

# ENGINEERING AND MINING JOURNAL

August 13, 1921



Iron Ore Unloading Docks at Buffalo, N.Y.

**Improvements in Nodulizing at Chrome, N. J.**

By C. L. Colbert

**Iron Ore Deposits in Hudson Bay**

By Dwight E. Woodbridge

**Replacement Copper Deposits**

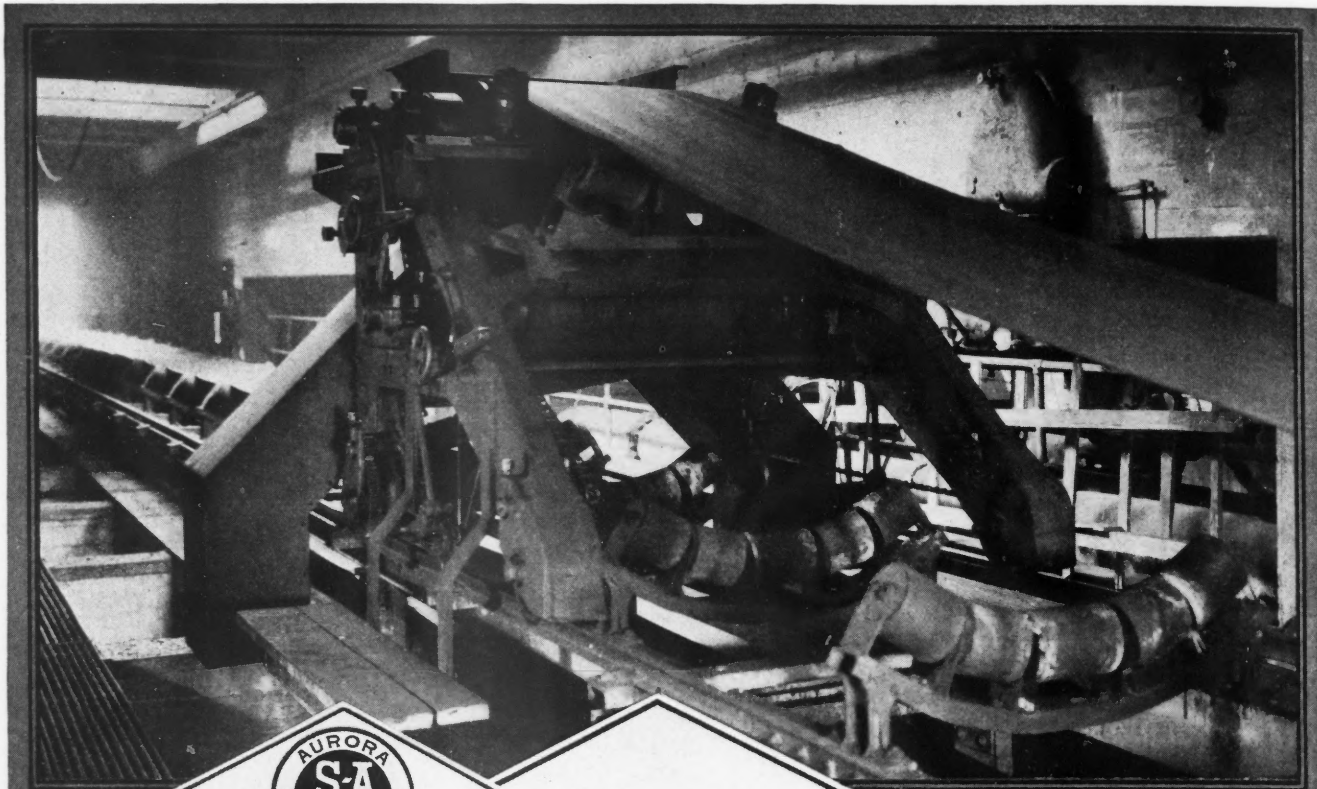
By Graham John Mitchell

**Biography of Albert Burch**

Is a new shaft-sinking record for the gold medal offered by the *Engineering and Mining Journal* being made at Eureka, Utah? Telegraphic claims to that effect are recorded in the *Mining News* this week.

\* \* \* \* \*

Dwight E. Woodbridge tells of a possible new link in Northern Ontario's chain of mining camps. Sudbury nickel, Cobalt silver and Porcupine gold may be supplemented by iron from islands in Hudson Bay.



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# Engineering and Mining Journal

*A Weekly Journal of the Mining and Mineral Industries*

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Number 7

## New York & Honduras Rosario Mining Co.

OCCASIONALLY a company report arrives at our desk that is as interesting to read as a well-written technical article; sometimes more so. Frequently it tells in a matter-of-fact uncolored way how a mining company has struggled against exasperating adverse conditions, financial, physical, and whatnot. The New York & Honduras Rosario Mining Co.'s recently issued annual report, a document of fifty pages, falls in this class. It treats comprehensively, yet concisely, of silver mining in Central America, and is so complete and such an exception to the general run of American mining reports that it deserves especial mention. The statement shows the creditable record of the company during the thirty-eight years of its existence and the fight it has had to make to decrease costs in the face of a declining silver market, a fight that was given up last June when productive operations ceased.

During 1920 the company had to contend with the biggest flood in its history, a fire which destroyed a mill and assay office, and the robbery of \$35,000 in bullion. Such is the romance of mining in Honduras! The lease of the company granted by the Honduran government expired on Dec. 31, 1920, and it was renewed by the national congress for another twenty years, at a convocation for that especial purpose. The terms are unique. The company is exempted from the payment of federal import taxes on its mining machinery, road tax, and export charges on its product. In return for these concessions it is obligated to purchase and install, within a period of two years after the plans are approved by the government, a water conduit and distributing system for the capital of Honduras, Tegucigalpa. Admirably pleasant relations are reported to exist between the government and the company.

To anyone interested in milling and mining costs, ore reserves, production, and other operating details, many instructive tables will be found in the report, admitting ready comparison with the record of previous years. The financial statements are compact, yet they do not lack the important essential of clarity and preciseness. They remind us somewhat of the statement of a New York bank which appears occasionally in the advertising columns of the New York papers with the heading "A Bank Statement That Any Man or Woman Can Understand." It means much to a stockholder or an outsider to have a frank unclouded account set before him, and such a report or statement cannot help but inspire confidence in the management of any corporation.

The manager of the New York & Honduras Rosario Mining Co., Mr. A. R. Gordon, and the officers and directors who have made the report public, can well take pride in the presentation of their record for 1920. The accounts are virtually a contribution to the economics of silver mining in the tropics. It is helpful to the student, mining engineer, economist, and last,

but not least, the investor. We hope the trying period through which the company has passed and which has forced it to stop work is only a temporary setback in the progress of this mining enterprise.

## The Imperial Mineral Resources Bureau

THE SECOND ANNUAL REPORT of the Imperial Mineral Resources Bureau is interesting chiefly on account of the complete and systematic way in which it is organized. The object of the Bureau is evidently a complete grasp of the mineral resources of the British Empire, and the prosecution and co-ordination of those mineral problems necessary to the most intelligent imperial and international mineral policy. England herself has never had necessity for a very elaborate geological survey, as has the United States, a new and undeveloped country; but the dominions and colonies of the empire, such as Canada, Australia, and New Zealand, have maintained active and efficient geological surveys and mining bureaus. Without much in the way of new machinery, and very little, we should judge, in the way of fresh expenditures, the power of all these organizations is now assembled in the Imperial Mineral Resources Bureau.

The control of the Bureau is in a Board of Governors, of whom there are fourteen, the chairman being Sir Richard Redmayne, past president of the Institution of Mining and Metallurgy. The governor nominated by Canada is Dr. Willet G. Miller. Corresponding members are tributary to the governors: for example, for Canada they comprise the Deputy Minister of Mines, at Ottawa; Chief of Division of Mineral Resources and Statistics, at Ottawa; the Provincial Mineralogist of British Columbia; the Deputy Minister of Mines for Toronto; the Superintendent of Mines for Quebec; the heads of the departments of mines of Nova Scotia and New Brunswick; and so on for each province.

Under the governors, the Bureau is organized into an Intelligence and Publications Section, a Legal Section, a General Purposes and Finance Section, and an Investigation and Development Section. The latter is the most inclusive, and comprises separate technical advisory committees on the following subjects: Publications, Libraries, and Abstracts; Iron and Steel, Copper, Tin and Tungsten; Lead and Zinc; Arsenic, Antimony and Bismuth; Nickel and Cobalt; Aluminum, Magnesium, Potassium and Sodium; Coal, Coke and By-products; Petroleum, Asphalt, and Natural Gas; Gold, Silver, Platinum and Mercury; the Minor Metals; Chemical Industries; Refractories and Building Materials; and Miscellaneous Minerals.

When we come to examine the personnel of these different committees, we find that they are not nominal but elaborate, carefully planned, and inclusive. For example, the chairman of the copper committee is Dr. Frederick H. Hatch, past president of the Institution of

Mining and Metallurgy, and the twelve other members of the committee include a distinguished representative, or sometimes two, from each of the following organizations: the Institution of Electrical Engineers, the Institution of Mining and Metallurgy, the Institute of Metals, the British Metal Corporation, Ltd., The United Alkali Company, the British Non-Ferrous Metals Research Association, the Air Ministry, the National Physical Laboratory, and the British Insulated and Helsby Cables, Ltd.

This typical example of one of the committees shows the breadth of the scope of the organization, like an imperial mineral resources chamber of commerce, under direct government guidance. Surely, with such an organization, the imperial government and those of the dominions will not fail to be provided with the best available and the most tangible advice looking toward intelligent and efficient national, imperial, and international mineral and metal policies.

We applaud the organization and hope it will be fully supported as to funds and contributed services.

The Bureau will take charge of a Mineral Exhibit at the British Empire Exhibition to be held in 1923. One of its immediate objects is the obtaining of a unified system of mining and metallurgical statistics, with standardization of weights and measures. The matter will first be considered with the Home and Dominion governments, after which the foreign governments will be approached "with the object of securing their concurrence in the adoption of a unified system of mineral statistics."

#### The Alaska Gastineau Mining Co.

IN OUR ISSUE of June 4, 1921, we noted the closing down of the Alaska Gastineau Mining Co. and the permanent cessation of operations of this company upon its mining property at Thane, Alaska. The date of closing down was June 1, 1921. According to the announced intention of the company, it will become an industrial operation, engaging in the manufacture and sale of paper pulp.

The Alaska Gold Mining Co. was organized as a holding company in 1912 to finance the Alaska Gastineau, which represented the consolidation of a number of separate properties. Active development was started about the middle of 1912. On Jan. 1, 1915, according to *The Mines Handbook*, there was a fully developed tonnage estimated at 21,000,000 tons of an average assay value of \$1.75. Including partly developed and probable ore, the estimate exceeded 75,000,000 tons "having a recoverable value of \$1.50." Operating costs were then estimated at 75c. per ton and tailing loss was computed at 25c. per ton. The apparently comfortable margin at that time appeared to be a reasonable assurance of a prosperous campaign. On the strength of this and the over-optimism of the investing public, shares sold up to \$40 in 1915.

Operations in 1915 showed a recovery of \$0.937 out of a gross value of \$1.156 per ton. Operating expenses were \$0.688 per ton. Excess of recovery over operating expenses was \$0.249 per ton. Operating profit was less in 1916 and 1917, and losses accrued in 1918, 1919, and 1920. The mill was started March 1, 1915, and to date a total of 11,711,314 tons has been milled, yielding a gross of \$9,508,168. During the years 1915, 1916, and 1917 the prices of materials used had not been affected to a great extent, but in 1918

the effects of the war began to be apparent. A scarcity of labor caused a reduction in tonnage. Increased cost of supplies also played its part. Conditions in the mine became such that hope of profit in mining the harder ores dwindled, and the predicted shutdown announced in the 1920 annual report of the company became an eventuality. The manager, G. T. Jackson, states that "had the 1915 prices for materials, supplies, and labor been maintained throughout the six years of operations, the actual operating costs would have been reduced over 15c., which would have resulted in a gain of \$1,800,000 on the tonnage milled."

The failure of this company is worth analysis. It begins with a failure of the sampling methods used at the time, which did not give accurate results. The average assay value proved to be unduly high. Next was the fact that in the mining operations there was an unexpected dilution of the ore with barren rock. Lastly was the unexpected trend of economic disturbances due to the war.

In so far as plant, equipment, operation, and administration are concerned, Alaska Gastineau has many splendid lessons for the mining industry. The technical staff consistently held down costs. The full story of the struggle to keep the outgo below the income has yet to be told. Good metallurgical results were attained, the costs, omitting the increases in labor and supplies due to the war, were kept within reason, but the expected richness of ore was not realized.

The period when the Alaska Gastineau was started off on its career represented a peak in mining history. Mining on a great scale, "wholesale mining," as it was termed by some, attracted the attention of many engineers. It was equally attractive to financiers, and capital for such enterprises was not difficult to obtain. The success of the Alaska Treadwell group and of a number of the "porphyry" coppers was in the air, and no doubt contributed to the optimism of the time. Failure appeared improbable, and, as it has since turned out, "success had a close run for its money." A slight additional margin would have turned Alaska Gastineau into a success.

We do not wish to record this failure as an indictment of large-scale mining operations, but we do speak for a more careful consideration of the limitations of ambitious and extensive mining projects. The initial determination of margins by exhaustive sampling methods is an element of safety in every mining enterprise. It is, needless to say, critical in the larger enterprises. A greater risk is permissible in smaller operations. The obvious lessons to mining engineers and financiers are probably worth what it cost to find them out.

#### Mine Superintendents' Meetings In California

A HIGHLY COMMENDABLE PRACTICE was introduced some time ago among the managers and superintendents of the Mother Lode mines in California. It consists of monthly meetings held successively at the different mines. A visit is usually made underground and through the surface and ore-treatment plants. This is usually a feature of the forenoon. After a luncheon courageously handled by the Dutch method, a conference meeting is held. Many topics are discussed and handed back and forth over the cigars. Details of mining methods, of equipment, man-

agement, the purchase of supplies, welfare and labor conditions are reviewed both broadly and in detail. The meetings are interesting. We have had the privilege of attendance, and can so state.

An important factor in making such meetings practicable is the automobile. Almost every superintendent has some kind of a machine, and forty or fifty miles, or even more, are feasible with but little loss in time. The telephone keeps each one in touch with his particular operation. Usually only a day, or at most two days, are required for a meeting. Not all of the superintendents attend each meeting, but there are always a sufficient number to make the gathering interesting and profitable. Not infrequently the superintendent brings his foreman.

Owing in part to a preponderance of private ownership or control of Mother Lode mining properties, there has been prevalent an extreme conservatism, which has found expression in closely guarding costs and other data. To such an extent has conservatism operated that it can be justly said that this important mining region is one of the least known in the United States. As a consequence of the lack of publicity there has been a surprising absence of interest in the mining possibilities of one of the oldest gold-mining districts in the West. Important geological information concerning ore shoots that should have been given out to encourage and stimulate discussion on this subtle phase of mining has been withheld. Helpful data on ore treatment have in only a few instances been given freely.

Other mining districts have shown notable progress, because of the encouragement given to discussion and publicity of technical details. As a whole, the success of the mining industries is due to the resultant thought of many technical as well as practical men. Publicity is the only broad avenue through which this can safely operate.

The superintendents' meetings are significant of a change which is gradually taking place in the conservative point of view so long held. We look upon it as the entering wedge which will in a relatively short time revitalize the Mother Lode and increase the mining interest in its future. To Edwin Higgins' foresight in initiating these meetings due credit should be given. Other districts may find in a similar plan decided advantages.

### Lower Costs the Way Out

**A**N AUTHORITY states succinctly, and afterward proves, that the chief reason why the United States is losing export trade is because of the higher prices charged by American manufacturers compared with those in England, Germany, and other countries. We do not believe that the American manufacturer is trying to make an excessive profit under present conditions, and, if he is not, then his costs must be higher than those which obtain in foreign countries. Ultimately labor is the principal factor in costs, and until wages are radically reduced from the present level it would appear that our foreign trade is destined to dwindle.

Most basic commodities, for example, cattle, copper, corn, cotton, hides, hogs, lead, petroleum, rubber, and wool, are practically at pre-war levels or below, and there is reason to believe that the price of other commodities and wages will be forced there by world con-

ditions. The alternative will be that the business stagnation will continue, though probably in a lessened degree as domestic demand improves. Still, even now, domestic demand is not as absent as some people think. The New York department stores, for example, are reported to be selling a larger quantity of merchandise than before the war. But the foreign business is decidedly disappointing, and this is normally so large that it must be considered. With a foreign trade of four billion dollars before the war, and of ten billions in 1919, we are not an independent nation economically.

As wages fall, so will the cost of living, so that the wage-earner will not suffer unduly. His standard of living will be maintained higher than that of his foreign brothers because of the natural advantages and resources of the country and the use of efficient machinery and methods which permit more work per man-day. These are the reasons why the American workman is better off than others. No man-made tariff, fluctuating up and down according to which administration is in power, is, in general, responsible.

As far as metals and minerals are concerned, prices are not likely to drop further, for they are already at pre-war levels. Compared with June, 1914, copper is 14 per cent cheaper; lead, 12 per cent dearer; silver, 9 per cent dearer; and zinc, 16 per cent cheaper. Neither may we expect to see metal prices rise much above present levels for a considerable period. The world has become used to doing without things, and it will be some time before it is economically able to indulge itself in a normal manner. But costs will come down, and in that way will our metal and mineral industries return to prosperity.

### Wanted—A Hoist Engineer

**N**EW YORK CITY and its environs is a great field for mining and metallurgical study. As we have stated repeatedly, much mining, milling, smelting, and refining are going on within commuting distance of New York. At the same time, tunneling under local rivers, and drilling and blasting of foundations for structures of all sorts, put into practice particular branches of mining.

Carrying the analogy a little further, the efficient and speedy elevators found in some of our tall skyscrapers may be likened to the hoists in a mine, with, of course, the difference in the refinements required in that service. Hoisting in buildings, however, has lately shown several defects, the daily press occasionally reporting the failure of an elevator rope, the plunging of the elevator down the shaft, and the consequent killing or serious injury of the unfortunate occupants of the "cage." Accidents such as these we would classify as being avoidable, mining practice teaching us that the use of safety catches, careful inspection of hoisting ropes, and the general use of safety devices makes mine accidents of this nature of rare occurrence.

The elevators in New York are inspected regularly both by city officials and insurance companies, yet accidents happen regardless. We don't doubt that the elevator manufacturers are on the job and employ all the safety devices possible, but surely something is wrong in the repetition of the failure of hoisting ropes and the smashing of elevator cars. There is room for a good mining engineer to work on New York's "hoisting" problems and introduce some of the ideas now considered essential in mining practice.

## WHAT OTHERS THINK

### Our Error, Our Error

You have the right name but the wrong "lousy." I am not the *political* Anne H. Martin, with all her brilliancy and honorable career, but *Annie* H. Martin, resident of Carson City since 1863 and never of Reno—much as I like the riverside burg and thoroughly enjoy visiting there. I have been a school teacher—thirteen years of it, and liked it—editor, manager, publisher, type-setter, society reporter, and bill collector on *The Carson News* for four years; have successfully managed a drygoods store and a stationery store; been church



ANNIE H. MARTIN

organist for forty years in addition to the weekly duties; and have taken personal interest in the entertainment of the inmates of the state prison on holidays and special occasions. J. Proctor Knott, of Kentucky (Congressman for many years and Governor of Kentucky for one term), was my uncle; Mark Twain was a personal friend of the family, and my last corporal punishment was received because I remained at his brother's house one evening over the time set by my mother to hear "Uncle Sam's" wonderful fairy stories, related to his niece, Jennie Clemens, and myself.

I have been a life-long Republican, but I have never taken any active part in politics. I have been with the Mint here since 1908, first clerk until 1913, when I

automatically became chief clerk when the appropriation was reduced, thus abolishing the clerkship. This year a further reduction in the appropriation, and the combination of the duties of the chief clerk with those of the assayer in charge, abolished the office of chief clerk, and I was left "high and dry" (not that the *dry* particularly mattered in my case). Good friends in Carson City and in Congress were successful in obtaining the appointment of assayer in charge for me, and I am still in Uncle Sam's service.

A great deal of explaining, perhaps, but I do like to be known for my own merits not those of somebody else. I could not qualify in so many of the "other Ann's" accomplishments that I like to set myself straight with those who have been so kind as to give such creditable notices.

With best wishes for the prosperity of the *Journal* and its staff, I am

Yours very sincerely,

Carson City, Nev.

ANNIE H. MARTIN.

[In our issue of July 16, on page 106, we published a personal paragraph concerning the appointment of Annie H. Martin as assayer in charge of the U. S. Branch Mint at Carson City, Nev. Wishing to supplement the mere announcement, our informant added a short biographical sketch obtained from *Who's Who in America*. But the subject of the latter is Anne H. Martin, the similarity of names causing the mistake in identity.—EDITOR.]

### Further Air Receiver Calculations

As none of the problems presented in Mr. Weeks' paper in the June 11 issue of *Engineering and Mining Journal* require a knowledge of the weight or temperature of the air, the formulas may be deduced in a simpler manner as follows:

- Let  $V$  = volume of air receiver in cu.ft.  
 $P_1$  = initial absolute pressure of air in receiver  
 $V_{at}$  = volume of free air withdrawn during  $t$  minutes  
 $P_2$  = abs. pressure of air remaining in receiver  
 $P_3$  = atmospheric pressure

Then, from Boyle's law, volume  $V_1$ , the free air occupied in the receiver before being withdrawn is

$$V_1 = \frac{V_{at} P_3}{P_1} \quad (1)$$

The volume  $(V - V_1)$  remaining in receiver now expands to volume  $V$  and assumes a pressure  $P_2$ . According to Boyle's law:

$$\frac{V - V_1}{V} = \frac{P_2}{P_1} \text{ whence } V_1 = \frac{V(P_1 - P_2)}{P_1} \quad (2)$$

Combining (1) and (2) gives

$$V_{at} = \frac{V(P_1 - P_2)}{P_3} \quad (3)$$

The pressure  $P$  of the air mixture from tanks  $A$  and  $B$  is found as follows: When the valve is opened, vol-

volumes  $V_1$  and  $V_2$  expand or contract to volumes  $V_3$  and  $V_4$ , respectively.

From Boyle's law:

$$V_1 P_1 = V_3 P \quad (4)$$

and 
$$V_2 P_2 = V_4 P \quad (5)$$

Adding 
$$\frac{V_1 P_1 + V_2 P_2}{(V_3 + V_4)} = \frac{P(V_3 + V_4)}{(V_1 + V_2)}$$
 As  $(V_3 + V_4)$  must be equal to  $(V_1 + V_2)$

$$P = \frac{V_1 P_1 + V_2 P_2}{V_1 + V_2} \quad (6)$$

Applying equation (6) to compressed-air haulage, gives

$$V_1 = \frac{V_2(P - P_2)}{P_1 - P} \quad (7)$$

in which  $V_1$  = required capacity of air storage  
 $V_2$  = volume of locomotive tank  
 $P$  = required pressure in locomotive tank after charging  
 $P_2$  = pressure in tank before charging  
 $P_1$  = initial pressure of air in storage

This presumes that no air is supplied to the storage system while locomotives are being charged, a condition that does not obtain in practice, except when there has been an accident to the compressor. In that event no amount of storage will keep up the pressure long enough for practical operations. Receiver or storage capacities are therefore not calculated according to the above formulas.

Receivers are usually dimensioned so that the demand of the air engines may exceed the supply from the compressors for a specified time without reducing the pressure below a permissible minimum.

Let  $V$  = required volume of receiver or receivers  
 $V_2$  = volume of compressed air withdrawn during a specified time  $t$   
 $V_1$  = volume of compressed air supplied during the same time  
 $P$  = initial absolute pressure of air  
 $P_1$  = permissible minimum pressure at end of specified time

Then at end of period  $t$ , volume of compressed air remaining in receiver is:  $(V - V_2 + V_1)$  which expands to a volume  $V$  and thereby reduces the pressure from  $P$  to  $P_1$ .

According to Boyle's law:

$$\frac{V - V_2 + V_1}{V} = \frac{P_1}{P}$$

whence 
$$V = \frac{P - P_1}{P(V_2 - V_1)} \quad (8)$$

It happens at times that at three of the largest mines in Butte, hoisting is in progress at the same time for thirty-six consecutive minutes, resulting in a consumption of compressed air of  $V_2 = 108,900$  cu.ft., while three compressors furnish compressed air each at the rate of 880 cu.ft. per minute, or a total of, say,  $V_1 = 95,000$  cu.ft. during the thirty-six minutes. The initial pressure ( $P$ ) is 102 lb. abs. The permissible drop is 13 lb., making  $P_1 = 89$  lb. abs.

