across it and a small trolley car is run across the cable to carry the hydrographer, who at fixed intervals drops his instruments into the water.

In measuring a large river, a cable a mile long may be used, the hydrographer traversing in his car the entire distance and making his sounding every few feet. The results of these observations are later computed to show the number of cubic feet per second flowing in the river measured and are afterward published in reports.

Welfare Films of U. S. Steel Corporation Shown at A. I. M. E. Meeting

THE eight or nine reels shown by the courtesy of U. S. Steel Corporation at the Welfare Session of the annual meeting of the A. I. M. E. in New York City last week were viewed by perhaps a hundred members in the course of Wednesday morning. The pictures emphasized the attention that successful industrial organizations are now devoting to the safety, health, and entertainment of their workers, and also the value of the cinematograph for the instruction and research of "Safety First" work. Aside from a few repetitions, the views shown conveyed a connected story of the worker's daily and weekly life, from the day when, newly hired, he is shown through the plant, until, as a valued employee with years of service still assured, he finds the great company also concerned for the health, safety, contentment, happiness, and education of his boys and girls.

The films showed new men actually learning the uses of the safety devices; how the men are encouraged to meet and discuss and devise additional devices or practices; and how the plant's hospital corps promptly rescues and cares for those who are injured. Here mention should be made of the "Why?" or "Visual Education" reels. These pictures from life, of dangerous combinations or practices, such as a shift of men piling through a freight train moving across their homeward path and the "injured" man who fell from one of the cars; or the careless closing of an unlocked and open safety cut-out switch, with the resultant explosion and the burned eyes inflicted on a fellow worker; the cruel "practical joke" that may lay up one's comrade for weeks—these teach impressively the need for care, thoughtfulness, "thought for the next man" at all times.

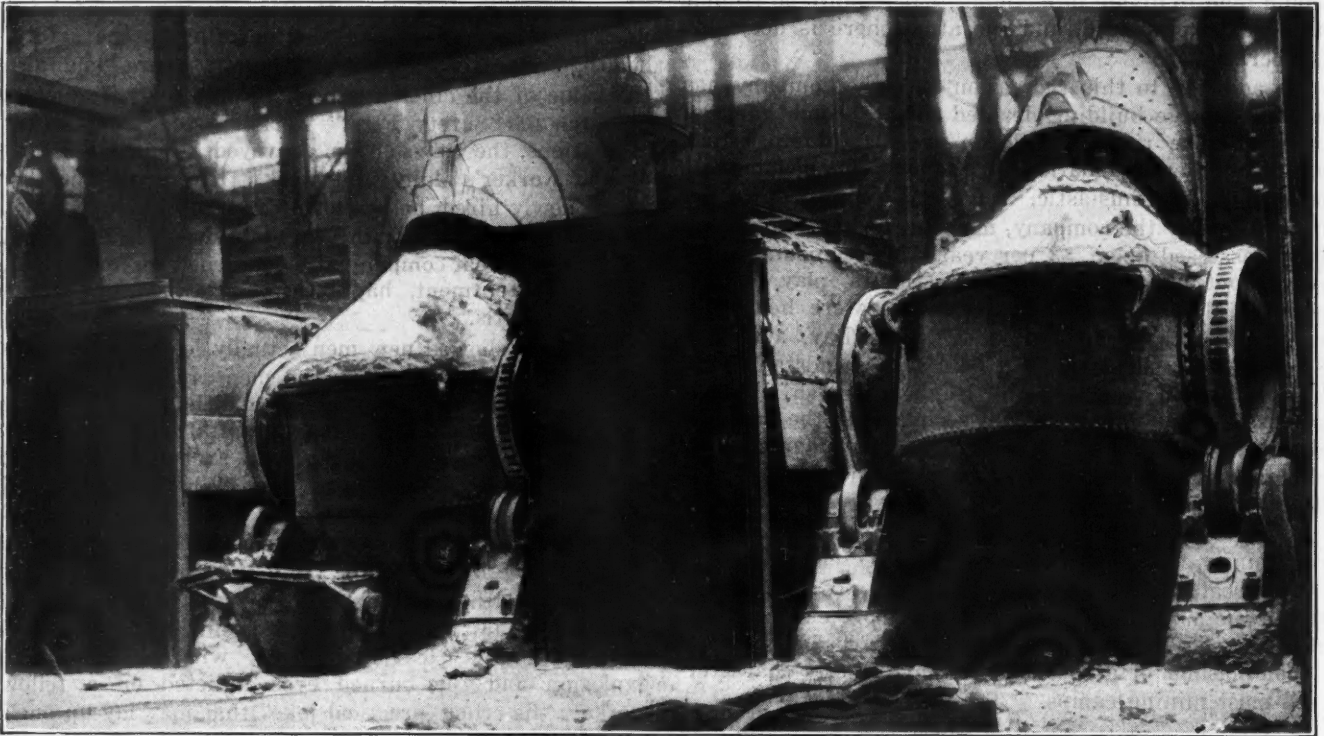
Other reels showed the locker rooms, wash-up and shower rooms, sanitary drinking fountains throughout the shops, rest rooms full of merry round-faced girls, and one of the great shop cafeterias at the rush lunch hour which are today driving out of business the solitary, grimy dinner pail, with its cold sandwich and slab of pie.

A whole series of reels carried the spectators to the neat cottages and attractive Y. M. C. A. at Gary, Ind.; to the multitude of playgrounds, swimming pools, and wading ponds, all full of merry, contented children, women, or men. The field days with their hosts of marshalled children rhythmically performing evolutions or dancing various figures recalled the great school festivals of Central Europe; but the field of negro girls and boys doing the toothbrush drill was certainly American.

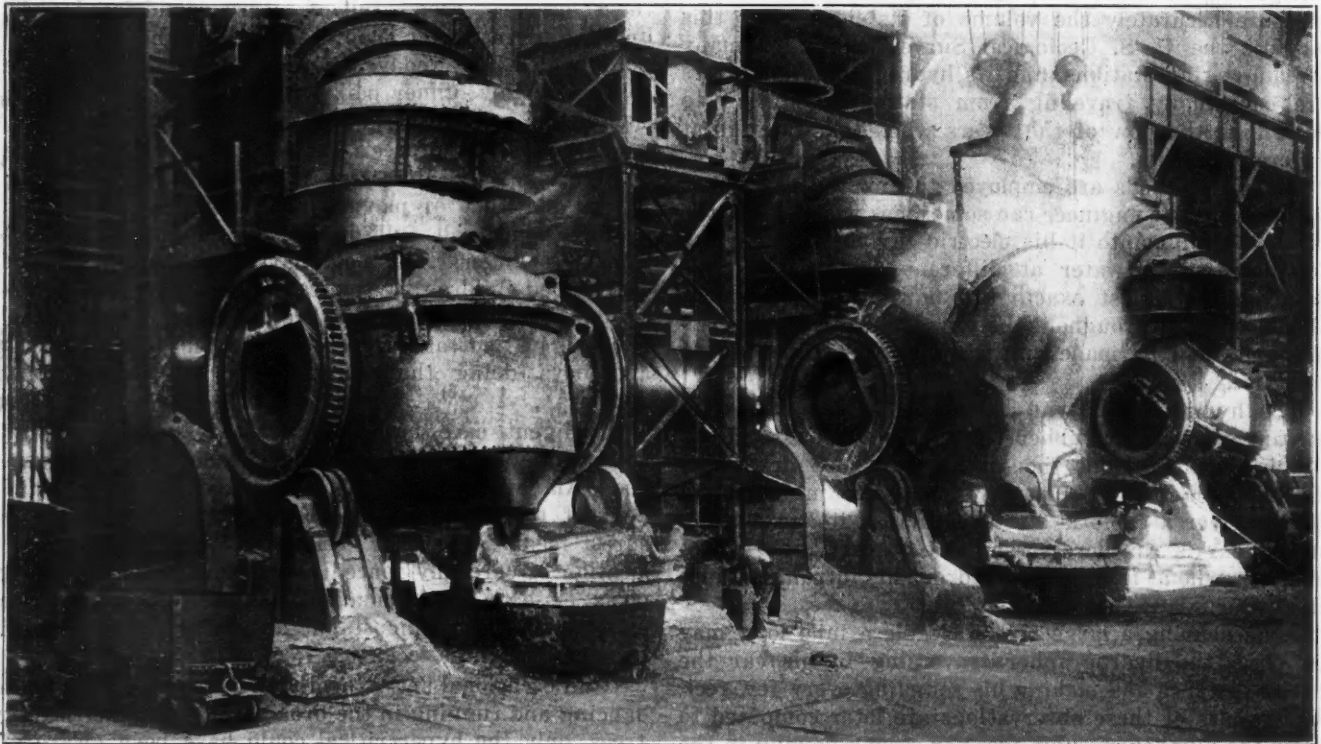
Intelligent care has been devoted to housing and recreation problems at Westfield, Ishkoda, and Muskoda, Ala., where the right method has been adopted and a great force of negroes won to steady labor by the surest means. Another reel showed how the strategic location of carefully fenced playgrounds and swimming pools, close to the fascinating, dangerous river and the railway yard, has almost put an end to fatalities and accidents in those localities.

If an occasional snowstorm view revealed the children dancing and running in the broad sunshine under leafing trees, only the hypercritical could have been aware of the fact.

Copper Converters in the Southwest



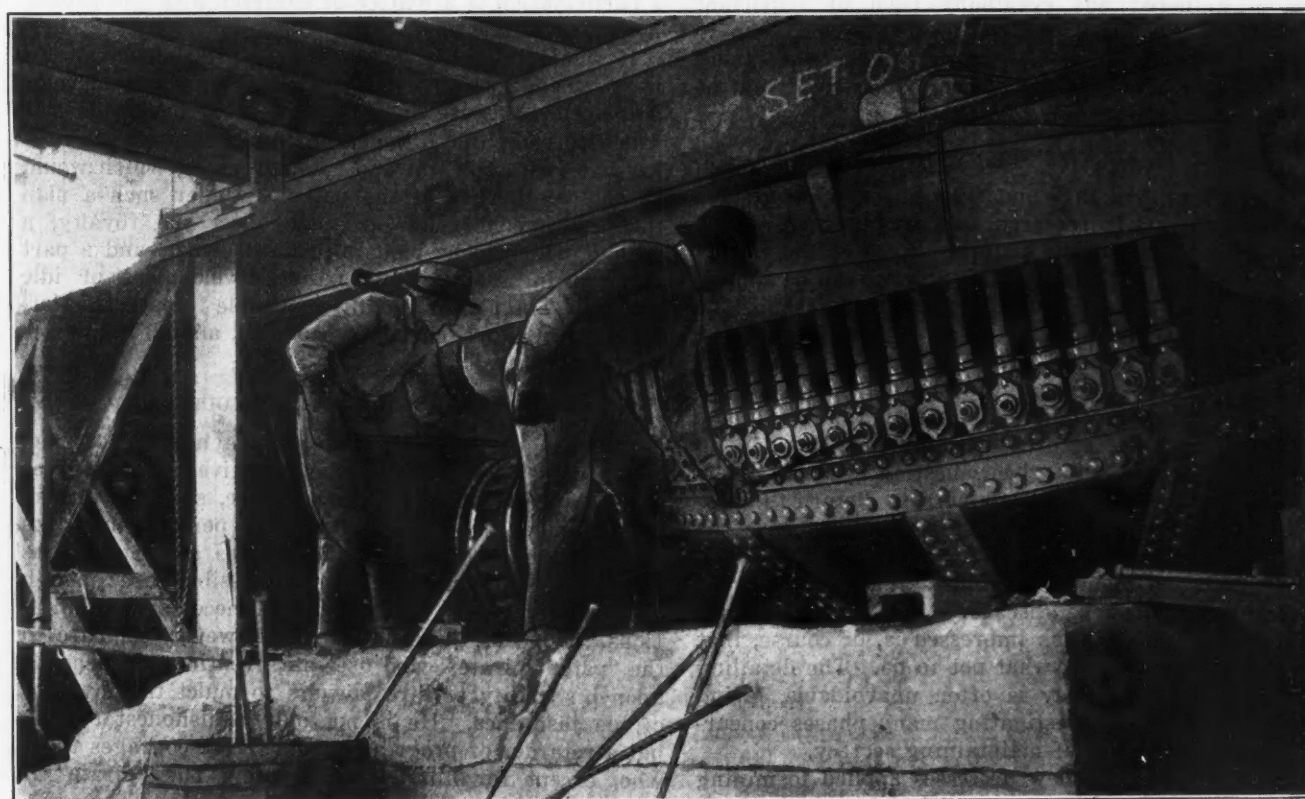
TWO OF THE FOUR GREAT FALLS TYPE CONVERTERS, 12 FT. IN DIAMETER. IN USE AT ARIZONA COPPER CO. SMELTER AT CLIFTON



CONVERTER DEPARTMENT OF THE COPPER QUEEN SMELTER AT DOUGLAS, ARIZ.



BASIC CONVERTER AND CASTING FURNACE AT THE OLD DOMINION SMELTER AT GLOBE



PUNCHING TUYERES IN A GREAT FALLS TYPE CONVERTER AT THE CALUMET & ARIZONA PLANT

The Value of Research in Mining and Metallurgy

Public Interest Held To Be Promoted If the Patent Law Were So Amended as To Permit Government Bureaus To Develop and License Valuable Inventions—Flotation And Dry Concentrating Methods Afford Wide Field of Opportunity for Investigation

BY SAMUEL H. DOLBEAR

Written for *Engineering and Mining Journal*

THE VALUE of intensive empirical research was conclusively demonstrated during the Great War. The work of the Naval Consulting Board, the National Research Council, the Bureau of Mines, and other investigative bodies was not, of course, entirely empirical in character. Nevertheless, the importance of such procedure has been determined definitely. Empirical investigations must, of course, have as their basis a scientific foundation to make them worthy of material consideration, and even then their importance is likely to be limited largely to the human element, and if the investigator does not possess the "inventive faculty," as well as scientific qualifications, the value of much of the work will be lost.

The "inventive faculty" manifests itself usually in one of two ways; sometimes the inventor or investigator may possess ability in both of its phases. The ability to discover (or recognize) new things is more characteristic of the academic type of investigator, whereas the faculty of discovering (or recognizing) new uses for things typifies the investigator of the commercial school.

There has been a good deal of discussion as to the worth of purely academic investigations—that is, research of a purely scientific character in which no commercial utility of the possible results is, at the time, apparent. It cannot be gainsaid that much information so gathered has eventually been of important commercial use, but to me it does not seem wise to encourage strictly academic work at a time when there are so many important problems to be solved and so few men engaged in their solution.

WAR STIMULATED SCIENTIFIC RESEARCH

During the years 1917 and 1918, the number of men engaged in scientific research was greater than at any other time in the world's history. Some of the results are of value for war purposes only. Some can be applied to peace-time pursuits and developments. Perhaps the most important achievement was the training of a large number of men as investigators. Unfortunately, that training was probably incomplete in many instances, because the individual investigator had to be detailed to specific features of a problem and had no opportunity to take up a given question, with its diversity in avenues of approach, to learn to discern the procedure most likely to bring results, to experience the disappointments of having to abandon "pet" theories, and to carry on months of painstaking work, only to learn that it must be discarded and new procedure adopted. The lesson thus impressed is, of course, that it is important to know what not to do. The detailing of problems in this way is often unavoidable, owing to the necessity of investigating many phases concurrently, and sometimes of maintaining secrecy.

The development of new processes applied to mining and metallurgy has been accomplished largely by indi-

vidual research and experimentation, and many good ideas are developed no further than the issuance of a patent. No central agency exists for measuring the value of an invention. If the inventor is successful in marketing the patent, or the product of the invention, it may come into general use. This is a long and often discouraging task, and if the effort fails, industry may be denied an important improvement in practice. Without doubt, the Patent Office conceals a great number of ideas and improvements in all lines of industrial achievement which would be adopted in practice if they were generally known.

The U. S. Bureau of Mines could render a service of the greatest value by the organization of a special branch of the Bureau to investigate and report upon patents relating to mining and metallurgy. A patent which has expired leaves the public free to use the invention which it describes, and development and demonstration by the Government would constitute a public service, the value of which would not be limited by royalties. On the other hand, progress in the mining industry should not be permitted to lag behind seventeen years merely because an invention is the property of the patent owner, and because a part of the benefit of its use will accrue to the owner. If the public has been instrumental in the development of a patent, the public must derive the benefit of its own participation. Such a participation is a matter of contract with the patent-holder, or of law.

It would be in the public interest if the patent law were amended to permit the Government to develop and license the use of an invention, if the owner has failed to show due diligence within a limited period—say five years or eight and one-half years, which would be half of the life of the patent. Under such a plan the Government could fix and collect the royalty, a part of which to be paid the patent owner, and a part retained in a fund for further development of idle patents. The plan is equally applicable to patents relating to agriculture, chemistry, textiles, and all industries and arts generally.

INVENTION SHOULD BE ENCOURAGED

As it is desirable to increase the number of men engaged in research work, the incentive must be great enough to attract them. The picture, so often drawn, of the poor inventor starving in penury amid his wonders, and the tales of the Morses and Stevensons ridiculed as dreamers of the impossible, are enough to discourage many who possess the necessary qualifications. None of these deterrents, however, compare to the "patent pirate," who uses an invention and depends upon his ability to hire lawyers to mulct the inventor of his just dues. He is not only a dishonest citizen, but a retarder of progress, in that he discourages those who, except for him, would create. The "pirate" is responsible for the statement attributed to Thomas A.

Edison, that "a patent is merely a license to fight a lawsuit."

In one conspicuous case, now in court, the patent owners are being called upon to defend themselves against a charge of *conspiracy in restraint of trade*, even after the Supreme Court has determined that their patent is valid. The patent law specifically provides the owner of a patent with a monopoly for a period of seventeen years, during which time he, and he only, can fix the rate of royalties or other conditions under which the patent may be used by others; and the principle is the same, whether the patent be worth \$10 or \$10,000,000.

The field for research in mining and metallurgy is an excellent one. Any new method or apparatus which will lessen the cost of production or increase the recovery, thus rendering available ores or products which cannot now be saved, is of the utmost importance. Mining is an operation against a wasting asset, and when the richer deposits have become exhausted, either the price must increase or means must be found to decrease the cost of production.

To attempt to set down the great number of opportunities for improvements in mining and metallurgy would occupy much space. In a general way the development relates to either the means of finding, removing, or treating ore. It is not generally known that considerable work has been done on attempts to locate orebodies, not visible at the surface, by other means than mining exploration and diamond drilling. One patent recently issued claims not only to locate the position of the orebody but to give data regarding its size, by the audio-frequency of a circuit applied at various points in the vicinity of the deposit. So far as I know, no attempt has been made to measure the continuity of an orebody between two points of exposure—as between two diamond drill holes—by placing the ore exposure in circuit and comparing the resistance in the ore to that in the adjacent wall rock.

Development of cheaper explosives is desirable, for it would lead to the development of an apparatus capable of mining ore without explosives, and delivering it to the mill in pulverent condition. The use of conveyors underground is little practiced, though desirable in many operations, both on levels and in stopes where the floor is flatter than the angle of repose.

Eventually, advantage may be taken of the potential horsepower of rock descending through chutes. The use of steel and concrete in place of timber in mines is increasing, although one does not yet hear of concrete square sets. Power shovels have replaced hand shovels in many mines, and it seems probable that eventually these will be made smaller and more flexible for general use.

POTENTIALITIES OF SELENIUM IN METALLURGICAL OPERATIONS

The field of research in metallurgy is greater than in mining. If the volatilization of metals can be made commercial, as suggested by Dr. Cottrell, an almost complete revision of our smelting practice is likely to follow. The use of selenium or other light sensitive substances has not yet been applied to concentration, although it is reported to act successfully in sorting coffee beans, advantage being taken of the difference in color of various beans.

Many ores possess colors by which they can be readily distinguished from accompanying gangue matter;

furthermore, crystalline materials usually reflect light; earthy substances do not. Ore sorting might also be accomplished by the selenium method, and perhaps also through the fact that many ores are better conductors of heat and electricity than the gangue.

The principles of flotation are still imperfectly understood. It has been suggested that flotation may ultimately be accomplished without reagents. Possibly a saving in power necessary to accomplish flotation could be effected by causing falling pulp to entrap a part, if not all, of the air necessary to flotation.

A large number of dry concentrating methods have been tried, but none, with the exception of the electrostatic process, has been successful for general application. Their failure is usually due to their inability to function with what might be called "dry slimes"—that portion which corresponds to the slimes of wet concentration.