Introducing these values in equation (8)

$$V = \frac{102 \times (108,900 - 95,000)}{102 - 89}$$

whence  $V = 109,000$  cu.ft.

Fifty-two receivers with a capacity of 2,100 cu.ft. each, or a total of 109,200 cu.ft., have been actually provided for this particular emergency.

Butte, Mont. THEODORE SIMONS.

### Work Better Than Rainbow Chasing

Regarding the communication of M. F. Graupner in July 9, 1921, issue, permit me to take exception to some interesting remarks which the author makes and which I believe are misleading if not injurious to the well-being of young mining engineers.

Your correspondent trusts his observations will put ambition into some really educated engineers to do more than seek and hold down a mediocre salary job; and he recommends that such men get out and prospect.

I hold that this advice to young engineers is misleading. It might even work hardship and cause injury. Prospecting is one thing; engineering is another. Shiftlessness and inclination to take chances are permissible and rather necessary for a prospector. He should be and generally is a restless spirit, who would rather have his little mite than punch a clock day in and day out. He is ambitious and ever optimistic. With a big goal in mind, he can never condescend to routine, and even if he did he is a failure because he is a misfit. These men are necessary parts of the society in general and mining industry in particular. It is a game, however, that does not satisfy the shrewd modern engineer. In it, success is rare, and, when accomplished, the remuneration is not always written in six figures, as in the instance cited by our friend.

The first fifteen or twenty years of an average mining engineer with a technical education may bring nothing more than a salary job. The position might be mediocre but not necessarily. In fact, after ten or twelve years of steady and conscientious effort it is rare to associate the positions these men hold with anything like mediocrity. The homely parable of the tortoise and the rabbit applies in mining engineering, too. Out of a hundred engineers who started their careers twenty years ago and devoted themselves to it few need be in financial straits. But out of the same number of prospectors only an insignificant percentage are at all independent. The remaining large majority are eternally after that goal which it is the luck of only one or two to reach. They grubstake, and disdain the man who sticks to a job.

My advice to the young mining engineer is to hold on to whatever job he has until he has a clear vision of something better. For a person with the proclivities of a prospector or a promoter, a regular technical training is unnecessary and a waste of time. But the man who wants to go to a technical school must hesitate to enter the threshold of such an institution if he is to look down to a salary job and is lacking in stick-to-itiveness.

DJEVAD EYOUB.

Brooklyn, N. Y.

### A Seven-Year Mining Course?

The recent articles in your columns regarding mining schools and the great number of graduates impels me to suggest a course that would probably remedy this state of affairs automatically. Why could not some representative mining school institute, say, a seven-year course in mining engineering, in which alternate years were allotted to field work at paid employment in and about the mines? Such a course, rigidly conducted, would turn out only serious-minded and practically equipped engineers, discouraging all others.

Park City, Utah.

J. E. RYPINSKI.

# Replacement Copper Deposits in the Warren District

Mineralogical and Geological Features of an Important Copper Mining Region—Deposition Intimately Associated With Faults and Fractures And Intrusive Rocks—Enrichment of Deposits Not Always Evident

BY GRAHAM JOHN MITCHELL

Written for *Engineering and Mining Journal*

**C**OPPER DEPOSITS of the replacement type offer an interesting field for applied geology. The genesis, mode of occurrence, structural relations, and mineralogy of orebodies of this class involve questions the solution of which requires detailed study. Observations in the Warren district, Bisbee, Ariz., during the last three years are summarized in the following discussion:

The distribution of ore with respect to the Sacramento Hill stock can be seen by studying Fig. 1, which is a horizontal projection of the known orebodies, many of which have already been mined. The granite-porphphy intrusive in which the Sacramento Hill ore occurs is bordered on the south and west by the sedimentary series, including Cambrian, Devonian, Carboniferous, and Cretaceous formations; whereas the dividend fault brings the Pinal schist to the surface on the north and northeast. The ore is seen to lie in a semicircle to the south of the dividend fault and is less extensive as the distance from the central porphyry mass increases.

Another evident feature is the extension of ore out along lines comparable to the spokes of a wheel, in reality representing mineralization in radiating zones of faulting and fracturing. The primary copper minerals, represented by the sulphides, chalcopryrite, bornite, and chalcocite, accompanied by pyrite, galena, and sphalerite, have replaced the limestone, frequently retaining the bedded character of the sedimentaries, whereas in others it is irregular with no semblance of bedding. The strongest metallization, as can be seen in Fig. 1, took place nearest the Sacramento Hill porphyry, where the sediments are also more strongly metamorphosed. It is not my purpose to enter into a general discussion of the geology and ore occurrences of the district, but rather to take up typical orebodies and to point out the geological features which characterize them.

## MINING OF OXIDE ORE PROFITABLE

The first mines to be developed in this district were in oxidized ore, the Copper Queen and Irish Mag being good examples of altered sulphide deposits which passed into primary copper ore in depth. Both mines are closely associated with the early history of the camp, the former marking the beginning of the Copper Queen Consolidated Mining Co., and the latter the foundation for the Calumet & Arizona Mining Co. The high-grade "oxides" from these mines have returned millions of dollars to their owners.

The mode of occurrence of oxidized ore is illustrated by *A*, *E*, and *F*, Fig. 2. The first is a good example of bedded ore, whereas in *E* only partial replacement along the bedding is evident. In *F*, the limestone bedding has exerted no influence upon the mineralizing

solutions which were guided to the seat of deposition by the fault. In *A*, the ore, represented in shaded black, is of malachite and azurite with a small quantity of "sooty" chalcocite in vugs in the carbonate masses. Impure brownish black manganese is intermixed with the carbonates, as is also impure limonite, kaolin, and partly oxidized limestone. The copper carbonates are strongly developed as botryoidal growths with an impure manganese mixture frequently forming the nuclei.

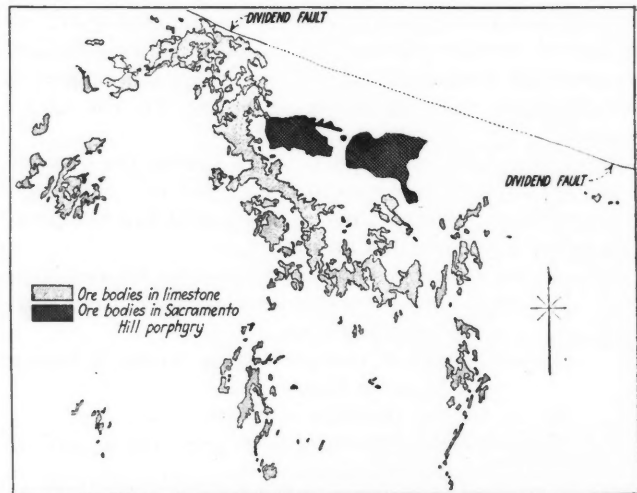


FIG. 1. HORIZONTAL PROJECTION OF OREBODIES IN WARREN DISTRICT

The order of formation of the minerals, as illustrated by many of the botryoidal forms, is first a central core of earthy manganese, then successive layers of massive malachite, with a final coating of massive and crystalline azurite. The individuals making up these grape-like forms are generally the size of a pea or smaller. Single groups attain diameters of as much as  $\frac{3}{8}$  in. The copper carbonates also assume a massive, banded form, with malachite and azurite in alternating layers, these layers sometimes being separated by impure manganese.

The relation of ore to the limestone and quartz-porphphy (*QP*) is shown in Fig. 2, *A* and *B*, the mineralization occurring on the upper side of the intrusive and replacing limestone along a steeply dipping fault. The contact of the igneous rock and ore, although somewhat altered, is rather sharp; that between the ore and limestone is gradational. On the left, in Fig. 2, *A*, the ore gradually passes into a fine textured white crystalline limestone which retains minerals of the period of primary metallization, pyrite, chalcopryrite, a little galena, and sphalerite in veinlets and small bunches in limestone.

The quartz-porphphy (*QP*) dike associated with this ore has undergone alteration to the extent of developing



sericite in the feldspar and chlorite from the mica and hornblende. The rock, which is strongly fractured, contains disseminated grains of pyrite and chalcopryrite and small rounded plainly visible knots  $\frac{1}{8}$  in. in diameter, made up of fine-grained parts of the rock mass. Thin sections reveal quartz and orthoclase as prominent phenocrysts, with plagioclase in a fine-grained groundmass of quartz and feldspar. The idiomorphic crystals of quartz are strongly corroded along the borders and

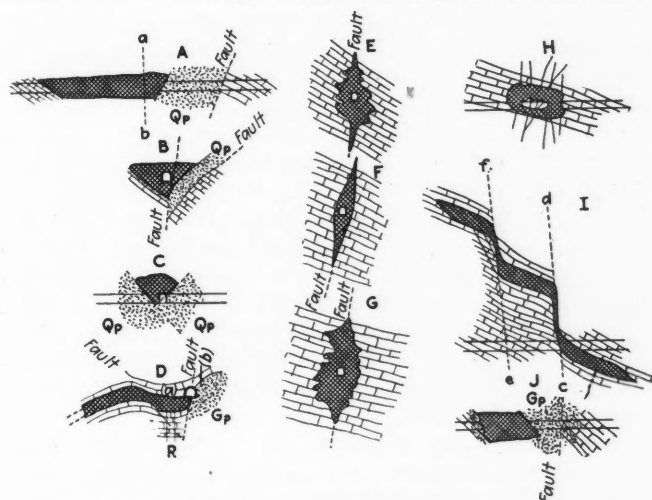


FIG. 2. TYPES OF ORE DEPOSITS SHOWN IN SECTION

are penetrated by fractures along which the iron and copper sulphides occur. Orthoclase and plagioclase, both as phenocrysts and in the groundmass, are strongly sericitized and contain scattered pyrite and chalcopryrite. Biotite and hornblende have been altered to chlorite and also contain pyrite and chalcopryrite. Chalcocite has formed in fractures in the chalcopryrite and along the edges of the sulphide. It also coats pyrite and is present in fractures cutting the iron sulphide. The presence of pyrite and chalcopryrite as primary minerals in the porphyry points to the source of original metallization solutions as being in this rock.

"Oxide" ore replacing limestone, both along faults and broken zones caused by such movements, is illustrated in Fig. 2, E and F. In E the replacement is irregular, working outward along the bedding from the fault. The ore minerals include azurite, malachite, cuprite, chalcantite, and native copper. The first four partly and completely replace the limestone, but native copper is more commonly found in thin layers of intergrown crystals along the bedding planes. Much material of this nature is deceptive, appearing upon superficial inspection to be copper-stained altered limestone. However, when broken, it is found to be an intimate mixture of the above minerals. Replacements of this type attain dimensions of 100 ft. or more along the dip and strike of the fault, with thickness of over 50 ft.

In Fig. 2, F, the copper minerals noted above replace the brecciated and crushed limestone along the fault, the pronounced irregular replacement seen in Fig. 2, E, being absent. The line between ore and altered limestone is controlled by pre-mineral faulting.

Orebodies of this type frequently contain the mineral delafossite, which in some instances is the chief source of copper. Superficially, it resembles graphite, in its lead-gray color, occurrence in flakes, and groups of thin flexible sheets  $\frac{1}{8}$  in. wide, which soil the fingers. It is

of interest to note that the mineral was first classified as graphite until determined and named by Friedel. The following notes on the determination and naming were secured for the writer by Dr. Charles P. Berkey, of Columbia University, New York City:

"The mineral 'delafossite' was first described by C. Friedel in the 'Comptes Rendus de l'Academie des Sciences,' Paris, Vol. 77, p. 211, of 1873. The type specimen was found at Ekaterinburg, Siberia, on a yellowish white lithomarge, by Abbé Grandidier, of St. Petersburg, in 1820. It finally reached the museum of the French National School of Mines, in Paris, as a specimen of graphite, and it was not until Friedel's article (quoted above) in 1873 that it was known not to be graphite. Friedel gave it the name delafossite, in honor of the eminent mineralogist, G. Delafosse, who was connected with the School of Mines and Natural History Museum in Paris at the time of Friedel's work there. Friedel gives the following data on the mineral: Hardness, 2.5; specific gravity, 5.07; easily soluble in HCl; color, dark gray; lustre, metallic.

"Analysis: Cu<sub>2</sub>O, 47.45 per cent; Fe<sub>2</sub>O<sub>3</sub>, 47.99 per cent; Al<sub>2</sub>O<sub>3</sub>, 3.52 per cent."

Delafossite was first identified in the Warren district by George Miller, formerly chemist for the Calumet & Arizona Mining Co. The specimens from the Bisbee mines were found to carry impurities which are absent in the analysis of the type specimen. These impurities, as shown in analyses by William W. Brostrom, chief chemist for the Calumet & Arizona Mining Co., include lime, silica, and manganese. Mr. Brostrom's analysis gives:

	Per Cent		Per Cent
Cu <sub>2</sub> O.....	37.00	SiO <sub>2</sub> .....	1.2
Fe <sub>2</sub> O <sub>3</sub> .....	39.19	CaCO <sub>3</sub> .....	16.2
Al <sub>2</sub> O <sub>3</sub> .....	2.00	MnO <sub>2</sub> .....	2.1
			97.69

Microscopic examination of crushed fragments shows the presence of fine quartz particles and grayish indeterminate dust-like material which probably represents the lime and manganese oxide.

Orebodies of the nature discussed represent oxidized primary copper minerals in place. The oxidizing solutions have attacked the primary sulphides and redeposited the copper in the form of oxides, carbonates, and native copper without a great amount of downward migration. The intimate association of ore with faults and fractures and the direct or close relation to quartz-porphyry and granite-porphyry are outstanding features.

At the February, 1921, meeting of the A. I. M. E., in New York City, Dr. James F. Kemp discussed the past and present position of chalcocite as a source of copper, and pointed out the fact that this sulphide is receiving more attention than formerly in ore development in many of the mines throughout the country. The mines at Bisbee afford a good illustration of the importance of chalcocite in making ore out of what would be classed as "low-grade" pyrite. The examples which follow serve to illustrate the importance of such enrichment.

Fig. 2, C, illustrates a "pocket" of ore in quartz-porphyry (QP), the minerals having been deposited in a V-shaped trough made by two intersecting fractures. Pyrite and chalcopryrite are the primary minerals which have altered to iron oxide and "sooty" chalcocite respectively. Assays of this ore range from 2 to 12 per cent, averaging better than 6 per cent copper. The inclosing porphyry assays 0.12 per cent copper, and megascopically is a grayish-white rock with quartz and altered feldspar prominent in a fine-grained grayish-white groundmass. Microscopic examination shows it to be practically the same type as that asso-

ciated with the oxide ore, the main difference being a stronger development of quartz and pyrite in the groundmass. Chalcocite is present as described in earlier illustrations.

#### IMPORTANT TO EXAMINE PYRITE

Bedded pyrite with disseminated chalcopyrite replacing limestone is common in the district, although the copper content of many such replacements, unless enriched by secondary alteration, falls below the present minimum grade for profitable mining. When such material is encountered in prospecting, and the copper content is too low, the question arises as to whether or not further prospect work is justified. Sometimes evidence warrants recommendation of more work; for example, when the pyrite is fractured and shows enrichment by "sooty" chalcocite along fractures it has been proved in many instances to develop into ore.

On the other hand, the lack of evidence of such enrichment in a single opening in mineral of this character does not preclude the existence of ore, as the following case illustrates: A drift cutting a 5-ft. bed of pyrite with a little disseminated chalcopyrite gave assays less than 2 per cent copper. The pyrite was fine grained, crystalline, and massive, with scattered specks of chalcopyrite. Work was discontinued, but later a raise proved the existence of small vugs in the main pyrite mass containing "sooty" chalcocite, and further prospecting encountered knots and bunches of chalcopyrite inclosed in the pyrite body, proving the necessity of prospect raises and crosscuts in deposits of this class. This ore was found within 200 ft. of dikes of quartz-porphry and along a zone of strong fracturing and faulting.

In Fig. 2, *D*, the crosscut (*a*) cut the fault (*b*) with granite-porphry (*GP*) on the right and a bed of pyrite and chalcopyrite enriched with "sooty" chalcocite on the left. The raise (*R*) was driven from the level below and picked up the ore as shown. Subsequent stoping has proved the bedded character of the deposit and has developed a tonnage averaging over 8 per cent copper. The inclosing limestone is dark gray, medium-bedded impure material with a bluish-white alteration product along the contact of limestone and ore. "Sooty" chalcocite has formed in numerous fractures and cavities and around the pyrite grains. The bed pinches and swells, but averages three feet in thickness.

The associated igneous rock has a light greenish-gray cast, with quartz, feldspar, and biotite easily recognizable in hand specimens. In thin sections the corroded quartz phenocrysts, with sericitized orthoclase and plagioclase, are set in a medium-grained groundmass of quartz and feldspar. Both these minerals have included grains of pyrite and chalcopyrite, which occur along fractures. The sulphides are also present in the groundmass, and chalcocite has formed on the periphery of the chalcopyrite and in fractures through it. Pyrite crystals are also surrounded by chalcocite. Biotite, partially altered to chlorite and inclosing pyrite and chalcopyrite, is a prominent constituent. Some apatite occurs in the groundmass. This rock shows less alteration than the quartz-porphry just described.

Fig. 2, *I*, illustrates a "low-grade" sulphide transformed into ore by secondary alteration and enrichment. The primary minerals, pyrite and chalcopyrite, replace dark-gray shaly limestone, following closely the bedding of the sediments. The ore has a maximum

thickness of 12 ft. but in places pinches out entirely. Stoping in this particular case extends over a horizontal area of 600 x 200 ft. The course of primary mineralizing solutions was determined by the faults (*cd*) and (*ef*), which also show post-mineral movement. These breaks have been cut 100 ft. below the ore and are marked by strong gouge and iron oxide. No igneous rock has been found directly associated with this ore, although small dikes of granite-porphry are in the vicinity.

In addition to the two faults mentioned, minor displacements and innumerable fractures cut the sulphide bed. Along these closely spaced breaks "sooty" chalcocite has formed, bringing the grade from 2 per cent or less up to an average of over 4 per cent ore. Along the faults (*cd*) and (*ef*) native copper is strongly developed, together with some cuprite. These minerals have also formed along the top and bottom of the sulphide bed, and grade outward from the sulphide into altered limestone stained red by iron. The oxidation of the bottom, as well as at the top of the sulphide, with the formation of native copper, cuprite, and iron oxide, is the result of descending waters working outward from the faults along the contact of the limestone and primary ore.

Replacements of limestone by pyrite with a small amount of chalcopyrite and bornite, the minerals grading upward into leached siliceous material, are characteristic of some of the mines of the district. Such deposits reach a maximum of 300 ft. on the dip and strike of the lime and attain a thickness of 50 ft. When penetrated by mine workings, much of the pyrite is found to be in small crystals, which separate from each other and run like sand. Chalcocite ("sooty") coats the grains and fills vugs throughout the pyrite mass. Chalcopyrite and small specks of bornite occur in the more finely crystalline pyrite. When "sooty" chalcocite is not present in such mineral masses, the grade frequently falls below 2 per cent, but when enriched, the chutes run 4 per cent or better. Unfortunately, many of these mineral replacements are not enriched and consequently fail to make ore.

The siliceous cover, into which the sulphides penetrate as small veinlets, is a typical "jasperoid," being very fine grained silicified limestone. Descending waters have dissolved the sulphides which formerly filled the network of small fractures cutting the "jasperoid," and have left in their place iron oxide, silica, and impure lime carbonate binding together the angular siliceous fragments. Such material is locally called "siliceous breccia." An interesting feature in these orebodies is the presence of cerussite crystals occurring in vugs and along fractures associated with "sooty" chalcocite. Many of the lead carbonate crystals are coated with chalcocite, which is distinguished from the black copper oxide tenorite by testing with silver nitrate solution.<sup>1</sup> A drop of 10 per cent silver nitrate solution placed on this material immediately begins to form tiny needle-like crystals of native silver.

#### PRIMARY MINERALS OF VARYING IMPORTANCE

The primary copper sulphide minerals in the Warren district include chalcopyrite, bornite, and chalcocite, with which are associated pyrite, galena, and sphalerite. Of these, pyrite and chalcopyrite are more widely devel-

<sup>1</sup>Palmer, Chase, and Bastin E. S. *Economic Geology*, Vol. 8, p. 146; 1913.)

oped, whereas bornite and chalcocite, although less conspicuous, are important factors in making "high-grade" out of what would in many instances be classed as "low-grade" ore. The bedded and irregular replacements of the former in limestone reach a maximum, in individual orebodies, of 500 ft. along the dip and 600 ft. on the strike of the sediments, with a thickness of 50 ft. When pyrite and chalcopyrite are the only sulphides present, the copper content holds close to 4 per cent, but when bornite and chalcocite enter into the composition, the grade noticeably increases. The latter minerals typically occur as knots or bunches inclosed in the main pyrite-chalcopyrite masses, and are associated with fractures cutting the former. In some instances they occur as disseminated specks in the iron and copper iron sulphide. Bornite and "steely" chalcocite are generally accompanied by galena and sphalerite, especially when the former two minerals are found in fractures cutting the pyrite-chalcopyrite bodies.

Fig. 2, *J*, shows a fine-grained, grayish, somewhat impure limestone replaced by pyrite, chalcopyrite, bornite, "steely" chalcocite, galena, and sphalerite, the thin-bedded structure of the limestone being retained by the sulphides. Pyrite forms the bulk of the minerals present, with the others disseminated through the bed. In the entire orebody there is no evidence of secondary alteration. The sill of granite-porphry (*GP*) is a medium-grained rock composed of quartz, feldspar, biotite, and hornblende, all of which are recognizable in hand specimens. Microscopic examination reveals these constituents as prominent phenocrysts in a medium-grained groundmass of quartz and feldspar.

Orthoclase is the most abundant feldspar both in the groundmass and as phenocrysts, and has been partially altered to sericite. Pyrite is abundant, with chalcopyrite and bornite present. The sulphides have not been affected by secondary alteration, and represent primary mineral deposition. Fig. 3, *A*, is a micro-drawing of this rock showing the phenocrysts, orthoclase (*Or*), hornblende (*Hb*) and quartz (*Qt*), set in a fine-grained groundmass of quartz and feldspar. Pyrite (*Py*) and chalcopyrite (*Cp*) are included in the hornblende and feldspar as well as in the groundmass. Bornite (*Bor*) is also present in the groundmass.

In Fig. 2, *G*, the sulphides, pyrite, chalcopyrite, bornite, "steely" chalcocite, galena, and sphalerite, form an irregular replacement in limestone along a nearly vertical fault. The inclosing sedimentary has been metamorphosed from a grayish medium-grained limestone to a fine-grained white crystalline lime. In this particular instance the ore has a vertical extent of 100 ft., with an average width of 15 ft., and extends irregularly along the strike of the fault for over 200 ft. If such an orebody were subjected to oxidation, there would result an occurrence of "oxide" ore similar to that shown in Fig. 2, *E*. This orebody is surrounded by small dikes of granite-porphry.

#### DEPOSITION INTIMATELY ASSOCIATED WITH INTRUSIVES

Lenses of "steely" chalcocite are found replacing limestone and are cut by tiny fractures in which occur calcite and "steely" chalcocite. These lenses range from a few inches to 1½ ft. in diameter, and, in the case illustrated by Fig. 2, *H* (the scale of which is exaggerated to bring out the essential features), a core of unreplaced limestone remains within the sulphide. The only secondary alteration evident is the formation of

"sooty" chalcocite around the periphery of the "steely" chalcocite. These lenses are in close proximity to granite-porphry and illustrate on a small scale what has taken place in larger deposits of the same character. The slight amount of alteration enables one to study geological details such as structure and mineralogy which are of value when examining other occurrences of this nature.