The scientific accomplishments of inventors have always been a large factor in the world's progress, and the men who possess the necessary talent in this direction should be encouraged to "carry on." The accomplishment in itself may be sufficient reward to some whose philosophy in life is altruism, but most inventors are quite as much disciples of the dollar as men in other walks of life, and monetary reward is an important, if not the most important, incentive. Conspicuous instances in which the inventor has reaped handsome rewards give the necessary impulse, both to the inventor and to the required financial assistance which he is likely to seek.

Adapting the "Blimp" to Mining Operations

The Great War created a demand for airplanes and dirigibles capable of carrying a considerable weight of death-dealing bombs and other war material. With the coming of peace, the progress in aeronautics was speedily turned to account in the establishment of airplane mail routes and the construction of large passenger-carrying planes.

The industrial utility of service through the air has become increasingly apparent in the last few months. Reports are at hand of the establishment of airplane service in British Columbia and the Great Northwest country, to aid in prospecting and development, and the January number of the *Mining and Oil Bulletin*, published by the Chamber of Mines and Oil, of Los Angeles, Cal., details the enlisting of the "Pony Blimp" to transport men, materials, and mineral products to and from regions difficult of access by the older transportation methods.

Chrome Mining in Quebec

Through a condition which made necessary the condensation of many of the articles published in *Engineering and Mining Journal* of Jan. 22—the Annual Review Number—an important statement was omitted in connection with W. J. Woolsey's article on Quebec. It was stated "The present status of the chrome industry shows an improvement." This should have read "The present status of the chrome industry shows an improvement over the 1900 period by reason of the fact that the present producer and consumer are identical, whereas in the former period the ore was sold in the open market. The future of the industry, however, will depend on the future shipping base for foreign ores."

The Oriskany Iron Ores of Virginia

The Importance of These Replacement Deposits Has Been Much Exaggerated, Although With Decreasing Coke Prices the Desirability of Virginia Iron Ores, Which Are Low Grade and Washable, Will Increase Locally.

BY SAMUEL E. DOAK

Written for *Engineering and Mining Journal*.

EFFICIENT INDUSTRIAL UTILIZATION of the Oriskany iron-ore deposits of Virginia has been retarded for many years by erroneous conceptions respecting their size and quality. Thirty years ago, they were assumed to be stratified beds, extending for long distances with fairly uniform cross section. Now they are definitely known to be replacement deposits, occurring in minable quantity only where several favoring circumstances are in conjunction.



BOTTOM OF INCLINE AND MOUTH OF TUNNEL AT LOWER LEVEL OF ORISKANY MINE

Despite complete and satisfactory papers, describing the origin and occurrence of these deposits, by R. J. Holden, E. C. Eckel, the late J. E. Johnston, Jr., and others, reports based upon the original assumption of their origin are still in active circulation, and it is always difficult, and frequently impossible, to persuade the owners of properties that their reserves are not comparable to those of the Lake Superior district. It is by no means unusual to receive prospectuses offering investments in these mines in which not only are the deposits described as stratified, but tonnages are claimed that far exceed the total output of the entire Oriskany district to date, notwithstanding that many of the best properties have been worked to exhaustion. Such super-optimism (to phrase it charitably) has hurt the district greatly, and has tended to obscure whatever real value it possesses.

PROBABLE DEMAND FOR VIRGINIA ORES

There is still sufficient Oriskany iron ore in Virginia to justify a few words concerning its occurrence, especially as it continues to be the subject of ignorant exploitation. There will probably always be a strong demand for foundry pig iron made in Virginia from local ores, and for this reason these deposits have a greater interest than their extent and richness warrant.

The ore derives its name from the Oriskany sandstone, which it usually underlies, and which it occasion-

ally enriches sufficiently by impregnation and replacement to justify extraction. The principal deposits, however, occur as replacements (and cavity fillings) in the upper beds of the Helderberg (Silurian) limestone, to which the iron in solution has been carried by meteoric waters descending through the highly ferruginous Romney (Devonian) shales. For the formation of rich deposits of any size it is essential that there should have been free circulation of water through the shales, with easy access for the iron-bearing solutions into pure beds of limestone. Conditions favorable to quantity deposition have evidently been lacking far oftener than not. It is frequently possible to form an estimate of the size of the deposit from the surrounding topography, which is probably essentially the same now as during the period in which the orebodies were formed.

EXPLORATION BY DRIFT AND PITS MOST SATISFACTORY

To convert these deposits into pig iron with the greatest economy it is necessary to know approximately what may be expected of them. From the standpoint of quantity it may be said that a deposit of 1,000,000 tons is above normal, and one of 10,000,000 tons has yet to be found. Accurate tonnage estimates are not possible until development work is far advanced. Core drilling has never been successful, for various reasons, and prospecting is best carried on by drifts and pits,



OLD CHARCOAL FURNACE IN VIRGINIA

with all their limitations. It is rather definitely established by experience, however, that the average depth of a large deposit is about 300 ft. on the dip, with a maximum of 700 ft., and that the average width of the ore is about 20 ft., with a maximum of 100 ft. The length of the body may usually be estimated quite closely after careful surface prospecting.

This ore is not mixed with as much clay as the other brown ores of the South contain, and it is safe to assume that 15 cu.ft. in place will yield a ton of clean ore. If these figures are kept in mind those interested in the development or utilization of the Virginia ores will be less likely to be deceived respecting the tonnage

of a deposit. It is well to remember that the greatest length along the strike is usually reached at or near the surface, and, above all, that the majority of deposits encountered are too small to be of commercial interest, excepting where they are close to either furnace or shipping point.

From the standpoint of quality, it may be said that the ore can usually be mined with sufficient care to average (after washing) 42 per cent Fe and under 22 per cent SiO_2 . Two or three mines in the district have produced a higher grade of ore than this over a long period, and there are several that have never attained the grade indicated.

SEPARATION OF QUARTZ FROM ORE PRESENTS PROBLEM

The chief impurities are clay, flint, loose sand, and quartz, the latter in the form of rounded grains intimately intermingled with the ore and iron-stained. The first three can be easily removed, but no economical method of separating the ore from the fourth has yet been evolved. To obtain a fairly complete mechanical freedom for the ore, the run of mine would have to be crushed through 10 mesh. Ordinary gravity methods fail to separate the ore from the quartz in this crushed product, chiefly because the latter is rounded, whereas the ore is comparatively flat. A fair separation can be made electrostatically, but the cost is prohibitive.

The most satisfactory method devised up to the present for preparing this ore for the furnace is to screen it over a grizzly with from 2-in. to 3½-in. openings, hand break and hand pick the oversize (which will usually run from 2 to 6 per cent higher in iron than the fines), and run the undersize through log washers. The oversize is ready for the furnace without further treatment. Hand breaking of the lump is more satisfactory than power crushing, as it necessitates careful inspection and results in better picking. The ore is broken into comparatively small size at the mines, and one man with an eight-pound hammer can break and pick about one and a half tons per hour on the tippie. If wages in Virginia ever reach Northern levels the hand breaking will have to be discarded. The oversize from a 2½-in. grizzly will average about 25 per cent of the total clean ore, provided the customary mining methods of the district are followed.

FINE ORE LOST IN WASHING OPERATIONS

The undersize from the grizzly is put through log washers with fine sand screens (about 16 mesh) at the head end. The clay goes out in the log tailings and the loose sand is removed by the screens. Considerable fine ore is lost with the sand, and occasionally it is advantageous to remove the screens and save all the product from the head end of the logs. The operation is completed by hand picking, unless there is a large amount of flint in the ore, in which event it is sized and jigged. In addition to removing the flint the jigs will take care of any clay that is too coarse to be washed away in the logs.

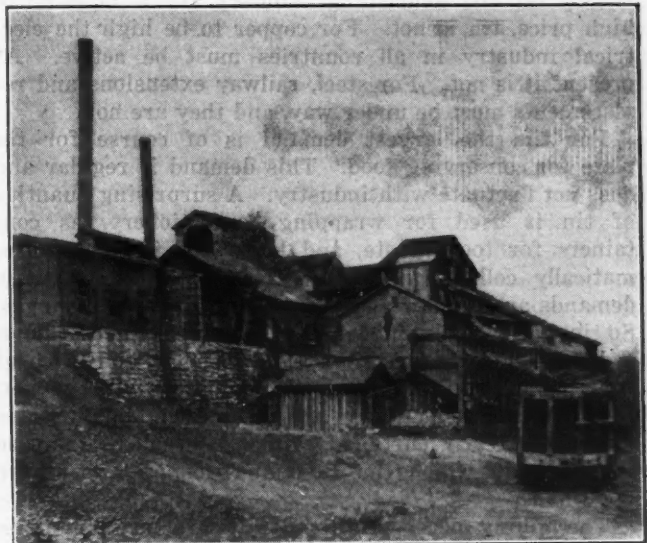
SELECTIVE MINING OF ORISKANY ORES NOT DIFFICULT

This series of operations will raise the iron content of the ore from 1 to 4 per cent, depending upon its character, but even when chemical analysis fails to show a reasonable enrichment the fine ore must at least be put through the logs. Failure to wash it at all is felt at once in the irregular working of the furnace. Ore that cannot be brought up to the desired

quality by the methods outlined must be left in the mine. This can usually be done with little trouble, as the leanest ores are generally along the hanging wall, and probably represent the hanging-wall sandstone which has been impregnated but not completely replaced by the ore. Along the foot wall there is less silica as quartz grains, and more flint and clay.

From the foregoing it will be seen that at best the Oriskany deposits are low-grade iron ores, occurring in comparatively small masses, but despite this they have for several years been the chief source of local ore for the Virginia pig-iron industry, and, as it is probable that they will continue to occupy this position for some time, they should be discussed in the light of the best and most recent information concerning them.

For the last few years the high price of coke has made it cheaper to smelt Lake ores in Virginia than the native ores, but as the price of coke decreases, a



ORISKANY IRON-ORE WASHERY IN VIRGINIA

point is reached where the reverse is true, and no Virginia furnace can operate continuously and successfully over a long period unless it has its own local ore supply.

In addition to several known deposits of Oriskany ore with a considerable tonnage blocked out, and to a few promising prospects that have been temporarily stifled by over-exploitation, there are several localities that may contain untouched deposits of some size, but it is the part of wisdom to look with suspicion on any claims for tonnages running into the millions, and at the same time to realize that acceptable profits have been and still can be made on these properties, provided their limitations are thoroughly realized.

Action of Acids on Concrete

Most acids have a deleterious effect on concrete, combining with lime to form corresponding calcium salts, says *L'Industrie Chimique*. Sulphuric, hydrochloric, and nitric acids, among the inorganic, and acetic, tannic, lactic, and butyric, of the organic acids, are most marked in effect, especially if the acids be concentrated. Soda, potash, and ammonia, when pure, do not affect concrete, nor do mineral oils which are derived from the distillation of coal.

The Future of Tin

Has Farther To Go To Reach Zero Than Lead, Iron, Copper, or Zinc—"Foolish-Metallurgy Reserves" Are Also Much Greater

BY MARK R. LAMB

Written for *Engineering and Mining Journal*

WITH the prices of all the metals going down, down, down, the safest mine to buy is of the metal which is furthest from the bottom and has the greatest *foolish-metallurgy reserve* (my discovery—copyrighted and patented).

Less than ten years ago, tin was about £100 per long ton. Today it is £170. A year ago it was £400 per long ton. It is much further to zero from 33c. a pound than it is from 4½c. a pound for lead, 2c. for steel, or 13c. a pound for copper.

Whereas copper, lead, steel, or zinc are dependent largely on one flourishing industry for a maintained high price, tin is not. For copper to be high the electrical industry in all countries must be active. At present it is not. For steel, railway extensions and replacements must be under way, and they are not.

For tin, the largest demand is of course for tin plate for conserving food. This demand is regular and does not fluctuate with industry. A surprising quantity of tin is used for wrapping confectionery, as containers for tooth paste, and lately for the new automatically collapsible marmit for mustard. All these demands are regular and not subject to violent changes. So tin, while coming down, comes slower. Furthermore, a much smaller proportionate lowering in the price of this metal reduces output as compared with copper. Already the production in the Federated Malay States has been greatly curtailed, with a consequent increase in the ratio which the Bolivian production bears to the whole.

The mining methods in the Straits are very primitive, and though some dredges are in operation, most of the tin concentrate is produced by the individual placer miners. This method leaves little chance for individual improvement, but *does* constitute an important *foolish-metallurgy reserve*. So soon as dredges definitely replace hand labor, further lower-grade areas can be worked at lower prices. The important producing mines of copper, lead, and iron have no such metallurgy reserves. The tin mines of Mexico have been neglected and not worked for so long that their metallurgy reserves have increased greatly. These mines have never seen a ball mill or a Dorr classifier.

The Bolivian tin mines have a valuable reserve of this kind, but as a result of the work of such men as Söhnlein, Grondijs, and Bliet, backed by capital and intelligent directors, this reserve is being converted into dividends.

The copper industry had profited so exceedingly during the war that the new generation of bankers, ignorant of rather recent history of the metal, were easily interested in the red metal as a basis of credit loans. Of course "the price could not drop below 18c.," but when it did the credits froze, and large copper operators were placed in an uncomfortable position and were unable to meet obligations. They are still in the same position. A few banks tried lead, zinc, and steel with similar results. Tin has not been such an unsatisfactory basis for credit, and recent bank requests to me for detailed reports on tin generally have been interestingly

on the increase. It is a pleasant variation to be able to be optimistic regarding a metal.

It is true that the Guggenheims have an important force of men in the Straits and a larger staff in Bolivia. Their shipments of machinery and supplies to Bolivia frequently run into six figures monthly. A short but excellent road and many buildings besides metallurgical equipment will require much time and money for their completion, and the production of tin will be delayed at least for a year and probably for two years, so that the effect on the price of tin need not at this juncture be discounted.

Incidentally, these mines of the Guggenheims will constitute an excellent school for tin engineers. The family will follow its usual procedure and spare no expense in getting the best possible metallurgical results. This will require more than the usual number of engineers, on account of the altitude. The engineering turnover will be more, even, than at Braden or Cerro. It will also require more than the usual accommodations for the staff, as irascibility increases at the rate of 20 per cent per 1,000 ft. above 10,000, and the Caracoles mines reach a maximum of 18,000.

There are no apparent immediate new sources of tin and no means of increasing production except by opening new mines or by developing old ones. Bolivia has not been prospected in the sense that the word is used in the mining states, but it has been pretty well walked over by Indians who know tin and silver, and new mines are harder to find than old ones.

Several important districts have been completely neglected, such as Berenguela, Potosi, and Chorolque, but these *foolish-metallurgy reserves* will be worked in time.

Tin offers the best and safest mining investment today. Competent metallurgical advice is now available, as it was not ten years ago. A good price for the metal is more assured than for any other metal. The present price is 100 per cent above cost of production in the average ore mine in Bolivia, and, finally, the *foolish-metallurgy reserves* are higher than those of any other metal. Mining laws in Bolivia are good and litigation is far less to be feared than in Butte.

Glass Sand Used in the United States

Sand forms from 60 to 75 per cent of all glass manufactured. According to recent figures of the U. S. Geological Survey a little less than 2,000,000 tons of glass sand was used in the United States in 1919. Fortunately, the domestic supply of glass sand of all grades is abundant.

Grinding, polishing, and blast sands are used to make smooth the rough places on metal, glass, stone, and other hard substances. Blast sand is clean, tough, sized sand, composed of either round or angular grains, which is driven by compressed air through a hose for such purposes as cleaning metal castings and dressing stone. In gun shops, locomotive and car shops, and most other places where heavy metal castings are made, the sand blast is used to clean off parts of the mold that adhere to the castings. The size of sand used differs according to the character of the duty and the nature of the operation that it is to perform.

Fire or furnace sand is highly refractory silica sand for lining furnaces and ladles used to contain molten metal, and so has a place in all foundries. About 500,000 tons is used annually in the United States.

BY THE WAY

Pro Bono Metallurgico

i wisht you wuld protest agenst the growing use of whats commonly called tabbles insted of jigs in mills. i am unprejudist because i can oparate any kind of jig. compared to a good jig tabbles is just as useless in a mill as they is in other places since this what they call prohibishun comes in. the tabble makers is getting bolder all the time to. why the other day i heard one of these here wiffly men say that a good ruffian table wuld do all that a jig wuld do an do it better. its a cinch he had never went to australia or he wuld no better. then theres the plato tabble. the gink that makes that is so durned ignorant that he dont no how to spell platteau. that deester overstrom tabble is another one. the overstrom is foreign for over streme meaning the streme flows over the tabble when it shuld be going thru a jig either the hancock or harts i can operate all kinds. they say they make that there overstrom tabble dimond shaped so it wont have no waste space. i suggest that they cramp that dimond out still flatter sos it will be a strait line and then there wont be no waist space a tall. the other day i seen what someone i suppose jokingly named a card tabble. the gy that invented that was a card alright alright. the mills today are getting so unparticular that they are putting in card tabbles and even butcher tabbles too. i suppose they get these butcher tabbles on acct. of their artistic curved lines but art has no place in a mill i say and a good reliable stanch hancock jig works more business like. i am good with the harts to. why an hell the man that makes what he calls the james tabble (named after his butler) wants to make it for i cant see because he makes jigs to but i suppose he has some fools for cusstomers. the funniest of all is what someone had the effruntery to call a universal tabble which stands up on its toothpick legs and shimmys without anything to make it shimmy but a pully wheel which someone used a broken mold for in casting so one side of it got cast sollid full of mettle. these tabbles as i have intimated is all fakes and offers a fertile field for your metallurgical idiottorial department compared with jigs. i remain,

b. slopover.

p.s. i resently invented a new tipe of jig which makes the hancock and harts and richards jigs tho all was good in their time obsolete.

b. s.

Buried Treasure

Some years ago it was suspected that a murder had been committed near Racine, Mo., in the Tri-State zinc and lead field, and by order of the county attorney an entire tailing dump was moved in the expectation of uncovering a body. This search, which was fruitless, may be simulated at Picher, Okla., according to latest reports. It seems that some months ago two bootleggers, hotly pursued by officers, cached several cases of high-grade whiskey in a pile of tailings at one of the Eagle-Picher Lead Co.'s mines at Picher, with the intention of recovering it the next night. The following day, however, the tailing launder was turned and many tons of tailings piled on the cases. The owners found themselves unable to recover their cache without

making more of a fuss than they deemed advisable. Accordingly the whiskey was allowed to remain and is still under the tailings, in spite of many independent searches made in the quiet of the night. No one is willing to go after it openly lest the county prohibition officers should seize it if recovered.

Regarding Apex Suits

"Been readin' lately, m'son," said Cap'n Dick, "some o' these 'ere strong h'arguments bein' passed forth an' back by tha h'experts h'as to w'en a lode is a lode, w'en a lode is nothin' moore'n a h'ordinary vein, an' w'en a lode becomes a 'ole bloody mountain, you, with 'eaven for tha 'angin' an' no foot wall this side o' 'ell's pits. Remin's me o' tha time Jim Trembath wuz h'employed h'as a witness h'on one o' they h'apex suits h'on tha Mother Lode. Jim 'ad worked in that camp for years 'pon years, an' 'ad once 'elped to sink a bit o' a shaf' 'pon a certain vein w'ich one set o' h'experts naow claimed as tha h'apex. But Jim were 'ired by tha h'other side, an' though 'e were'nt no h'expert, 'e nawed well 'nough w'ich side 'e b'longed workin' h'on. So w'en 'e wuz h'asked to describe this 'ere shaf' an' vein, 'e sez, 'She's as pretty a shaf' as h'ever a man put win'las to; straight h'away for two 'undred feet; h'eight by ten sets, with sawed laggin' set snug an' fitty.' 'Describe tha vein,' sez tha lawyer. 'Well, mister,' sez Jim, 'some men might call un a vein. But, min' you, I 'elped put daown h'every bloody foot o' they shaf', an' it h'appeared to me like h'as if we 'ad no bloody vein at h'all 'pon surface. Then she pinched smaller an' smaller h'as she went daown.'"

Isn't Nature Wonderful

A correspondent in describing prospective petroleum developments in the Pouce Coupe district, in the Peace River country, repeats the story of a resident of that region to the effect that along the rugged canyon of the river there is a natural cup in the shale formation from which there gushes, at intervals of about ten minutes, with the regularity of a heartbeat, a small quantity of petroleum. We presume that volcanic fires distill the stuff deep hidden far below, and that storage facilities have been provided by nature or soon will be supplied by the first man that can get a barrel into the district—or make one. Nothing is said of the by-products, but they are doubtless accumulating. When the Mother Lode in California was discovered there was printed a tale of a wonderful gold occurrence over a fumarole, which periodically heated up the formation, causing the casting in a tiny fault of an ingot of pure gold, which was removed for years regularly by the lucky prospector who watched the operation. The gnomes who practiced this ancient metallurgy appear to have gone North.