One question which always arises during the study of a mineral deposit is the source of solution responsible for metallization. In the Warren district the evidence clearly shows that granite-porphry and quartz-porphry, the former best exposed in Sacramento Hill, are the rocks responsible for ore deposition. Those who have studied this district have pointed to the porphyry of Sacramento Hill and the exposure of similar rock in the mines as being closely related to a parent deep-seated igneous mass. The following description of the deepest igneous rock so far encountered in the region is of interest in suggesting the character of rock to be expected at greater depth:

The granite-porphry (Fig. 3, *B*) which is from a dike encountered in the Junction shaft at 2,337 ft., proved to be practically the same as that illustrated

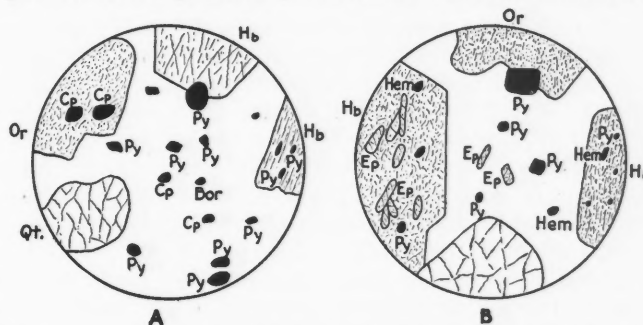


FIG. 3. A. MICRO-DRAWING OF GRANITE-PORPHYRY ASSOCIATED WITH ORE. B. MICRO-DRAWING OF GRANITE-PORPHYRY FROM DEPTH OF 2,337 FT. IN JUNCTION MINE

by Fig. 3, *A*, from the 1,800 level, the only difference being in the strong development of epidote. The phenocrysts, quartz (*Qt*), orthoclase (*Or*) and hornblende (*Hb*), are set in a medium-grained groundmass of quartz and feldspar with small hornblende and biotite crystals. The most striking feature of the rock is the strong development of epidote which has been derived from the hornblende. Orthoclase has been partially sericitized and biotite and hornblende altered to chlorite. Pyrite and hematite are included in the hornblende and orthoclase, as well as occurring in the groundmass. Quartz phenocrysts with corroded borders are filled with numerous dust-like inclusions. Apatite completes the list of minerals present.

#### MOST NOTEWORTHY GEOLOGICAL FEATURES

The outstanding geological features of the Warren district which have a bearing on prospecting for and developing ore may be summarized as follows:

1. Intimate association of ore with faults and fractures, which, together with bedding planes, have served to conduct mineralizing solutions to places of deposition.
2. Close association of ore with granite-porphry and quartz-porphry intrusions.
3. Occurrence of "knots" or "bunches" of chalcopyrite, bornite, and chalcocite in "low-grade" pyrite, the presence of which may not be evident in a single open-

ing in such material. This necessitates crosscutting and raising to prospect mineral bodies of this character.

4. The importance of "sooty" chalcocite in enriching pyritic replacements. This enrichment is not always evident, and such material should be thoroughly prospected.

5. The presence of enriched pyritic masses below leached "siliceous breccia," especially when such masses are strongly fractured and broken by faulting.

6. Displacement of ore by post-mineral faulting. Many large orebodies have been thus affected.

7. Occurrence of ore in Paleozoic formations and Sacramento Hill porphyry.

## Is Moist Air Desirable for Copper Blast Furnaces?

BY JULIUS H. GILLIS

Written for *Engineering and Mining Journal*

NEARLY EVERY ONE who has engaged in the smelting of ores has considered the probable effect of moisture in the air supplied to the furnaces. It is not the intention here to enter into a discussion of the theoretical considerations in connection with the subject or even to review the conclusions reached by metallurgists who have had to deal with the problem. The general opinion is that moisture is not particularly desirable, but most of these conclusions are determined theoretically and, except in iron blast-furnace practice, little published data are available that have been derived from actual practice. The object of this article is to record some actual observations in regard to moisture in the air supplied to a copper-nickel blast furnace, in the hope that they may lead to further experiments, which will tend to prove or disprove the conclusions set forth.

In March, 1920, an exhaust pipe was so placed that the small amount of steam escaping was being drawn into the intake of a certain blast-furnace blower. Some days elapsed before this was corrected, and the incident was soon all but forgotten. Some weeks later, when I was making careful investigation as to certain operating conditions, it was noticed that there was a particularly favorable period extending over a few days, with no corresponding favorable conditions to account entirely for it. After eliminating other factors to determine the cause of these conditions, I came to the conclusion that, as it corresponded with the period in which the steam was being drawn into the intake, possibly the extra moisture was the factor sought. The data, however, were not conclusive; they were affected by other conditions and could not be taken as definitely establishing much basis for future investigation. A search of the available literature on the subject, and discussions with the local metallurgists, failed to explain the results observed, and it was October before further experiments could be made.

A test was then determined upon, and a  $\frac{3}{4}$ -in. pipe was connected between the air main and a steam pipe carrying 180 pounds of steam with 100 deg. superheat. A decided change in the operation of the furnace resulted, but here again the results were confused by other factors. The experiments were continued, and larger quantities of steam were added, but the results after the first few days were rather negative. The

steam would be turned on and gradually increased, with the result that at first the furnace would speed up, and crusts and accretions would be eliminated, and then the good effects would disappear. No bad effects were observed, however, until sufficient steam was used so that the water from the condensation in the blast began to give trouble around the tuyères. No accurate methods of measuring the steam used were available, but deductions could be made from the temperature of the blast and its moisture-carrying capacity. The experiments were temporarily discontinued owing to inability to get definite results.

After careful study of the various operating curves covering the period of the experiments, I came to the conclusion that we had been using too much steam, and decided to make another trial as soon as a favorable opportunity presented itself. About the last of January, 1921, after two weeks of uniform furnace operation, the steam was again connected, and a very small amount used. The temperature of the air outside ranged between zero and freezing, and the air in the blast main about 70 deg. F. above that. Sufficient steam was added so that the air was just saturated; that is, some condensation showed in the valves and bends of the pipe. Rough calculations indicated that about 300 lb. of steam was used per hour, or 7,200 lb. per day, which, at our cost of evaporation (which was high that month), amounted to \$7.20 per day for steam.

The tabulated results show an increased tonnage of 14.7 per cent for the two days of the test over the average of the five days' previous, and at no time, even with the use of extra coke, had it been possible to make the same record without steam, although in the previous experiments it had been nearly equaled on several occasions. There was no change in any other operating condition during the period and no material change in the weather.

The first day's run does not coincide exactly with the period for which steam was on, as the statistical day started at 7:30 a.m. and steam was connected about 9:30 a.m. On the third day the furnace was down a few hours to change the spout, and I had no opportunity of making further tests while connected with the plant. Although the results given show increased capacity only, there are reasons to believe that corresponding savings in operation costs could be made through saving in coke and flux and in smooth operation.

FURNACE PERFORMANCE BEFORE AND DURING THE TEST

	Ore	Flux	Coke	Per Cent of Coke on Ore	Per Cent of Coke on Charge
	811.20	327.60	119.00	14.7	10.4
	811.20	327.60	116.60	14.4	10.2
Five days previous to test	764.90	293.60	107.30	14.0	10.0
	712.85	269.00	99.85	14.0	10.0
	713.60	306.70	116.70	14.3	10.4
First day of test.....	896.40	315.40	125.44	14.0	10.4
Second day of test.....	899.10	316.35	127.45	14.2	10.5

The furnace was 50 in. x 30 ft., of ordinary water-jacketed type, and was smelting raw pyrrhotite ore with converter slag as flux. The results obtained certainly indicate an advantage to be gained by the use of steam in smelting sulphide ores, and tests could be conducted at little expense in almost any plant, which would tend to increase the available information on the subject and perhaps make a material saving on operating costs.

[We would be grateful for the privilege of publishing the results of any tests of this practice made at other smelters.—EDITOR.]

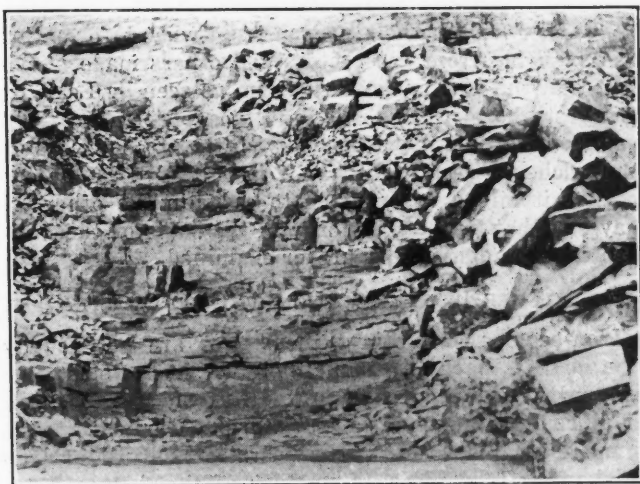
## Iron-Ore Deposits on the Belcher Islands

Formations Similar to Those of the Lake Superior Region, Showing Folding and Extensive Glaciation and Offering Geological and Economical Possibilities, Have Been Discovered In the Hudson Bay Region—Transportation Difficulties and Inaccessibility of the District

BY DWIGHT E. WOODBRIDGE  
Written for *Engineering and Mining Journal*

THE CANADIAN GEOLOGICAL SURVEY is sending a party of geologists to the Belcher Islands, Hudson Bay, this summer to make an examination of the iron-ore formation existing there. The Ontario government has begun the construction of a railway line, northward from Cochrane, Ont., toward Moose Factory, at the foot of James Bay, with the intention of extending the line to the bay if the iron ore is found to be of satisfactory quality to permit mining. The immediate purpose of this extension is to develop lands lying to the north of Cochrane, which is situated at the junction of the Temiskaming & Northern Ontario with the Transcontinental, both of which railroads are owned by the government.

That enormous beds of iron-bearing formation exist on the Belcher Islands is well known to a few. These



IRON-ORE FORMATION, SHOWING BLOCKY CHARACTER OF ORE

probably cover an area considerably greater than the beds of the Mesabi Range, and are of about the same type. In 1909, Dr. C. K. Leith headed a party that went up the east shore of James and Hudson bays, as far north as Richmond Gulf, North Latitude 56 deg. 50 min., and there found a large area of rocks that he characterized as being "of remarkable lithological similarity to the iron formation of the Upper Huronian or Animikie group of the Lake Superior region." He added: "All phases, both altered and original, of the Animikie are here represented, with one exception. The altered phases are the jaspers, ferruginous cherts, and ores. The original phases are the iron carbonates. Unaltered greenalite rock was not seen, but the lower part of the iron formation seems originally to have consisted largely of the greenalite or taconite of the Mesabi district of Minnesota. The upper part of the Nastapoka

(this is the name which Dr. Leith gave to the formation around Richmond Gulf) iron formation consists principally of ferruginous cherts and jaspers of a more regularly banded type, similar to those resulting from the alteration of iron carbonate in the Gobeic and Marquette districts of Michigan. The depressions on the dip slopes of the iron formation, where the overlying ferrodolomite has been stripped off, contain concentrations to iron ore. No large deposits of good grade are exposed."

When Dr. Leith made the above mentioned examination, the existence of the Belcher Islands, except as a group of dots on the map, was unknown to white men. A subsequent investigation by some hardy prospectors, acquainted with iron ore, disclosed the fact that the islands showed numerous and well-defined iron formation outcroppings, and that, far from being mere dots, a line circumscribing the islands incloses an area of about 3,500 square miles.

During the summer of 1920 I made an examination of the iron formation of the islands, assisted by George H. Rupp, a mining engineer from Ironwood, Mich. That part of the islands examined consisted of the greater portion of the northern half of the group, roughly speaking lying north of Parallel 56, North Latitude. The formation consists of folded pre-Cambrian sediments with their main axes nearly north and south, iron rocks, and lava flows. As a consequence of this folding and of the tremendous glaciation that has taken place, the islands consist of long parallel ridges separated by deep bays, most of the latter being protected and forming admirable harbors, sheltered from the action of wind and the movement of ice. Harbors ample for the largest ships are numerous. No vegetation exists on the Belchers excepting moss, and, in a few sheltered spots, subarctic flowers and mosses. Over large areas the rocks show great glacial erosion, which seems to have been quite recent.

Such a journey as I took to the Belchers is unusual and remarkable, for at present the only way to get there is by a roundabout course afforded by rivers large enough for canoe travel, and across the bays themselves. We traveled about 500 miles by canoe and 900 miles, all told, by small motor boat. Hardships and disasters, more or less serious, are sure to be met. There are dense fogs which, in those seas, never shadowing a sail nor beaten by a wheel, with no lights nor aids to navigation, are hazardous in the extreme; there are frequent storms, for these northern latitudes are subject to sudden and severe winds; there is ice, and to run into it from windward in fog or wind is death to a thin-ribbed, river-built motor boat. There is the actual wreck of these boats, perhaps, and the usual untoward incidents always to be expected during a trip into a new and distant region where there are no accommodations nor facilities of any sort whatsoever. But all these would soon be forgotten if the region were to be

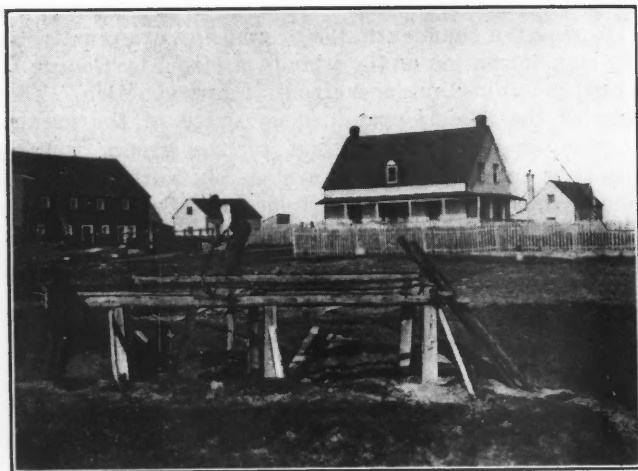
<sup>1</sup>*Engineering and Mining Journal* of Aug. 28, 1920, contains an article, "Ore Deposits of Arctic Canada," by E. S. Moore, which will be found interesting in connection with this subject.

opened and connected with the outside world. They would make an attractive human-interest story, but are not necessary to a discussion of the mineral possibilities of the Hudson Bay region.

The northern slope of the great Laurentian shield, extending as it does along the St. Lawrence River and west to the Lake Superior country, consists essentially of sediments generally similar to those on its southern side. In the latter are mineral-bearing regions of tremendous importance, iron, copper, nickel, silver and gold, as well as other minerals. The northern side of this shield is practically unexplored; the interior of Ungava Land has been traversed but a few times, by A. P. Low and others; the maps show no geology except along the coasts and close to the banks of the larger rivers.

#### DIFFICULTIES OF TRANSPORTATION IMPEDE PROSPECTING

Wild tales are told of croppings of copper and other minerals, but transportation is so difficult that few have made the attempt to corroborate these stories. There are reports of other iron deposits than the Belchers in this vast region; I have heard of billions of tons of commercial ore in the interior of Ungava, only 200 or 300 miles north of the St. Lawrence. Copper specimens are brought to civilization; nickel and cobalt and lead ores are shown by the few prospectors who have braved



BUILDINGS AT FORT ALBANY, WITH THE SAWMILL IN THE FOREGROUND

the interior. But it is an unknown land, with its myths and its mystery, and no one knows the truth regarding it.

Aside from the mineral possibilities there is an attraction in this far country, that which every explorer feels in scenes that others have not visioned. Off to the south lie the oldest posts of the Hudson's Bay Company, Ruperts House, Moose Factory, Fort Albany, Fort George, and the rest—there are seventeen stations in the James Bay district alone. There are the Eskimos and south of them the Crees. There is the wild life of the country—polar bear, moose, Arctic fox and hare, otter, seal and walrus, innumerable water fowl and plenty of fish. There are the broad deep rivers, like the black Albany that flows for hundreds of miles with a current boiling like oil, between dense forests of dark and virgin spruce; or like East Main, so large that an ocean liner might sail for fifty miles from its mouth. There are exposed the titanic results of glacial

erosion, extensive lava beds, with the geologic story easy to read because it is uncovered, with neither trees, nor moss, nor soil, for hundreds of miles. Four scientific journeys have been made to the Belchers, within my knowledge; to each of these some near-disaster occurred, but none of them has met with anything more than might be expected from such a region.

#### SHIPPING FACILITIES MAY OFFSET ORE-PRODUCING HANDICAPS

The possibilities of the district were appealing, especially as Dr. Leith had stated that he had found, in the Nastapoka formation, concentrations of merchantable ore up to four or five feet in thickness. It seemed to me that, if such concentrations did occur anywhere in that formation, there might be localities where it would be of a greater and commercial thickness; also, it was not too far away. Although the name Hudson Bay suggests a distant and inaccessible region, it is a fact that under a rail rate which the Canadian government probably will make on ore, if shipped from there, the district is strictly and immediately competitive with Lake Superior, all things considered, for iron ore that is of equal purity with the averages from the lake. The one additional handling and the increased rail freight charge to get that ore to Lake Erie ports are counterbalanced by royalty and taxation charges current in Minnesota and elsewhere.

A brief study of the situation from what information was available from prospectors and others made it evident that the Nastapoka formation, as seen by Leith on the west shore of Ungava Land, near Richmond Gulf, was identical in many respects with that to be found on the Belcher Islands, and that if iron existed in the one locality it might be expected to exist in the other. I may say that this conclusion was the basis of the decision that the district be further examined.

#### BELCHER IRON FORMATION OF GOOD QUALITY

Iron-bearing formations themselves are not usually of a quality that will permit their use in the blast furnace; they are generally too low in iron and too high in silica or other inert or deleterious elements to be commercial. A process of concentration, natural or artificial, must take place. Sampling of the formation at the Belchers, this sampling extending over a length of many miles, showed it to be of a grade comparing favorably with the iron formations around Lake Superior in their entirety. The average iron content of the 125 square miles of the Mesabi district, for instance, is computed to be about 30 per cent iron; about 50,000 drill holes in the Gogebic have given an average of about 35 per cent iron. The comparable average of the Belchers is about 38 per cent iron, with all samples of 50 per cent or better excluded from the computation. In considering this newly discovered area and in comparing it with other and developed districts, one must be mindful that it is a wide extending formation, and not mines, that are the basis of comparison. A spade has never been put into the ground on the Belchers, nor has there even been sunk a drill hole. The whole study is one of geologic possibilities and similarities, with comparisons of the great mass of the iron-bearing formation.

At the Belchers the iron-bearing formation shows a thickness up to 400 or 500 ft. and can be followed along its eroded edges for many miles. My own work included fifteen miles of outcroppings, running up to about 400



CREE INDIAN VILLAGE ON LOWER JAMES BAY

ft. in thickness. The formation is underlain by quartzites and early limestones and is capped by various recent lava flows, several different flows being discernible. The foldings and the erosions have cut through all these, disclosing greenstones, similar to those of the Lake Superior region, and it is not difficult to formulate an ideal cross-section of the various rocks.

#### CONDITIONS WARRANT INVESTIGATION OF COMMERCIAL POSSIBILITIES

Extensive areas were found in the formation where there had been sufficient concentration of ore to present faces up to 25 ft. in thickness of an average iron content of better than 52 per cent natural iron. The ore is very dense and close grained, blocky, breaking in rhombohedral blocks, reminding one of the Newfoundland ores under the sea at Bell Island, and the moisture content is extremely low, considerably less than 1 per cent. But not enough commercial ore was disclosed by my examination to permit a recommendation that the development of mines, the construction of ships, docks, and a railway, were warranted without further and considerable definite knowledge to be derived from exploration by drill or otherwise. It was reasonably safe to assume the actual presence of commercial ore in minable thicknesses up to a tonnage of not far from a million tons, but this was altogether too little on which to base the large expenditures necessary. It is enough, however, to base thereon a material exploratory campaign. If concentration of commercial ore in such a field, in minable thicknesses, is obtained, the probabilities are that there is vastly more to be found by search, and it is not impossible that on these islands exists one of the greater potential iron-ore fields of the world.

#### GEOLOGICAL DETERMINATIONS SPECIFIC RESPECTING FORMATION

Geologically speaking, two questions arise as to the possibility of commercial tonnages of iron ore in this region: First, if the geological conditions were such as to allow the depositing iron-bearing solutions, did such solutions exist; that is, are there underlying comparatively impervious rocks in basin or synclinal form in which these solutions might have been arrested and deposited their iron? Second, were the iron-bearing rocks exposed to atmospheric action for a sufficient

period to permit this concentration to proceed adequately to make ore?

As to the first query: There has been much folding of sedimentary series, including the underlying quartzites and the iron formation. This is definite, and there can be little doubt on this point on the part of anyone who has studied the situation. As to the second query: Such an examination as Mr. Rupp and I were able to make showed that the upper jaspers of the formation are lean and cherty and almost devoid of iron, and they seemed to show a considerable leaching action that could not have taken place if the lava and the formation sediments were synchronous or nearly so. Also, if the lava flows had been coincident with the foldings of the sediments, one would expect to find, in the upper bedding planes of the formation, sills or intrusions of the molten masses between the stratification of the iron rocks. We were unable to find such appearances, although the formation for many miles was closely studied for that phenomenon. Everywhere the contact of the base of the lava and the upper portion of the formation was clear and sharp, with no effect on the jasper but that magnetization that might have been expected and that is incident to baking in a reducing atmosphere, such as must have been prevalent here at some time. This all was to be expected, for the ages of the formation and of the overlying flows probably are far apart in geologic time.

#### MINING POSSIBILITIES, IN LABOR AND TIMBER

The only inhabitants so far north are Eskimos, and there are thousands of them in the tributary regions, up to Baffin's Bay and Chesterfield Inlet. They are a willing, kindly, trustful, hard-working and happy race, amenable to reason and discipline. This I found not only from my own observations, but from the unanimous consensus of opinion of those who knew them well. They live daily in fear of starvation, without the slightest semblance of comforts or knowledge of the amenities of civilization. True, they probably would not exist long if too much comfort was accorded them, but if properly handled and properly fed with the only supplies they are used to—raw sea products and such other food as is natural to their habitat—and if assured of life from which the fear of starvation and drowning were removed, it is probable that the labor supply would be ample and excellent. Think of a race that has never seen a potato nor cooked food!



ESKIMO SUMMER VILLAGE, SEALSKIN TYPE

The Eskimos are physically and mentally able. They have to be, or they could not survive. Their life is and always has been a constant struggle against the sea and the climate, and that they exist at all is proof of their adaptability and the sharpness of their intellects. One will note the same condition among northern Norwegians of the older type—that same struggle for life with the sea and the rocks, and their mental alertness and characteristic aptitude are the results of conditions, not so severe though of like type, as those under which the Eskimos live. These people are so built physically as to warrant the belief that they would make excellent miners. It is fortunate that it is not necessary to consider Indians as miners, for there is as much difference in the mental and physical attitude of the two races as there is between an I. W. W. and a man working on his own.

No timber exists on the islands or on the mainland adjacent, but on James Bay, 100 to 150 miles south, the rivers are channels through magnificent forests of spruce, owned by the dominion government, and as yet of no value at all. Mining timber should cost at the islands not a third of what it now costs in the Lake Superior region.

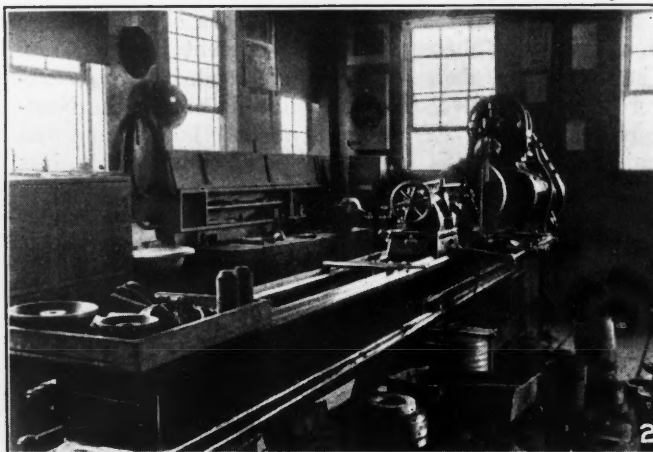
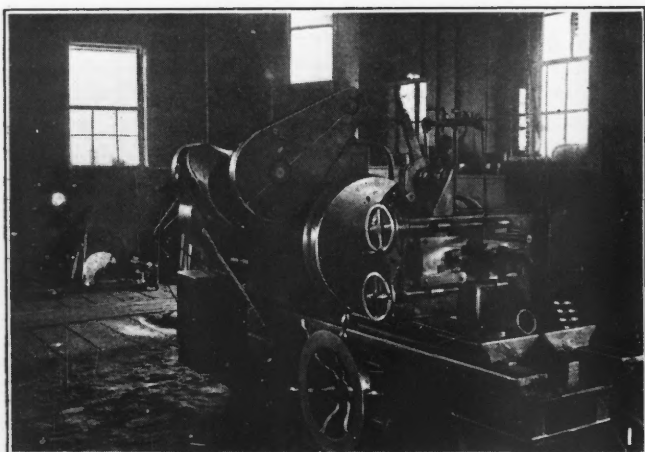
The possibilities of this newly discovered iron-formation region are truly interesting, and the more it is studied the more clearly do they stand out and the obvious objections fade away.

### German Sulphur Industry Recovering

Although in former years large quantities of sulphur required by the German industries were imported from Italy, preference is now being given to the American raw sulphur. At the same time Germany is making great efforts to become independent of foreign resources. Before the outbreak of the war, considerable quantities of sulphur were produced within the country. In 1912 no fewer than 109 factories were engaged in the manufacture of sulphuric acid, with a combined production of 1,650,000 tons per year. During the same year 2,017,000 tons of sulphur-bearing minerals was worked up, of which, however, only 999,000 tons was mined in the country. On account of war, conditions underwent radical changes, as Germany was cut off from any importations of sulphur as well as raw materials. For this reason the exploitation of the domestic pyrite deposits assumed large proportions, and alone in the district of Meggen, in Westphalia, the production of cupriferous gravel, sulphuret of zinc and lead, and other sulphur-bearing minerals, rose from 200,885 tons in 1914 to 766,371 tons in 1920.