Giving Subscribers Their Money's Worth

We note that the London *Mining Journal* publishes a theatrical section, by following which mining engineers in the provinces may be kept advised of the latest dramatic successes along the Strand, and thus be able to order their tickets in advance when visiting the home office. Truly, this is Service Plus. The suggestion was broached that we do the same, but the rivalry as to who should become the dramatic editor threatened to disrupt the staff, so the idea had to be abandoned. Or possibly we might better serve our subscribers by running a list of local bootleggers. Lack of space, however, forbids.

HANDY KNOWLEDGE

Dodges Useful in Surveying*

BY H. L. THACKWELL

THE following dodges are listed for the benefit of those who may find them useful. The writer has used all of them with one exception, that in No. 3.

1—HOW TO GET ALONG WITHOUT BACK-FLAGMAN

In the West a surveyor is frequently called upon to survey a ranch or homestead, and, upon arriving on the ground, finds that, although plenty of assistance had been promised for the work, only the client and his small boy present themselves. They would act as rodman and a x e m a n respectively.

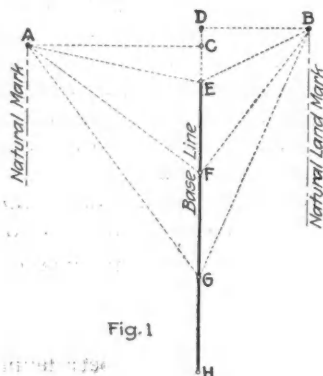


Fig. 1

How to get along without a back-flagman is illustrated in Fig. 1. The point of origin of the survey is at *E* and the survey is to be run in the direction of *EG*. Lay off the base line *EF*. Pick out two conspicuous points in the landscape, *A* and *B*, one on either side of the line to be run, and choose them with respect to their visibility and ease of bisection. Triangulate these points and compute the distances *AC* and *BD*, also *CE* and *DE*. Set up the transit on *E*, foresight on *F*, and set a point *G* on line. Then measure the distance *FG*. In the notebook keep a column or progressive distances from the point of origin *E*. Set up the transit on *G*; since there is no back-flagman recourse can be made to either of the natural monuments *A* and *B*, using that one which happens to be visible. Having the distances *AC* and *DB* and the progressive distances *CG* and *DG* the angle *AGC* and *BGD* can be readily computed.

If the landmark *A* is chosen set the angle *AGC* off on the plates, backsight to *A*, turn the plate in the correct direction so that the vernier reads zero, and the instrument is then in line. Proceed in this manner until the sighting points are invisible or the included angles become too small for accurate use, then triangulate two more points and repeat the process.

2—LAYING OFF TRUE MERIDIAN WITH SOLAR TRANSIT

To lay off a true meridian and to find the time with a solar transit the following method may be used:

Guess at the time as nearly as possible by glancing at the sun. With this inaccurate time calculate the declination and make a solar observation. Read the hour-circle and correct the original declination by the new time. Make another solar observation and read the hour-circle again. If there is any appreciable error between the first and second hour-circle readings, repeat the process until there is no further error. The resulting meridian and time will be as close as if the correct time had been used in the first observation.

*Excerpt from *Engineering News-Record*, Dec. 16, 1920.

3—WHEN DAY OF MONTH IS FORGOTTEN

If the day of the month has been forgotten make an equal altitude observation of the sun and establish a true meridian. Measure the angle from the meridian to the sun, also the sun's altitude. Compute the declination of the sun by the formula

$$\cos. Q = \frac{\sin. \text{dec.}}{\cos. \text{lat.} \times \cos. \text{alt.}} - \tan. \text{lat.} \times \tan. \text{alt.}$$

The sign of the first term of the right hand side of the equation is minus when the declination is south; the second term is plus where the latitude is south. If the algebraic sign of the result is plus, *Q* is the angle between the sun and the North point, but if it is minus it is the angle between the sun and the South point. Correct the resulting declination by the hourly distance to obtain the declination at Greenwich. If the observation has been made correctly an inspection of the ephemeris will disclose a declination similar to the computed one, and the date corresponding to this declination is the date of the observation.

4—TO AVOID HIGH HILL IN LINE OF SURVEY

In the mountain districts the surveyor is often confronted by a high wooded hill in the line of the survey. In such a situation it is frequently advisable to triangulate to the top of the summit, thus avoiding delay in clearing the line. To project the line over on to the other side without occupying the summit station go around the hill and triangulate back to the station. Obtain the bearing of the line by solar observation. The original line can then be located by computing the necessary offset from the triangulated station.

5—TYING IN LARGE OBJECTS

When in a topographic survey it is necessary to tie in objects of large diameter, such as smokestacks, monuments, and similar objects, read an angle first to one edge and then to the other. The mean of the two angles will be the angle bisecting the object.

6—SIGHTING BOX FOR TUNNEL WORK

In aligning a tunnel under ground a capital sight can be made by using an old powder box, as in Fig. 2. Cut a diamond-shaped opening in the box and tack a piece of vellum over the opening. Take a section of an old level rod about one foot long and nail it across the top of the box. Take a level-rod target and bore a small hole through it near the circumference and on the horizontal line. Slip the target over the rod with the hole downward, then slide it into position over the center of the diamond shaped opening. Hang a plumbline from the hole

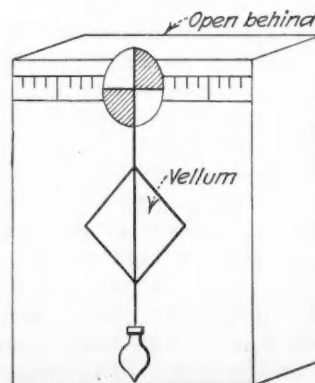


Fig. 2

in the target and place a light inside the box. In the dark the plumbline will show up vividly against the light background. Clamp the target with the setscrew and move the plumbline into the exact alignment by means of the target micrometer screw. This sight can be used to advantage at night for marking a meridian obtained from a stellar observation.

7—SAVING TIME BY ELIMINATING PLANE TABLE

In making topographic surveys a great saving in time can be made by doing away with the plane table and using the following method:

The party should consist of an instrument man, a recorder, and several stadia rodmen. The transitman sets his instrument over a known point and orients it so that the horizontal angles can be taken by azimuth. The recorder, who is provided with a drawing board mounted on an easel, should be seated close to the transitman. The instrument man reads out the observed angles and stadia distances to the recorder, who immediately plots the points on his drawing board. The plotting is accomplished by the aid of a large semi-circular protractor, which is held in position over the station by a needle stuck through its center into the board. The distances and elevations are computed by a stadia slide rule, and the contours are drawn in the field before moving on to the next station.

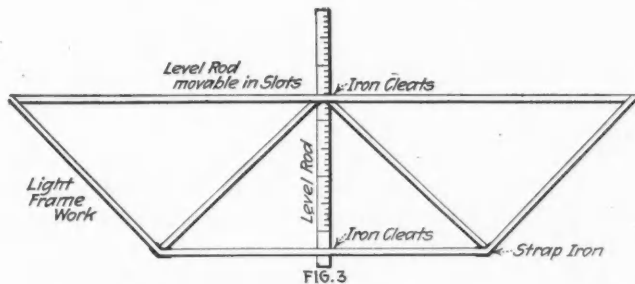
As much as 1,200 acres per day of rolling sagebrush land has been mapped with 5-ft. contours by this method. This system has the advantage in speed over that of the plane-table, and the paper can be kept cleaner than would be possible if an alidade were rubbing over its surface. If an accurate angle is required it can be measured directly by the transit plates, whereas the plane-table method would only give approximate angles.

8—PROJECTING ACCURATE LINES

When projecting very accurate lines over rough country, such as tunnel alignment surveys, it is of great importance to have as fine fore and backsights as possible. If there are any extra transits at hand, set them up over the points and sight at the plumbline with the aligning transit. The foresight can be set very accurately by this method, even though the observer can not see the head of the tack in the stake.

9—MEASURING EXCAVATED PRISMS

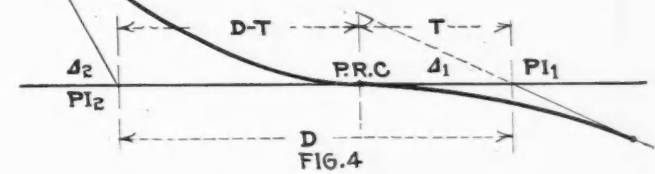
In measuring up the excavated prisms in small canals much time can be saved by making a template, as in Fig. 3. The template should be constructed of light



pine strips, the shape being that of the prism cross-section. The center line of the frame should be provided with slots in which can be placed a standard level rod. Readings can be taken on the rod for grade, and by sliding the template down the rod the size and shape of the prism cross-section can be accurately checked.

10—PIPE LINE LOCATION ON HILLSIDE

In making a location survey for a pipe line along a tortuous hillside it often happens that the distance between two P.I.'s is so short that a reverse curve must be used. Make both curves of equal radii, so that the pipe will have the least curvature. The following simple formula will solve the curve, Fig. 4:



$$T = \frac{D \cot \frac{1}{2}\Delta_2}{\cot \frac{1}{2}\Delta_1 + \cot \frac{1}{2}\Delta_2} \quad R = T \cot \frac{1}{2}\Delta_1$$

In locating a flume line around a winding hillside it is economical to build the flume as close to the convex hillside as possible, and in extreme cases even cutting the hillside and building the flume on mounds. Where the contour is concave build the flume well out so as to give the trestle its maximum height.

The average trestle height should be approximately that which will make the total cost of the line the least. Such a procedure will make the flume of such length that any change in the flume location would increase its total cost. To locate such a line measure the external distance from the P.I.'s of the trial line and by level ascertain the height of the trestle at that point. By reference to previously prepared tables of cost for various trestle heights the economic external distance can be computed.

To Lay Off Degrees With Steel Square

BY JAMES I. BURR

Written for *Engineering and Mining Journal*

To lay off degrees with the steel square: From a table of tangents take the tangent of the angle required, using the first three figures from the left and calling them so many sixty-fourths of an inch. Tables of natural tangents are usually calculated to the radius unit, and are therefore decimal fractions. Multiply each by 1,000, thereby obtaining whole numbers. For example, let it be required to lay off an angle of 10 deg., the natural tangent of which is 0.176327. Multiplying this by 1,000 makes 176.327. Discarding the decimal we have 176, and calling the figures sixty-fourths of an inch we have $\frac{176}{64}$ or $2\frac{7}{8}$ in. The radius 1 treated in like manner makes $\frac{1000}{64}$ or $15\frac{5}{8}$ in. Now take $2\frac{7}{8}$ in. on the tongue of the square and $15\frac{5}{8}$ in. on the blade; the blade gives the angle 10 deg. and consequently the tongue gives 90 deg. less 10 deg., or 80 deg.

Material for Mine Fireproofing

The practical value of cement in mine fireproofing and in sealing off water flow and seepage is well established. Where abundant and cheap, other materials that can be rendered plastic can be utilized to good advantage. Thus, a coating of magnesia cement on mine timbers is reported to be an efficient and cheap protection against fire, particularly under climatic and operating conditions in which timbers and other woodwork become highly inflammable and are expensive to replace. There is in this new application of some of the cheaply mined minerals a promising field for experimentation.

Byproduct Expansion in Non-Metallic Mineral Industries*

BY OLIVER BOWLES
U. S. Geological Survey

IN MANY of the non-metallic mineral industries the waste incidental to producing operations is so great that the expense of handling it is an important item in the production cost, so that the utilization of waste or byproducts is receiving unusual attention at present. The most obvious advantages of such utilization are: (1) Conservation of mineral resources; (2) the removal of waste heaps that in many places obstruct development; (3) manufacture of new and useful products; (4) reduction of production costs through elimination of a large part of the item of waste-disposal expense. In many industries there is keen competition between producers of various products used for the same purpose, so that advantage will accrue to the manufacturer who is able to reduce his production costs.

The recent development of various types of artificial roofing has adversely affected the slate industry; but if by the development of byproducts the cost of slate production could be materially reduced, this industry might be able to compete successfully with substitute products. In the slate industry, the proportion of waste is remarkably high, in some places exceeding 90 per cent of gross production. The North Wales Development Co., Ltd., of Bethesda, Wales, has developed a series of waste slate byproducts that promise to utilize profitably the great volume of waste material in that region. The waste is said to have been used satisfactorily for the manufacture of pottery and tiles, samples of which are on exhibition at the company's office. Waste slate is also pulverized and graded in powdered form from 20 to 200 mesh or finer; the finest powder is air floated and collected with a Sturtevant fan dust collector. This dust is marketed under the trade name of "Myrttox," and is used chiefly as a filler in abrasive soaps, rubber, asphalt, paint, flooring and similar applications. The most important byproduct is brick, whose production is about 10,000 per day.

During 1920, the Bureau of Mines conducted an inquiry with reference to the development of slate byproduct industries in this country. Many samples of slate flour were sent to prospective users for laboratory tests, and reports received so far indicate that it can be used to advantage as a filler in asphalt-road mixtures, molded rubber goods, and other products.

In the granite industry there is considerable waste, particularly in monumental granite areas, where the proportion of waste is almost as high as in slate quarries. As crushed granite is an excellent road material, the enlarged program of highway construction offers a promising outlet. In the St. Cloud granite district of Minnesota, a large crushing plant has been built to utilize for state highway construction the tremendous waste heaps in that locality. It is reported that in Vermont, crushed granite is mixed with lime, molded, and hardened by pressure into bricks, which are similar to sand-lime brick and are said to be excellent for structural purposes. Much of the waste in monumental granite districts could be utilized in the manufacture

of building and paving blocks; many granite masses containing defects that render them unfit for monuments would be good material for structural uses or street paving.

In the mica industry, waste is utilized in the manufacture of ground mica. There is, however, the possibility of byproduct development in the mining process. Mica occurs in pegmatites, which consist chiefly of feldspar and quartz; possibly much of this feldspar could be utilized in the ceramic industries. Where the feldspar is intimately associated with the quartz, the two minerals might be pulverized together, forming a material similar to the English "Cornwall stone"; in any event a considerable percentage of quartz is permissible in commercial feldspar. The fact that certain mines in North Carolina formerly worked for feldspar are now worked for mica indicates the feasibility of operating the mines for the twofold purpose of producing mica and feldspar.

Waste marble is used to some extent for riprap, for terrazzo flooring, and for agricultural purposes. The latter use could be greatly extended. Marble waste is also pulverized and sold as marble flour. For certain purposes, this has been successfully substituted for imported whiting. In an attempt to discover profitable uses for small pieces of marble, two companies, independently, have recently experimented with a process of facing concrete blocks with small slabs of marble.

In many limestone centers, there is a great waste of screenings or other unsuitable stone that could be utilized for agricultural purposes. A large part of the price paid by the farmer for agricultural limestone is for the freight charges. A map showing the potential sources of supply of byproduct agricultural limestone and their relation to land areas in need of lime treatment would indicate the most convenient source of supply from which ground limestone could be obtained at a minimum transportation expense. A fluorspar company, in Illinois, recovers calcite from the jig tailings and pulverizes it for agricultural limestone.

In the talc industry, waste could be utilized by manufacturing a greater variety of products at individual plants, for thus material that is unsuitable for one use may be utilized for another. Though nearly all the off-color and impure talc now mined in the United States is wasted, in South Africa and Germany such materials are manufactured into special products, which have found a ready market.

These examples of possible or actual byproduct utilization in the non-metallic mineral field indicate the possibility of a much wider development of such enterprises. Undoubtedly mineral producers are awakening to the fact that, with present high costs of labor and equipment, as small a proportion as possible of the materials produced should be thrown on the dump and abandoned. Producers are beginning to realize the great need of more energetic investigation and experimentation, and the more progressive companies are ready to co-operate heartily with any reputable agency attempting a solution of their byproduct problems.

*Abstracted from the *Transactions* of the American Institute of Mining and Metallurgical Engineers.

THE PETROLEUM INDUSTRY

Petroleum and Asphalt in Venezuela*—II

BY ARTHUR H. REDFIELD

Written for *Engineering and Mining Journal*

THE PARIA DISTRICT comprises the coastal belt of the Gulf of Paria from the northern part of the Orinoco delta to the Peninsula of Paria, an area roughly seventy miles long and thirty miles wide. To this may be added the coastal belt and outlying islands from the Peninsula of Paria as far west as Barcelona, where oil seepages occur in local areas.

The oldest rocks exposed in the Paria district are the pre-Cambrian gneisses and schists which form the backbone of the Peninsula of Paria. In the metamorphosed sediments which accompany these a few Ordovician fossils have been found; but in general the oldest determinable rocks of this district are Cretaceous.

In the Paria district the Lower Cretaceous begins near Cumanacoa with a thin-bedded dark-blue limestone accompanied by a black, thin-bedded quartz-schist. Above this formation is a gray limestone, succeeded by a bluish limestone, similar to the Barbacoas limestone of the Maracaibo district. The oldest beds of this limestone alternate with a dark shale, and, more rarely, with red sandstones. Sandstones are indeed rare in the Lower Cretaceous; their place is taken largely by dark quartz-schists. The clayey rocks are not as abundant as the limestones and quartzose rocks. They lie in some places as hard, dark, schistose rocks in alternation with the limestones and quartz-schists of the Lower Cretaceous, and in places in the form of yellowish beds between the limestones on the contact between the Lower and Upper Cretaceous.

A series of yellow calc-schists follows, alternating with marl, slates, and clay shales. Upon this series rest blue-gray cavernous limestones (compact and uniformly blue in the mountains of Cumaná), identified by thin fossils as Upper Cretaceous, in alternation with white micaceous sandstones which contain no fossils. The sandstones, colored red or reddish-brown where they outcrop at the surface, increase in thickness toward the upper part of the group. Alternating with the most recent beds of the sandstones are red or brown-spotted clay or marl shales, which cleave into parallelepipedal fragments. In the neighborhood of the shales, the limestones cleave more readily.

The post-Cretaceous formations, which occupy the llanos from Araguá, Punceres, and Pilar southward to the Orinoco and eastward to the ocean, as well as in small coastal areas near Cumaná and Araya, have not been differentiated with certainty. These formations, overlying the Cretaceous unconformably, are correlated by Wall with the Newer Parian group of Trinidad, which ranges from the early Tertiary possibly into the Quaternary. A dominantly calcareous series, corresponding to the Tamana and lower series (Eocene to

Miocene?) of the Newer Parian, has been recognized in the coastal areas near Cumaná and in the Peninsula of Araya. The llano region, however, of Monagas, eastern Sucre, and the Territory of Delta-Amacuro, is occupied by beds apparently equivalent to the Caroni (Miocene?) and the Moruga (Pliocene-Pleistocene?) series of the Newer Parian. These consist prevalently of conglomerates with a ferruginous cement, coarse and fine sandstones, shales, and loose sands, with carbonaceous members.

Still less is known of the tectonics of the Paria district than of its stratigraphy. There have been observed in the Cretaceous rocks a number of minor anticlinal and synclinal folds, whose bearing is in conformity with the general strike of the series; namely, about N. 67 deg. E. In the Guanoco area the strike of the strata was assumed by Sievers as N. 75 deg. E. An anticline is known to occur at Guanoco. Nothing further, however, is reported as to the geologic structure of the area.

INDICATIONS OF OIL AND ASPHALT

Bermudez Lake—The most striking evidence of the occurrence of petroliferous formations in eastern Venezuela is the famous Bermudez asphalt lake, situated near the town of Guanoco, three miles above the confluence of the Guanoco and San Juan rivers. The lake is twenty-five miles from the Gulf of Paria and 105 miles due west of the equally renowned Pitch Lake on the island of Trinidad.

The Bermudez Lake is formed by the overflow of several oil springs on a swamp. It is about 1,110 acres in extent, and varies from 1.9 ft. in thinner parts to 20 ft. in thickness near the seeps. The lake is believed to consist of the residues of an asphalt base petroleum, the lighter oils having been distilled away. The flows are composed of alternate layers of asphalt and fine sand. Crusts of slag and burned asphalt point to fires caused by Indians or by the natural ignition of gases emanating from the lake. The lake is overgrown by jungle and covered with water. Blowholes of gas occasionally occur. Water accompanies them, frequently rather warm and highly impregnated with sulphuric acid.

The asphalt of Bermudez Lake shows upon analysis 64.39 per cent of bitumen soluble in carbon disulphide; 30 per cent of water; 2.08 per cent of inorganic matter, and 3.53 per cent of organic matter. After extracting the water the remainder gives 96 per cent of bitumen and 2 to 5 per cent of earthy matter, with a loss of 2 per cent. Ultimate analysis of the bitumen reveals 82.88 per cent of carbon, 10.79 per cent of hydrogen, 5.87 per cent of sulphur, and 0.75 per cent of nitrogen.

*Part I of "Petroleum and Asphalt in Venezuela" appeared in Feb. 19 issue of *Engineering and Mining Journal*. Published by permission of the Director, U. S. Geological Survey.

The Bermudez asphalt has a specific gravity of 1.06 to 1.08 at 25.6 deg. C. (78 deg. F.). Its consistency at that temperature ranges from 22 deg. to 26 deg. by the Bowen penetrometer scale. Its luster is resinous. It breaks with a conchoidal fracture, softens at 71 deg. to 77 deg. C. and fuses at from 77 deg. to 82 deg. C.

The Bermudez asphalt lake is owned and exploited by the New York & Bermudez Co., a subsidiary of the General Asphalt Co. of Philadelphia, which is also owner of the Pitch Lake of Trinidad.

In extracting the asphalt a dam of slag and waste is built to exclude water, and the water within the inclosed area pumped out. The asphalt is dug out by hand and loaded into cars. These are hauled by cable to the light railroad, which conveys it eight miles to Guanoco. A refinery with a capacity of fifty metric tons a day expels the water. The refined product is then ready to be exported. The United States takes practically all of the shipments of Bermudez asphalt, except occasional small exports to Trinidad.

The production and exportation of asphalt by the New York & Bermudez Co. is illustrated by the following table:

ASPHALT PRODUCED AND EXPORTED BY THE
NEW YORK AND BERMUDEZ CO., 1910-1919

	Production, Metric Tons	Exports, Metric Tons
1910.....	(a)	32,732
1911.....	(a)	48,718
1912.....	(a)	50,050
1913.....	(a)	81,231
1914.....	(a)	57,354
1915.....	(a)	25,364
1916.....	47,201	44,621
1917.....	52,991	48,844
1918.....	46,453	42,850
1919.....	45,932	42,459

(a) No data.

Minor Indications—A second pitch lake occurs in the Pedernales field, at La Brea, on the northwest coast of the island of Capuré. The lake is half a mile in length and 100 to 200 yards across. It is fed by several active oil springs and one asphalt cone. About three-fourths of a mile south of the main deposit are two small cones; additional deposits occur two miles to the northeast. Asphalt deposits are also found on the island of Plata, and at Pedernales.

The Pedernales asphalt deposits were exploited by a German firm for a short time in 1902. The ruins of the German refinery are still visible one mile from Pedernales. Mud volcanoes are reported near Bermudez Lake and in the neighborhood of Maturin.

The Bermudez Co.—The New York & Bermudez Co. (operating under the name of The Bermudez Co.), after a detailed survey by ten geologists, selected, in 1910, under the terms of its concession, nineteen areas of 500 hectares (1,235.5 acres) each near the Bermudez asphalt lake; six areas on the Peninsula of Paria, and four areas on the island of Pedernales.

Development began in 1913. Wells had been drilled on all areas by June of that year. The lands on the Peninsula of Paria were soon decided to be not commercially valuable, and were abandoned. Seven wells, ranging from 200 to 1,100 ft. in depth, were drilled on Pedernales Island. Difficulties with heaving sands, soft mud, and gas pressure necessitated several changes in the method of drilling. Traces of oil were found, but none in commercial quantity. Four areas in the Pedernales field were renounced to the Venezuelan government in March, 1918; nine others were retained for exploration.

Several wells were sunk in the Guanoco area, near Bermudez Lake, ranging in depth from 200 to 4,200 ft. In some a heavy oil of 1.020 specific gravity, almost an asphalt, was found. Such an oil would have to be heated in order to be pumped. No oil of commercial value was obtained. Much geologic investigation was done to find the oil, which was believed to exist here in large quantities. The World War, with the consequent difficulties of obtaining necessary supplies, halted operations during the war period. No new wells were drilled in the Guanoco field during 1919.

All three regions exploited by the New York & Bermudez Co. lie in swamps. Portable tracks have to be laid on trestles. The field camps have been found to be unhealthy; there has been much malarial fever. The headquarters of the company in this region owe their comparative salubrity to their location upon a group of hills.

The Caribbean Petroleum Co.—The Caribbean Petroleum Co. has been drilling in the Chapapotal field, fourteen miles northwest of Maturin, in the State of Monagas, near Chaguaramal, and in the Guanipa field. A road was built in 1917 from the Maturin-Araguá highway to Chapapotal, and a camp established. The field headquarters of the company are at Guanoco. Two wells were drilled in 1918 in the Chapapotal field. The first was abandoned at a depth of 208 ft. after an accident. The second was carried to a depth of 3,231 ft. Asphalt was encountered but no fluid oil in commercial quantity. The exploration work was nearly completed at the end of 1919, with results that do not appear to indicate a commercial value for the deposits.

The Guanipa field lies along the Guanipa River, in the district of Maturin, State of Monagas. During 1917 the area was explored, a camp established, and preparations were made for the development of the field. Two wells were drilled in the Guanipa field in 1918. The first had to be abandoned at a depth of 950 ft., because of an accident to the drill. The second well was drilled without obtaining oil.

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British Columbia Oil Lands Not To Be Exploited by Speculators

SPECIAL CORRESPONDENCE

The Dominion government has given notice of the declaration of a reserve on lands in the neighborhood of Fort Norman, Yukon Territory, that may be presumed to carry oil. This will probably have the effect of discouraging the many prospectors and opportunists who were planning to journey to the Canadian north-land next summer. However, there is no doubt that there will be a considerable rush to the district, where oil was found by representatives of the Imperial Oil Co., notwithstanding the government's mandate, and arrangements already are being made by transportation companies for the accommodation of those desiring to make the trip.

Premier Oliver, of British Columbia, points with some satisfaction to the action of the federal administration as a vindication of his policy. Recently he said:

"My policy is to hold these lands (the oil-bearing lands of the Peace River District, B. C.) and their wealth for the benefit of the whole province and not to hand them over to speculative exploiters. And the crowning piece of approval of our policy is contained in this evening's papers, where you may read that the

Dominion government has followed our lead and declared a reserve on the Fort Norman oil lands. Except that they waited two years while we acted, the Dominion government has done exactly as we did."

Casing Wells in the Salt Creek Field

Recommendations as to the best methods for casing wells being drilled in the Second Wall Creek sand, in the Salt Creek field of Wyoming, and for the drilling of wells in the First Wall Creek sand of the same field, were agreed upon at a meeting recently held at the office of F. B. Tough, Government Supervisor of Oil and Gas Operations, Denver, Col.

In drilling wells in the proved area of the Salt Creek field there was a chance of encountering production in the shale crevices at depths ranging from 200 to 1,200 ft., and for this reason, as well as for mechanical convenience, it was necessary to cement a conductor casing at about 80 feet below the surface, using about ten to twenty sacks of cement. In view of the shallow depth and small amount of water, if any, to be shut off by this string, it is not customary to allow more than twenty-four hours for the cement to set. Of course for such a short time the cement should be placed in as thick a mixture as possible. The casing is to be screw pipe in good serviceable condition. Commonly, this string is 10 in., but not necessarily so.

A smaller string of pipe is then carried through the First Wall Creek sand and approximately forty feet into the firm shale below, at which point it is cemented with sufficient neat cement mixture to extend well above the First Wall Creek sand. The quantity of cement required for this operation varies with respect to the size of casing, the size of hole in which it is set, whether or not caving strata has been penetrated, and other operating factors. An exact computation of the amount of cement to be used is often impossible and an estimate must suffice. This estimate should allow a good margin of safety, so as to be sure that the cement is forced well above the First Wall Creek sand. To facilitate these estimates the U. S. Bureau of Mines has prepared a table showing the number of linear feet filled by one sack of cement when set in the annular space outside various sizes of casing in various sizes of hole. For cementing 8½-in. casing forty feet below the First Wall Creek sand, fifty sacks of cement are frequently used.

It was generally conceded that, owing to the chances of encountering shale-oil production, a string of 80 ft. of screw pipe in good serviceable condition should be cemented, in the case of first sand wells as well as those drilled for the second sand. Considerable discussion ensued as to the best method for preventing loss of oil and gas into the shale below the 80-ft. casing point and above the First Wall Creek cap rock on which another string of pipe was to be seated. This discussion arose in view of the fact that in numerous operations the string of casings set or supposed to have been set on or near the cap rock of the first sand failed to prevent the passage of oil and gas into the overlying shale, and in some instances through it to the surface at points two or three hundred feet distant from the nearest well.

As no new wells are now being drilled to produce from the First Wall Creek, the question of properly seating the inner string for first-sand wells was left open for further consideration, and those interested were requested to communicate their views to the Government Supervisor of Oil and Gas Operations.

Book Reviews

Geology of Petroleum. By William Harvey Emmons. Cloth; 6 x 9; pp. 624, 254 maps and illustrations. McGraw-Hill Book Co., New York. Price, \$6.

This comprehensive treatise on the world's petroleum is one which will be gladly welcomed by the student and the practical geologist. The thoroughness of the author is evident to any one who reads its pages; and the reader will welcome the detailed yet balanced presentation of a great array of carefully selected facts.

The first chapter is introductory to the general subject, and touches briefly on occurrence, uses, and geographic and geologic distribution. The second chapter treats of surface indications of petroleum, such as oil seeps, bituminous material, gas, mud volcanoes and dikes, and oil shales. A brief chapter expounds the subject of openings in rocks; another, the character of rocks containing such openings (reservoir rocks); following is a chapter dealing with the origin of petroleum and natural gas from organic matter, and another discussing the principles of petroleum accumulation in quantity. The structural features of oil and gas reservoirs are specifically considered.

The second part of the book is devoted to examining in appropriate detail the oil fields of the world, giving their structural and chemical peculiarities, and their geologic occurrence.

In North America, the various oil fields, from the Appalachian to the Pacific Coast, are summarized in different chapters; and the work then reviews the fields of Europe, Asia, Oceania, the Caribbean Islands, and South America, in the order named. The book is well illustrated, and full of interesting data. It will not fail of appreciation.

As a review is supposed to criticize, if need be, a question might be raised as to the arrangement of chapters, which appears a little haphazard. In the geographical section, for example, it might be thought that the Caribbean Islands, and then South America, might follow Mexico, instead of having Europe, Asia and Oceania interjected. Similarly, in the first part of the book (which might well be so designated, to separate it from the descriptive latter part) we might suggest that the present chapters could well be rearranged as follows: I, VI, VII, XIV, IV, XII, IX, III, V, X, XI, II, VIII, XIII—which would arrange the chapter heads as follows: (A) Introduction, Properties of Oil and Gas, Origin, Petroliferous Provinces, Association of Petroleum and Salt Water, Metamorphism of Petroleum; (B) Accumulation of Petroleum, Openings in Rocks, Reservoir Rocks, Structural Features of Reservoirs, Deformation of Petroliferous Strata; (C) Surface Indications of Petroleum, Maps and Logs, Gas Pressure, and Oil Recovery.

In the chapter on petroliferous provinces, the writer properly points out that the conception is analogous to that of petrographic provinces and metallogenic provinces. It is: therefore why the -graphic, -genic, and -ferous for one conception? The endings all have different meanings: and the natural thought is that a committee of three geologists, rock-, ore-, and oil-, might well make a pilgrimage to the shrine of some philologist, who might purge them of their careless handling of the Greek and Latin.

J. E. S.

Stones and Quarries. By J. Allen Howe. Cloth; 4½ x 7; pp. 137; 36 illus. Isaac Pitman & Sons, New York. Price, \$1.

This recent addition to Pitman's "Common Commodities and Industries" series includes in its introductory part a brief history of stone working, a description of the common rock-forming minerals, and the classification of rocks. Chapters are devoted to the origin, occurrence, and varieties of limestone, sandstone, slate, marble, granite, and other igneous rocks. The final chapters deal with the application of stone to various uses, and the method and equipment employed in quarrying and preparing stone for market. When so small a book is devoted to so broad a subject, it must of necessity constitute an outline only, but the author has covered the field as fully as seems possible in the space at his disposal. As a subject having many ramifications is treated with brevity, it is regrettable that a more complete bibliography was not added, thus directing the reader to sources of more detailed information. The book is of English publication.

O. B.

Technical Papers

Western Australia—The annual report of the Department of Mines of Western Australia for 1919 is now available on application to the Department at Perth.

Geological Survey—The annual report of the director of the U. S. Geological Survey for the year ended June 30, 1920, is now available, and may be had on application to the Survey at Washington.

Idaho—The Twenty-second Annual Report on the Mining Industry of Idaho for the year 1920 has been issued. It is a pamphlet of twenty-four pages and may be obtained on request to Robert N. Bell, State Mine Inspector, Boise, Idaho.

South African Limestone—Geological Survey Memoir No. 11 is entitled "The Limestone Resources of the Union." Vol. II is at hand, describing the limestones of Natal, Cape, and Orange Free State provinces. Price, 5s. from the Geological Survey, Pretoria, South Africa.

Stenches as Mine Warnings—The U. S. Bureau of Mines has issued Technical Paper 267, supplementing No. 244, giving further information on the properties of chemicals used as stenches. It may be obtained for 5c. on application to the Superintendent of Documents, Washington, D. C.

Cyaniding—U. S. Bureau of Mines *Reports of Investigations* No. 2,205 (obtainable on request to the Bureau at Washington) gives the results of the cyanide treatment of amalgamation tailings. The cost of erection and operation of a small plant is detailed and a flow sheet is presented for the solution of the given problem.

Mine Safety Orders—A bulletin of mine safety orders, effective Jan. 1, 1921, in the mines of California, has been issued by the Industrial Accident Commission of California. The safety orders were revised at a public hearing on Aug. 17, 1920. They are worthy of study by mining engineers. The booklet can be obtained from the commission at 525 Market St., San Francisco, Cal.

Manganese Ores—Part I of U. S. Geological Survey Bulletin No. 710 (248 pages, free from the Survey, Washington, D. C.) "Contributions to Economic Geology," is principally devoted to deposits of manganese ores in New Mexico, Costa Rica, Panama, Arizona, California and Nevada. Thirty-six pages are given to zinc-lead and antimony ores in the Pine Creek district of Idaho.

Cementation in Mining—In the *Proceedings* of the South Wales Institute of Engineers issued Jan. 21, 1921 (price 10s. from the Institute, Park Place, Cardiff, Wales) fifty-six pages are devoted to a paper by H. F. Ball, entitled "The Application of Cementation to Mining." The paper is well illustrated and describes in a complete manner the use of cement as a means of sealing off water in mining operations in fissured ground.

Properties of Crude Oils—The U. S. Bureau of Mines in its *Reports of Investigations*, Serial No. 2,202, gives data showing the properties of typical crude petroleum samples from New York, Pennsylvania, West Virginia, Kentucky, Ohio, Indiana, and Illinois. For purposes of comparison, figures for a few samples from several other states are included. The report covers forty-seven mimeographed pages and may be obtained upon request.

Iron and Steel—The U. S. Geological Survey has issued Bulletin No. 703, "The Iron and Associated Industries of Lorraine, the Sarre District, Luxembourg and Belgium," by Alfred H. Brooks and Morris F. LaCroix. The publication makes a complete survey of pre-war conditions in the iron and steel industry in France, Germany, and Belgium. A preliminary summary of the subjects, prepared by Mr. Brooks, appeared in *Engineering and Mining Journal* of May 8, 1920.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Industry's Need for Research Is Expounded Before Engineers Of National Council

Benefits to the Makers of Explosives, Nickel, Copper, and Steel. Emphasized at Meeting in New York City.

Some benefits to industry resulting from research scientifically conducted were interestingly stated by Dr. Charles L. Reese, chemical director, E. I. du Pont de Nemours & Co., and Mr. A. J. Wadhams, general superintendent, International Nickel Co., in addresses before the division of engineering of the National Research Council, on Friday, Feb. 4, at the Engineers' Club, New York City.

Dr. Reese emphasized the value to industries of organized research in particular. Some research projects are not immediately productive of financially profitable returns, others yield great savings or large profits immediately. If research be properly organized, or conducted on a co-operative basis by one great industry or a group of industries, a winning average, from the accountant's method of keeping score, is much more likely to be made. But organization and co-operation must be so conducted that the individual research worker feels no restraint.

Mr. Wadhams told of the hurdles research had to take successfully to become established in old industrial plants. Three groups particularly required "converting," the directors, the shop superintendents, and the foremen. Success depends largely upon the human qualities of the research personnel and their ability sincerely to recognize the value of the knowledge gained by the practical man in his experience, as well as laboratory knowledge.

The fruits of research gathered by the two corporations represented by the speakers are indisputably shown in the prosperity and the great contributions both companies were able to make to the winning of the war. Their aid began with the Allies long before America participated. The du Pont company furnished inconceivably large quantities of explosives to the Allies and to the United States, and despite mounting wages and rising cost of living was able actually to reduce the prices of "powder." The International Nickel company supplied practically all the nickel used by the Allies and our army.

Research in the du Pont laboratories made the manufacture of explosives safe and further reduced the chances of loss of life or personal injury by substituting machines for hand labor in hazardous operations. It cut the time required for making "powder" from

months to days. It led to the production in huge quantities of sulphuric acid and of materials used in the dye industry but also essential in the manufacture of explosives. Research made possible the elimination of the great lead-lined tanks and pipes formerly believed to be necessary in acid plants; It substituted the cheap and quickly available iron and steel, saving the labor of thousands of lead burners, a very special type of skilled labor.

The story of nickel was no less interesting. Within the memory of middle-aged men, the standing of nickel among metals was hardly above that of a nuisance to the producer of copper, especially from certain ores. Its chief use was for the humbler coins of the world. Only after years of research and many disappointments were discovered economical and successful methods for separating nickel from copper, and then no one knew quite what to do with all the nickel.

In the early 80's it was discovered that steel alloyed with nickel was useful in refrigerating apparatus. About that time a cholera epidemic occurred in our Southern States, and it was believed at that time that the cholera germ could not survive at low temperatures. Congress passed a bill providing for the construction of a nickel-steel ship in which a refrigerating apparatus could be installed so that the cholera victims could be kept aboard this ship under low temperatures. The attempts to carry out this contract led gradually to the large use of nickel for alloying with steel for many purposes.

Galen H. Clevenger, consulting metallurgist to the U. S. Smelting & Refining Co., Boston, presided at the meeting of the division of engineering, which was attended by twenty-two members and guests. The division's work is directed toward stimulation of research in the industries, bringing about co-operation in the acquisition of new scientific knowledge, and its dissemination among the engineers and managers of our industries. The division is supported by the National Research Council and by Engineering Foundation.

United Engineering Society Elects Officers

At the annual meeting of the Board of Trustees of United Engineering Society Jan. 27, the following persons were elected officers of the Society for the ensuing year: President, J. Vipond Davies; first vice-president, Calvert Townley; second vice-president, W. L. Saunders; secretary, Alfred D. Flinn; treasurer, Joseph Struthers; assistant treasurer, George H. Pegram.

San Francisco Section, A. I. M. E., Discusses Institute Finances

Suggests Five Members of Committee To Examine and Report on Present and Future Expenses

The San Francisco section of the A. I. M. E. met on Feb. 7. At the meeting the secretary read the reply from the secretary of the Institute to the following resolution passed by the San Francisco section on Jan. 11:

The San Francisco section is not entirely in accord with the action of the finance committee of the Institute in debiting the members' accounts with a charge of \$10, leaving the payment or non-payment of same to the discretion of each member, with no alternative to pay a lesser amount. The section desires to be advised regarding the necessity for this action, which appears to be establishing a dangerous precedent.

With no desire to criticize the action of the committee in adopting such course, the section respectfully suggests that a committee be appointed to examine (and report on) the finances of the Institute and to submit a report with recommendations; whereby the future expenses of the Institute shall not exceed its income. The section suggests that the committee consist of seven members, three of whom shall be thoroughly conversant with editorial and publication work.

Secretary Stoughton's reply of Jan. 31, stated that at a directors' meeting held in New York City on Jan. 28, 1921, the following resolution was passed:

Appreciating the deep concern in the welfare of the Institute which has been characteristic of the San Francisco section, and sensible of the continued support which the Institute can always expect from our Pacific Coast members, the board of directors would ask the San Francisco section to suggest the personnel of the committee which it has spoken of in its recent communication, in order that the investigation proposed may be conducted in a manner and by persons entirely acceptable to our San Francisco members.

RESOLVED: That the officers of the Institute be instructed to furnish the San Francisco section full information to carry out the proposed investigation.

The members of the San Francisco section were of the opinion that the subject was of interest to the Institute membership as a whole, and on motion suggested five members for the committee, the remaining two to be selected by the board of directors of the Institute. The members named were W. R. Ingalls, E. W. Parker, C. R. Corning, R. M. Raymond, and A. S. Dwight.