A new process by which sulphur is gained from gypsum and sulphate of magnesium is being improved at present. Germany requires 140,000 tons of sulphur per month. In 1917 the monthly production of sulphur from domestic raw materials amounted to 64,000 tons, and it has largely increased during the last four years.

## A Well-Equipped Mine Machine Shop



INTERIOR VIEWS OF REPAIR SHOP AT THE STARPOINTER SHAFT, RUTH MINE OF THE NEVADA  
CONSOLIDATED COPPER CO., RUTH, NEVADA

1—Pipe-threading machine. 2—Long bed lathe. 3—Emery wheel, light drill press and power hacksaw. 4—Hydraulic press.



## Improvements in Nodulizing at Chrome, N. J.

An Agglomerator To Press Roasted Product Into Cakes and Pulverized Coal Burned in an Exterior Combustion Chamber Effect Marked Economies—No Rings Whatever Now Form

By C. L. COLBERT

Smelter Superintendent, U. S. Metals Refining Co., Chrome, N. J.

Written for *Engineering and Mining Journal*

THE ROTARY KILN has been used at the smelter of the U. S. Metals Refining Co. at Chrome, N. J., for nodulizing flue dust and fine ores for a number of years. This machine successfully handled large tonnages with low costs, before affected by the war-time prices of fuel oil and labor. The rapid rise in costs without the ability to obtain increased tonnages finally made nodulizing for a time prohibitive.

The principal reason for the limit in tonnage which could be treated was the difficulty in keeping the kiln in operation continuously, owing largely to the impossibility of preventing the formation of rings of semi-fused ore on the lining. The original method of operation offered a choice between two evils. In one case firing the kiln so that a good nodulized product would be discharged, resulted in a ring formation of such nature and so high up in the kiln as to make its removal very expensive. The other, so firing the kiln as to bring the rings close to the discharge end, where they could be easily handled, involved the making of an inferior nodulized product. The aim formerly was to effect a compromise between these two extremes by getting a good nodulized product with as little ring trouble as possible. This mode of operation required close and intelligent attention on the part of the operators.

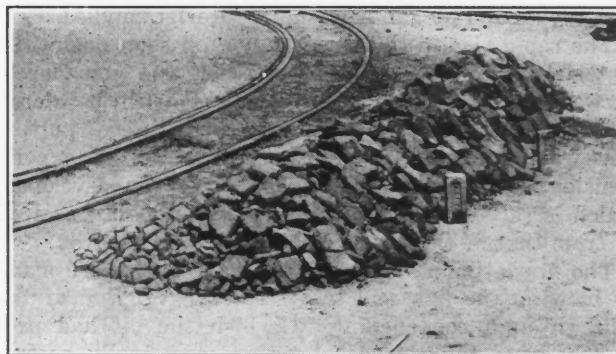
With the decreased intelligence of the available labor and with the great letting down in efficiency that took place during the Great War, it was found impossible to obtain satisfactory operation except for short periods, and the kilns were always producing an unsatisfactory product or carrying bad rings. After a heavy ring had formed, it was always necessary to shut down, cool off the kiln, and send men inside with bars and hammers to cut through the ring, which process was usually detrimental to the brick lining, as a portion of the lining came off with the ring. Occasionally it was possible to change the charge and partially flux out the ring, but the operation afforded only a temporary improvement.

The Chrome installation contains two 60 x 7-ft. Vulcan kilns. Previous to 1921 these were fired with 28 deg. Bé. fuel oil, under 50 to 75 lb. air pressure, burned in a standard Hauck burner, the flame discharging directly into the discharge end of the kiln through an orifice in the brickwork of the hood.

The troubles outlined made it imperative that some solution for the ring problem be devised, which, besides giving a product physically satisfactory for smelting, would permit a reduction of treatment charges. Both of these objects have been accomplished through the design (1) of a mechanical agglomerator, and (2) a combustion chamber for properly firing the kiln with either pulverized coal or fuel oil.

The mechanical agglomerator as developed consists of two co-operating rolls, as shown in the sketches, be-

tween which the semi-plastic material discharged from the kiln is passed and by which it is compressed. One of these rolls is built with side flanges between which the periphery of the other roll passes so as to confine the material while it is being subjected to pressure. One of the rolls may move toward or away from the other roll, thereby allowing the pressure on the material to be varied or to allow for varying quantities of material discharged from the kiln. As shown by the sketches, this movement is secured by supporting one roll from a shaft about which it may move angularly through the small range necessary, a movable counterweight being provided at the opposite side of the shaft to permit of adjusting the apparatus as desired. Only the other roll is power driven, the adjustable roll rotat-

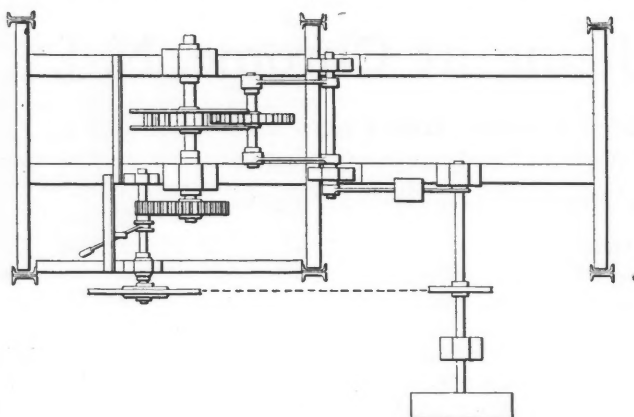


AGGLOMERATED CAKES OF FLUE DUST

ing by frictional contact. To insure rotation, its surface is provided with irregularities, alternate depressions and projections.

This apparatus was made and installed in January, 1920, and has been very successful. The material as discharged from the kiln is rolled out into a ribbon 4 in. wide and usually from  $\frac{3}{4}$  in. to  $1\frac{1}{2}$  in. thick, the thickness varying somewhat with the amount of feed and the spread of the agglomerator. The ribbon, as it rolls downward, breaks off into lengths of 3 to 6 in., which are carried away to storage.

To get best results, the product discharged from the kiln into the agglomerator rolls should be at a bright red heat, at which temperature the material is semi-plastic and can be pressed readily into a flat ribbon. After agglomeration, the hot product should be removed as quickly as possible to suitable storage. A screen test of this final product will show less than 5 per cent passing  $\frac{1}{4}$ -in. mesh. The photograph shows a pile of cold agglomerated product. An idea of the size of the pieces can be obtained by noting the common building brick standing on end. The capacity of the agglomerator depends principally upon the width of the wheel. The drive for the wheel had best be pro-



PLAN OF AGGLOMERATOR MECHANISM

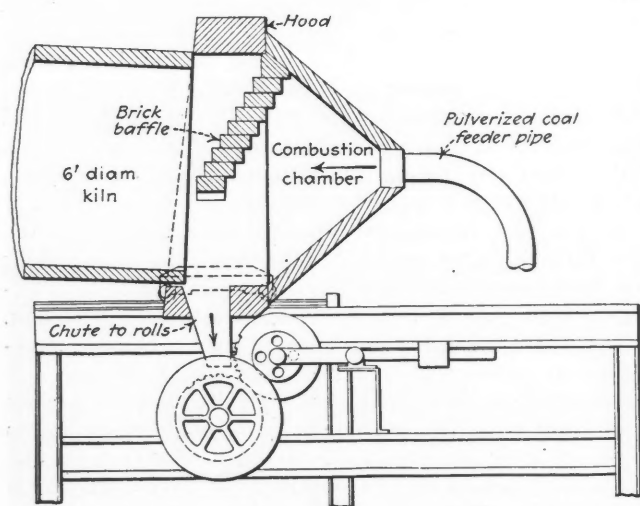
vided with a variable-speed motor to permit quick adjustment for the ordinary variation of the kiln feed.

#### THE PROBLEM OF PROPER FIRING NEXT SOLVED

Oil firing, as originally practiced, was not altogether satisfactory from the agglomerating standpoint, as the proper degree of heat was hard to control without constant regulation. Under skillful handling, satisfactory results were obtained, but a little carelessness on the part of the operator speedily developed ring troubles. The oil consumption under average conditions varied between 20 and 30 gal. per ton of material handled.

The rapid rise in the price of fuel oil soon made this material prohibitive, and other fuel was considered. It was finally decided to experiment with powdered bituminous coal, and the smallest size of "Aëro" pulverizer was purchased. After several weeks of experimenting, a method of firing has now been developed, which is satisfactory from the cost standpoint, as well as from that of the product obtained from the kiln.

The first attempts at powdered-coal firing were made by blowing the fine coal into the discharge end of the kiln, through the opening in which the oil had previously been introduced. Ignition was finally accomplished, but only at a point far up in the kiln, close to the feed end. Excellent nodules of large size were made for a short period, but it was soon necessary to stop and dig out the ring which quickly formed. So high a temperature was developed that metallic copper was

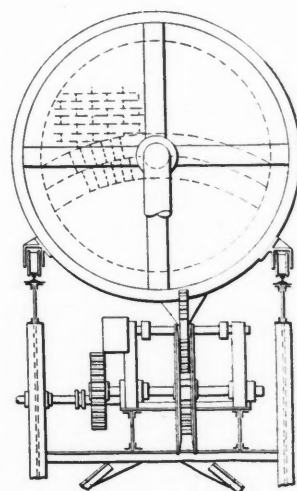


SIDE ELEVATION OF DISCHARGE END OF NODULIZING KILN AS IMPROVED

found in the rings. The screw-feed apparatus could not stand such excessive heat, and this method of firing had to be changed.

#### A COMBUSTION CHAMBER THE SECOND BIG IMPROVEMENT

A number of different experiments finally led to the use of a stationary brick combustion chamber at the discharge end of the kiln. The pulverized coal and air, properly mixed, were delivered into this chamber, which was maintained at a white heat. The hot gases were then discharged under a bridge wall into the mouth of the discharge end of the kiln. The proper height for the bridge wall is very important for obtaining the right position of the zone of maximum temperature inside the kiln. For the conditions existing at Chrom 22 in. has been determined upon as the proper height. The kiln shows a visible red heat not further than 10 to 12 ft. from the discharge end, with the highest heat at the point of discharge. The result of firing under these conditions has been the complete elimination of ring formations. Since the device has been installed, over six months ago, no time has been lost on this account, and as long as the conditions mentioned are maintained, a ring cannot form. The heat control is remarkably even, and firing causes little trouble. With these improvements, the quantity of feed was pushed to the limit of the capacity of the agglomerator, and the quantity of coal burned per ton of material treated was gradually lowered, until now the cost of fuel is considerably under the cost obtained with fuel oil at pre-war prices. Continued experiments demonstrated that fuel oil can be burned in the combustion chamber



END ELEVATION, SHOWING ARCH OF BRIDGE WALL AND AGGLOMERATOR

in place of pulverized coal, giving the same agglomerator conditions; and using fuel oil, the combustion is much more economical in the quantity of oil burned per ton of material treated than formerly. The efficiency of oil, however, based on B.t.u.'s per ton of kiln material, did not equal that given with coal. These results cannot be considered as final, for only one type of oil burner was used.

The more efficient burning of the fuel has increased the kiln tonnage from 30 to 40 tons per day to 80 to 90 tons; the limit has been restricted only by the size of the agglomerator and lack of better provision for taking care of the product. The kiln tonnage under proper conditions could be increased to 125 to 150 tons per kiln day.

The experimental combustion chamber now in use is only a makeshift, and one designed properly should be much more economical in operation. With the present arrangement, a ton of agglomerated material is produced by burning 70 lb. of bituminous coal. By using oil, the production is a ton of agglomerated material for 10½ gal. of oil. The oil, from the B.t.u. standpoint, as already mentioned, is not as efficient as pul-

verized coal. To get equal heat efficiency, one ton of material should be treated with  $6\frac{1}{2}$  gal. of oil. This present figure of  $10\frac{1}{2}$  gal. for oil is about one-third the old thermal requirement for fuel, and the second figure would be approximately one-fifth of the former requirement.

The figures given for bituminous coal are for coal containing 3 to 6 per cent moisture. Such coal is easily obtained, and the only preparation necessary ahead of the pulverizer is a crushing and screening of the run-of-mine coal in a short rotating screen. Coal containing a high percentage of moisture must be dried so that efficient grinding can be obtained at a reasonably low power cost.

Some work has been done, substituting the "buck-wheat" size of anthracite for the soft coal after the combustion chamber has been heated. Short runs have been made, successfully demonstrating that if supply bins of both kinds of coal be provided, a considerable saving might be made by using a cheaper coal part of the time.

#### METHOD CONSERVES SULPHUR

The smelter at Chrome has been for the last few years, and still is, deficient in sulphur, and the small content of sulphur received in the material to be smelted must be conserved as much as possible. It is, therefore, aimed to retain as much sulphur in the kiln product as possible, and not put fine sulphide into the kiln unless absolutely necessary. The flue dust charged to the kiln carries about 7 to 9 per cent of sulphur and the agglomerated product about 4 to 5 per cent, the sulphur elimination not exceeding 50 per cent.

Previous work on high-sulphur-bearing concentrates, run under the former conditions, gave a sulphur elimination of 70 per cent on a 30 per cent sulphur feed. Another run, on flue dust, gave a 60 per cent sulphur elimination.

My opinion would be that the amount of sulphur eliminated could be closely regulated by varied lengths of kilns, speed of revolution and pitch, as well as varying the method of firing. All of these factors should give complete control, and a certain combination of factors could be changed, to a considerable degree, in a kiln installation to give a variable product to suit conditions.

The character of the material treated will govern the results to be obtained; a flotation concentrate containing high iron, sulphur and copper will melt easily if exposed to much heat for an extended period, and will require a short kiln for treatment, especially should conservation of the sulphur be an important item. Flue dust low in sulphur, or concentrates which require long heat treatment to attain the proper temperature for the elimination of all the sulphur possible, will require a much longer kiln and more revolutions per minute. Carefully prepared mixtures are not necessary for kiln treatment, and high sulphur contents require only a reduction in fuel requirements.

#### Blasting Mats of Wire Netting

Blasting mats made of mine netting have been successfully used in quarry work, according to the *Quarry Magazine Journal*. A mat is 6 ft. in length,  $2\frac{1}{2}$  ft. wide, and the netting is about  $\frac{1}{8}$ -in. x 4-in. mesh. Each piece of wire matting weighs about twenty-eight pounds.

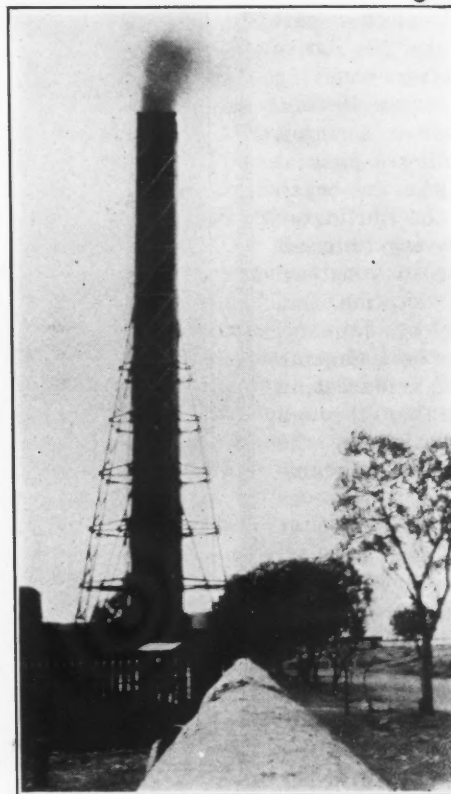
## A Wooden Smelter Stack

BY S. PAUL LINDAU

Written for *Engineering and Mining Journal*

When the smelter of the Compañía Metalúrgica Mexicana, at San Luis Potosí, was started in 1891 there was an adobe stack 60 ft. high for the roasters, and a self-supporting wooden stack for the lead and copper blast furnaces. The adobe stack has long ago been discarded, but the wooden stack still remains in good condition and is doing the work it was intended for. It has been overhauled possibly twice.

The stack and, in fact, the entire smelter were designed and built by Franz Cazin, consulting mechanical engineer, of Denver, Col. Before this, two wooden stacks were built at the old El Paso smelter by the



WOODEN STACK AT SMELTER OF CIA. METALÚRGICA MEXICANA, SAN LUIS POTOSÍ, MEXICO

late R. S. Towne, but proved rather unsatisfactory, as they had to be held up by a multitude of guy ropes.

The reason for building the wooden stack at San Luis Potosí was primarily the difference in cost, which was about one-half; then the convenience in building and erecting it on the ground with the regular crew and material. Texas long-leaf pine was used.

The main point of interest is the method of construction of the corner posts and braces. These are made longitudinally in two pieces, the 8 x 8-in. members being made of two 4 x 8-in. pieces well bolted together, with broken joints and fishplates at joints. This makes them practically one piece and gives sufficient strength to withstand the tensional strain caused by the high winds which occur there every spring. This also made construction much easier.

The stack is 164 ft. high and 11 ft. 6 in. square inside. The stone foundation is 8 ft. high. The amount of lumber used in construction was 41,000 ft.

## Mining Engineers of Note

### Albert Burch

**A**LBERT BURCH'S career is a direct refutation to the conclusion that a university training is a prerequisite to a successful professional life. His mining experience was acquired through the hard knocks administered by practical work in his profession. He received

little technical schooling, for in 1880, when he was only thirteen years old, he left school because of the removal of his family to another part of Nebraska, his native state. After receiving a short course in surveying under a tutor, and spending a year at York College, he began work for the Burlington R.R., busying himself with railroad construction and location and advancing by January, 1887, from back flagman to chief of first locating party. He then, through the solicitation of the superintendent, became underground surveyor and outside foreman at the Bullion Beck & Champion mine at Eureka, Utah. In 1890 he was commissioned a U. S. Mineral Surveyor and opened an office for patent survey work. Three years later he was offered the superintendency of the Bullion Beck & Champion mine, which he accepted, but

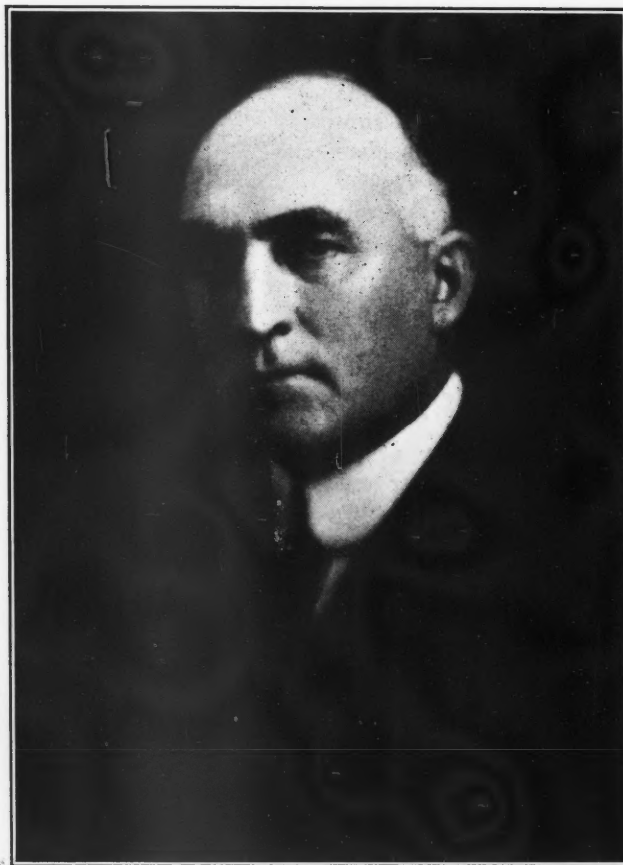
he was fired a year later by one "Cabbage" Ryan, into whose control the mine had passed. Reopening his office as mineral surveyor, he also took over some mining leases, and with C. E. Loose promoted the Grand Central Mining Co., of Mammoth, Utah, and other properties, all of which proved to be successful and gave him valuable training in mine promotion. Continuing his patent surveys, he became, in 1897, manager of Lawler's Gold Mines, Ltd., a small gold property in western Oregon. It was there, after a few months' work, that he met F. W. Bradley, who was examining the gold mine, and who offered him the superintendency of the Bunker Hill & Sullivan mine, at Wardner, Idaho, an offer that was accepted. He was in charge during the trying labor disputes and conflicts in the Cœur d'Alenes, a period noted for the violence of the activities of the strikers and outsiders attracted by the disturbances, the blowing up of the company's mill, and for its loss of life. In June, 1901, he was appointed manager of the B. H. & S., a position he held until 1903,

at which time he organized the firm of Burbridge & Burch, with headquarters at Spokane, Wash., and engaged in the development of various mining properties under option. This work was not entirely successful. Mr. Burch then moved to San Francisco to engage in

consulting practice, and has remained there ever since. His work has carried him from Alaska to Mexico, but he has been chiefly confined to the United States in the examination of many mines and prospects. At various times he has been consulting engineer for the Kimberley Estate, of Sharon, Pa.; the Chicago Exploration Co., of Chicago; the Bunker Hill & Sullivan Mining Co. (litigation only), the Goldfield Consolidated Mines Co., of Goldfield, Nev.; the Mountain Copper Co., Ltd., of California; the California Exploration Co. and the Plymouth Consolidated Gold Mines Co., Ltd., both of London; the Primos Co., of Philadelphia, and other companies. During the war he "did his bit" as consulting engineer for the U. S. Bureau of Mines, reporting upon manganese and chrome deposits in Cuba and stimulating production of war minerals in Cal-

ifornia and Oregon. He was personally connected with the development, equipment, and operation of the Plymouth Consolidated Gold Mines, Ltd., which is a British corporation, obtaining the option upon the property and intending first to turn it over to American capitalists. However, due to the withdrawal of this capital, he received British financial assistance.

Unlike the career of some mining engineers whose work has taken them to the four corners of the earth, Mr. Burch's field has been pre-eminently the development of our own domestic resources in time of both peace and war. Throughout his long contact with mining he has been an exponent of cordial co-operation between not only his employees and himself but also between his companies and the public. He has his own ideas as to value of welfare work, and feels that much of it lacks the essential quality of sincerity. His professional record bristles with the romance and adventure of mining, and it is apparent that he has got the fullest enjoyment from all his work.



ALBERT BURCH

## CONSULTATION

### How To Test for Platinum in Ores

"Will you please give me a method of testing platinum ore, simply to identify the platinum content?"

Although most of the world's platinum is derived from placer deposits, it also occurs in veins associated with chromite and disseminated in peridotite rocks. Its specific gravity is commonly given as 14 to 19, whereas that of gold is 15.6 to 19.3. Concentration by panning will show platinum grains as readily as gold. Platinum is infusible at ordinary temperatures, but may be fused with the oxyhydrogen blowpipe. The metal is soluble in aqua regia only, and has a shining steel-gray streak. In color it resembles some common metals from steel to silver, so that this characteristic alone is an unreliable indication of platinum. However, the properties recorded, infusibility and insolubility in ordinary acids, enable a preliminary qualitative test to be satisfactorily made, which should be confirmed by an analysis, or assay for platinum, performed by an experienced assayer or chemist.

No confusion should exist between the identification of platinum and other metals. Logan, in a bulletin of the California State Mining Bureau, "Platinum and Allied Metals in California," records the mistaken identity of fine grains of silvery white metal, highly magnetic, (platinum may also be magnetic), but lower in specific gravity than platinum, for the metal. The grains were mostly iron, although a mineral called awarite,  $Ni_3Fe$ , had also been identified in the sands of the river from which the metal had been taken. A blowpipe would have disclosed the error and assisted in the determination of the mineral.

Chemical means may be used for the detection of platinum. The so-called "Glow Reaction" is one method, and was first used by L. J. Curtman and P. Rothberg, who disclosed the test in a report of the American Chemical Society. The substance to be tested for platinum is brought into solution by dissolving it in hot aqua regia, and about 0.2 c.c. of this solution is absorbed in a piece of thin asbestos paper by alternately dipping the paper into the solution and heating until the required volume is absorbed. The moist paper, held by one end in a pair of tongs, is heated to redness in a bunsen flame and then removed. After redness has ceased, but while the paper is still hot, it is brought into a stream of mixed illuminating gas and air from a bunsen burner. If platinum is present, the asbestos paper will begin to glow. The glow must last for some time, and can be brought back after it has once died out, by again heating the paper and holding it in the stream of gas. The burner must be arranged to supply a fairly good mixture of gas and air, and the pressure must not be too great. For the greatest sensitiveness, the solution should not be too acid, the asbestos paper must be thin, and the glow is intensified by having the gas warm.