At the conclusion of the business meeting C. M. Eye presented a paper on the mineral resources of the Philippines. He reviewed the history of mining and discussed gold, silver, copper, iron, salt, oil, and coal. E. H. Clausen followed with a brief discussion of the geology of the gold deposits and gold-mining conditions.

The American Engineering Council has recommended to President Harding that an engineer be appointed Assistant Secretary of War.

MEN YOU SHOULD KNOW ABOUT

E. W. Shaw is investigating reported showings of oil near Summerville, S. C., for the U. S. Geological Survey.

F. L. Ransoone, of the U. S. Geological Survey, is studying the geology of Boulder Canyon, Nevada.

Dr. Louis D. Ricketts and Col. John C. Greenway, were in New York City during the past week.

T. H. Jenks, mining engineer, has returned to Los Angeles, Cal., from a visit to Colorado.

Edwin J. Collins, consulting mining engineer of Duluth, Minn., was in New York City early in February.

A. L. Flagg of Phoenix, Ariz., recently spent several days examining mining properties in Yavapai county, Ariz.

C. H. Fry, mining engineer of San Francisco, Cal., has returned from examining mines in Tuolumne County, Cal.

D. S. Dean spent several days recently inspecting the Gogebic Range properties of the Keweenaw Association.

W. G. Swart, vice-president and general manager of the Mesabi Iron Co., has gone east on a business trip of several weeks.

R. B. Phillips, mining engineer, has been elected assistant recording secretary of the Bisbee, Ariz., chapter of American Association of Engineers.

Walter Harvey Weed recently made an extensive examination of the properties of the United Arizona Copper Mining & Smelting Co., near Mayer, Ariz.

Cornelius F. Kelley, who has been inspecting Arizona and California properties of Anaconda Copper Mining Co., has left Butte, Mont., to return to New York City.

Mark Elliott, general superintendent of the Interstate Iron Co., has returned from Pittsburgh, Pa., where he attended to business matters relative to his company.

M. G. Gulley, of the U. S. Geological Survey, has gone to California to investigate the reported showings of petroleum in wells drilled in the Imperial valley.

J. W. Sherwin, general manager for the West End Consolidated Mining Co., with headquarters in Oakland, Cal., was in Tonopah, Nev., recently to inspect the West End mine.

Charles S. Witherell, metallurgical engineer, recently on the metallurgical staff of Guggenheim Bros., has entered private practice. His office is at 150 Nassau St., New York City.

W. T. Lee, of the U. S. Geological Survey, addressed the Pick and Hammer Club of Washington, D. C., on Jan. 22 on the application of aerial

photography to the study of geology as practised by himself.

Willis Lawrence, mining engineer and general superintendent of the Mammoth mines, Mesa, Ariz., has returned there from a three weeks' examination trip into Sinaloa, Mexico.

Dr. A. O. Hayes, formerly on the staff of the Geological Survey of Canada, is giving lectures on the minerals and ore deposits of the Maritime Provinces of Canada, at Queen's University, Kingston, Ont.

C. E. Julihn, superintendent of the Lake Superior experiment station of the U. S. Bureau of Mines, was in Washington last week conferring with officials of that bureau in regard to plans for the coming fiscal year.

H. Foster Bain, the acting director of the U. S. Bureau of Mines, has been selected as chairman of the interdepartmental committee on standardization of petroleum specifications. He also represents the Interior Department on the committee. At present Mr. Bain is paying an official visit to several of the mid-West stations of the Bureau.

H. D. Pallister recently resigned as superintendent for the mines of the McKinney Steel Co., at Wolfpit, Pike Co., Ky., to become professor of mining in the School of Mines of the University of Alabama. Prof. Pallister enters on his new duties Mar. 1, next, and his address will be University, Ala.

Lawrence Wilkerson Wallace, consulting mechanical engineer, serving a third term as president of Society of Industrial Engineers and vice-chairman of F. A. E. S. Committee on Elimination of Waste, was unanimously elected secretary of Federated American Engineering Societies, at Syracuse, N. Y., on Feb. 14.

Mathew Van Sicklen has been appointed assistant chief mining engineer of the U. S. Bureau of Mines, to succeed C. L. Colburn, who has been made safety engineer in charge of the co-operative work between the U. S. Bureau of Mines and the National Safety Council. Mr. Van Sicklen was graduated from the Columbia School of Mines in 1906. He has had an extended mining engineering experience in this country and in South America.

E. A. Hayes, of California, who has been nominated by the President to be one of the directors of the War Finance Corporation, has been prominently identified with the mining industry in the West. His nomination, like all others being made by the outgoing administration, probably will not be confirmed by the Senate. In the case of technical appointments or men specially qualified for positions, it is anticipated that renominations will be made by the incoming President.

Mining engineers recently visiting New York City included George C. MacKenzie, of Montreal, Que.; Fedor F. Foss, of Washington, D. C.; Edward B. Corbet, of San Francisco, Cal.; and M. R. Wolfard, of Cambridge, Mass.

SOCIETY MEETINGS

The Institute of Metals meets in London, on March 9 and 10.

The Institute of Mining and Metallurgy holds its annual meeting in London, on March 17.

The Canadian Institute of Mining and Metallurgy holds its annual meeting Mar. 2 to 4, at Montreal instead of at Ottawa.

The Northwestern Mining Convention holds its twenty-sixth annual session at the Spokane Hotel, Spokane, Wash., Feb. 28 to Mar. 5.

The American Association of Petroleum Geologists holds its fifth annual meeting on March 17 to 19, at Tulsa, Okla. Prominent geologists from all parts of the United States expect to be present, and the program promises to be interesting. Wallace E. Pratt, Houston, Texas, is president, and Charles E. Decker, Norman, Okla., is secretary-treasurer.

The Engineering Section of National Safety Council will hold its mid-winter meeting at Philadelphia, Pa., on Feb. 28. The meeting is held jointly with the local Philadelphia council and with the local section of The American Society of Mechanical Engineers. The program includes important papers on signals and signaling, dust explosions, crane overhoist limit stops, boiler accessories and safety in operation electrical fatalities, and air-compressor lubrication.

OBITUARY

Charles T. Krusse, the Michigan representative of the Jones & Laughlin mining interests, and who had been connected with the company for thirty-four years, died Feb. 14, at his home in Ishpeming, Mich.

Georges Humbert, an inspector general of mines, and member of the Academie des Sciences, was buried at Paris, on Jan. 25. Mr. Humbert was also professor of analytical chemistry in l'Ecole Polytechnique and in le College de France.

F. Close, metallurgical engineer, who had been staying in Switzerland recently, suffering from an attack of septic pneumonia contracted during the epidemic of 1918, died there on Jan. 25, last. Mr. Close was known in connection with the early stages of flotation processes in the United States. He went there about 1910, representing Elmore Bros., in the interest of their vacuum flotation process, but later returned to England and was for some time associated with those developing the Murex process.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Butte Operators Confer With Union Representatives

Con Kelley, Spokesman, Tells Delegates Oppressive Working Rates Must Come Down

At a series of conferences in Butte last week between mine operators and representatives of the unions, Con F. Kelley, president of the Anaconda Copper Mining Co., acting as spokesman for the operators, announced that the companies were disinclined at this time to continue to enter into long term contracts with the unions, thus departing from the custom which has prevailed for years with organized labor. In no uncertain language, Mr. Kelley informed the delegates that unless oppressive working rates which resulted in inefficiency and high costs were changed, the Anaconda company would break with the unions and break for good. The unions also were assailed for their financial support of an alleged Soviet newspaper whose avowed object was destruction of the Anaconda company and the American Federation of Labor. The attitude of the companies suggests that the Butte district is near the threshold of the "open shop."

Of the proceeds of the copper sold during the last four months of the past year at from 13c. to 14c., stated Mr. Kelley, labor received 10c. with 2½c. paid to railroads and refineries. Anaconda had had to secure funds with which to purchase mine supplies, he continued, and copper costs had mounted to 16.7 cents.

It is said that the delegates will report back to the unions for action. The conference is regarded as the most important in Butte in years.

Colorado Industrial Commission Probes Into Wage Reduction

At the hearing of the Colorado Industrial Commission in Denver on Feb. 15 for the purpose of inquiring into the wage reduction that the mining companies of the state had announced would become effective on that date, representatives of forty-eight companies appeared. Among these the chief witnesses were George E. Collins, Bulkeley Wells and Jesse F. McDonald. Not a representative of the miners appeared to protest against the reduction, which in the case of the minimum wage was from \$4.50 to \$4 per day. It is presumed that the wage reduction will be allowed.

WEEKLY RÉSUMÉ

Important conferences took place at Butte last week between the operators and union representatives of the district, the latter being told that oppressive working rates must be changed unless the unions wished to break with the companies for good. At Helena, in the same state, a hearing was held on two pending mine taxation measures proposing a 1½ per cent levy on the net revenue of copper companies. Vancouver, B. C., was recently the scene of the annual meeting of the British Columbia section of the Canadian Institute of Mining & Metallurgy. Final decision is expected soon as to whether the proposed Arizona & Sonora Ry., whose route from Ajo to Rocky Point on the Sonora coast is being surveyed, will be constructed or not. At the hearing in Denver on Feb. 15 on reduction of miners' wages no representative of the miners appeared. Conditions throughout the country remain unchanged from last week. Word has come that the Dwight-Lloyd sintering plant of the Broken Hill Associated Smelters at Port Pirie, Australia, was destroyed by fire in January. In London, the market situation is reported to be worsening. In Mexico, the Torreon smelter has been blown in. The A. S. & R. plant at Monterey has shut down.

At Washington the requests for protective tariffs on all sorts of things are piling up. The American Mining Congress has put in its plea for a duty on certain minerals and mineral products. The loudest demand has come from producers of ferromanganese, though these same interests are opposed to a tariff on manganese ore. Secretary John Barton Payne has pronounced against liberalizing the War Minerals Relief Act. The National Safety Council and the U. S. Bureau of Mines have decided to co-operate in safety work.

Dwight-Lloyd Plant Destroyed

The Dwight-Lloyd sintering plant of the Broken Hill Associated Smelters Pty., Ltd., Port Pirie, South Australia, was totally destroyed by fire on Jan. 25, according to word just received by mail. The fire spread to the ore bins, conveyors, rock roaster section and iron stone crusher, which were all seriously damaged. An early resumption of work at Port Pirie had been hoped for but cannot now take place until the Dwight-Lloyd plant has been replaced. This will doubtless hinder a full resumption of work at Broken Hill.

State Mine Taxation Hearing Held at Helena, Mont.

Operators Oppose Measures Designed to Levy 1½ Per Cent Tax on Net Copper Revenue

A public legislative hearing on two administrative measures designed to levy a tax of 1½ per cent on the net revenue of metal was held at Helena, Mont., on Feb. 11, and brought forth the statement from representatives of the mining companies operating in the Butte district that copper was being produced at a loss of 5c. to 6c. per lb. by the companies. Statistics were furnished to show the heavy burdens the mining companies already were laboring under, and to impose additional taxation, it was stated, simply was inviting a complete shutdown of the industry in Montana. Colonel Charles Muffy, president of the Montana Mining Association, declared that at present not a silver mine in the state is paying dividends and that 95 per cent of the properties are closed because of low metal prices and high production costs.

L. O. Evans, chief of counsel for the Anaconda Copper Mining Company, said that the main trouble is that people fail to appreciate the theory of mine taxation, explaining the utter impossibility of valuing a mine because of the fact that no one can tell the value or the amount of ore underground. He stated that the Butte mines cannot keep their ore reserves open for more than a year or two in advance.

Mr. Evans declared that the Anaconda company for the years 1917, 1918 and 1919 had paid 20.15 per cent of the total general taxes of Montana, and that under the present net proceeds tax they are being taxed 100c. on the dollar. In the six years from 1912 to 1917 it has paid in wages \$132,264,695 and in taxes \$5,679,000, while many millions more have been spent for supplies, the total expenditures for the half dozen years totaling \$251,000,000. An additional \$17,279,000 for custom ores was distributed.

"We had only one good year in the copper industry," continued Mr. Evans, "and then when we were making a fair profit the Government shot the price of the metal down from 32c. to 23c., which later was increased to 26c., equal only to 15 or 16c. a pound in normal times."

"The only other state in which the license tax proposed by the measures now under consideration has ever been tried is Utah, in 1917 and 1918, but the



EIGHT CARLOADS OF MACHINERY MADE BY YUBA MANUFACTURING CO. FOR GUIANA DEVELOPMENT CO.'S 7-CU.FT. DREDGE ON ITS WAY FROM MARYSVILLE, CAL., TO STEAMER FOR SHIPMENT TO SOUTH AMERICA

revenue was only 3 per cent of the net proceeds, while under the old system the tax was 3½ per cent of the net proceeds. The act was repealed," said Mr. Evans in conclusion.

Guiana Development Co.'s Dredge Shipped Promptly

About six months ago the Guiana Development Co., 120 Broadway, New York, ordered a 7-cu.ft. dredge from the Yuba Manufacturing Co., of California, for its operations in Dutch Guiana. The Yuba company has been successful in making prompt shipment and recently began loading the dredge parts at San Francisco into a chartered steamer that will take the machinery, together with purchased electrical equipment and hull lumber, direct to South America. The accompanying photograph shows eight carloads of the dredge machinery on its way from Marysville, Cal., to the steamer.

Last October, Perry Tiffany, president of the Liberty Company, and George A. Laird, general manager of the Guiana Development Co., sailed for South America with a party of ten engineers and operators to begin active work of installing dredging equipment on the Maroni River between French and Dutch Guiana. In the past, attempts made to install equipment in the upper waters of the Maroni have been unsuccessful, owing to the obstacles in the way of transportation. The present company, however, is equipped for all emergencies.

At the annual meeting of the Montana chapter of the American Institute of Mining and Metallurgical Engineers Fred W. Bacorn, of Butte, was elected chairman. About 100 engineers from throughout the state attended the session. L. V. Bender, of Anaconda, was chosen vice-chairman and E. B. Young, of Butte, was re-elected treasurer.

Cariboo Miners' Association Seeks Changes in Placer Mines Act

BY DONALD D. FRASER

The miners of Cariboo, B. C., have recently formed an association, the object of which is to promote the general welfare of the Cariboo mining district. The organization now has branches in Stanley, Barkerville, Quesnel and Harper's Camp and over 100 members. The first effort of the association has been to draw up a set of resolutions bearing on the Placer Mines Act, which has been sent to Victoria with the request that the legislation recommended be enacted during the present sitting of the House.

The most important resolution calls for the abolishment of the free miner's license as a condition of title. More than one mining proposition in the province in the past has been turned down by capital because of this, on the ground that the title was not good. At present if a lessee does not take out his free miner's license when due he loses all title to any mining ground he may hold. The tax is only \$5, but the amount which is contingent on one certificate is often very large. As a remedy, the association recommends that a certificate of work be issued by the gold commissioner when he has received one rental payment plus a declaration showing that the required assessment work has been done. The certificate would then be conclusive evidence of the validity of the lease to which it pertains.

It is furthermore recommended that the rentals for leases be payable on one day, Nov. 30. Delinquent leases are recommended for tax sale instead of cancellation, giving the owner the privilege of buying them back up to the time of the sale. This measure would tend to bring more revenue into the public treasury and also gives the owner a chance to reclaim if he so desires.

Fate of Arizona & Sonora Road Still Undecided

Proposed 100-Mile Railway Would Link Ajo with Rocky Point on Sonora Coast—Survey Now Under Way

The proposed route of the Arizona & Sonora railway is being surveyed at the present time. The line runs from Ajo, Ariz., to Rocky Point, Sonora, on the Gulf of California. Whether or not the road will be built has not been decided as yet. Dr. Louis D. Ricketts and Col. John C. Greenway, prime movers in the project, are in New York on business said to bear on this matter.

Most of preliminary survey has been completed and the location work in Mexico is being finished. The line will be a little less than 100 miles long and the heaviest grade, it is reported, will be only 0.5 per cent, with only a little rock work in the hills. There are tangents over 20 miles long on the desert. Rocky Point, it is said, should make a splendid ocean terminal, with over 35 ft. of water at the shore line.

The line, if built, will be owned by Arizona copper interests, including the El Paso Southwestern Ry. Much is said to depend on the attitude of the latter. About 50 miles of the line will be in Mexico and 50 miles in the United States. The Mexican government has stipulated that a Mexican engineer shall accompany the party.

Protest Against Increasing Ontario's Taxes

The proposed legislation to increase the taxes on mining, now before the Ontario Legislature, is meeting with very strong opposition throughout Northern Ontario. A meeting of the Temiskaming Associated Boards of Trade was held at Cobalt on Feb. 16, at which resolutions were adopted protesting against any increase.

British Columbia Section of Canadian Institute Meets at Vancouver

Discussions of Metallurgical Subjects Feature Sessions—H. N. Thompson Attempts To Reconcile Producers and Smelters—Activity of Various Districts of Province Described
—E. E. Campbell Succeeded as Chairman by Col. J. Leckie

BY ROBERT DUNN

Metallurgical problems with which operators of the silver-lead-zinc properties of the Kootenays are faced; the difficulties confronting the coal mining companies of Vancouver Island; and a general summary of mining conditions of British Columbia were outstanding features of the program of the annual meeting of the British Columbia division of the Canadian Institute of Mining & Metallurgy held in Vancouver City, B. C., Feb. 9 to 12. There was a large registration of delegates and from Wednesday morning, when Mayor R. H. Gale extended his welcome, until Friday afternoon, when the end of the business sessions was reached, the meetings were well attended.

Following the luncheon to the visitors, business was opened on Feb. 9 by William Fleet Robertson, provincial mineralogist, who recounted his impressions of the condition of the mining industry in 1920, taking for a basis the preliminary review and estimate of the Department of Mines, issued recently.

Among the Government mining engineers who spoke was J. D. Galloway, of the northeastern district. There was a large tract of territory, particularly north of the Grand Trunk Pacific Railway, that had been traversed by but few prospectors, said Mr. Galloway. Lack of capital explained the slow development of the mineralized sections of this area. Most of the known mineral deposits came within the classification of medium-grade ores, but high-grade ores had been found. While in his district in 1920 there had been no activity in copper mining placer gold mining had held its own, the production being about the same as in 1919. Attention now was being paid to the possibilities of dredging the placer grounds and a number of leases were being tested by Keystone drill with this object in mind. Several dredges were to be installed and, at Quesnel, operations were being started by the Cariboo Platinum Extracting Co., a concern interesting itself in the recovery of the platinum and gold values from the sands of the Fraser River and several of its tributaries; and also in the testing of the alluvial sands of other parts of the province.

P. B. Freeland, the engineer in charge of a considerable part of the older and better known mineral zone of what is generally described as the Boundary, was able to speak optimistically of the prospects within his "bailliwick," notwithstanding that here are situated the Copper Mountain

mine and the new concentrator of the Canada Copper Corporation, recently closed down; the Hedley Gold Mining Co.'s mines, now idle; Phoenix, until a few months ago a thriving mining camp operated by the Granby Consolidated, now a deserted town; to say nothing of the inactive smelter, of the same company, situated at Grand Forks.

A. G. Langley, of the Kootenays, referred specially to the development and the activity of the Consolidated's Sullivan mine. A talk by William M. Brewer, of Vancouver Island and the lower British Columbia mainland, on coal mining and the Britannia mine, together with the statement that the Lucky Four claims, situated in the Cheam Range, promised to become one of the large mines of the West; a description of the Dolly Varden mine operations by P. W. Racey; and an appeal by J. D. MacKenzie, of the faculty of the University of British Columbia, on behalf of returned men who are completing their technical training, concluded the session.

"Mining Camp Village Planning and Improving" was the subject of a public lecture, under Institute auspices, delivered by T. B. Adams, of the Commission of Conservation, Ottawa, on Wednesday evening.

With S. S. Fowler in the chair the session Friday morning was opened with a discussion of "Metallurgy in British Columbia." Horace Freeman outlined the problem of dealing with the complex ores of the Kootenays, containing lead, zinc, silver, copper and iron, in varying proportions. The trouble was caused by the zinc, he said, and the zinc content of British Columbia lead mines usually increased with depth. Zinc sulphides also were found in some high-grade native silver deposits. In lead smelting and in silver cyaniding this zinc hitherto had proved a serious obstacle to successful economic treatment. In the first case there were produced infusible slags and in the second a part of the silver could not be dissolved in the cyanide solution.

After referring to the practices of the past and the present Mr. Freeman said that what British Columbia lead-silver-zinc miners wanted was a simple concentration of the lead, silver, and zinc in one body, shipment of this, and treatment by a process capable of yielding the three different elements in a very few steps. The Honorary Advisory Council for Scientific and Industrial Research had made a grant for research having as its goal the

solution of this problem. The work was in progress but the funds available were lamentably inadequate. Loans had been made by the provincial government through its industrial department upon which there was little prospect of return.