The glow reaction depends on the catalyzing action of the finely divided platinum compound, which hastens

and intensifies the oxidation of the hydrogen in the illuminating gas. The test shows the presence of as little as 0.002 mg. of platinum, 0.005 mg. of iridium, 0.0005 mg. of palladium or 0.0009 mg. rhodium, but it does not reveal the presence of osmium or ruthenium. It may be applied successfully to black-sand concentrate or to solutions, without preliminary separation of other substances. This is not a test suitable for use in the field, but one that can be rapidly employed in the laboratory or where the materials necessary for the reaction are available.

A method that may be used in the field requires nitric and hydrochloric acid to form aqua regia, and some potassium iodide. A few grams of the material to be tested is dissolved in a casserole by means of aqua regia, gently evaporated to dryness, and the residue heated until every trace of nitric acid is expelled, which is indicated by the disappearance of the acid fumes. The residue, containing platonic chloride, is dissolved in water and filtered. A few drops of potassium iodide solution added to the clear liquid gives platinum iodide, which dissolves, producing a deep rose-colored liquid resembling cobalt nitrate. A variation of this method may be had by dissolving the material in aqua regia as before, evaporating to dryness, and redissolving in hydrochloric acid, and evaporating again to a thick paste. Dilute with water and then add a few drops of  $H_2SO_4$  and a crystal of potassium iodide. The solution will assume a wine-red color if platinum is present, but does not work satisfactorily if large quantities of iron are contained in the sample. There are other wet tests for platinum, but the ones given here will suffice.

Discussing qualitative tests for the platinum metals, Hall<sup>1</sup> states that to differentiate and determine the metals of this group requires considerable equipment and a skilled analyst. Many published methods will not give accurate results, and others are accurate only under certain conditions. According to the authority quoted, "Aqua regia converts silver to chloride and dissolves palladium, gold, and platinum, but not iridium except with vigorous treatment or when alloyed with platinum. All these elements, except silver, give colored solutions, which range from yellow through orange to dark red, depending on the combination and concentration of the metals. Oxalic acid precipitates gold from slightly acid solutions, but not the others. Potassium or ammonium chloride in concentrated solution will precipitate platinum and iridium, but not gold or palladium in its usual condition. Potassium iodide, even in dilute solution, with gold gives free iodine; with platinum, brownish red color of platonic iodide; with palladium a black precipitate soluble in excess. This last reaction is extremely delicate. . . . Silver chloride precipitated in the presence of palladium and platinum is contaminated by these metals." Platinum assays are difficult and troublesome to make. In case of doubt it is well to have results checked.

<sup>1</sup>"Assaying," by E. J. Hall, Section 30, of Peele's "Mining Engineers' Handbook."

## HANDY KNOWLEDGE

### Shaft-Testing Apparatus

BY ALFRED GRADENWITZ

Written for *Engineering and Mining Journal*

Apparatus recently perfected by E. Jahnke, professor at the Berlin Technical High School, in conjunction with G. Keinath, chief engineer of the Siemens & Halske firm, permits shafts and cables to be checked in operation by automatically making record of any defective places in the shaft or places where the cable is put to excessive strain. The apparatus is lowered into the shaft and readily ascertains its condition. It is described as a vertical acceleration gage, and is attached to the wall of the cage, without interfering with

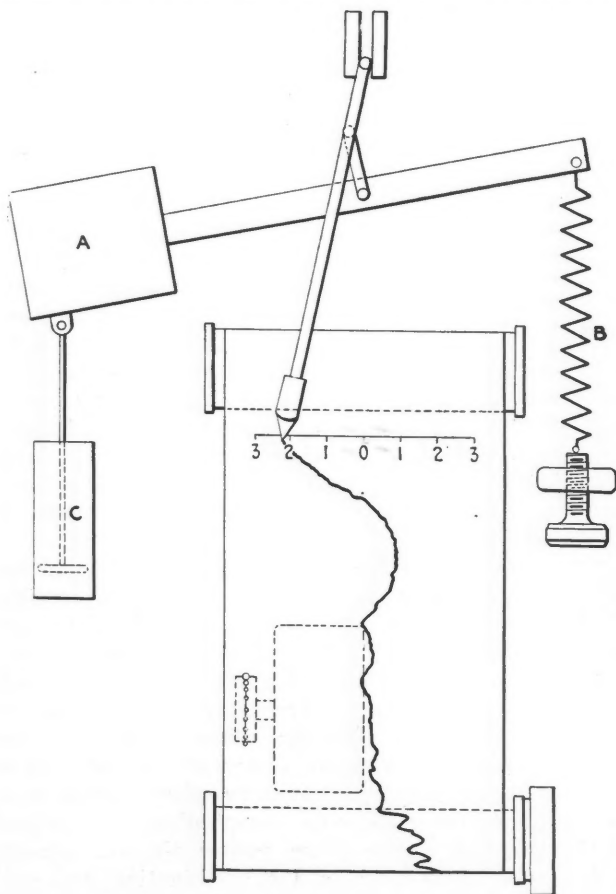


FIG. 1. SKETCH OF SHAFT-TESTING APPARATUS

the operation of the latter. After it is run up and down with the cage for about ten minutes, the diagrams recorded by the apparatus are removed.

The apparatus is a sort of seismograph and records all vibrations made by the cage. As may be inferred from Fig. 1, it consists of a weight *A* carried by a one-arm lever and kept in equilibrium by the spring *B*. This weight is lifted or lowered, as the case may be, by any acceleration shock acting on the cage, its motion being transmitted by a pair of toothed wheels to a recording lever moving in a straight line. Its maximum deflection is 60 mm., its sensitiveness being adjusted by exchanging the spring *B*. To insure ac-

curate records the working of the recording lever should be aperiodic; this is obtained by connecting the weight with an oil-damping device consisting of a piston moving up and down in a pot. The influence of temperature on this device can be checked from outside. Another condition that must be observed to insure accurate records is that the vibration of the device itself should be of short duration, so that the recorder may follow any rapid vibrations. This has likewise been met in a most satisfactory way, the recorder having a frequency of seven half-vibrations per second. The recorder writes with a non-spluttering pen on a paper tape, 120 mm. in useful width, advancing 5 mm. per second under the action of clockwork. The whole outfit is contained in an oak case fixed to the cage.

The apparatus described is mainly intended to serve as a safeguard in preventing accidents due to the breaking of cables. Being an elastic body, the cable under the action of the drive, the operating devices, and any irregularities in the structure of the shaft will undergo acceleration shocks tending to lengthen it. The energy of these shocks will be converted partly into tension energy of the cable and partly into energy of motion (kinetic energy). The following types of vibration are thus produced:

1. Starting vibrations, namely, harmonic vibrations, especially marked when the cage is suspended from a long cable. These vibrations, in employing electric or steam operation, will be rather light, unless their amplitude be increased by periodically changing variations of acceleration. When, in steam operation, the unavoidable jerks at starting come into resonance with the frequency of the cable, the amplitudes of vibration are likely to assume very considerable figures.
2. Braking vibrations, produced during the final stage of the run, when the operating device does not insure a uniform retardation as well as under the action of loads and when the engineer is unable to insure by hand a uniform run-out of the cage.
3. Guide vibrations occurring when the cage is running in bent guides or, when the load is not uniform, is moving to and fro between its guides. This type of vibration is characterized by sharp peaks in the acceleration curves.
4. Spring vibrations, noted when a spring is fitted between the cable and cage.
5. Tension vibrations, produced in the cable under the influence of the cable weight and reflected repeatedly at the upper end of the cable as well as at the cage.

Comprehensive tests made with this apparatus have shown any defects in the shaft and at the hoist to be readily detected by its means. In fact, the curves obtained in a ten-minute test (during which the cage is moving up and down) enable any change in the condition of the shaft and cage to be ascertained. They also show whether the operating devices are working well, how the engineer is operating the lever, and so on. Finally, by comparing the diagrams obtained at different periods, any decrease in the elasticity of the cable can be ascertained. In fact, the acceleration gage could properly be termed "shaft tester."

The fact that the apparatus also permits the winding engine to be checked is strikingly shown by Fig. 2. The irregular course of that diagram was due to two concurrent circumstances. On the one hand, there was an accidental defect in the adjustment of the operating mechanism, and on the other, the engineer, being tired, failed to operate the hoist in a normal manner.

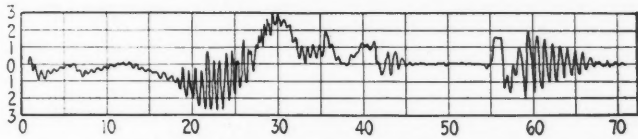


FIG. 2. RECORD INDICATES DEFECTIVE OPERATION OF HOIST

Inasmuch as in interpreting diagrams obtained by means of the acceleration gage there can be a doubt as to the cause of a given trouble, it is a good plan also to provide a rotary acceleration gage which will record the acceleration of the cable on the drum or Koepe disk. The type of apparatus used by Jahnke and Keinath is based on the following fundamental idea:

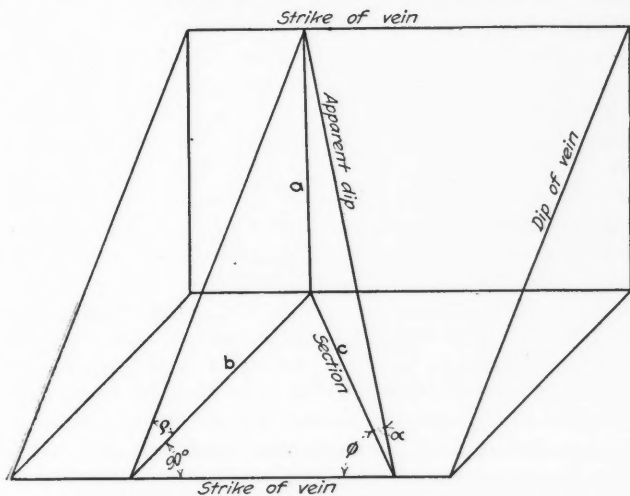
To the drum or Koepe disk there is coupled a small continuous-current dynamo supplying a continuous-current pressure corresponding to the number of revolutions. To this is connected across a condenser a recording milli-ammeter. Inasmuch as the current is proportional to the rate of variation of electric pressure—that is to say, to the rotary acceleration—this apparatus enables the operation of the engine to be checked at any time and at any distance from the engine house, in a much more perfect manner than would have been possible by observing the speed.

### Determining Dip of Vein at Depth

BY D. M. STRANAHAN

Written for *Engineering and Mining Journal*

During the course of work at Edwards, N. Y., it became necessary to determine if possible, whether the ore found at a low level in one of the diamond-drill holes was the same vein that was being worked above. The diamond-drill hole, however, was not in the same section as the mine workings, but further southwest along the strike. Consequently, it was not possible to use the true dip of the vein in making the section through the workings and the drill hole. Therefore it was necessary to calculate the apparent dip. This



SKETCH ILLUSTRATING METHOD OF DETERMINING VEIN DIP

was worked out in the formula given below, so that it could be used in connection with any dip and any angle for the section.

The true dip and strike are known; also the position of the diamond-drill hole in reference to workings. Therefore, using the diagram

Let  $\rho$  = true dip;  
 $\phi$  = angle of section with strike;  
 $\alpha$  = apparent dip.

Then  $b = c \sin \phi$ ;

$$c = \frac{b}{\sin \phi};$$

$$\tan \alpha = \frac{a}{c}$$

but  $\frac{a}{b} = \tan \rho, a = b \tan \rho.$

Therefore  $\tan \alpha = \frac{b \tan \rho}{\frac{b}{\sin \phi}} = \tan \rho \sin \phi.$

Then  $\alpha$  = angle whose tangent is  $\tan \rho \sin \phi$

### Filling Matte Ladles

Written for *Engineering and Mining Journal*

At the smelter of the Calaveras Copper Co., Copperopolis, Cal., the matte from the forehearth of the blast furnace is discharged through a cast-iron launder into small matte pots and hauled to the matte beds. To reduce the spillage to a minimum, a short section of cast-iron launder is mounted upon wheels supported by



MOVABLE LAUNDER PREVENTS SPILLING WHEN FILLING MATTE LADLES

tracks over the discharge end of the launder. When a ladle car is almost full, the short section is rolled into place and the stream of matte runs into the next car. The section is of sufficient length to more than span the space between the cars.

# THE PETROLEUM INDUSTRY

## The Comodoro Rivadavia Petroleum Fields\*

Development of Argentine Oil Field Has Been Steady  
—Use of American Drilling Outfits Has  
Resulted in Reduced Costs

THE settlement of Comodoro Rivadavia, in the National Territory of Chubut, Argentina, was founded in 1901 as a trading post on one of the most desolate parts of the desert coast of Patagonia. In December, 1907, while the government engineers were drilling for water, they encountered oil at a depth of 535 meters.

Though oil had been discovered previously in other parts of the Republic no attempt was made toward government exploitation until the discovery of the Rivadavia fields in 1907. Since then government development in Comodoro Rivadavia has steadily increased up to the beginning of the present year, when the monthly production reached over 200,000 bbl. During the last year reservations have been decreed also in the National Territory of Neuquen, and exploration wells have been sunk there by the Federal Bureau of Mines.

### LITTLE DEVELOPMENT DONE IN OTHER FIELDS

Besides the Comodoro Rivadavia oil fields there are three distinct oil regions in Argentina as determined by seepages and drillings. These are at Neuquen, Mendoza (Cachueta), and Salta-Jujuy on the Bolivian border. In addition to these fields, surface indications are said to point to oil in the region of Bahia Blanca, and along the coast north of Mar del Plata, both in the Province of Buenos Aires. Several geologists also believe that the general trend of the Patagonian formations would indicate that oil may be found in other parts of Patagonia than Comodoro Rivadavia and Neuquen. In comparison with the evident potential possibilities of the Argentine oil fields little development work has been done.

The accompanying figures give the output, in barrels, of the official workings at Comodoro Rivadavia since the first well was drilled in 1907. Production on private workings began in 1916 with an output of about 55,000 bbl., and in 1920 still amounted to less than 10 per cent of the total production.

Year	Barrels	Year	Barrels
1907	101	1915	514,837
1908	11,454	1916	816,316
1909	18,801	1917	1,142,918
1910	24,676	1918	1,242,740
1911	13,096	1919	1,183,105
1912	46,930	1920	1,465,570
1913	130,411	1921 (first three months)	538,855
1914	275,471		

### CHARACTERISTICS OF COMODORO RIVADAVIA PETROLEUM

In its natural state the oil of Comodoro Rivadavia is black and viscous, with a smell of benzine. It has a specific gravity of 0.912 at 15 deg. C. and of 0.8041

at 150 deg. C. An analysis made by Dr. Fritz Reichert for the Argentine Bureau of Mines showed the following contents: Carbon, 78.136 per cent; hydrogen, 12.010 per cent; oxygen, 4.637 per cent; sulphur, 0.340 per cent; nitrogen, 1.130 per cent; water, 3.500 per cent; and ash, 0.247.

### GOVERNMENT EXPLOITATION OF OIL

Official production of petroleum in Comodoro Rivadavia began immediately upon its discovery in December, 1907, about 100 bbl. being produced that month. Up to 1910, 5 wells had been drilled, all yielding oil or gas, and the production that year reached 24,000 bbl. By the end of 1917, 63 wells had been drilled, and 11 more were being drilled, while the yearly production passed the 1,000,000-bbl. mark. From then on the production has been limited by transportation facilities, and the actual production of 1,465,570 bbl. in 1920 does not at all represent the potential capacity of the 90 producing wells.

No dry wells have been struck on the government reservation, although several drillings were abandoned before completion on account of their undesirable location. Most of the wells are approximately 150 ft. above sea level and are grouped in two small valleys, 2 and 3 miles north of the town, and directly above the seashore.

### AMERICAN EQUIPMENT USED IN WELL DRILLING

A general characteristic of the wells is that the production is greatest during the first month, and after that the output decreases decidedly. The temperature of the oil is about 32 deg. C., as it stands in the wells at a level of 300 to 400 meters below the surface. All of the first wells were drilled with the Austria Fauck machines, capable of reaching a depth of 1,000 meters, but the deepest drilling so far has been but 634 meters. All of the government engineers at first were Germans, but later an American engineer in the service of the Argentine government was permitted to use American outfits in drilling two wells, and a considerable saving of time and money was demonstrated by the use of this equipment. Although the original cost of labor at the field has been cheap, the time consumed in drilling has often been great, and the total cost relatively large. Some wells drilled in 1915 cost \$45,000. The water in the wells is salty. During the first years sea water was used in drilling, but in 1912 the government wells began piping water a distance of 15 miles through a 4-in. pipe line which gives 200,000 gal. per day, and a larger pipe line is now being installed.

Three methods of extraction are being employed in the fiscal wells—namely, piston, hollow plunger, and pump. Many of the early wells are still giving good results, although some difficulty has been met with from time to time, due to several of the wells becoming choked with sand, which either reduced the output considerably or caused it to come to a standstill for some time. Since 1917 several wells have produced large supplies of gas at high pressure, but as the nearest

\*Abstracted from *Commerce Reports*.



city of any size is 600 miles distant, no attempt has been made to utilize this gas except to meet the small local requirements.

As previously mentioned, the actual production of oil from the Comodoro Rivadavia fields seems to be limited to the quantity which can be transported in the three tank steamers owned by the Argentine government, which have capacities of 4,300 tons, 3,000 tons, and 2,400 tons. Two others are expected from England this year, which will have a capacity of 5,000 tons each. Storage tanks are provided at Buenos Aires and at the military port near Bahia Blanca, and it is proposed to erect tanks at Rosario and other points, as well as to increase the present storage capacity at the ports in anticipation of increased production from the fields. Six more tanks of 6,000 tons' capacity have been ordered.

Each well is now provided with one or more tanks of 6,000 tons, and one of 8,000 tons' capacity, located at the loading wharf. The wharf at Comodoro Rivadavia, which is of steel, is 2,800 ft. long, 27 ft. above high-water mark, and carries a 10-in. pipe. The water depth at the end of the wharf is 23½ ft. at low water, and the rise of the tide is 18 ft. Because of the strong winds the tank steamers are moored to buoys away from the wharf and receive the oil through a flexible pipe 250 ft. long. The loading capacity of the pumps is 600 tons per hour, or the oil can be loaded by gravity at the rate of 200 tons per hour.

Analyses of the Argentine mining laws by legal authorities seem to establish definitely that there is no great obstacle to the exploitation by foreigners of the petroleum of Comodoro Rivadavia. However, all Argentine political parties and the Argentine people in general seem to view with suspicion any company that has the appearance of being a "foreign trust," and American companies interested, therefore, should consider the example already set by British and German capital of forming national companies incorporated under the Argentine law.

A market for the oil exists in the country and in the neighboring republics. In the year 1919 in addition to the domestic production of approximately 1,500,000 bbl., Argentina imported over 2,000,000 bbl. of crude and fuel oil, besides quantities of gasoline, benzine, and other petroleum products. The petroleum needs of Argentina have been estimated by an Argentine engineer at 35,000,000 bbl., including the requirements for the operation of the railways and industrial establishments, but excluding the needs of steamers taking on fuel in the River Plate ports and at Bahia Blanca. Allowing for increases in operation and in transportation, the Argentine Petroleum Department estimates that the fiscal workings will yield something less than 5,000,000 bbl. by the year 1924, and the deficiency in the national needs must be made up, therefore, by the workings of private companies. British, German, Dutch, and Norwegian capitalists have already shown active interest in the development of the Comodoro Rivadavia oil region, and it would seem well worth the attention of American interests.

#### Permits Under Leasing Act Increase

During June, the U. S. Geological Survey reported upon the structural relations of 1,066 applications for prospecting permits under the oil sections of the leasing act of Feb. 25, 1920, thus bringing the number of such reports rendered since July 1, 1920, to 6,994.

## Mackenzie River Oil Field

### SPECIAL CORRESPONDENCE

T. A. Link, geologist, and W. H. Waddell, surveyor, of the Imperial Oil Co., have arrived at the company's location in the Fort Norman oil area, and have staked for the company an additional sixty square miles of territory, which the company will prospect in the immediate future. Preparations are being made to drill for additional wells in close proximity to the well sunk last year. Across the river on Bear Island a crew of the Imperial Oil Co. is building a derrick for the rig of No. 2 well, which will be put down on the most northerly point of the island. A gasoline distilling plant is being installed near No. 1 well. Six miles up the river a well-drilling equipment has been landed for the Mackenzie River Oil Co., which will drill a well there this summer. Other companies which are bringing in machinery are the Fort Norman Oil Co., which will drill one well, and the North Northwestern Oil Co., which will sink two wells. Mr. Link confirms reports which have obtained currency, as to the recklessness with which staking has been done all along the river.

Of the 700 square miles more or less staked on both sides of the river between Fort Norman Post and the site of the original well, 53 miles down the river, Mr. Link estimates that not more than 200 square miles have been properly staked out and will be recorded. Many of the boundary lines of the stakers are crossed and recrossed and tangled in the most inextricable manner.

#### New Arizona Oil Field To Be Drilled

A deep test well is to be sunk by a Nogales syndicate in the new field, near Elgin, Ariz., where oil of paraffin base was found lately in a water well. There also is to be exploration by an Oklahoma company of the northern part of the same district, near the Empire ranch.

The State Corporation Commission is investigating the books of the International Oil & Refining Co., a local corporation, in connection with ownership of certain Texas leases claimed by the company and also by the Border States Petroleum Products Co., another Tucson organization.

#### Wildcat Wells in Arkansas

### SPECIAL CORRESPONDENCE

Notwithstanding the recent drop in crude oil prices, a strong interest is centered on the wildcat wells now being drilled in Independence County, Ark. Grigsby No. 1, the third well in the local field, was recently spudded in on the Grigsby farm, five miles south of this place, by the Walbert Oil Co. Adams No. 1, drilled by the Independent Development Co., and Earnhart No. 1, drilled by the White River Oil & Gas Co., have both experienced slight gas pressure and show a small amount of oil. The former is being sunk two miles west, and the latter five miles west, of Batesville. The gas and oil showing came from the Moorefield shale at a depth of approximately 300 ft. The Big Six Drilling Co., which has the contract for sinking Cave City No. 1, twelve miles north of this place, is having trouble getting tools shipped. The derrick is up, and everything is ready to start work as soon as the rest of the equipment arrives.

## Technical Papers

**Sphalerite—Fluorspar Separation**—The Rolla, Mo., station of the U. S. Bureau of Mines has been experimenting with the separation of the sphalerite, silica, and calcite from fluorspar in ores from southern Illinois and Kentucky. The conclusions are embodied in the Bureau's *Reports of Investigations* No. 2,264, three pages, obtainable from the U. S. Bureau of Mines, Washington, D. C., free of charge. The ordinary practice is to sort out a small percentage of high-grade acid spar by hand and remove the impurities from the remainder by jigs and tables, thus obtaining a product of about 85 per cent CaF<sub>2</sub>. Everything but the fluorspar is wasted. The ore on which the tests were made contained 7.3 per cent lead, 27.9 zinc, 35.7 calcium fluoride, 9.5 silica, and 4.7 per cent calcite. Electrostatic processes were tried, and also flotation in connection with tabling. The former seemed particularly promising, a marketable zinc product being made. Before passing through the electrostatic separator the ore is wet-ground to 10 mesh, and classified for table feeds and to remove slime. Tabling is employed to recover lead. Copper sulphate to the amount of about 1½ lb. per ton of ore, used in weak solution, seems to give the sphalerite a thin coating of copper, which makes the electrostatic separation better. The ore is then dried, screened to minus-10 plus-20 mesh, minus-20 plus-48 mesh, and minus-48 mesh, followed by electrostatic treatment of these three sizes, yielding zinc concentrate, fluorspar, and tailing. The process may be troublesome to conduct in wet weather, and further work on a commercial scale is required to prove its practical advantages over present methods.

**Chile Copper**—A. W. Allen has published three articles entitled "The Chuquicamata Enterprise" in the *Mining and Scientific Press* for June 4, June 18, and July 23 (San Francisco, Cal., price 15c. each). The papers cover the history of the Chile Exploration Company's work, and the present mining and metallurgical methods and results.

**Mineral Concessions in India**—The *Journal of Indian Industries and Labour* for May, 1921 (Superintendent of Government Printing, Calcutta, India, price Rs. 1-8) contains a sixteen-page article entitled "Principles Governing the Grant of Mineral Concessions in India." The present rules have been in force since 1913.

**Alberta Mineral Resources**—The second annual report on the mineral resources of Alberta, for 1920, is now available from the Provincial Secretary, Edmonton, Alberta. The principal mining industry of that province is, of course, coal, though the deposits of clay, iron, mica, petroleum, salt, sodium sulphate and talc are also discussed.