Mr. Langley endorsed Mr. Freeman's estimate of the importance of the work and was pleased to note that the latter was engaged in such research. In the Kootenays there were thousands of tons of ore on dumps, containing, say, 80 oz. silver, a considerable percentage of lead, and 25 per cent zinc. The smelters refused it. If shipped to smelters south of the line there were freight rates which, in conjunction with penalties, made it scarcely worth while. To know more of the art of separating the zinc economically was of vital importance to British Columbia, according to Mr. Langley.

Oscar Lachmund detailed a proposal for establishing sampling plants in different mining centers. These would be financed by the government. Ores would be purchased, sampled, mixed, and a material thus obtained that would be acceptable at the smelters.

E. E. Campbell, late of the Granby Consolidated Mining, Smelting & Power Co., expressed himself as interested in the remarks of Mr. Freeman but observed that, in his experience, many things were done in practice that were not strictly scientific. While, no doubt, the general principles were never departed from, the best results were not always obtained by strict adherence to chapter and verse. In Anyox, for instance, it had been necessary to adapt practice to conditions; to adopt a "cut and fit" policy. This had been done in connection with the product of the Hidden Creek mines with success and experiments were now being carried on by means of a small mill, the results of which, it seemed assured, would be beneficial.

Prof. H. N. Thompson, of the University of British Columbia, essayed to clear away some of the misunderstanding between smelters and mining men because of the penalties levied by the former against the ores of the latter. If the problems of the smelters were better appreciated there would be less ill feeling, he said. There appeared still to be an impression among some mining men that their returns should be based on the full market value of the mineral content of their product. He then detailed some of the difficulties the smelters are "up

against" when presented with ores containing combinations of copper, lead, silver, zinc and iron. No metallurgical picnic this, he assured his hearers, and very graphically he depicted the effect of reactions on the furnaces in zinc smelting, and in lead smelting, when the metal, the recovery of which was sought at the moment, was associated with too great a quantity of the other or when some slight miscalculation had been made in the course of treatment. The argument was not all on one side he told his miner friends. However he looked forward to the happy time when the lion and the lamb would lie down together in amity, being careful to refrain from specifying which properly should be termed the "lion" and which the "lamb."

It happened that the Associated

Boards of Trade of British Columbia were meeting at the same time and place as the Mining Institute which explains the novelty of the joint luncheon of Thursday. The "tit bit" of this was an address by Thomas Graham, general superintendent of the Canadian Collieries, Ltd., on "The Coal Industry of Vancouver Island." The people of Vancouver Island are agitating for cheaper coal but by the time Mr. Graham finished the impression was that it would be fortunate indeed if retail prices did not take still another jump.

J. D. MacKenzie presided over the session of Friday morning which was featured by an admirable paper on "The Relations of Geology to Mining in British Columbia," by Dr. S. J. Schofield. "The Relation of the Institute to

Government" introduced by H. Mortimer Lamb in the afternoon was generally discussed. It was felt that the sphere of influence of the organization could well be enlarged by closer cooperation with the provincial government in the consideration and the framing of legislation dealing with the mining industry.

The meeting ended with a dinner at which formal notice was given of the retirement from the chairmanship of E. E. Campbell, owing to his approaching departure, and the accession to the vacant office of Col. J. Leckie, who is held in high esteem both because of his standing as a mining man and his military experience and honors. Col. Leckie's informative lecture on "Campaigning in Northern Russia" closed the proceedings.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Payne Against Liberalizing War Minerals Act

Says Best Way, If Further Relief Is Advisable, Is to Compensate All Producing in War Period

Liberalization of the War Minerals Relief Act so as to include those who were induced to produce by published statements of the Government's needs would be unwise, in the opinion of John Barton Payne, Secretary of the Interior. "If Congress in its wisdom," says Secretary Payne, "shall decide the claimants receiving a published request are entitled to compensation, it would be better, in my judgment, simply to provide that all persons producing manganese, pyrites, chrome and tungsten, from the declaration of war to the armistice, shall be entitled to compensation for their net losses. If the measure be thus enacted the determinations of loss will be matters of valuation and accounting."

This expression from Secretary Payne is contained in a letter written to Representative Rhodes, chairman of the House Committee on Mines and Mining, in regard to the bills which have been introduced proposing a more liberal construction of the "request or demand" feature of the law. Any such legislation, Secretary Payne says, "would necessarily permit reopening all claims which have been adjusted, for the reason that in these the beginning of allowable loss has been set by determination of a definite date of Government request or demand." Continuing he says:

"If the law be amended to allow awards for losses following published request there can be no refusal to reopen all claims whether heretofore rejected or allowed in part, since if a claimant asserts that at an earlier time than now established he was encouraged

by public request to undertake the operation which resulted in loss there can be no possible means of determining the correctness of such claims other than his own statement."

"Such legislation," Secretary Payne says, "necessarily will involve the reorganizing of a force of engineers and accountants of the size originally employed by the War Minerals Relief Commission and the continuance of the commission for an indefinite time. The awards necessarily will be much larger than in the past and an additional appropriation will be required, not only for relief but for expenses."

The Senate has authorized the publication as a public document of the report of the commission.

Awards were recommended by the War Minerals Relief Commission during the week ended Feb. 12 as follows (the name of the claimant, the mineral, the amount recommended, and its percentage relationship to the amount claimed are shown): William A. Blanton, chrome, \$400, 32 per cent; L. B. Stokes, chrome, \$553.62, 32 per cent; Tungsten Reef Mines Co., tungsten, \$15,446.61, 71 per cent. In addition the claim of the Vindicator Consolidated Gold Mining Co., which previously had been disallowed, was reopened and an award of \$13,089.04 was recommended. The recommendation is 34 per cent of the amount claimed.

Safety Council To Co-operate with Bureau of Mines

In an effort to arouse greater interest in safety in mining and to co-ordinate and develop the safety work being conducted by the National Safety Council and the U. S. Bureau of Mines a co-operative agreement has been entered into by those organizations.

Mining Congress Asks Tariff on Certain Minerals

Ferromanganese Manufacturers Want Duty on Their Product But Wish Ore Admitted Free

The American Mining Congress has asked the Committee on Ways and Means to remove a number of minerals and mineral products from the free list and allow them the benefits of a protective tariff. The minerals are: Fluorspar, graphite, chromite, ferrochrome, manganese, ferromanganese, magnesite, pyrites, tungsten and ferrotungsten. In meeting the objections which have been raised to these duties, Herbert W. Smith, who appeared for the Mining Congress, said that in view of the losses sustained by the producers of war minerals during the recent emergency that private enterprise never again would go into the war-time development of these resources. If it is done at all the work will have to be done by the Government, which would mean great loss of time before production could be obtained. He used this as a reason why it is impracticable to leave war minerals in the ground as potential reserves. He said the safe way to be prepared in this particular would be to enable these industries to develop under reasonable tariff provisions.

Very determined opposition was forthcoming against the proposal to put a duty on manganese ore and on iron pyrites. The manufacturing chemists contend that sulphuric acid is such a basic necessity to the chemical industries that an extensive and highly ramified activity should not be hampered by a duty on its principal raw material, when no important pyrites industry has been developed in the United States, where all indications point to very high costs of production

and transportation from American sources to the points of consumption.

The producers of ferromanganese pointed out to the committee that there is about \$15,000,000 invested in their plants and that there is a deliberate attempt on the part of an English pool to wipe out the American industry. This should be met, it was argued, by placing a duty of 2c. a pound on ferrotungsten and by allowing the American manufacturers to obtain their raw materials at the lowest available cost. Some sympathy was shown for the domestic production of manganese ore but it was stated that the lower grade of the domestic ore, the transportation cost involved, and the irregular grades of these ores, as well as the fact that it requires more fuel to smelt it, are difficulties which militate against its use. In case any duty should be described for manganese ore, it was pointed out that a higher duty would have to be asked on imports of ferromanganese. It was stated that the ferromanganese industry would require a duty on ferromanganese at least the double of any duty that might be prescribed on ore. If the suggested duty were 3c. per lb. on the manganese content of ore it would require 6c. per lb. on ferromanganese.

Due to the importance of manganese as an essential in making steel the chairman of the committee asked one of the witnesses if the domestic production of the ore should not be encouraged. While the representatives of the ferromanganese industry repeatedly stated that they did not oppose a reasonable duty on the ore it was very evident that they were not enthusiastic about that phase of the situation. At one point in his testimony E. G. Lavino, of Philadelphia, said: "The domestic ore is in remote localities and there is not much of it. I think it would be better to conserve it for emergencies. Otherwise it will be worked out in a couple of years and economically it is not good business." On being questioned Mr. Lavino stated that he referred to the Batesville, Ark., district in stating that the supply would be mined in two years. He said that the domestic producers had the advantage of very high prices during the war, were given priority in the matter of transportation and had many other advantages but with it all brought out only a small production. His firm contracted for 100,000 tons at that time, it is stated, but only 1,000 tons were furnished on these contracts. The chairman of the committee suggested to the witness that he wanted protection for his product but was opposed to protection for the ores. This led Mr. Lavino to say: "I am in sympathy with any reasonable protection of any industry in the United States but we do not feel in view of our experience that there is a sufficient quantity of manganese ore in the United States to begin to supply the need. Moreover the quality is not good."

On the other hand Charles W. Potts, representing the Northern Minnesota Ore Co., presented an exhaustive state-

ment to show that there is enough manganese ore in the United States on which to found an industry. He asked that a duty of 35c. per unit of metallic manganese be placed on crude ores and concentrates. He said that the experience during the war had demonstrated that the former objections to the building up of the domestic manganese industry are now invalid. Among other things he said:

"That domestic sources cannot be depended upon to supply domestic needs is now an absurd argument; for the production of American mines in 1918 disclosed the fact that the ore is available, and that it is so plentiful that in a very few months domestic production increased to a tonnage equal to prewar requirements and the industry was just getting started when the war closed."

Operators of salt mines and wells in the United States are asking that their product be removed from the free list and a duty of 25c. per 100 lb. be imposed. The producers of graphite have asked a duty of 1c. per lb. on ore under 50 per cent graphitic content; 2c. per lb. on ore with more than 50 per cent graphite; 3c. per lb. on lump graphite; 6c. per lb. on flake graphite; 20 per cent ad valorem plus 5c. per lb. on the graphitic content of graphite bricks.

The removal of graphite from the free list was opposed vigorously by the manufacturers of crucibles. By insisting upon a high tariff, it was declared, the miners of graphite are jeopardizing their own interests, since the crucible industry offers practically their only market.

Manufacturers of safety fuses have asked for a duty of \$1 per 1,000 ft. on imported fuses. The present duty is 15 per cent ad valorem. In like manner the manufacturers of blasting caps requested a duty of \$2.25 per 1,000 caps. The present tariff is \$1 per 1,000. The rate asked is the same as that carried in the Payne law. A duty of 50c. a unit on potash has been requested by the United States Potash Producers Association. The representative of the Association stated that with such a duty a domestic industry would be able to meet outside competition within five years. A duty of 50c. a unit, it was argued, would mean only an increase of \$1 a ton in the average fertilizer. The United States is now producing one-half of its normal requirement of potash, it was stated.

Salt Lake Experiment Station Reports for January

The Salt Lake City station of the U. S. Bureau of Mines for the month of January reports the continuance of work with various volatilization processes. Experiments have proven that it is possible by this process to extract 94 per cent of the silver and 80 per cent of the lead in the complex ores of Good Springs, Nev. Ores from the Utah Apex at Bingham have been successfully treated by the Bradford process. Microscopic work was also

carried on, studies being made of ores from the Deadwood Lead & Zinc Mining Co., of sponge iron from California, platinum ore from Idaho, etc. Experiments have been continued with oil shales, the oil retort recently installed being made use of for this purpose.

Zinc Standardizing Plans Made

The American Engineering Standards Committee upon which the Department of the Interior is represented, has designated the American Zinc Institute and the American Society for Testing Materials as sponsors for the projected standardization of zinc. This action was taken following a suggestion from the Belgian Standardization Association. The American Society for Testing Materials and the American Zinc Institute have accepted this joint sponsorship and are undertaking the formation of a committee under the rules of the American Engineering Standards Committee. After reviewing the entire field it has seemed that a representative committee competent to consider this broad project can be formed. It is to be composed of fifteen members. Five are to be producers of zinc representing the mining, smelting and rolling industries. Five members are to be consumers of zinc representing the three major users of metal, that is manufacturers of brass, galvanizing industry and sheet zinc industry. Five members are to represent general interests comprising independent consulting engineers and representatives of appropriate Government departments.

The American Zinc Institute is arranging for the selection of five producers of zinc and the American Society for Testing Materials has undertaken to arrange for the selection of the other representatives. The Bureau of Mines has designated Dr. Chas. H. Fulton as its representative. The Bureau of Mines is particularly interested in methods of analysis and settlement of contract for ore.

The American Society for Testing Materials through the activities of its committee on non-ferrous metals and alloys has adopted standard specifications and methods of analysis for spelter. It is thought that these standards are entirely acceptable, so far as they go, to the industry and it is expected that those standards will serve as a starting point for the activities of the sectional committee. Considerable standardization in the zinc field already has been accomplished. The problem now is to extend the work already done to cover more recent developments such as requirements for rolling sheet zinc. There is in addition the important question of receiving, sampling and determining moisture of ores.

Government's Silver Purchases Over 37,000,000 Oz.

Purchases of silver under the Pittman Act at the close of business on Feb. 19 totaled 37,315,391 fine ounces.

NEWS BY MINING DISTRICTS

Special London Letter

Market Situation Worsening—The Position of Santa Gertrudis—Large Gold Field in Congo Reported

BY W. A. DOMAN

London, Feb. 8—If anything the malaise in the world of mining, as in other branches of industry, is being aggravated rather than moderated. The fall in the prices of metals has been so continuous that mining companies, whether precious or base metal, are "feeling the draught." For December the figure at which it was estimated the Transvaal gold would be disposed of was £5 19s. 0d. per fine oz., a very high level, and when the subsequent course of the metal is considered a doubt arises in the mind as to whether the estimate was actually realized. If it were, there is a tremendous drop as regards the sales for January, the figure taken being 14/— down at £5 5s. 0d. Profits consequently have suffered. It is rather unfortunate that the present moment should have been chosen for another labor agitation on the Rand. The miners are demanding more pay and shorter hours and the companies see their revenue dwindling. It seems almost like a nail in the coffin of Kaffirs. There is just one ray of hope and that in a speculative sense, for this market at the moment. Share prices have been low partly because of a large block of "enemy" holdings being on offer by the respective officials of the Home and Union governments. These two gentlemen could not agree as to the course to be taken, and as quotations continue to fall away and no one is benefitting the Custodian of Enemy Property in South Africa has come by invitation to London, to work out a scheme in conjunction with the Public Trustee. They have had differences as to which of them is the real holder of certain shares.

Investors in silver mining companies have become very nervous of late owing to the low level to which the metal has fallen. Not only do they see their profits disappearing, but their capital is also endangered. One of the most popular companies is the Santa Gertrudis, and, as I reported recently, the company raised additional capital in the shape of notes. These were distinctly attractive at the time, but they have since gone to a heavy discount. Fears have been expressed that as a result of the slump in silver and of other causes the company will not be able to pay its way. The board has consequently taken steps to alleviate anxiety by explaining the position. Mr. J. A. Agnew, a member of the technical committee, in the course of an interview states that, even with silver at its present price, a very good profit can be made by Santa Gertrudis, while treating from 30,000 to 40,000 tons of

ore monthly. The position is really aggravated by other troubles, for the company has suffered from a lack of filtration capacity. Now that this has been removed, the rate of output is checked by a limitation of power. The consumption has to be cut down by 25 per cent and this fact prevents the management from taking advantage of additions to the mill, the expenditure upon which has almost ceased. Mr. Agnew states that while a material improvement in the position is postponed by the shortage of power the views of the directors as to the future of the mine are unchanged. Of course the fall in silver has checked the expansion of the National Mining Corporation and the Mexican Corporation.

I learn that, according to private advices from the Congo, a gold field is being traced out of a size to dwarf the Witwaterstrand.

AUSTRALIA

Queensland

Hampden-Cloncurry Smelters To Stay Shut Down, Likewise Those of Mt. Cuthbert—Chillagoe State Smelters Also Forced Down—Mt. Quamby Gold Strike Less Alluring

Brisbane, Jan. 10—The falling prices of metals, especially of copper, is having a very serious effect on the mining industry of Queensland. The production of copper in the Cloncurry district is said to cost, under existing conditions, somewhere about £80 per ton, and with the London price down to about £71 or £72, it was not difficult to predict that something must happen. It is now definitely announced that the smelters of the Hampden-Cloncurry company, which closed down at the usual time for the Christmas holidays, are not to be blown in again until prices improve, although development work in the company's group of mines is to continue as usual. The chairman of the company recently stated that costs have gone up to such a level that the workers' efficiency has become so unsatisfactory, and that the price of the metal has dropped to so low a point that the owners of Australian copper mines cannot now earn profits. The smelters of the Mount Cuthbert company, which had only a short campaign last year, are also to remain idle for an indefinite period after the holiday recess, but development work in some of its mines is to go on.

The Chillagoe State smelters have had to follow suit and close down. The reason given was that, owing to the low market prevailing, producers would not sell their ores.

The Government has up to the present been able to work only one mine (the Einasleigh copper mine) in connection with the Chillagoe smelters, which several times ran short of ore,

but during the session lately closed parliamentary authority was obtained to operate other mines and to spend a larger sum annually on the development of State mines and in operating the smelters than was previously available. The State Battery at Wolfram remains closed, and must so remain while the prices of the rare metals continue as low as they are, for the simple reason that there is nothing for the battery to work on.

The Mount Morgan company, as a large producer of copper, is, of course, being much affected by the ruling low market, although it is assisted to some extent by its gold output and the help which it gets from the Gold Producer's Association. Up to the beginning of 1920 the company paid dividends pretty regularly, and has distributed in all nearly £9,400,000, but the last payment to shareholders was made in April, 1920, and the general manager recently stated that the copper production is now being conducted at a loss, and that the vanishing point as far as dividends are concerned appears to have been reached. There is, however, fortunately no intention to close down the big mine for the present, and operations will be continued in the hope of an early improvement in prices and possibly a reduction in the cost of production. When the last mails left there was a slight upward movement in metal quotations.

The gold discovery at Mount Quamby, in the Cloncurry district, which was to prove another Rand, has had much of the romance knocked out of it by the matter-of-fact, cold-blooded geologist whom the Government sent out to examine the property. This geologist, L. C. Ball, confirms the reports of the existence of immense quantities of conglomerates, but he says the rock has been demonstrated to be gold-bearing only in the southernmost part and that much prospecting must be done before any pronouncement can be made as to the remainder. The deepest working is 12 ft. down. Much of the conglomerate tested has been found to be barren, some gave low values, and one sample went 1½ oz. to the ton. The average of twenty-four samples from the surface workings, which are scattered over a length of 700 ft. with a maximum width of 100 ft., was just about half an ounce to the ton. There is, therefore, no doubt that the conglomerate is auriferous, but much work has to be done before it is proved that it can be exploited profitably.

MEXICO

Coahuila

Torreón—Feb. 12—The Torreón smelter is being blown in after an idleness of several months. The plant will be operating in full blast before the end of this month, giving employment to several hundred men.

CANADA

British Columbia

Queen Mine, Near Salmo, Bonded to C. H. Cassill—McAllister Shareholders Meet

Salmo—Wisconsin interests, which have held the Queen mine, on Sheep Creek, for a number of years, have bonded the property to C. H. Cassill, of Spokane, president of the First State Bank of Ovanda, Mont. The consideration involved is \$150,000, with a \$20,000 payment due in July, 1921, \$10,000 six months thereafter and three payments of \$40,000 covering a period of a year and a half. The property, consisting of fifteen claims, is credited with a gold production of \$1,529,000 within the last 20 years. Mr. Cassill intends to incorporate a company under the laws of British Columbia with a capitalization of 1,000,000 shares of a par value of 25c. per share to take over the Queen group and amalgamate with this ground a number of other claims in the vicinity, and which he has held for a long time.

Three Forks—The McAllister M. & M. Co. shareholders met in Spokane on or about Feb. 10 to authorize the closing of a deal whereby W. A. Grimes and associates take up the bond held on the McAllister group, prior to maturity, which would not be until a year from next May. The McAllister company will be dissolved and it is likely that the syndicate acquiring the property will seek incorporation. The property is on the North Fork of Carpenter Creek, and produces a high-grade dry ore. A wagon road will be completed to the mine this year. The consideration involved in the present deal is \$35,000.