**Manganese**—The manganese deposits near Bromide, Okla., are described in an eighteen-page bulletin, No. 725-E, issued for free distribution by the United States Geological Survey, Washington, D. C. The deposits are small and cannot yield large quantities of high-grade ore, but their relations and the minerals they contain are unusual.

**Mineral Resources**—Recent publications of the United States Geological Survey, Washington, D. C., in the "Mineral Resources" series, issued for free distribution, include "Asphalt and Related Bitumens in 1919" (eighteen pages); "Graphite in 1919" (with a history of graphite mining in Pennsylvania) (fifteen pages); "Fluorspar and Cryolite in 1919" (twenty pages); "Magnesite in 1920" (sixteen pages); "Barytes and Barium Products in 1919" (twelve pages); and "Slate in 1919" (six pages).

## Recent Patents

**Flotation**—No. 1,383,321 F. E. Marcy, Salt Lake City, Utah. A new design of bottom for a pneumatic flotation machine.

**Flotation**—No. 1,383,881. J. I. Thomas, Garfield, Utah. In this patent the impeller of the ordinary mechanically agitated machine is replaced by a device in which the blades are hollow and permeable to air. Compressed air is forced down the hollow shaft, and, emerging from the blades, rotates the device.

**Dust Filter**—No. 1,383,715. L. Geschwind, Paris, France, assignor to Manufacture de Produits Chimiques du Nord, Eyablisements Kuhlmann, Paris, France. A dust chamber similar to the ordinary wire-hung dust chambers commonly used, with the exception that chains are used instead of wires.

**Petroleum Drilling**—No. 1,382,602. A. H. Neilson, Tulsa, Okla. Design for a multiple sucker-rod socket.

**Concentrating-Table Support**—No. 1,382,276. E. Deister and W. F. Deister, Fort Wayne, Ind., assignors to Deister Machine Co., Fort Wayne, Ind. An improved design for the supporting mechanism of concentrating tables.

**Shoveling Machine**—No. 1,382,001. S. J. Kruly, Miami, Ariz. A mechanically operated dipper and track up which the dipper is drawn for discharge into a receiving car.

**Method of Cleaning Oil Wells**—No. 1,382,337. G. C. Bellis, Butler, Pa., assignor of one-half to T. H. Brown, Butler, Pa. A method of cleaning oil wells consisting in pouring a caustic alkali solution into the well, and after allowing it to remain for a time, pumping up the solution together with the material in the well which it has loosened.

## Book Reviews

**The Mining Catalog** (Metal and Quarry Edition). Cloth; 9 x 12½; pp. 674. Compiled and published by Keystone Consolidated Publishing Co., Inc., Pittsburgh, Pa., 1921. Free to mine-operating officials.

This is the first edition of this book and the publishers have done well. It will be found an excellent condensed catalog of a large number of manufacturers of mining and metallurgical equipment, and a handy reference work for purchasing agents and operating men who must tell the purchasing agent what they want. Much valuable information not of an advertising nature is also included, partly tabular matter, and charts, such as may be found in handbooks, and partly complete articles taken from the bulletins of the A. I. M. E. and from the technical press, descriptive of the principles on which the classes of machinery listed operate. Those sections devoted to ore dressing and milling are particularly rich in technical information of this kind. It is unfortunate that none of this material is indexed, for its availability is thereby lessened. References to products and to advertisers are, however, well indexed.

Only those manufacturers who have paid for space are included and the list of manufacturers of any given product is therefore not complete. Most of the better known companies are represented, though some, such as the Allis Chalmers Company for instance, are conspicuous by their absence. However, the name of at least one company manufacturing a given product may usually be found.

**Petroleum Register**—Cloth; 9x12; pp. 640, illustrated; 1921 edition. *Oil Trade Journal*, New York. Price. \$10.

An annual directory and statistical record of the petroleum industry in the United States, Canada, and Mexico. The text includes lists of producers, refiners, compounders, marketers and jobbers of petroleum and its products, natural-gas, gasoline manufacturers, pipe lines, geologists, manufacturers of and dealers in equipment, and officers of oil associations. In the statistical section will be found comprehensive figures on production, consumption and export of crude and refined products; statistics of Mexico's oil industry; price records; registry of tankers, barges, and fleets of the principal companies, and other important data. Maps of Arkansas, California, Indiana, Kansas, Louisiana, New York, Ohio, Oklahoma, Pennsylvania, Texas, West Virginia, Wyoming, and Mexico are also included. The issue will prove a most valuable work to those interested in the production, refining, and marketing of petroleum. The book has now passed through several editions, which has given the opportunity for any inconsistencies in earlier issues to come to light.

# ECHOES FROM THE FRATERNITY

## SOCIETIES, ADDRESSES, AND REPORTS

### New York University To Conduct Petroleum Lectures During Fall and Spring Terms

Conferences Will Cover Development of Industry and International Trade Competition and Related Subjects

New York University announces a series of lectures on petroleum to be given at the Wall Street Division of the School of Commerce by Ernest R. Lilley, Sc. D., consulting petroleum geologist and lecturer in commercial geology, during the Fall term of 1921.

Making a survey of the industry as a whole, the lecturer will cover its development to date, its future both in this country and abroad, and its relation to other industries, emphasizing particularly its relation to those with which it is in active competition. Special attention will be given to the growth of corporations, the scope of their operations and their function in international trade competition. The subject outline follows:

Price Control—Determining Factors.  
The Mechanism of the Oil Industry.  
The Development of America's Oil Resources.

Corporation Control in the American Petroleum Industry.

Oil in South America, Europe and the Far East.

Petroleum in World Trade.

Supremacy in Oil Resources—International Rivalry.

Gasoline from Gas—The Casinghead Gasoline Industry.

Oil from Shale—The Scotch Industry.  
Oil from Shale—American Shale Oil Possibilities.

Oil and Gas from Coal—The Coal Tar and Producer Gas Industries.

Power from Water—The Hydro-electric Power Plant as a Substitute for Fuel Oil.

The Future of the American Petroleum Industry.

Power from Natural Fuels—Oil, a Competitor of Coal.

During the Spring term of 1922 another series of lectures will be given on the development and valuation of oil properties. In this series stress will be laid particularly upon the mechanism of the producing branches of the oil industry. The methods used by the geologist in preliminary work, the value of his reports to the investor, the cost and methods of drilling, the handling of production, and the methods used in the valuation of properties will receive full attention. The subjects of the lectures are:

Market Values of Oil Properties.

Oil Pools—Their Origin and Value.

Foreign Concessions—How Developed.

“Structures”—The Work of the Geologist.

Drilling Methods and Costs.

Field Equipment and Pipe Line Installation.

Forced Production—Shooting—Flooding, etc.

Marketing—The Function of Pipe Line and Refinery.

Marketing—Competitive Values in Oils.

Valuation of Leases—Developed Properties.

Valuation Methods—Partly Developed Leases.

Valuation—“Close in” Leases.

Valuation—“Wildcat” and Concessionary Tracts.

The Prospectus—How Analyzed.

Lectures will be given at the Wall Street Center, New York University, 90 Trinity Place, New York City, on Wednesdays from 5:15 to 7:00 p.m. Either series may be taken separately.

### Mexican Department of Mines Issues Production Figures

Gold, Silver, and Lead Outputs Now Below Pre-War Levels

The Department of Mines of the Ministry of Industry, Commerce and Labor of Mexico announced in July the figures covering the production of the principal minerals during 1919. The figures given are as follows: Gold, 23,586 kg.; silver, 2,049,898 kg.; copper, 56,172,235 kg.; lead, 71,375,968 kg.; zinc, 11,559,685 kg.; quicksilver, 118,940 kg.; antimony, 470,738 kg.; graphite, 4,023,015 kg.; tungsten, 21,970 kg.; tin, 1,588 kg.; arsenic, 2,246,378 kg.; manganese, 2,294,227 kg., and molybdenum, 1,767 kg. The statement from the department also gave the production of gold for May, 1921, as 1,703 kg. The silver production given for May, 1921, was 121,419 kg.

Figures also are given by the department covering production during the years prior to 1919 as far back as 1910. Owing to the internal disturbance throughout that entire period, figures as to Mexican production have been fragmentary. For that reason the following are reproduced, production being given in kilograms:

Year	Gold	Silver	Copper	Lead	Zinc
1910.....	41,419	2,416,669	48,160,365	124,291,705	1,833,084
1911.....	37,119	2,518,202	56,072,071	116,758,097	1,592,606
1912.....	32,431	2,526,715	47,244,504	105,159,621	1,265,564
1913.....	25,809	1,725,860	52,591,779	68,343,000	959,904
1914.....	8,635	810,646	26,621,115	5,703,200	792,563
1915.....	7,358	712,599	205,978	19,970,952	5,806,028
1916.....	11,747	925,992	28,411,248	19,970,786	37,449,226
1917.....	23,582	1,306,987	50,985,923	64,124,752	45,180,778
1918.....	25,313	1,044,542	70,223,455	98,837,154	20,698,996

### Mining Congress Exposition To Be International in Scope

Mexican Exhibit Will Be Large for Meeting To Be Held on Oct. 17

The National Exposition of Mines and Mining Equipment which is to be held in Chicago under the auspices of the American Mining Congress will be international in character.

Approximately 250 exhibits representative of the latest forms of mining equipment machinery made in the United States will be shown at that time. Latin-American countries will be represented in Chicago with official delegations, who will come to the exposition for the purpose of studying American methods and equipment.

Mexico will also be officially represented with a large exhibit, illustrative of its natural wealth. No question is of more interest to American mining men at the present time than the future of Mexico. Millions of dollars of American capital was invested in Mexico in the days of Diaz and there are unlimited opportunities for future mineral development as soon as a policy has been adopted which will enable close co-operation between Mexican and American interests.

It is hoped that as a result of the conferences and discussions at the convention of the American Mining Congress, the mining interests of the United States will indorse and agree upon definite resolutions in regard to a policy toward Mexico. It is the feeling of many of the Western mining states that President Obregon has shown constructive ability in handling the domestic problems in Mexico and that his government should be recognized by the United States as a first step toward bringing about the possibility of American mining interests working effectively in Mexico.

There will also be representative delegations from European countries.

The National Exposition of Mines and Mining Equipment is, therefore, attracting both a national and an international interest, and it is believed that this joint meeting in Chicago will result in a formulation of plans which will have a far-reaching effect upon the future development of American mining interests, both at home and abroad.

## MEN YOU SHOULD KNOW ABOUT

E. E. Free is in San Francisco.  
R. T. McKinney, of Gold Hill, S. C., is in Toronto.

M. G. Gulley is doing geologic work in the oil fields of the Big Horn basin.

Augustus Locke has left San Francisco for Calumet, Mich., on professional work.

O. R. Whitaker, mining engineer of Denver, has been in Mexico on professional business.

John M. Fox has been appointed superintendent of the Kelly mine at Randsburg, Cal.

James M. Platt, mining engineer, is filling a professional engagement at Las Truchas, Mexico.

Howard K. Welch, manager of the Hardshell Mining Co., of Patagonia, Ariz., is in New York.

Charles Janin, who has been in Washington for several weeks, has returned to San Francisco.

L. G. Mosburg, of the U. S. Geological Survey, has been assigned to work in the Eldorado, Ark., oil field.

John C. Anderson, of Tucson, Ariz., is engaged in mine examination work in the Pioche district, Nevada.

Norman Carmichael, general manager of the Arizona Copper Co., Clifton, Ariz., is in British Columbia.

Lewis Sanders, who has been investigating mining property in Colorado recently, has returned to New York.

A. J. Eveland, mining engineer, has returned to Mexico City, following an extended visit in the United States.

J. B. Eby, of the U. S. Geological Survey, has been assigned to work in the vicinity of Lewiston, Mont.

Morton Webber, accompanied by his assistant, W. T. Benson, has been engaged in examination work in Sonora, Mexico.

E. B. Knopf has completed the geological field work which he has been doing in the Quarryville - McCall's Ferry area.

L. S. Ropes has returned to Helena, Mont., from the Yellowstone Valley, where he has been engaged in examination work.

F. G. Stevens has returned to Toronto from the Rex mine, northern Manitoba, which he has been examining for New York interests.

Fred Pope, of New York, has been looking over the Cobalt, Kirkland Lake, and Porcupine camps, in Ontario, during his vacation.

R. A. Bryce, of Toronto, has returned from examining properties in the Fort William and Goudreau districts, in western Ontario.

T. W. Vaughan, of the U. S. Geological Survey, will be engaged in field work in New York State during August and a part of September.

A. R. Globe, formerly assistant manager of the Hollinger Consolidated Gold Mines, has returned to the Porcupine

district after two or three years' absence.

F. W. Denton, Painesdale, Mich., has been appointed a member of the board of control of the Michigan College of Mines, succeeding James McNaughton, of Calumet, Mich.

A. J. M. Sharpe has resigned as managing director of H. S. Willcocks & Co., Ltd., of London and Manchester, to become manager of the International Metal Service, London.

J. B. Tyrrell has recently been elected one of the vice-presidents of the American Association for the Advancement of Science, and chairman of the Engineering Section of that body.

James G. Ross, consulting mining engineer for the Milton Hersey Co., Ltd., of Montreal, has returned from an extended examination trip to the northern interior of Quebec.

Edwin Higgins, of Oakland, Cal., recently visited the Lake Superior district, where he was formerly in charge of mine rescue work for the U. S. Bureau of Mines.

E. S. Bastin, of the University of Chicago, is spending a part of the summer in the service of the U. S. Geological Survey, investigating the enrichment of silver ores.

S. N. Graham, professor of mining at Queens University, is making Haileybury, Ont., his headquarters for the present and from there will investigate various properties in northern Ontario.

Edwin L. Derby, Jr., chief geologist for the Cleveland-Cliffs Iron Co., and John M. Bush, superintendent of the company's North Lake mines, both of Ishpeming, Mich., are in Washington, D. C.

C. L. Adams, who has been assistant superintendent of the Copper Range stamp mills at Freda, Mich., has succeeded A. F. Cavanaugh as superintendent of the Mohawk-Wolverine mills at Gay.

Donald B. Gillies, of Cleveland, was elected president of the Alumni Association of the Michigan College of Mines at the third reunion at Houghton, Aug. 5-6. William Kelly, of Vulcan, Mich., was elected an honorary member.

George A. Laird has resigned as general manager of the Guiana Development Co., and, after completing some examinations for the same company, will return to the United States, expecting to be in New York by Christmas time.

J. P. Bonardi has resigned his position in the U. S. Bureau of Mines to become manager of the assay and chemical department of the Mine & Smelter Supply Co., at Denver, Col. Mr. Bonardi has been with the Bureau for five years.

McKinley W. Kraigh has been appointed acting chief of the tax division of the American Mining Congress. He will assist mining companies in making their tax returns and also will attempt to secure adjustments where inequities have arisen.

Sherwin F. Kelly, representing C. &

M. Schlumberger, Prospection Electrique, of Paris, has arrived in New York preparatory to making an extensive study of American and Canadian ore deposits to determine their adaptability to investigation by means of the system of electrical prospecting developed by Professor Schlumberger, and described in the issues of the *Engineering and Mining Journal* of May 7 and May 14. Mr. Kelly is staying temporarily at 9 West 83d St., New York.

Mining engineers and metallurgists recently in New York City included: R. T. Wilder, Matehuala, S. L. P., Mexico; A. W. Stickney, London, England; M. Gardner Talcott, Cleveland; Nelson Dickerman, San Francisco, and W. H. Seamon, Jr., Sherwood, Md.

## SOCIETY MEETINGS ANNOUNCED

American Association for the Advancement of Science, Engineering Section, will hold its next meeting at Toronto, Canada, Dec. 27 to 31.

The Executive Board of the American Engineering Council of the Federated Engineering Societies will be held at the Cosmos Club, Washington, D. C., on Sept. 30. The most important business coming before this meeting will be the election of a president to succeed Herbert Hoover, who resigned after he became Secretary of Commerce. Nominations to fill this vacancy were ordered at the last meeting of the Executive Board, so that they could be reported at the September meeting. Some of the other items which have been before the Executive Board will come up for further consideration. Special attention will be given the plans for the Engineering Assembly, extension of employment service, and the question of licensing and registration of engineers.

## OBITUARY

John L. Cochrane, for many years statistician of the U. S. Bureau of Mines, died in Cleveland Aug. 3. His death came suddenly following an apparent recuperation from a paralytic stroke which occurred in January. He had been in the Federal service in Washington for about fourteen years, first with the technologic branch of the U. S. Geological Survey, and later with the Bureau of Mines. Since the creation of the Bureau in 1910 he had been in charge of the publications work of the organization, and, through the dissemination of safety information and literature, had played an important rôle in the work of the Bureau in reducing the death and accident rate in the mining industry. Mr. Cochrane contributed to the technical press a large number of articles on mine-safety and mineral conservation topics.

# 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

### Walter Fitch, Jr., Co. Claims Shaft Sinking Record

A telegram dated Aug. 6 has been received by the *Engineering and Mining Journal* from the Walter Fitch, Jr., Co., stating that the company had already broken the world's shaft sinking record by 15 ft. with 9 days yet to go. The company began its effort to break the record at 8 a.m., July 15 last, when it started the work of deepening the Water Lily shaft of the Chief Consolidated Mining Co. at Eureka, Utah. The present world's shaft sinking record is 310 ft., made by the Crown Mines, Ltd., Johannesburg, South Africa, in July, 1919.

### Imperial Iron Mine in Michigan Being Opened by Ford

The Ford interests have started work preparatory to opening the Imperial mine at Michigamme, Mich., on the Marquette Range, which was acquired last year. The old buildings are being torn down and will be replaced by new structures. New machinery, all of which will be electrically driven, will replace the old machinery now at the mine. There is a first-class steel head-frame in position, which will be used. Double tracks will be laid in place of the single tracks in one of the incline shafts. It is expected that actual mining will be started by fall.

The Michigan Tax Commission credits the Imperial with 1,000,000 tons of limonite iron ore, the average of which is about 52 per cent iron. The ore will be shipped to the River Rouge plant of the Ford company, near Detroit. This is Henry Ford's first venture in the metal mining business. Albert Richards, son of the late Captain W. J. Richards, who was in charge of mining operations for the McKinney Steel Co., is the superintendent of the Imperial mine.

### Afterthought Copper Co. Sued For Patent Infringement

Suit for infringement of patent has been brought against the Afterthought Copper Co. by George C. Carson. The patents involved are No. 1,302,307, of April 20, 1919, and No. 1,149,495, of Aug. 10, 1915, and apparently cover side feeding in reverberatory furnaces. The trial will take place on Aug. 17.

### WEEKLY RÉSUMÉ

At Washington, the House Committee on Mines and Mining, at the suggestion of Secretary Fall, has recommended that the War Minerals Relief Act be amended to permit consideration of claims mailed before noon June 2, 1919, and to allow the correction of errors made through miscalculations. Director Bain of the U. S. Bureau of Mines is quoted as stating that the mining industries should concentrate on means to improve underground methods, which, he says, have not kept pace with improvements above ground.

The Walter Fitch, Jr., Co. claims to have broken the world's record for shaft sinking, an object it set out to accomplish on July 15. In California, the Shasta Zinc & Copper Co is said to have found it necessary to install further refining equipment. Suit has been brought against the Afterthought Copper Co. for infringement of patents apparently covering side feeding in reverberatory furnaces. A zinc smelter near Los Angeles has been acquired by the Simon Silver-Lead Mines Co., of Mina, Nev., which has announced its intention to engage in the manufacture of zinc oxide. In Utah, the Utah Steel Corporation is said to be planning to install a blast furnace with a view to smelting local iron ores. In Michigan, the Ford interests have started to open the Imperial iron mine. Independent iron ore operators in the Lake Superior district have again cut wages. In Mexico, the Dolores Esperanza Corporation has placed a new modern power plant in operation at its Dolores mines.

### Shasta Zinc & Copper Co. Completes Initial Run Work Stopped To Add Further Refining Equipment

The zinc oxide plant of the Shasta Zinc & Copper Co. at Winthrop, Cal., has completed its initial run, demonstrating the metallurgical success of the new installation. The smelting operations will be suspended for the time, pending the increase in facilities for the further refining of the zinc oxide produced. An experimental furnace has been erected and operated for some time on refining the zinc-oxide, and has demonstrated that the output of the baghouse, with additional refining, will make an acceptable product. It was at first hoped that the baghouse product would be sufficiently pure to be directly marketed.

### Crafts Declare Strike Lost at Tonopah and Divide

#### Miners Expected To Take Similar Action Soon—Assured They Will Not Be Discriminated Against

The crafts unions in the Tonopah and Divide districts of Nevada have declared the strike which began in April 16 lost. Members have been reinstated except where their positions have already been filled. The miners have not yet officially declared the strike lost, but many of them are applying for work. The miners' committee met the operators Aug. 8 and were assured that they would not be discriminated against. It is believed that the strike will be declared lost and off without delay.

### Simon Silver-Lead Company Acquires Zinc Smelter

#### Announces Intention To Engage in Manufacture of Zinc Oxide

The Simon Silver-Lead Mines Co., operating at Mina, Nev., has issued a letter to stockholders announcing that it has acquired control of the Kirk-Simon Smelting Co., at Harbor City, Cal. This plant has been acquired for the purpose of manufacturing zinc oxide, which the company claims will enable it to dispose of its zinc concentrates at a substantial profit. It is located about eighteen miles from the center of Los Angeles and about three miles from Los Angeles harbor. This plant is now being remodeled.

### Utah Steel Co. May Smelt Local Iron Ores

The Utah Steel Corporation is planning to add a blast furnace and sheet mill to its plant at Midvale, Utah, in the near future. As is well known, there are large deposits of iron in Utah, as well as large coal fields. Last year 600,000 tons of sheet iron and tin plate were shipped to the West from Eastern points, and these products, manufactured in Utah, could be delivered at greatly reduced freight rates, it is said. Eastern capital is stated to be available, and the company is making a campaign for Western support. The officers of the Utah Steel Corporation are: C. W. Whitley, vice-president of the American Smelting & Refining Co., president; M. S. Rosenblatt, general manager; N. Rosenblatt, vice-president; S. Rosenblatt, secretary; M. H. Sowles, treasurer.

## NEWS FROM WASHINGTON

By PAUL WOOTON  
Special Correspondent

### Ending Assessment Work Year At Noon Advantageous

Will Prevent Disputes Arising Where  
Two Locate Same Ground at Night,  
Not Seeing Each Other

The text of the bill prescribing a change in the period for doing annual assessment work of unpatented mineral claims, which passed the House of Representatives recently, reads as follows:

"That Section 2 of 'An act to amend sections 2,324 and 2,325 of the Revised Statutes of the United States concerning mineral lands,' approved Jan. 22, 1880, be, and the same is hereby, amended to read as follows:

"Sec. 2. That Section 2,324 of the Revised Statutes of the United States be amended by adding the following words: 'Provided, That the period within which the work required to be done annually on all unpatented mineral claims located since May 10, 1872, including such claims in the Territory of Alaska, shall commence at 12 o'clock meridian on the first day of July succeeding the date of location of such claim: Provided further, That on all such valid existing claims the annual period ending Dec. 31, 1921, shall continue to 12 o'clock meridian July 1, 1922.'"

In the course of the discussion of the bill in the House, Representative Hayden, of Arizona, said:

"The wisdom of beginning the year in which assessment work must be done, at noon instead of at midnight, will not be disputed by any one familiar with the location of mining claims. There have been frequent disputes caused by two or more men going upon the same piece of ground in the middle of the night, often without seeing each other. Rights to mineral claims henceforth will be initiated when the sun is at meridian height, instead of at that time of night 'when churchyards yawn and hell itself breathes out contagion to this world.'

"The desirability of changing from the calendar to the fiscal year long has been recognized. It meets with the approval of practically all those engaged in prospecting and mining."

Representative Summers, of Washington, made the following statement to the House:

"One important reason for this legislation is that temporary roads are necessary to get to these mining properties. These roads generally are washed out during the winter. If the year can be made a fiscal year, the prospector, instead of building the road every year, can build the road once in two years, and do one year's work before July 1 and another year's work after July 1."

It is believed that the Senate's concurrence in this matter is insured and that the bill will become a law in the near future.

### Underground Mechanical Development Lagging, Says Bain

Industry Generally Slow To Adopt De-  
vices Already Proved Successful—  
Should Concentrate To Improve  
Methods

Now that there is the most urgent need for the adoption of the most efficient methods in mining, H. Foster Bain, the Director of the U. S. Bureau of Mines, thinks the mining industries should concentrate on means to improve underground methods. Improvements underground, Mr. Bain says, are not keeping pace with improvements above ground. He has in mind mechanical developments and the general layout of underground workings. In metal mines, particularly, he points out, there are many operations in which there would be ultimate economy if the present workings were abandoned and an entirely new mine was opened. The mine then could be designed in advance so as to permit of economical transportation and other savings.

Before mills, smelters, or other surface improvements are installed in connection with mining operations, Mr. Bain points out, the whole subject is given careful preliminary study. If a mine is to be opened, there is a small expenditure for surveys and a little outlay on blueprints, and that is about all the preliminary work done on the matter of layout or the method of working. Once a mine is opened, the operator practically has committed himself, because changes of layout afterward made involve almost prohibitive expense.

Despite the notable improvements that have been made above ground in mechanical devices, mechanical development below ground, Mr. Bain points out, has lagged far behind. Shoveling, one of the largest underground costs, is still done largely by hand labor in face of practical perfection of mechanical shoveling devices. It has been a matter of common knowledge for many years that there must be an increasing shortage of common labor. There has been no secret about the trend of the nation's immigration policy. Despite the knowledge that mechanical means must be resorted to to supplant the shortage of common labor, there has been little advancement in the installation of many mechanical devices in metal mines. Even where such improvements have been installed, with great reduction in costs, the example set has not been followed generally. In the opinion of Mr. Bain, the time is particularly opportune for thought on this subject by the operators of metal mines.

### Amendments to War Minerals Act Recommended by Committee

Ask Consideration for Claims Mailed  
Before Noon on June 2, 1919—  
Would Permit Correction of  
Errors in Calculation

Following a suggestion from the Secretary of the Interior, the Committee on Mines and Mining of the House of Representatives has recommended amendments to the War Minerals Relief Act which will permit the consideration of claims deposited in the mail prior to 12 o'clock noon on June 2, 1919, and permit the correction of errors made through miscalculation. No effort was made on the part of the House committee to broaden the language of the Senate bill, which refers to extending the scope of stimulation. It has been contended that the Senate bill will apply only to those claims on which the Secretary of the Interior has not acted. The Secretary of the Interior does not share that view, as is indicated in his letter to Representative Rhodes, the chairman of the House committee. The text of Secretary Fall's letter follows:

"Senate bill 843 merely amends the act of March 2, 1919, relative to war minerals relief in relation to the character of request or demand; that is to say, stimulation. It broadens the scope of stimulation along the line which, I may say, I should have followed had I passed upon the cases already decided as an original proposition.

"In reviewing these cases, I have power, in my judgment, to reach the end provided in this bill without additional legislative authority.

"However, much more serious questions are presented in the consideration which is now being given by way of review of some of these cases and original examination of others.

"It appears that the commission passing upon these cases submitted to the comptroller and had a ruling from him upon the question of time limit in the matter of presentation of cases. The rule was adopted that although a case might have been mailed prior to the expiration of the time limit, unless it had reached the hands of the commission itself prior to 12 o'clock it should not be considered and no such cases were in fact considered.

"I am unofficially informed that a messenger was watching for mail, and at exactly 12 o'clock the mail which had arrived was taken out, and that no cases arriving through the mails or otherwise at any time thereafter were considered.

"Second. Cases which were considered and upon which a decision was reached allotting or allowing a certain amount to be paid were later reopened or reconsidered and an additional amount allowed, it being shown that an error had been made by the commission itself, and not through any

fault of the claimant, in arriving at the original sum. The comptroller declined to pay the additional sum.

"Should the pending measure (S. 843) be adopted, or even without the authority contained therein being granted, should the secretary find upon review that additional amounts were due to some of those who have already had their claims passed upon by the commission, such conclusion being reached either under authority of legislation or under the present incumbent's interpretation of the law as it exists, the comptroller, under his prior rulings, would decline to pay such amounts so found to be due.

"It will thus be seen that should the comptroller adhere to his rulings, while the Secretary of the Interior might, in so far as his authority extends, grant relief or additional relief in reviewing cases, or in original consideration of those yet pending, and such action of the secretary be (as it would be) contrary to the rulings of the comptroller, no recourse would be left except an appeal to Congress for leave to file claims before a court of claims or some other tribunal.

"I had hoped that no legislation whatsoever would be necessary, and in my conception of the law none would be necessary; but it is impossible, of course, for the Secretary of the Interior to control the judgment or action of the comptroller. Congress can do so, and it also can afford relief.

"I therefore consider it my duty to suggest to you that S. 843 be passed with an amendment to the effect that claims filed or mailed at any time prior to the expiration of the time limit fixed in the congressional act may be considered as if same had reached the par-

ticular office of the claims commission in the city of Washington at the time when the claims which were considered by the commission did so reach their office. Of course, I am not suggesting to you the words of this amendment.

"That the bill should also be amended to provide that should a review of the cases already decided develop the fact that by mistake in calculation, or by a strict ruling of the commission contrary to the proposed provisions of S. 843, as to the matter of stimulation, that amounts or additional amounts so found due should be approved for payment by the comptroller."

### Employment Situation Worst in Metal Industries

In analyzing the employment situation during July, the United States Employment Service reports improvement in the vehicle industry, in railroad repair shops, in the leather industry, in textiles, in lumber manufacture, tobacco manufacture, and in the paper and printing industries, with the broad conclusion that indications everywhere point to the certainty of an approaching business revival. In the course of its summary, the Employment Service says:

"The darker side of the picture has to do with metals and metal products. From mining to manufacturing, the entire process in all its ramifications has felt the full force of the present industrial depression. As a result there continues to be serious unemployment in a multitude of interrelated industries and in widely separated sections of the country, affecting the mountain districts of the West, as well as the

thickly populated industrial areas of the East. The outstanding causes are a falling off in the foreign demand and continued listlessness of the domestic market; in other words, an almost unprecedented lack of orders."

### Copper Going East Via Panama

An analysis of Panama Canal traffic for June shows that 9,525 tons of copper passed through the canal during that month. Of that amount, all but 1,000 tons was en route to eastern ports of the United States. The 1,000 tons went to Europe. Tin shipments totaled 1,350 tons, of which practically all came to the United States. In addition, 1,030 tons of copper ore was shipped through the canal, all of which went to the east coast of the United States. The same is true of 5,040 tons of iron ore. Zinc ore to the extent of 1,400 tons moved through the canal during June.

### Government Sells Copper

The Bridgeport Iron & Metal Co. has purchased from the Government 127,075 lb. of copper rotating bands assembled on cast-iron projectiles. The purchase included 2,527 gross tons of cast iron. The price for the copper was 8½c. per lb. The price paid for the cast iron was \$9.37 per gross ton.

Purchases of silver under the Pittman Act to Aug. 10, totaled 344,614 fine ounces. This brings the total purchases under this act to 65,909,430 fine ounces.

## NEWS BY MINING DISTRICTS

### London Letter

**Modderfontein B Company's Last Report Shows Increase in Reef Width and Gold Content—Randfontein Central's Development Position—Mount Morgan's Report**

By W. A. DOMAN

London, July 25—When dealing with a narrow reef such as that worked on the New Modderfontein and Modderfontein B properties on the Far Eastern Rand, a variation in thickness of 5 in. is of some moment. The June quarterly development report of the Modderfontein B company shows this difference. Here are the figures for the first half of the current year on the Main Reef Leader:

Quarter	Feet Sampled on Reef	Feet Pay.	Width, In.	Assay Value, Dwt.
March.....	3,730	1,985	12	34
June.....	0,035	1,100	17	43

Coincidentally with the increased width, the gold content has improved, and taking the number of in.-dwt., as is usual on the Rand, as an indication of profitability, the result is: March, 408; June, 731. The first is quite good; the second

excellent, and about compensates for the lower payability, the percentages being respectively 72.7 and 36.5. If reference be made back further still to the December quarter of last year it is found that 60.4 per cent of the footage sampled was payable, the reef width being 18 in. and the gold content 34.8 dwt., or 626 in.-dwt. During the nine months, 8,365 ft. were sampled and 4,655 ft., or 55.6 per cent, came within the payable category.

Generally speaking the average of payable ore for the whole of the Far Eastern Rand is estimated to be in the neighborhood of 60 per cent, so that the Modderfontein B does not fall far short of the average. In any case the value may be regarded as exceptionally good.

Comparing the above with the results of the New Modderfontein for the first six months of the year, the figures for the latter company are:

Quarter	Feet Sampled on Reef	Feet Pay.	Width, In.	Assay Value, Dwt.
March.....	2,985	2,415	14	49
June.....	3,970	3,230	16	39.9

In in.-dwt. the results are: March, 686; June, 638. Of the 6,955 ft. sampled, 5,645 ft., or 81.1 per cent, were

payable. This showing is in keeping with what is expected of so great a mine.

At the western end of the Rand the development position of the Randfontein Central has greatly improved of late. Here are the results of nine months' operations:

Quarter	Feet Sampled	Feet Pay.	Average Value, Dwt.	Avg. Width, In.
Dec., 1920....	5,210	4,435	22.2	18
March, 1921..	1,050	326	32.4	17.7
June.....	6,030	5,025	26.5	14

Relatively little development work was done in the March quarter, owing to labor troubles, but work has since got into swing again. Possibly under the present management shareholders will be given more information as to the technical position than under the Robinson regime, for I believe they were never actually told the number of reef bearing claims comprised in the property. The debenture and share capital combined exceeds £7,000,000, and it is essential to work on a large scale and economically in order to get any return upon it. The company has only paid 17½ per cent since it came into existence.

For the twelve months ended May 29 last, the Mount Morgan Gold Mining Co. earned a revenue of £1,038,683 at a cost of £918,524, the surplus being £120,159. The surplus was earned owing to the realization of copper and gold produced previous to the present financial period at prices greater than those at which the same were taken into account for the previous financial period. Owing to the decline in the price of copper, the miners were asked to accept a lower scale of wages, as production of blister would cause the company a loss of £2,300 weekly. The government offered to meet the company by reducing rail wages £1,000 weekly, but no arrangement with the men has yet been made. During the year 148,574 tons of material was treated in the smelting section for a production of 5,149 tons of copper and 76,463 oz. of gold. These figures compare with 178,055 tons of material and 5,880 tons of copper and 80,578 oz. of gold in the preceding twelve months.

## CANADA

### British Columbia

#### Gold Production of Province Expected To Increase This Year

Victoria—George H. Kilbourne, of the Consolidated Mining & Smelting Co., is reported to be making satisfactory progress in the mineral survey of the Esquimalt & Nanaimo land belt, Vancouver Island, of which work he has charge. He has two parties in the field, and the ground is being thoroughly covered. When his reports are submitted the Canadian Pacific Railway Co. will be in a position to resume negotiations with the provincial government with a view to placing the administration of the minerals of the belt under the sole jurisdiction of the province.

Vancouver—That the gold production of British Columbia for 1921 will be considerably greater than that of 1920 is indicated by the receipts to date at the Dominion Assay Office, Vancouver. The total receipts of bullion this year so far aggregate in value \$1,275,000, as against \$1,073,000 for the same period last year. The improvement, generally speaking, is ascribed, first, to the reopening of the Rossland mines by the Consolidated Mining & Smelting Co. and, second, to the fact that the placer-mining areas are working under more satisfactory conditions, there being plenty of water, which was scarce last year.

Trail—Ore shipments received at the Consolidated smelter the week ended July 31 were as follows:

Mine	Locality	Tons
Sally,	Beaverdell,	34
Surprise,	Republic,	231
Company mines		12,496

Kaslo — Negotiations are under way between Thompson & McKinney, who have been operating the North Star mine at Kimberley, and the Utica Mines, Ltd., for a five-year lease of the latter's property at 12-Mile. The negotiations, if concluded, will obligate the

lessees to expend at least \$3,000 per year in development, and pay the company 15 per cent royalty on output.

Ainsworth—Two carloads of high-grade silver-lead ore have been stoped at the Blue Bird mine, on Woodberry Creek, following a strike made on the property by Eric Johnson, the owner.

Cranbrook — The East Kootenay Prospectors' Development Co., an offshoot of the local Prospectors' Association, is being financed by issuance of \$9,000 worth of stock, which is being sold throughout this section.

## Ontario

### Silver Islet Exploration Co. Opening Old Property

Porcupine—The Dome Mines during the three months ended June 30 realized profits of \$235,697, or at the rate of a little over 20 per cent, on the issued capital. Operations at the lower levels have been so favorable as to make it possible to treat a grade of ore much higher than in former years. It is officially intimated that dividend disbursements of only 10 per cent will be continued, and that additional distribution will come in the form of capital return. A disbursement in the latter form of 20 per cent is expected before the end of the present fiscal year.

Fort William—Good progress is being made at the Silver Islet mine, which has been reopened after having been closed down for forty years. The Silver Islet Exploration Co. has completed 200 ft. of the drift which is being run beneath Lake Superior, by which the operators expect, after driving 1,200 ft., to tap three rich veins.

## MEXICO

### Chihuahua

#### New Modern Power Plant of Dolores Mines Placed in Operation at Madera

Madera — One of the most up-to-date and modern power plants in Mexico has recently been completed and put into operation at Madera, Chihuahua. This plant has been built to supply power for the mill and mine at the Dolores mines, one of the units of the Dolores Esperanza Corporation. The power is transmitted over a distance of thirty miles through one of the roughest mountain regions in northern Mexico. The all-steel tower transmission line was installed about nine years ago, at which time an oil-engine plant was to have been built. However, because of the troublesome times during this period, nothing was done until the summer of 1920, when work was started on a steam-turbine installation, a short description of which follows:

The building is of all-steel construction, having a floor area of 5,250 sq. ft. The windows are of Fenestra steel sash, glazed with factory ribbed glass. All doors are of steel, which makes the structure absolutely fireproof throughout.

The main generating units consist of two Allis-Chalmers three-stage turbo-generators, 2,300 volts, 60 cycle. The condensers are of the Allis-Chalmers jet type, driven by Keer steam turbines, evactors being used for extracting air. All of the auxiliaries are steam driven, the class of labor for operation having been considered.

One of the most unique features of this plant is the abundant water supply, which is drawn from a mill pond belonging to the Madera Lumber Co., Ltd. The cold water is carried to the cold well by an underground concrete conduit the dimensions of which are 2½ by 3 ft. by 720 ft. long. From the cold well all condensing and plant supply water is drawn, the latter being pumped into a 10,000-gal. supply stand tank. All of the discharge and drains are returned to the mill pond through a similar concrete conduit for a distance of 350 ft. and then in a 2½ by 2-ft. wooden flume. With this ample cold-water supply there is a very small temperature drop in the condensing water, and a high vacuum is easily maintained.

The steam-generating units consist of two 500-hp. B. & W. boilers, with a working pressure of 220 lb. per sq.in. The boilers were shipped from Glasgow, Scotland. They are equipped for both coal and oil firing. The stoker installation is of the hand-shaking type manufactured by the Files Engineering Co. Three Best oil burners are installed in each boiler. The gases are carried in an underground concrete flue to a 7 by 150-ft. self-supporting steel stack.

The fuel-oil system consists of two storage tanks and a 14,000-gal. underground measuring tank. The oil is supplied to the burners by pumps and maintained at a constant pressure by means of pump governors and relief valves in the circulating line.

The outside substation consists of a bank of three 50-kva. Allis-Chalmers transformers, with one spare. The current is here stepped up from 2,300 to 33,000 volts.

This plant was designed by Woodell & Resler, architects and consulting engineers of New York, under the supervision of G. A. Schroter, consulting engineer for the Dolores Esperanza Corporation. The plant was erected and put into operation by the firm of Kniffin & Thornhill, engineers and contractors, of Chihuahua, Mexico.

Chihuahua—In Chihuahua unsettled political conditions and strikes of railroad and mining company employees have affected the production of minerals during recent years to a considerable extent. Most of the mines in the more distant districts have been closed down for years. The low prices of metals and insufficient means of transportation have handicapped the normal production even in the near-by camps. The fall of the price of silver during the last year has forced the majority of mines producing low-grade ore also to shut down.

The same troubles accounted for the



closing of most of the smelters in the republic, and have also affected the Avalos smelter of the American Smelting & Refining Co., near Chihuahua.

The beginning of the current year brought some betterment of labor and transportation conditions, and the slow rise of silver prices has encouraged the reopening of many mines which were doing construction or development work on a small scale during the critical period.

The smelter at Avalos is again working to the full capacity, treating ores not only from the properties owned by this corporation, but also a considerable amount of custom ore coming from the south, and producing silver-gold bullion and lead bullion, which is being shipped to the United States, either for refining or for reshipment.

The Tecolotes unit of the American Smelting & Refining Co., at Santa Barbara, resumed its operations in June after a shutdown of several months.

The large San Diego mill, at Santa Barbara, property of the American Smelters Securities Co., has been completed and is now operating.

Reports from Parral are to the effect that the mining district has regained its former activity. Most of the mining companies there are working full time. The A. S. & R. also resumed the work of unwatering and examining the important Tajo group of mines in the city of Parral. This company has an option on these mines, and it is thought will purchase them.

The American Metals Co., which had an option on the Inglaterra mine at Santa Eulalia, ran into large quantities of good ore early in the year, and purchased the mine outright in May from Dale Brothers, British bankers and former principal owners.

La Reina Mines, Ltd., a London concern, Lindsay Brown, general manager, is doing development work on a small scale. The 900-ft. shaft has been re-timbered and a new headframe installed. This mine, situated in the heart of the rich Santa Eulalia mining district, has already produced over 10,000 tons of silver ore. At present a chimney of rich ore, running as high as 400 oz., has been struck, though on account of the high cost of labor and material, combined with the low silver prices, a very reduced number of workmen is being employed. Extensive development work is being left until conditions improve.

The Buena Tierra Mining Co., British owned, closed down in June on account of the high cost of production and low grade of ore, according to current reports.

The Cigarrero mine, rich in lead-silver, intends to reopen shortly.

The Julieta mine, a well-known gold-producing property, Paul Ginther manager, has started operations.

Guadalupe Galvan, an individual operator, has shipped from the Talamantes mines, situated in the Parral district, three carloads of a high-grade manganese ore to the Monterrey smelter.

The Santa Elena or Santa Marina silver mine of the Cusi Mexicana group in Cusihiuriachic has been unwatered and examined by engineers of the Peñoles company, which is the Mexican corporation of the American Metals Co.

The Pinos Altos mining company has had engineers examining its silver-gold properties near Concheño and states that it is possible that operations will be resumed, giving work to about fifty men at first and to a greater number later on. Like so many other properties in the western part of Chihuahua, the Pinos Altos mines have been closed for a number of years.

The Cia. Minera Lepanto has closed down. Low prices of silver are given as the reason. It has at the station of Conchos of the National Railways over 50,000 tons of ore dumped, which on account of inadequate service of this road could not be shipped to the Monterrey smelter.

Parral—The Minas Nuevas mine near Parral, a unit of the American Smelting Securities Co., is working a full force of between 400 and 500 men.

The San Patricio mine of the Cia. Minera de San Patricio, S. A., is working a full force of about 250 men and running its 300-ton mill. This is a subsidiary company of the Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A., the large Canadian power company. T. G. Mackenzie is general manager of the concern, and A. W. Morris is mine superintendent. The company has been shipping bullion from its new mill for some months.

#### Guanajuato

Aurora Mine Near Xichu in New Hands—Former Operations Described

Xichu—In northeastern Guanajuato the Aurora mine has passed to new ownership; also the new management has built an automobile road from San Luis de La Paz, the railroad terminus, to Higuera beyond Victoria, near the base of the Sierra Gorda, and machinery is arriving for the construction of a new treatment plant. The Aurora lies 65 miles northeast of San Luis de La Paz. Eleven years ago there was a tolerably fair road to the Sierra Gorda, about 30 miles away, and across the mountains a trail only fit for pack and saddle animals. The valley of Xichu is narrow, with steep slopes, and drained by a little river of the same name. The town of Xichu, six miles up the river from the mine, is headquarters for the valley and is surrounded by little farms, orchards and gardens. The climate is mild, and orange, lemon, banana, cane and other subtropical plants abound.

As a mining region, this is apparently an old one, antedating Spanish occupation. At all events many old holes give evidence of having been made by use of fire and water instead of explosives. Some smelting plants of the type employed between two and three hundred years back are scattered through the valley, an indication of the age of the industry.

The Aurora is the only large operation that has been under way in the district in recent times. It is said that two other mines, the Olympo and Soledad de Reyes, had been developed and abandoned, whether from lack of ore, or lack of ore salable at that time, was not made evident.

Studies of the Aurora indicated an abundance of zinc blende and pyrite, with a lesser amount of galena, the real commercial ore (at that time), all silver bearing. The country at the Aurora is clay slate and limestone, or slate, with much lime carbonate. The center of the mountain mass is apparently andesite, highly mineralized, which has undoubtedly played quite an important part in the genesis of the ore.

The mine is reputed to have produced, during the many years of its operation, from four to five million pesos in silver and lead. In 1910 all of the exploited orebodies were above drainage level, and access to the mine was gained by adits or crosscuts. The lowest one, the Socavón de Cristo, enters from the main valley, or Arroyo de Xichu, 16 meters above the river, and at least five others enter from a lateral arroyo, Barreño. The Tenacidad level, 42 meters above the Cristo, was long the principal working level and a track was laid from its portal along the mountain side to the terminus of a cableway crossing the Arroyo de Xichu, to a smelting and milling plant on the opposite side.

Near the loading station was a dump of 20,000 tons of mixed zinc-lead-silver ore. The smelting works were built in 1895 and included two 36-in. Frazer & Chalmers water-jacketed blast furnaces, a reverberatory furnace, a 10-stamp battery, a crusher, six concentration tables, and other equipment, all out of use then. The reason given was that the presence of so much zinc interfered with the profitable treatment of the ore.

In 1910, about 200 men were employed, nearly all of them in the upper working. The ore mined was galena, running 1 to 3 kg. of silver per ton. The work was on the *buscon* system, half the ore's value going to the owners and half to the workers, after the deduction of a fixed sum to cover freight and smelting charges. The run of mine was roughly concentrated by picking and breaking, then screening and washing the fines on a wooden *planilla*. The product was shipped by burros over the Sierra Gorda to San Luis de La Paz, and then by rail to the smelting plant at San Luis Potosí.

#### ALASKA

Anchorage.—A stampede has been caused by the report of a discovery of gold quartz in a district thirty-nine miles south of Anchorage.

The Collector of Customs for Alaska reports that the value of products shipped from the territory during May amounted to \$868,895. The largest item was more than 4,000,000 lb. of copper ore.

## ARIZONA

**Tom Reed Sends Weighty Exhibit to Phoenix—Two Killed in Shaft at Bisbee**

**Oatman**—The United Eastern is reported to be preparing to sink the Big Jim shaft 400 ft. deeper and also to deepen the Eastern shaft.

**Phoenix**—As an exhibit in the appeal of the Tom Reed Gold Mines Co. from a Superior Court decision in favor of the United Eastern Mining Co., 3,400 lb. of ore and rock, in thirteen crates, have been forwarded from Kingman to the clerk of the Supreme Court at the Capitol in Phoenix. For lack of "filing" space, the exhibits were returned by the clerk to the express office, to be held till the high court should have made order concerning their disposition.

Protest has been made to the State Board of Equalization by H. J. Duffy, chief clerk of the United Verde Mining Co., against a ruling of the board fixing at 15.7c. the taxable valuation of copper bullion on hand in Arizona. It was alleged that the bullion is worth no more than 13c. It was explained that the commission's figure were based upon the average price of copper for the previous year.

**Miami**—An El Paso firm has secured a contract for erecting a two-story, reinforced-concrete department store, 100 x 75 ft. in dimensions, for the Miami Consolidated Copper Co. The foundation will be on piling.

**Bisbee**—An unusual accident, in the Wolverine & Arizona shaft, has resulted in the death of two men. They were buried under a fall of earth from the shaft collar, brought down by a flood of water from a torrential rain-storm. At the time the men were in a bucket that was being hoisted and were only 50 ft. from the surface when the avalanche struck them. They were thrown to the bottom, 350 ft. below, and the bucket crosshead was wedged in the shaft.

Construction work has been completed on the big plant of the Apache Powder Co., near Benson. Operation will wait on the reopening of the larger copper mines of Arizona, nearly all of which have a financial interest in the enterprise.

**Globe**—C. E. Hart, superintendent for the Louis d'Or Mining Co., reports that at 80 ft. in the new main working shaft ore has been struck carrying about 1 per cent copper, in bornite form. Exploration by drilling, he states, has shown the presence of an orebody 8,000 ft. long and almost 2,000 ft. wide, averaging 300 ft. thick.

A 100-ton mill is being erected on the El Capitan property, the enterprise financed in Texas and managed by L. F. Williams. In addition to concentration, the mill is to have an acid-leaching unit for surface ores. Mr. Williams states there has been development on the property of 2,000 tons of ore that will average 24 oz. silver, with some gold.