Sydney Inlet—The Tidewater Copper Co. has temporarily stopped production. A certain amount of underground development and diamond-drill work will be undertaken to better define the ore-body. Dan Drumheller, superintendent, reports that the mill which was recently remodeled was doing excellent work at the time of the shutdown. A good operating profit was reported for December, in spite of the unsatisfactory market.

Ontario

McIntyre Planning To Increase Milling Capacity

Porcupine—The McIntyre is planning to increase its milling capacity to between 900 and 1,000 tons per day. The extent and gold content of the No. 5 ore body now being worked at the lowest level are rated to show an increase at depth.

A syndicate including local and American interests is negotiating for the acquisition of the Porphyry Hill property in Deloro Township about half a mile south of the Dome mines.

The Gold Reef is planning the sinking of a shaft to the 300 level, to open up a strong vein indicated by diamond drilling.

NORTH CAROLINA

New Talc-Grinding Plant Built—Re-opening Old Spoon Mine

Troy—Operations are under way in the new Hemp talc district, which has been developed in an old gold-mining region. The most active work is that of the Standard Mineral Company, Inc., 858 Woolworth Building, New York City. This company is building a 35-ton talc-grinding mill and expects to be ready to ship ground talc soon. A crayon mill, with capacity of 100 gross daily, will start at the same time. Bins are being erected at the mine, and an Ingersoll-Rand compressor, drills and channeling machine are being installed.

R. I. Dickens is opening the old Spoon gold mine, northeast of Ashboro, for New York owners and is sinking a shaft and crosscutting. Donald Cameron has completed his Marathon mill plant at the Porter mine and will soon begin grinding.

A. J. Overton is installing a rock crusher and a haulage system at his thirty-stamp mill recently built. This mill is now in operation.

Waynesville—The Cons. Natural Abrasives Mining Co. has been organized with a capital stock of \$2,000,000. This is a consolidation of rhodolite, corundum and garnet properties said to cover 7,000 acres in Jackson, Macon and Clay counties, N. C., and Tower County, Ga. It is intended to raise funds to remodel the present plant and add equipment sufficient to permit the production of 150,000 tons of finished product per year.

ARKANSAS

Manganese Mining Practically Closed Down—No Ore Sold for This Year

Batesville—Little of note has happened recently in the Batesville manganese district. Ore contracts expired Dec. 31, and there was a spurt of shipping the last week of the year, getting rid of accumulations and getting the yards and bins cleaned up. No ore has been sold for this year as yet, and the probabilities are that it will be March at least before any new contracts are made. The prices to be paid will no doubt be low. The industry is practically closed down. The Northern Minnesota Ore Co. is working a few men contract mining on high-grade ore only, as is R. S. Hanford at the Davis Hill property and Snapp land and Pottorf property north of Pfeiffer. A. G. Gray also has a few men working on his land near Pfeiffer. Otherwise no ore is being mined whatever.

Little development work is being undertaken. E. C. McCombs, representing the Independence Mining Co., is using the interval of no production to repair and enlarge and overhaul his washing plant at the Polk-Southard property, north of Cushman, and will install a crusher to put the ore in better size for sampling. The Northern Minnesota Ore Co. expects to do some test-pitting this spring or in

the near future. The National Manganese Ore Co., of Indianapolis, Ind., going ahead with the projected 30-ft. dam on Lafferty Creek just below the town of Anderson and putting up washing plant, and other equipment.

The consolidation of the Eureka Manganese & Mining Co. and the Southern Hill Manganese Co. was effected Jan. 20 by the organization of a new company capitalized at \$250,000 and to be known as the United States Manganese Co. The new company takes in the Eureka mine and mill of the Eureka company, which was owned by W. H. Beatty, W. H. Denison, and N. A. Adler, and the Southern Hill property, which was mined during the war by C. H. Lord, of Chicago; and associates. The new company also takes over 543 acres of mineral land, formerly belonging to the Gregory estate, some of which is expected to be valuable. The principal stockholders war by C. E. Lord, of Chicago, and McFatrigh, of Chicago, M. A. Losee, of Chicago, and W. H. Beatty, of Cushman. Dr. Roe is president, Dr. McFatrigh, vice-president, and W. H. Beatty, secretary and manager. The company started operations at once with a view to getting the Eureka mine in shape for economical operation. In the absence of a market, the company expects to be able, financially and physically, to stockpile the product.

MICHIGAN

The Copper Country

Arcadian Consolidated Re-elects Directors—C. & H. Electrolytic Down Temporarily

Houghton—The Arcadian Consolidated Mining Co. held its annual meeting in Houghton on Feb. 8. Directors were re-elected as follows: R. H. Shields, president, W. B. Anderson, L. W. Killmar, J. W. Shields, S. T. Everett, J. C. Shields, H. W. Fesing, J. G. Stone and F. W. Miller. The only work being done at present is the sinking of the New Baltic shaft, which will be down 940 ft. by March 1. It will then be connected with the New Arcadian shaft, which is about 3,500 ft. away. A thousand feet of drifting has been done from the New Arcadian shaft toward the New Baltic.

Chief Engineer H. W. Fesing in his report states that the showing of copper on the 250, 400, 500 and 600 levels is very good. On the last the vein is 26 ft. wide, with mineralization across the entire lode. He goes on to say: "Should the vein between these two shafts disclose such copper values as the openings in the various levels of both shafts would indicate, then there can be no doubt that possibilities exist here for the development of an immense tonnage of commercial rock. Even in the block of ground lying above the 900 level, between the two shafts, and allowing for the usual discard in rock selection, no less than 1,000,000 tons of merchantable vein rock should be supplied."

The Quincy Mining Co. continues to

operate but one of its stamp mills. Production is about 3,000 tons per day or about 60 per cent normal.

The Copper Range Co. has been increasing its mine forces slightly at its three operating mines in the last few weeks. The total output of ore is now about 65,000 tons per month. Of this the Champion produces about 60 per cent, the Baltic about 25 per cent, and the Trimountain 15 per cent.

Calumet & Hecla has suspended operations at its electrolytic plant for about two weeks. This action was caused by the decreased supply of copper mineral with the required silver content.

Dwight E. Woodbridge, mining engineer of Duluth, Minn., gave an interesting talk on the Hudson Bay country to a group of Copper Country business and professional men on Feb. 9. He touched on the history of the Hudson's Bay Co. and the peculiar habits and customs of the Eskimos. But the greater part of his address was devoted to the great iron deposits in that country, especially on a group of islands in Hudson Bay. He was of the opinion that if future detailed examination bears out the results of the preliminary examination, these great iron ore deposits will come into direct competition with the ores of Michigan and Wisconsin.

Menominee Range

B. C. Neeley Buys Iron Ore Tract Including Vivian Mine

Iron Mountain—Benjamin C. Neeley, of Crystal Falls, Mich., has purchased 640 acres of mineral lands in Breitung township, Dickinson County, the description being the west half of Section 33 and the west half of Section 34. The Vivian mine, operated many years ago, is located on these lands, and was worked by Pickands-Mather interests. There is a very large tonnage of low-grade ore on the property and the recent purchaser is to begin diamond-drilling with the idea of finding high-grade. Neeley has been a successful operator in the Iron County district of the Menominee Range for many years.

At the Ernst mine the shaft is being deepened from the 9th to the 10th level. When this is done the mining force will be increased. The Ernst is doing diamond drilling.

The Bates mine shaft is being concreted.

Marquette Range

Rolling Mill Mine Closed Down Pending Better Market

Negaunee—The Rolling Mill mine, operated by the Clement K. Quinn company, has been closed pending a better ore market. Men will be retained to conduct diamond drilling explorations and to repair shafts and machinery. About 100 men are out of work as a result of the shut-down.

The Mary Charlotte mine, operated by the Breitung interests, closed down on Feb. 17. About 100 men were laid off. Large stocks of ore and no sales are said to be the reasons.

MINNESOTA

Mesabi Range

Republic Iron & Steel Closes Mines on Mesabi Range—Air Tank Explodes at Hill-Crest

Nashwauk—Although the Hawkins mine, which is being stripped, has closed down for repairs, the mining industry in the near vicinity is still moving. The La Rue mine is operating with full crews, also the Crosby mine, and it is anticipated that the York mine will reopen in another month as there is certain preparatory work to be accomplished before the shipping season. Stripping operations continue at the properties of the Butler Bros.

Gilbert—The Republic Iron & Steel Co. closed all mines of the company on the Mesabi Range on Feb. 12. The three mines in Michigan will be operated at only 50 per cent of normal. The mines affected on the Mesabi Range are the Petit and Schley at Gilbert, the Union at Virginia, the Kinney at Kinney, and the Bray at Nashwauk.

Ely—The North Chandler mine, of the Chandler Mining Co., has reduced its working schedule to four days a week. About 100 men will be employed.

The Zenith mine is still working six days a week with a reduction of the number employed which is approximately 150 men.

Ironton—The 6 x 10-ft. compressed air tank at the Hill-Crest mine exploded and caused considerable damage to the engine room besides breaking one of the arms of the engineer with other minor injuries. Part of one of the walls of the engine room was destroyed and the equipment badly damaged.

ARIZONA

Calumet & Arizona Finds New Body of High-Grade Carbonate Ore

Bisbee—In drifting on the 770 level the Calumet & Arizona company has cut a body of high-grade azurite and malachite ore. The immediate purpose of driving this drift was to develop some low-grade siliceous ore found in churn drilling. The new discovery was unexpected and from appearances is the top of an orebody. It is located on the Ormond claim and the ore is typical of the high-grade specimen ore mined in the early days of Bisbee.

A geological examination of its property is being made for the Higgins Development Co. in Bisbee by F. H. Farrell, of Los Angeles.

Tombstone—Rushin & Hobbs, leasing on the Silver Cloud mine, eleven miles northeast of Tombstone, have shipped three cars of silver ore from the dumps. Some development work is being done in the mine.

Courtland—F. J. Gibbons is leasing on the property of the Great Western Copper Co. No shipments are being made. Ore is being stockpiled until the copper market is more favorable. A few others are also leasing in a small way but not shipping.

MONTANA

Butte-Jardine Trying Out Champion Mill—Western Smelting Co.'s Furnace Almost Complete

Champion District—Tuning-up operations at the 200-ton Champion mill of the Butte-Jardine are under way with the concentrates showing a recovery around 95 per cent. The Champion dumps all will be milled, the silver values running up to 15 oz.

Cooke City—The 300-ton copper blast furnace of the Western Smelting & Power Co. is about 90 per cent complete. At the mine, on Henderson mountain, a crosscut tunnel is being driven to open at depth orebodies the existence of which has been shown by tunnels higher up on the mountain. A hydroelectric plant of the company has been in operation for the past five years.

COLORADO

Modoc Company's New Hoist Running

The new 250-hp. hoist at the Modoc mine is in operation, and is lifting two double-deck cages from the 15th level. The hoist is designed to lift 3-ton skips from the 22nd level. The equipment was built by the Wellman-Seaver-Morgan Co. of Cleveland, Ohio. The installation cost approximately \$50,000.

UTAH

Tintic Standard Strikes Rich Ore on 1,100 Level

Eureka—The Tintic Standard has opened exceptionally rich ore in a drift from the No. 2 shaft on the 1,100 level. The drift has shown shipping ore for 500 ft. and the exceptionally rich silver ore has come in in the last 100 ft. It is felt that this level will equal the 1,250 and 1,200 levels in productivity. Milling ore has also been developed on the 1,100. The new mill is treating 175 tons daily, and the first cleanup, when the percentage of recovery can be determined, will be made in a few weeks.

NEVADA

Mining Engineers Object to New Licensing Bill

Mining engineers throughout the state of Nevada are making vigorous objections to the passage of Senate Bill No. 21, an Engineers' License Bill affecting all classes of engineers. This measure was prepared and introduced in the state Senate through the efforts of a small group of civil engineers in Carson City and its existence was a surprise to the engineering profession in the state of Nevada. Mining engineers as a whole opposed the bill on account of its loose construction and ambiguity. There are divers opinions regarding this type of legislation through this state, and it is generally felt that before a bill of this kind is introduced it should be scrutinized closely by representatives of all concerned. It is not likely that the bill will pass.

THE MARKET REPORT

Daily Prices of Metals

Feb.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
17	12.65	28.5	32.50	4.35@4.40	4.25	4.95
18	12.65	29.0	32.75	4.25@4.40	4.15	4.90
19	12.55	29.50	32.75	4.25	4.10	4.90
21	12.50	28.50	32.25	4.10	4.00	4.85@4.90
22	.....	.....	.....	.....	.....	.....
23	12.25	28.25	32.00	4.00	4.00	4.80@4.90

*These prices correspond to the following quotations for copper, "delivered": 12.90, 12.90, 12.80, 12.75, 12.50c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Feb.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
17	73½	71½	76	168	172	20	20½	24½	25½
18	73½	71½	76	173½	176½	20	20½	25½	26½
19	.....	.....	.....	.....	.....	.....	.....	.....	.....
21	72½	70½	75	170	173½	19¼	20¼	25½	26½
22	70¾	69¾	74	170	173	19	19¾	25½	25½
23	70¾	70	74	169	172½	18½	19¾	25½	26

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Feb.	Sterling Exchange	Silver			Feb.	Sterling Exchange	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
17	388¼	99½	60	34¾	21	386¾	99½	57¼	33
18	387½	99½	58¼	33¾	22	.....	.....	.....	33¾
19	385	99½	57¾	33¾	23	387¾	99½	57¾	32¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, Feb. 23, 1921

Absence of any demand, and pressure to sell, caused a fresh crop of price reductions in the local market during the last week. Declines in copper and lead have also occurred in London. Dealers are very pessimistic, and can see no immediate hope of a betterment as long as some interests seem disposed to market their current output regardless of price. However, business in some lines shows some prospect of improving, and in several instances corporation directors have shown a disposition to lay in moderate stocks of metals at current low prices when financial conditions allow.

Copper

Consumers generally show no interest in the market, and are not even willing to make a bid. Copper for prompt shipment was freely offered by at least two interests at 12½c. delivered, on Monday, and this afternoon sales were made at 12.50c. The larger producers claim to be maintaining their price at 13c., without, however, moving any metal. It is to their interest of course to do this, inasmuch as any marked decline just at this time might interfere somewhat with the marketing of the \$40,000,000 bond issue recently placed. Premiums of ¼c. per month are generally being asked by all would-be sellers on metal for forward delivery. Export demand has turned very weak.

Lead

The American Smelting & Refining Co. reduced its official price of lead, New York and St. Louis, from 4.60c. to 4.50c. on Friday the 18th, and the next day made a further reduction to 4.40c. This is still considerably above the market, and another revision is likely.

The outside market has declined violently, owing to the cutting of prices by two interests, one in St. Louis and the other here in New York. In one case the price reduction was inspired by considerable stocks, which had to be marketed to raise cash, and in the other by the fact that declines in London and the pressure of Spanish lead make importing look attractive. Some promising business has been booked on the decline, and close followers of the market are advising buying at current prices. Inquiries for small lots have not been as numerous as a few weeks ago, but were in evidence to some extent, particularly on Monday. The business of lead consumers is fairly good in some lines, particularly in the paint, storage-battery, and cable industries. The two producers of chemical lead have so far shown no disposition to sell under 4.50c. St. Louis, but how long they will persist in their policy is unknown. Apparently no business is being booked at that price.

Lead for forward delivery is approximately the same price as for prompt, but there is somewhat more disinclination to sell on the part of producers. Possibly about five points premium for each month in the future would about represent their ideas.

Zinc

The market has continued very listless, with few sales recorded. The further decline is attributed largely to the continuation of tight money conditions in the West, for when the question of ready cash is paramount, the price received for zinc or any other metal is a secondary consideration to procuring funds. European zinc is still being imported, and helps to prevent the market from recovering, although not much of it has been sold. American brands are said to constitute part of the imports, but are admitted duty-free only after satisfactory proof that it is primarily zinc of American origin, and not a bonded product, and such conditions are difficult to meet. High-grade zinc continues at 7.25c. New York and ordinary grades are reported offered in St. Louis at 4.80c. today.

Tin

London was somewhat stronger last week, owing to reports of greatly curtailed Bolivian production. Such of these reports as we have seen would

appear to be greatly exaggerated, and it is unlikely that more than a one-third cut in production is in effect or contemplated. Even at present prices, Bolivian producers are probably making money. Chinese tin is being more actively offered in the local market than for some time.

Straits tin for future delivery: Feb. 17th, 33@33.25c.; 18th, 33.50@34c.; 19th, 33.25@33.75c.; 21st, 32.50@33c.; 23d, 33@33.25c.

Arrivals of tin, in long tons: Feb. 15th, Australia, 5; China, 10; 18th, London, 205; 19th, London, 25.

Gold

Gold in London: Feb. 17th, 104s. 11d.; 18th, 105s. 6d.; 21st, 106s.; 22d, 105s. 6d.; 23d, 105s. 8d.

Foreign Exchange

The probability that Great Britain would be in the market for American dollars with which to pay interest on loans made by this country during the war had an adverse effect on sterling exchange in the closing days of last week, but sterling was stronger again Monday and today. A large amount of buying by speculative interests has accompanied the recent rise, so that there is a pronounced long account now to be considered.

On Monday, Feb. 21st, francs were 7.265c.; lire, 3.655c.; and marks, 1.64c. New York funds in Montreal, 15½ per cent premium.

Silver

The silver market has continued weak, on account of further selling by China and the Indian bazaars; and London fell today to 32½d., which is the lowest quotation since Nov. 4, 1916. The New York market has also declined, but with the lower prices a scarcity of silver and an inclination on the part of sellers to hold their product are becoming apparent.

Mexican Dollars—Feb. 17th, 45½; 18th, 44½; 19th, 44½; 21st, 43¾; 23d, 43¾.

Other Metals

Aluminum—List prices of 28@28.5c. are nominal. Outside market 24@25c.

Antimony—Chinese and Japanese brands, 5¼c.; market quiet. W.C.C. brand, 6¼c. per lb. Cookson's "C" grade, spot, 9¼c. Chinese needle antimony, lump, nominal at 4¼c. per lb. Standard powdered needle antimony¹ (200 mesh), 6½@7c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, wholesale lots, 7c.

Bismuth—\$2.35@2.40 per lb., 500-lb. lots.

Cadmium—Nominal, \$1.40 per lb., in 1,000-lb. lots.

Cobalt—Metal, \$4.50 per lb.; black oxide, \$3@3.10 per lb. in bbls.; sulphate, \$1.35 per lb. in bbls.

Iridium—Nominal, \$325 per oz.

Magnesium—Crude, 99 per cent, \$1.25@1.35 per lb., f.o.b. Philadelphia.

¹Molybdenum Metal in rod or wire form, 99.9 per cent pure, \$32@40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 38@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, \$70@80 per troy oz.

Palladium—\$65 per oz.

Platinum—\$70 per oz. Strong.

Quicksilver—Nominally \$50 per 75-lb. flask. San Francisco wires \$47.75.

¹Rhodium—\$200@225 per troy oz.

Ruthenium—\$175@200 per troy oz.

¹Selenium—Black powdered, amorphous, 99.5 per cent pure, \$2@2.25 per lb.

¹Thallium Metal—Ingot, 99 per cent pure, \$20 per lb.

¹Tungsten Metal—Wire, \$35@60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr₂O₃, foreign ore with a maximum of 6 per cent silica, 50@55c. per long ton unit, f.o.b. Atlantic ports.

Manganese Ore—40c. per unit, seaport; chemical ore (MnO₂) \$60 per gross ton, lump; \$65@70 per net ton, powdered.

Molybdenum Ore—85 per cent MoS₃, 55@60c. per lb. of contained sulphide, New York.

¹Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 40c. per lb. in ton lots.

¹Titanium Ores—Ilmenite, 52 per cent TiO₂, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO₂, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO₃, and over, per unit of WO₃, \$3@3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U₃O₈ and 5 per cent V₂O₅, sells for \$1.50 per lb. of U₃O₈ and 75c. per lb. of V₂O₅; ore containing 2 per cent U₃O₈ and 5 per cent V₂O₅ sells for \$2.25 and 75c. per lb., respectively; higher U₃O₈ and V₂O₅ content commands proportionately higher prices.

Vanadium Ore—\$1.50 per lb. of V₂O₅ (guaranteed minimum of 18 per cent V₂O₅), New York.

¹Zircon—Washed, iron free, 3c. per lb.

¹Zirkite—According to conditions, \$70@90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at \$1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 19—Zinc blende, per ton, high, \$26.90; basis 60 per cent zinc, premium, no offers; Prime Western, \$22.50@20; fines and slimes, no offers; calamine, basis 40 per cent, offer \$15, no sales; average settling price, all grades of zinc, \$25.24.

¹Furnished by Foote Mineral Co., Philadelphia, Pa.

Lead, high, \$48.45; basis 80 per cent lead, \$45@40; average settling price, all grades of lead, \$46.15 per ton.

Shipments for the week: Blende, 5,943 tons, lead, 1,185 tons. Value, all ores the week, \$204,710.

Less than 900 tons of zinc was sold this week, over half of which is reported on \$22.50 basis, with the rest reported bought on \$20 basis. A large mercantile establishment claims the purchase of 1,000 tons on \$22.50 basis for speculation, but as this must be resold to smelters, it is not reported as purchased ore until more may be known of the transaction, no producer having acknowledged the sale.

Lead ore declined \$5 at the close, with little animation on \$40 basis.

Platteville, Wis., Feb. 19—No market for lead or zinc ore. Shipments for the week: Blende, 614; lead, 30 tons. Shipments for the year: Blende, 5,796; lead, 510 tons. Shipped during week to separating plants, 185 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, \$2,000@3,000; No. 2, \$1,400@2,000; spinning fibres, \$400@1,000; magnesia and compressed sheet fibres, \$325@500; shingle stock, \$110@150; paper stock, \$60@75; cement stock, \$17.50@30; floats, \$8.50@15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, \$10@12 per net ton; ground (white) \$24@30 in bags, carload lots; (off-color) \$22@26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, \$23; ground (white), \$45; ground (off color) \$30@32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, \$10 per ton, f.o.b. cars, Missouri; floated, \$28 per ton in bbls.; \$26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, \$8@10; washed, \$10@12; powdered, \$15@20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, \$15@20, f.o.b. Virginia points. Domestic lump, \$10@20; powdered, \$25@30; imported lump, \$15@25, f.o.b. American ports; powdered, \$35@45, f.o.b. New York.

Feldspar—Crude, \$8@14 per gross ton, f.o.b. Maryland and North Carolina points; \$7.50@10, f.o.b. Maine; ground, \$27@30, car lots, f.o.b. Baltimore; ground, \$17@21, f.o.b. North Carolina points; \$17@21 per ton, No. 1 ground, f.o.b. New York State; \$21@23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$25 per ton, f.o.b. Illinois mines, and \$25, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, \$60; lump, \$17.50, f.o.b. Heathden, N. M. In Canada

85 per cent calcium fluoride sells for \$20 per ton, f.o.b. Madoc; output limited. Canadian price generally \$18 (Canadian currency) per ton, f.o.b. mines.

Fuller's Earth—\$16 per ton, carload lots, f.o.b. mines.

Graphite—Ceylon lump, first quality, 8@9c. per lb.; chip, 7c.; dust, 5½c. No. 1 flake, 7½c.; high-grade amorphous crude, 3c.

Gypsum—Plaster of paris in carload lots sells for \$4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, \$3.50@\$4.50; calcined stucco, \$9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, \$1.60@\$1.65; 2@8 in., \$1.55@\$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, \$1.65@\$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined—High-grade caustic calcined, lump form, \$35@\$40 per ton, carload lots, f.o.b. California points. In Chicago district, \$57.70; Atlantic seaboard, \$61@\$63.

Dead - Burned—\$38 per net ton, Chewelah, Wash.; \$58@\$64, Chester, Pa. Austrian grade, \$55@\$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, \$1.20; No. 4, \$2.50@\$3; No. 3, \$3.50@\$4; No. 2, \$4.50@\$6; No. 1, \$5.50@\$6.50. Clear block: No. 6, 50c.; No. 5, \$1.75; No. 4, \$3.25; No. 3, \$5; No. 2, \$6.50; No. 1, \$8; A1, \$6.50@\$8.50; extra large, \$25; ground, wallpaper grade, \$90@\$160 per ton (depending upon quantity); all f.o.b. New York.

Monazite—Minimum of 6 per cent thorium oxide, quoted \$30 per unit, duty paid.

Phosphate Rock—According to a Tennessee producer, there is little demand for phosphate rock. Owing to the decreased price of farm products farmers claim they are not going to use fertilizers this year, so manufacturers are holding off purchasing phosphate rock, as they had accumulated fairly good stocks during the fall months. Quotations: Per long ton, Florida ports: 77 per cent tricalcium phosphate, \$13; 75 per cent, \$11.50; 75@74 per cent, \$11; 70 per cent, \$8.35; 68 per cent, \$7.85; 68@66 per cent, \$7.60. Finely ground Tennessee rock sells for \$8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, \$9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 16c., c.i.f. Atlantic seaport; furnace size, 16½c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, \$10; 1½ to 2 in., \$14; rice, \$17; all net ton, f.o.b. Baltimore; lump, carload lots, \$5@\$7.50 net ton, f.o.b. North Carolina mines.

Sulphur—\$18 per ton for domestic; \$18@\$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, \$11@\$20 per ton; roofing grades, \$8.50@\$13; rubber grades, \$11@\$18; all f.o.b. Vermont. California talc, \$18@\$45, talcum powder grade. Southern talc, powdered, carload lots, \$10@\$14 per ton; less than carload, \$25, f.o.b. cars; freight to New York \$5.25 per ton, carload lots; less than carload lots, \$9.25. Imported, \$40@\$50; Canadian, \$20@\$40 per ton.

Mineral Products

Arsenic—White arsenic, 10@11c. per lb.; sulphide, powdered, 14@15½c. per lb. in carload lots.

Sodium Nitrate—\$3 per cwt. ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, \$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; \$32 per ton, New York.

Potassium Sulphate—Domestic, \$220@\$230 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, \$200@\$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., \$12@\$15.

Ferrocrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 16@17c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, \$100, f.o.b. furnaces; resale, \$90, delivered; English, \$100, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, \$40@\$45, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, \$55@\$60; 50 per cent, \$80@\$85; 75 per cent, \$145@\$150.

Ferrotungsten—Domestic, 70 to 80 per cent W, 55@60c. per lb. of contained tungsten, f.o.b. works. Foreign, 60c.

Ferro-uranium—35 to 50 per cent U, \$7 per lb. of U contained, f.o.b. works.

Ferrovandium—Basis 30 to 40 per cent, \$5 per lb. of V contained, plus 75c.@\$2 differentials and according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 15½.

Lead Sheets—Full lead sheets, 8½c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver—33½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 19½c.; sheathing, 19½c.; rods, ½ to 3 in., 16½c.

¹Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc Sheets—\$11 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, \$160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr₂O₃, \$45@\$50 per net ton, and \$55 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, \$80 per net ton, shipping point; arches, keys, wedges, \$85; splits, soaps, \$100.

Fire Brick—First quality, 9-in. shapes, \$55@\$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, \$45@\$50.

Magnesite Brick—9-in. straights, \$90@\$100 per net ton; 9-in. arches, wedges and keys, \$105; soaps and splits, \$120.

Silica Brick—9-in., per 1,000: \$45@\$55 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Feb. 22, 1921

The break in steel prices on the part of the independent producers has made practically no progress since last report, the reason being that there is no disposition on the part of buyers to take hold, so that little opportunity for competition is afforded. Minimum prices quoted thus far, by comparison with Industrial Board or Steel Corporation prices, are as follows: Bars, 2c., against 2.35c.; shapes, 2.20c., against 2.45c.; plates, 2.25c., against 2.65c.; hoops, 2.85c., against 3.05c.; blue annealed sheets, 3.20c., against 3.55c.; black sheets, 4.10c., against 4.35c.; galvanized sheets, 5.35c., against 5.70c. Standard steel pipe has not been shaded, remaining steady at 57½ per cent basing discount, and tin plate is also steady at 77.

It is a question whether the failure of buyers to take hold was a surprise to independents. The chief object in cutting prices is assumed to have been to force the Steel Corporation's hand, causing it to reduce prices and therefore wages, and thus bring about a redistribution of demand.

Pig Iron—The first sales of basic iron this year have just been made, and at the new low price of \$25, Valley, a 1,000-ton lot being included. Bessemer is quotable at \$27, Valley, and foundry remains nominal at \$28.

Semi-Finished Steel—There is no inquiry for billets or sheet bars in the open market and quotations remain purely nominal at \$45 and \$47. The Steel Corporation has receded from its \$47 price on sheet bars, but is offering steel only to regular contract customers.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls., hardwood, 5½c. per lb., in 250-lb. bbls. Barrel charge is 35c. additional.

Connellsville—Furnace, \$5@\$5.50; foundry, \$6@\$6.50.

Weak Support to Silver Market in the Far East

American Producer Unaffected by Present Conditions—Over One-Seventh Pittman Act Purchases Completed—Indian and Chinese Trade Depression Not Helpful to Foreign Silver Market — Movements of Silver in 1920 Comparatively Light

THE SILVER PRODUCER in the United States is practically the only metal-mine operator who, under present conditions in the metal markets, can profitably work his property. With the fixed price of \$1 per oz. for silver established by the Pittman Act, he can look forward for upward of three years' operations at a high price for silver and in the face of continually declining commodity and production costs. He is in a fortunate position compared with his fellow operators in low-priced copper, lead, and zinc.

Unfortunately, most of the silver produced in the United States is byproduct metal obtained from the refining of copper and lead, so that a relatively small number of mining companies are directly engaged in producing silver exclusively. However, the fixed price of silver has been of great importance in aiding the copper and lead producers to make "both ends meet." Were it not for the high precious-metal content of Idaho lead ore and Montana copper ores, the production of lead and copper from these two states would undoubtedly be much smaller.

PITTMAN ACT WORKING SMOOTHLY

Over 36,000,000 oz. of silver had been purchased by the Treasury under the Pittman Act by the middle of February, or more than one-seventh the total required purchases of 207,000,000 oz. Talk of repeal has been quieted in this country as a better understanding of the working and principles of the Pittman Act has been realized. It is well that this should be so, for the mistaken impression that the Government was losing heavily on these purchases seemed widespread. Criticism at present directed against the act has come mainly from abroad, where it has been pointed out that there are good reasons why high silver prices are inimical to the best interests of the United States. One reason advanced was that high silver prices prevent importation of Eastern commodities or increase their cost, to which one may make rejoinder by pointing out that high priced silver is beneficial to our export trade to the East, as it enables Asiatic peoples to make large purchases from the West.

BRITISH ARE PAYING SILVER PRODUCER

It should not be forgotten, in discounting arguments for the nullification of the Pittman Act, that the American silver producer is being virtually paid by British funds, as it was Great Britain's demands for silver during the war for use in settling India's trade that led to heavy purchases from the U. S. Government at \$1 per ounce. This British money is now literally being passed along to the American producer in replacing the silver in the Treasury.

The silver market at present seems without any firm foundation. Currency requirements are small; in fact, nations appear anxious to be rid of their silver currency. Mexico is an exception, as silver pesos are being coined to replace exported Mexican coins. China and India are in the throes of severe trade depression. India, which ordinarily has a favorable trade balance, necessitating heavy shipments of silver to the East, had an adverse trade balance in 1920 of about 307,000,000 rupees, compared with a favorable balance of 1,208,000,000 rupees in 1919. Under such circumstances there is little wonder that India, the greatest silver consuming country in the world, has recently been *selling* silver instead of buying. Chinese trade is in a similar position, but no accurate figures are available regarding trade conditions in China.

INDIA'S INACTIVITY IN THE SILVER MARKET

One cannot help but conclude that India's tremendous absorption of silver during the war—it will be remembered that

in the year 1918-1919 India consumed more than the entire world's production—has found an insecure resting place, and has not been satisfactorily digested. Furthermore, this points to the advisability of continuing the course mapped out by the Pittman Act in buying up again the great stock of silver the United States released in a few months during the war, and thus removing a demoralizing market agency.

India is still having trouble with her rupee currency system, which was recently reorganized to change the rupee from a basis of fifteen to the sovereign to ten to the sovereign. Although this step was taken to restore the token character of the rupee, and ostensibly to link the rupee to gold and not the pound sterling, the rupee has fluctuated in response to the price of silver and seems to have disregarded its relation to the price of gold. This has been due primarily to the unwillingness of the Indian government to convert or freely exchange rupees for gold, thus making the rupee an inconvertible token coin.

Although the rupee now has a face value of 2s., or 0.487c., it is quoted around 27c. in the exchange market. Considering that rupee exchange has fluctuated greatly in the course of twelve months, it is not surprising that Indian trade is in an unsatisfactory condition.

SMALL EXPORT BALANCE OF SILVER IN 1920

During the calendar year 1920 exports of silver—as might be expected from the effect of the Pittman Act—dropped off. Whereas in 1919 India was the greatest purchaser from this country, in 1920 India's imports were relatively small. Exports to China in 1920 were much larger than to any other country, and illustrate how important China has recently been as a sustaining factor in the market. The following table gives a comparative record of silver movements to and from the United States in 1919 and 1920:

EXPORTS OF SILVER			
To	1919	1920	
China.....	\$77,583,367	\$61,347,610	
British India.....	109,180,718	642,408	
Hongkong.....	10,245,351	24,872,571	
Canada.....	7,854,378	7,061,755	
England.....	15,635,386	4,924,788	
Japan.....	3,946,453	4,673,784	
Others.....	14,575,398	10,093,308	
Totals.....	\$239,021,051	\$113,616,224	
IMPORTS OF SILVER			
From	1919	1920	
Mexico.....	\$63,303,437	\$53,197,337	
Peru.....	8,862,537	11,990,677	
Central American States.....	5,200,481	7,198,851	
Canada.....	7,171,469	3,788,435	
Chile.....	1,927,324	3,744,351	
Others.....	2,944,770	8,140,390	
Totals.....	\$89,410,018	\$88,060,041	

Compared with an excess of silver exports over imports in 1919 amounting to \$149,611,000, the balance in 1920 was only \$25,556,000.

The last month for which detailed silver movements are available—December, 1920—shows an excess of exports amounting to \$1,455,278, despite the diversion of the entire United States production to the Treasury. However, repurchases first began in May, and from the last day of April to the first of the year 1921 an excess of \$3,853,161 in silver had been imported, presumably for the benefit of consumers in the United States, who naturally prefer to satisfy their requirements by purchasing lower-priced foreign silver. It can be expected that for several years imports of silver will exceed exports.

COMPANY REPORTS

United Verde Extension Mining Co. Records Operating Loss

Copper: Arizona

A report of operations of United Verde Extension Mining Co. for the year ended Dec. 31, 1920, states that ore mined during the year amounted to 164,307 dry tons, averaging 12.84 per cent copper, 0.023 oz. gold, and 2.22 oz. silver, and that smelted during the year amounted to 161,617 dry tons, which yielded 41,942,700 lb. copper, 5,530 oz. gold, and 359,370 oz. silver.

The amount of ore developed and remaining in the mine above the 1,500 level is estimated at 1,148,800 tons, averaging 11.81 per cent copper, 0.023 oz. gold, and 2.22 oz. silver.

The operation of one furnace at the smelter during the year was continuous and the output was 41,942,700 lb. Costs per lb. were as follows:

Mining.....	\$0.0343
Smelting.....	0.0214
Freight on ore.....	0.0010
Freight on bullion and refining.....	0.0274
Other expenses.....	0.0011
Total.....	\$0.0852

These costs do not include (1) depreciation, (2) reserve to return capital (depletion), (3) taxes.

General conditions are satisfactory, with the exception of the additional cost of coal and coke at the mine and the increase in railroad freight rates, which must be reduced before the mining industry of the state becomes healthy.

The state and county taxes paid during 1920 amounted to \$367,257.70, a burden which must be reduced in order that the demand for lower cost may be met.

Earnings for the year ended Dec. 31, 1920, follow:

Gross revenue from metals produced.....	\$7,591,814.72
Other revenue.....	202,843.37
	\$7,794,658.09

Deductions:	
Mine and smelter operating, freight and selling expenses, etc.....	\$3,407,829.77
Other expenses, including taxes paid and accrued.....	570,808.43
	3,978,638.20
Earnings from operations.....	\$3,816,019.89

Less:	
Amounts written off to reserves for depletion and depreciation.....	4,635,228.70
Net loss to surplus.....	\$819,208.81

Dividends amounting to \$2,100,000 were paid on the \$525,000 capital stock outstanding.

Surplus account on Jan. 1, 1920, stood at \$5,904,067.54; on Dec. 31, 1920, at \$2,984,858.73.

Mount Lyell Mining & Railway Co.

Copper: Tasmania

A report of the Mount Lyell Mining & Railway Co., Ltd., for the year ended Sept. 30, 1920, indicates that 107,879 tons of ore was shipped from the Mount Lyell mine, containing 0.38 per cent copper, 0.99 oz. silver, and 0.038 oz. of gold per ton. The North Mount Lyell mine shipped 50,905 tons of ore, assaying 7.56 per cent copper, 1.36 oz. silver, and 0.11 oz. gold per ton, to the smelters, and 22,876 tons of ore, assaying 3.92 per cent copper, 0.58 oz. silver, and 0.008 oz. gold per ton to the flotation plant. The Lyell Comstock mine shipped 11,459 tons, assaying 2.15 per cent copper, 0.14 oz. silver, and 0.034 oz. gold, to the flotation plant. A comparative production table follows:

MOUNT LYELL PRODUCTION YEARS ENDING SEPT. 30

	1920	1919	1918
Copper, tons.....	4,536	5,314	5,705
Silver, oz.....	168,109	266,864	320,344
Gold oz.....	5,164	5,538	7,042

Costs per ton of ore amounted to £1 1s. 2d. for mining; £1 2s. 2d. for concentrating and smelting, and 2s. 7d. for converting copper.

The working account shows a profit of £152,162 7s. 3d. After deducting prospecting, development, and depreciation charges amounting to £57,059 19s., the net profit from all sources amounted to £76,007 11s. 8d. The company's liquid assets at Sept. 30, 1920, show a surplus of £533,861 19s. 9d. The working account follows:

DEBITS			
	£	s.	d.
Mining charges.....	180,494	5	11
Mine preparatory works overburden.....	4,110	18	5
Mount Lyell mine underground development.....	19,685	7	10
Ore concentration.....	32,948	0	4
Smelting expenses.....	154,535	16	7
Converter expenses (bessemerizing).....	17,480	3	9
Railway traffic expenses, maintenance, management and repairs.....	34,896	15	4
Freight and charges on copper.....	55,990	1	4
Balance to profit and loss.....	152,162	7	3
Total.....	£652,303	16	9

CREDITS			
	£	s.	d.
Blister copper and chemical works.....	622,045	4	2
Less ore purchase.....	3,064	0	7
	£618,981	3	7
Railway traffic revenue.....	33,322	13	2
Total.....	£652,303	16	9

A dividend of 2s. per share was paid Dec. 19, 1919, and a dividend of 1s. per share on June 28, 1920. Surplus balance on Sept. 30, 1919, was £411,003 5s. 2d., and £217,624 0s. 2d. on Sept. 30, 1920.

The company is capitalized at 1,300,000 shares of £1 each, of which 1,289,195 shares have been issued.

St. Mary's Mineral Land Co.

Copper: Michigan

A report on the affairs of the St. Mary's Mineral Land Co. for the year ended Dec. 31, 1920, follows:

RECEIPTS	
Cash on hand Dec. 31, 1919.....	\$95,953.79
Payments for wood and timber.....	\$64,969.00
Payments for surface.....	5,350.00
Depletion of Champion Copper Co. ore reserves.....	300,000.00
Distributions.....	1,280.00
Dividends.....	312.00
Notes collected.....	31,750.00
Ground rent.....	4,519.50
Interest.....	16,208.10
Sundry other receipts.....	714.64
Total.....	\$521,057.03

EXPENDITURES	
Mayflower-Old Colony Copper Co. assessment.....	\$3.00
Naumkeag Copper Co. assessment.....	4,170.00
Houghton Copper Co. advances.....	1,400.00
Charter, capital stock, and land taxes.....	49,545.45
Salaries and expenses at Portland, Boston and Houghton.....	26,784.32
Treasury certificates of indebtedness.....	50,000.00
1920 distribution No. 1.....	320,000.00
Total.....	\$451,902.77
Cash on hand Dec. 31, 1920.....	\$69,154.26

No demand developed for mineral lands, which was perhaps not unnatural in view of the unsatisfactory price at which copper was selling for most of the year. No dividends were paid by the Champion Copper Co., but one capital distribution of \$600,000 was made by that company for moneys set aside as representing depletion of their ore reserves. From the company's share of this distribution and similar distributions previously received, \$2 a share on this company's stock was sent to stockholders as a distribution of capital on June 15 last.

MINING STOCKS

Week Ended February 19, 1921

Table of Mining Stocks with columns for Stock, Exch., High, Low, Last, Last Div. Includes sections for COPPER, GOLD, SILVER, GOLD AND SILVER, SILVER-LEAD, NICKEL-COPPER, LEAD, ZINC, VANADIUM, ASBESTOS, and MINING, SMELTING AND REFINING.

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