**Mayer**—Partridge & Leonard have purchased the old Rigby reduction plant, overlooking the Mayer townsite, and will junk the machinery. The plant was operated in 1906, with rated capacity for 125 tons of ore a day, using the patented Poehle & Croasland volatilization process, understood to have been unsuccessful under local conditions.

**Patagonia**—Richard Kingdon, recently mine superintendent for the United Verde Extension at Jerome, has been engaged to take charge of the development of the Arizona-Patagonia property, better known as the Blue Nose.

**Duncan**—The property of the Duncan M. & M. Co., recently sold by the receiver, is in the hands of A. M. Frasier, trustee for the company bondholders at Hillsboro, Tex. An effort is being made to consolidate with other interests in the same district. All the free-milling ores are to be handled in the new mill recently completed on the Duncan property.

The Norman King mine and the Great Ballalli group which adjoins it have been taken under lease and option from the Utter brothers by H. W. Evans and L. C. Butlar, of New York. The property is situated near the old Clear Lake mill, in the Steeple Rock district. Several carloads of ore already mined will be shipped at once. Mr. Evans will be in charge.

## NEW MEXICO

**White Syndicate To Work Last Chance Mine—Octo Company Sued for \$32,000 Due on Notes**

**Lordsburg**—An association known as the White Syndicate has been organized to work the Last Chance mine, which is under the direction of John White, who took the property over under a lease and option last spring. The syndicate is composed of J. G. Nicholas, William (Missou) Hines, E. T. Williams, Joe Crites, all of Denver, Col., and John H. White, who will continue as manager.

Suit was filed July 19 by the Anita Copper Co., represented by G. W. Forman, of Los Angeles, against the Octo Mining Co. for \$32,000 in promissory notes alleged to have been given by the Octo company to certain of its stockholders for funds advanced and used for work on the property. These notes had been turned over by them to the Anita company, a new company that was organized under the laws of California for the purpose of taking over the Octo assets. Some of the stockholders of the Octo, however, refused to turn in their stock: hence the filing of the suit.

This situation has led to a suit asking for the appointment of a receiver for the Octo by Lawrence R. Boyd, of Lordsburg, claiming an unpaid balance of \$3,800 due on property now held by them.

Frank G. Kaerwer is pushing developments of the Ruth property. A new hoist house and gallows frame has

been erected, and a 12-hp. Novo hoist installed. The shaft has been timbered for 40 ft. and a complete camp equipment built. The shaft shows a 6-ft. vein of siliceous lead-silver sulphides. This carries an average of \$40 in lead-silver and some gold. The force will be increased soon.

**Steins Pass**—The McGee Brothers have given a contract for sinking their main shaft another 100 ft. to Akers and Tabor, of Lordsburg. Work will begin at once.

**Fierro**—Sam L. Houghton, formerly geologist for the Hanover-Bessemer I. & C. Co. and the Chino Copper Co., has made a contract for 1,000 tons a month of fluxing ores to be shipped to the El Paso smelter. The ore will be taken from the H-B property at Fierro under lease.

**Silver City**—The properties owned by the C. Amory Stevens estate on Chloride Flat have been opened to lessees. This is silver ground that has produced silver extensively in the old days and has many miles of old drifts. Colonel Porterfield is in charge.

The Hecla-Devide Mining Co. is figuring upon a mill on the Langston property, at Pinos Altos. F. H. Davis is superintendent.

## COLORADO

**Vindicator Opens Promising Ore at 2,000 ft.; To Deepen Main Shaft**

**Victor**—A promising orebody has been opened on the 2,000 level of the Vindicator mine. The company plans to sink the main shaft another 150 ft. The pumping problem at the Vindicator is serious, as the water must be raised about 2,000 ft., and the company, probably in co-operation with other mining interests in the neighborhood, has tentative plans which involve the extension of the Roosevelt tunnel a distance of about 3,300 ft. The work would require about two years and would be expensive, but it is believed that the cost would be justified by the fact that extensive orebodies would become workable at a profit, and much promising territory would be made available for development. The new orebody is in the downward extension of the Lillie vein, which was opened in the 1,900 level last year. The ore has been opened for a horizontal distance of about 300 ft., and is payable throughout this distance. George Stahl is general manager.

**Cripple Creek**—The Heck Gold Mining & Leasing Co. has been organized to operate mining properties in the Cripple Creek district. The company is capitalized for \$300,000. Alfred Steele is president and C. B. Heckler general manager. The directors are, in addition to the above, S. A. Gaston, Francis P. Haynes, and Walter C. Cockran.

The Damon property of the United Gold Mines Co. is being developed and operated under lease by Stuart Cox and associates. Electrical hoisting equipment has been installed, and the company is mining about fifty tons

per day. The ore averages about \$15 a ton.

The Engineer's Luck property is being developed by lessees and a 4-ft. vein of 1-oz. gold ore has been opened. The first shipment has been made to the Golden Cycle mill at Colorado Springs.

**Idaho Springs**—The Columbian Mountain Mining & Leasing Co. has installed a new seven-drill air compressor. Development work is in progress, and a promising vein has been opened.

#### SOUTH DAKOTA

##### Discovery of Gold in Black Hills Commemorated

A monument to commemorate the discovery of gold in the Black Hills of South Dakota was dedicated at Custer, S. D., on July 27. The site on which it is erected is on French Creek, where H. M. Ross, a practical miner who accompanied Custer's expedition, first discovered gold in 1875.

#### WASHINGTON

##### New Era Iron & Steel Corporation To Try Making Iron on Commercial Scale

**Spokane**—Objection has been raised by the mining committee of the Spokane Chamber of Commerce and other organizations to the provisions of the Fordney Tariff bill which call for a duty on coal coming into the United States equal to that imposed on coal by the country of origin.

**Sultan**—A good wagon road is being built to the section northeast of Sultan, which has some very promising mineral showings. This should stimulate mining development greatly, but owners so far are contenting themselves with doing development only.

**Sedro-Woolley**—After months spent in experimenting in the making of pig iron from black sand, the New Era Iron & Steel Corporation is ready to start a smelter on commercial production of iron from local iron ores mixed with certain varieties of black sand. Some of the best pig iron produced in the United States has been turned out, it is claimed, in recent trials.

#### MONTANA

##### Boston & Montana Mill To Be Ready Sept. 15—Butte-Jardine Mill Running Steadily

**Elkhorn**—Installation of milling equipment at the Elkhorn mill of the Boston & Montana Development Co. is speeding up, and an effort will be made to have the plant ready for operation by Sept. 15. More than fifty more men were added to the mill force the last week, and the total mill and mine force now approximates 200 men. The ore showing continues favorable, and further tonnage is looked for on the 300 level.

**Race Track**—From 100 to 130 tons of ore is now being treated daily by the Butte-Jardine mill at the Champion mine. The heads are reported to be running from \$13 to \$20.

#### IDAHO

##### Foundations for Armstead Mill Almost Completed—Interest Revived in Warren District

**Sandpoint**—A winze being sunk on the property of the Falls Creek Mining Co., on Pend Oreille Lake, 20 miles south of here, is now down 25 ft., and the orebody has widened to 3 ft., about 8 in. of which is a high-grade galena. The values are chiefly in silver and lead, with some copper and zinc. Drifting will be started at 50 ft.

**Talache**—With preparations for mill construction under way and accommodations for a large crew of men being built, much activity is manifested around the property of Armstead Mines, Inc., which for the past three or four years has been systematically developing the old Keystone group. The improvements in the wagon road to Sagle, the shipping point on the Northern Pacific Ry., have been completed, and the foundations for the 150-ton flotation plant are almost completed.

The Blue Bird property, adjoining the Armstead mine, and which is under lease to Messrs. Coleman and Ward, has been developed to a stage where production of some high-grade silver ore may be looked for, beginning this month.

**Warren**—More interest in the Warren district has been manifest this season than for years past, and the same may be said of the Marshall Lake section. The gold-bearing veins of the district are once more proving attractive to people seeking investments in metal mining.

#### UTAH

##### Power Contract Case Appealed to U. S. Supreme Court

**Salt Lake City**—Lead furnaces in blast at the Salt Lake Valley smelters Aug. 1 were: United States Smelting Co., at Midvale, four lead furnaces, including one furnace on matte concentration; A. S. & R., at Murray, four lead furnaces. No lead furnaces were in blast at the International.

The right of the Utah Public Utilities Commission to abrogate special power contracts between the Utah Power & Light Co. and large users of power, entered into a number of years ago before the creation of the commission as a body, is again being called into question. As has already been reported in these columns, the Utah Copper Co. and other large users of power, twenty in all, brought the matter before the

Supreme Court of Utah, which held that the Utilities Commission had the right to fix power rates, and therefore the right to abrogate the contracts. Now the Union Portland Cement Co. and the Ogden Portland Cement Co., and the Utah-Idaho Central Railroad Co. have filed preliminary appeals against the ruling of the Utah court with the United States Supreme Court, the cement companies fixing increase in power costs at 70 and the railroad at 80 per cent.

**Eureka**—Ore shipments from the Tintic district for the week ended July 30 amounted to 153 cars. Shippers were: Tintic Standard, 56 cars; Chief Consolidated, 31; Iron King, 14; Dragon,



MONUMENT COMMEMORATING DISCOVERY OF GOLD IN BLACK HILLS, ERECTED RECENTLY AT CUSTER, S. D.

11; Eagle & Blue Bell, 10; Victoria, 10; Iron Blossom, 6; Centennial-Eureka, 3; Little May, 2; Swansea, 2; Colorado, 2; Gemini, 1; Bullion Beck, 1; Eureka Hill, 1; Mammoth, 1; Gold Chain, 1; and Sunbeam, 1.

A survey is being made at the Tintic Standard on the 1,100 level with a view to drifting 1,500 ft. to the site of the proposed new or No. 3 shaft.

**Alta**—The Little Cottonwood Transportation Co. has been operating its narrow-gauge line from Alta to Wasatch steadily throughout the present shipping season.

**Park City**—Shipments for the week ended July 30 amounted to 1,997 tons, as compared with 1,273 tons the week preceding. Shippers were: Silver King Coalition, 534 tons; Judge allied companies, 474; Ontario, 389.

## NEVADA

**Hamilton District Now More Active—  
Activity in Gold Hill District  
on Comstock Lode**

Virginia City—Gold Hill is a busy place. Since the completion of the railroad spur across American Flat, trainloads of building material and machinery have been coming in regularly, almost daily. Visitors are surprised at the scale of operations, as much is being done and little said. A lodging house, with a club and recreation rooms in connection, with accommodation for 150 men, is about half completed. Construction work on the cook and mess houses has been started. Excavation for the coarse-crushing plant, a steel frame building about 250 ft. in length, is well under way, and railroad spurs are being laid through the mill site.

Underground all energy is being devoted to the completion of the main haulage tunnel, and remarkable progress is being made. Some development work on various levels is being accomplished from the Imperial.

At the North End the Con. Virginia and Ophir continue development work and regular ore shipments.

Ely—The Hamilton district is becoming more active and a large number of operations are under way. Old properties that were producers in the early days of the White Pine excitement are being worked on a small scale. The Jennie A mine in the northern part of the district is under lease to Ely men and a small but steady production is being made.

The Lake Valley mine, 60 miles from Ely, is attracting some attention. A 50-ton mill is being built. The ore contains silver and a little gold, the values being contained in a white sugary quartz ledge which can be traced for several miles. A 450-ft. tunnel has opened up much milling ore.

## MICHIGAN

**The Copper Country****Quincy's New Furnace in Operation—  
Copper Range Experimenting With  
Underground Shovel and Picker**

Houghton—A total of 6,526,000 lb. of copper was shipped out of the Lake Superior district in July. Rail shipments were confined to a few carloads. July metal sales exceeded those of June, when 5,858,000 lb. was shipped by boat. In comparison with shipments in July of last year, however, the total was considerably less, 10,034,000 lb. going out by water in July, 1920.

Calumet & Hecla is in receipt of orders for 200,000 lb. of copper for domestic consumers and 100,000 lb. for export. This metal will be shipped soon, these orders being all that are on the C. & H. books. Calumet & Hecla continues to operate two furnaces at the smelting plant.

Work on Quincy's new furnace, No. 5, of 130,000 lb. capacity, has been finished, and the furnace went into blast as a completed unit on July 28, when

80,000 lb. of copper was refined in a test charge. It worked with the smoothness of perfection in every operation, and with its automatic casting machines, trolley dipping system, and other automatic devices will help keep smelting costs down to a minimum.

Quincy has only one furnace in operation. Copper Range is using two out of five furnaces, smelting its own mineral and that of Mohawk and Wolverine as well. Although the Copper Range plant—that of the Michigan Smelting Co.—has five furnaces, it seldom has used more than three, even in normal times. Calumet & Hecla is down to two furnaces out of a total of twenty-four.

The development of mechanical devices underground in the Copper Range mines is having some success. A combination shovel and picker has been devised for work in the stopes and is now in use in the Champion. A power shovel takes up the rock and throws it back on a belt conveyor, where men are stationed to pick out the poor rock. This method of handling and selecting rock is proving satisfactory. In rock selection one man will now do the work that formerly required three men. The device was built in the Copper Range shops.

**Menominee Range****Florence Mine Running Three Days  
Per Week—Wages Cut 10 Per Cent**

Florence—The Florence mine has been placed on an operating basis of three days per week, and wages have been cut 10 per cent. This mine is on the Wisconsin side.

Crystal Falls—The M. A. Hanna Co. has issued orders to ship 145,000 tons of ore from the Carpenter mine and 65 tons from the Monongahela. This will about clean up the stockpiles at both mines, which are not hoisting at present. With the ore on hand disposed of it is likely that both mines will resume in the fall if general conditions are improved. It is understood that the Hanna company disposed of the ore to Henry Ford, who has been using Crystal Falls ore in his River Rouge furnaces for several years. The Hanna company is the only mining company with docks near the Ford furnaces.

**Marquette Range****Mary Charlotte Mine Closes Down  
Again**

Negaunee—Soon after starting operations with a full crew of men, the Mary Charlotte was closed down last week. The company has suspended shipments which were going to East St. Louis, Ill. The pumps are being continued in operation.

The independent iron mining companies of the Lake Superior district reduced wages 12½ per cent on Aug. 1. This order followed the one of the Oliver Iron Mining Co. which called for a cut of 10 per cent on the same date. The independents have cut a total of 37½ per cent this year, and the Oliver has cut 30 per cent. Few underground

mines in the entire Lake Superior region are being worked full time, most of them being operated on a basis of three shifts per week. The Oliver company's mines on the Gogebic Range are giving each man eight days' employment every four weeks.

## MINNESOTA

**Mesabi Range****Operations at Hill-Trumbull Pit  
Temporarily Increased**

Chisholm—At the Dunwoody mine, the Tod Stambaugh Co. is preparing to sink a shaft preparatory to mining ore that is not available for direct loading in the pit. The shaft is to have four compartments and is to be sunk a depth of 225 ft. The sinking will begin at once. The work on the headframe, which is to be of wood, is to be started soon.

Nashwauk—The Hawkins mine and concentrator of the Wisconsin Steel Co. have been reduced to a one-shift basis. About fifty men have been laid off.

Marble—The Mesabi Cliffs Iron Mining Co. has increased the number of shifts at the Hill-Trumbull pit and concentrator to two shifts of twelve hours each. The operations had previously been confined to one shift of fourteen hours. The twelve-hour shifts are temporary only, the operators desiring to increase shipments.

**Chronology of Mining****July, 1921**

July 1—Empire, North Star, and Idaho-Maryland mining companies in Grass Valley district, California, shut down, following refusal of men to accept wage cut of 75c. to \$1 effective on this date.—International smelter at Tooele closed.—Quincy Mining Co., Michigan, cut wages 6 per cent.

July 15—Minerals Separation North American Corporation made party plaintiff in Miami Copper Co. suit.—Walter Fitch, Jr., Co. set out to break world's shaft sinking record in Water Lily shaft at Eureka, Utah.—International Nickel Co., Ontario, cut wages.

July 17—Central Eureka Mining Co., Sutter Creek, California, cut wages 50c. per shift.

July 18—Petroleum placed on free list by House.—Bill providing for compulsory use of metric system introduced in Senate.

July 21—Fordney Tariff bill passed House.

July 23—Meeting held at Charleston, W. Va., preliminary to organizing a Charleston Section of the A. I. M. E.

July 25—Utah State Industrial Commission fixed attorneys' fees in workmen's compensation cases.—Federal Trade Commission began hearing on iron ore freight rates in effect in Lake Superior district.

July 26—Over 250 power consumers in Utah petitioned Public Utilities Commission protesting against the rates charged by the Utah Power & Light Co.

# THE MARKET REPORT

## Daily Prices of Metals

Aug.	Copper, N. Y., net refinery*		Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.	
4	11.625	25.25	26.00	4.35	4.15@4.20	4.20	
5	11.625	25.50	26.25	4.35	4.15@4.20	4.20	
6	11.625-11.75	25.75	26.50	4.35@4.40	4.20	4.20	
8	11.625-11.75	26.75	27.50	4.35@4.40	4.20@4.25	4.20	
9	11.75	26.75	27.625	4.35@4.45	4.20@4.25	4.20@4.25	
10	11.75	26.125	27.00	4.35@4.45	4.25	4.25	

\*These prices correspond to the following quotations for copper, "delivered": Aug. 4th and 5th, 11.875c.; 6th and 8th, 11.875@12c.; 9th and 10th, 12c.

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

Aug.	Copper			Tin		Lead		Zinc	
	Standard	3 M	Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M	Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
4	70½	70¾	74½	158	160	23¾	23¾	25	25¾
5	70½	70¾	74	159¼	161¼	24	23¾	25½	26¾
6	70	70¾	74	161¾	163¾	23¾	23¾	25¾	26¾
8	70	70¾	74	162¾	164¾	23¾	23¾	25¾	26¾
9	70	70¾	74	162¾	164¾	23¾	23¾	25¾	26¾
10	70½	70¾	75	159¼	161¼	23¾	23¾	25¾	26¾

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

Aug.	Sterling Exchange "Checks"	Silver			Aug.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
4	358	99½	61½	38¾	8	366½	99½	61½	38¾
5	359	99½	61¾	38¾	9	366	99½	60	36½
6	359½	99½	61¾	38¾	10	365	99½	60¾	37

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. Sterling quotations represent the demand market in the forenoon.

## Metal Markets

New York, Aug. 10, 1921

Although trading has shown only a slight improvement during the week, a much more favorable sentiment is noticeable, both among producers and consumers. All the metals share in the better tone. Copper sagged a little, but made a strong recovery. Lead is still the strongest of all the group. Zinc is showing a firmer tendency. The hope is expressed by producers in close touch with industrial conditions that the corner in the metal markets is now being turned, but the behavior of the metals has been so erratic and variable that it is idle to make any definite declaration.

The freight rate on copper to Conti-

mental ports has been lowered and is now \$5.50 to Hamburg and \$5 to Rotterdam, Antwerp and Havre, compared with \$9 and \$8 respectively. Trans-pacific rates to Hongkong and Kobe are now \$8.

## Copper

Copper staged a strong come-back during the week. Last Thursday and for two days thereafter copper was sold below 12c. delivered, in fair-sized tonnages, the aggregate being over 1,750 tons of copper which we can trace. A larger tonnage has possibly been sold. Some consumers, on learning of the low price, 11½c., that had been paid, attempted to obtain still lower quotations, but met with a stern refusal from producers; in fact, the market stiffened

to such a degree that no more metal was available at the 11½c. level, and today it would be difficult to procure any below the 12c. level of last week. Most of the copper purchased is intended for immediate consumption, but at least one lot was sold because the purchaser felt that copper at 12c. and below was exceedingly cheap and was worth purchasing and holding. A few weeks ago it was reported that the Government was intending to dispose of about 10,000,000 lb. of copper, and was to open bids for this amount last week. It is now understood that this copper has been temporarily, at least, withdrawn from the market. Possible use for this metal may be found among the various copper-consuming departments of the Government. Besides unduly depressing the market, the sale of this copper at the present time would have been to the detriment of the price that might ultimately be received. Export business has not been particularly good, but shipments are being regularly made to European countries at prices equivalent to those here. The market appears much stronger today and is ripe for an upward movement.

## Lead

The American Smelting & Refining Co. is continuing its official contract price of 4.40c. Lead is still the most favored non-ferrous metal, and is in a good statistical position. Inquiries and sales have been made in good volume, particularly when compared with other metals, and several thousand tons have been sold. Another order of 1,000 tons was marketed during the week. The demand for lead is again becoming more diversified and is confined to no one or two groups of consumers, as during last week. As a result of the satisfactory movement of lead into consumers' hands, some of the largest producers are well caught up on production and can afford to keep out of the market for a time or refrain from pushing sales. There has been a little more activity in the Chicago market than usual, lead being sold at prices about 10 points above the St. Louis level.

## Zinc

The market is practically the same as last week. A slightly greater volume of inquiries is reported and there is a firmer tendency in today's quotations, owing chiefly to the fact that producers are unwilling to sell at present levels. One encouraging fact is that zinc is not only being bought by galvanizers, but is finding ready sale among jobbers and brass people.

No interest is manifested in future zinc, which is quoted at a 5 point premium for each month. High-grade zinc is being sold for 6c. per lb., but is

reported to have been shaded on at least one sale.

#### Tin

The tin market has been inactive, prices fluctuating as usual in conformity with sterling exchange and the London market. No support has been given the trade in this country. Tin for forward delivery is quoted the same as spot.

Arrivals of tin, in long tons: Aug. 1st, Straits, 25; 8th, London, 125; Rotterdam, 25; 9th, Hongkong, 25; Liverpool, 50.

#### Gold

Gold in London: Aug. 4th, 115s. 1d.; 5th, 114s. 2d.; 8th, 113s. 3d.; 9th, 111s. 4d.; 10th, 112s. 7d.

#### Foreign Exchange

Sterling took a sudden advance on Monday, demand selling at one time as high as 372½. The rise was attributed to covering by shorts and was followed by a relapse on Tuesday, as expected. Cable transfers are now quoted 1c. higher than the demand figures given on page 275. On Tuesday, Aug. 9th, francs were 7.76c.; lire, 4.365c.; and marks, 1.235c. New York funds in Montreal, 11½ per cent premium.

#### Silver

Since our last report the London market has been weak, on account of selling by the Indian bazaars and China, and on the 9th fell to 36¼d. The sharp advance in sterling exchange partly offset the London decline, and with sellers in New York and Frisco withholding silver, the New York market ruled higher than the London parity. Today both London and New York are quoted higher, and the market closes steady.

Mexican Dollars—Aug. 4th, 46½; 5th, 47½; 6th, 47½; 8th, 47½; 9th, 46½; 10th, 46½.

#### Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 21@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 4.60@4.65c.; market dull. W.C.C. brand, 5½@5½c. per lb. Cookson's "C" grade, spot 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb<sub>2</sub>O<sub>3</sub>, wholesale lots, 6½@7c.

Bismuth—\$1.50@1.55 per lb., 500-lb. lots.

Cadmium—Range \$1@1.10 per lb., in 1,000-lb. lots. Smaller quantities, \$1.10@1.25 per lb.

Cobalt—Metal, \$3@3.25 per lb.; black oxide, \$2.35 per lb. in bbls.

Iridium—Nominal, \$165@185 per oz.

Molybdenum 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 ton-nages, spot, 35@40c.

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

Osmium—\$70@\$80 per troy oz. Nominal \$70, Los Angeles, Cal.

Palladium—Nominally, \$50@\$53 per oz.

Platinum—Nominally, \$69@\$72 per oz.

Market has become much stronger, due to the withdrawal of offerings and an increasing interest among consumers.

Quicksilver—Nominally, \$43.50@\$45 per 75-lb. flask. San Francisco wires \$46.25.

Rhodium—\$150 per troy oz.

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

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

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

#### Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr<sub>2</sub>O<sub>3</sub>, crude, \$20@\$25 per net ton; ground, \$30; analyzing 45@50 per cent Cr<sub>2</sub>O<sub>3</sub>, \$30; ground, \$35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, \$6.45; Mesabi bessemer, 55 per cent iron, \$6.20; Old Range non-bessemer, 51½ per cent iron, \$5.70; Mesabi non-bessemer, 51½ per cent iron, \$5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, \$4.85; old bed concentrates, 63 per cent, \$5.75; Harmony, cobbed, 63 per cent, \$5.75; new bed low phosphorus, 65 per cent, \$8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO<sub>2</sub>) \$50@\$55 per gross ton, lump; \$70@\$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS<sub>2</sub>, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalum acid, 50c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO<sub>2</sub>, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO<sub>2</sub>, 12c. per lb. for ore, with concessions on large lots or contracts.

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

Uranium Ore (Carnotite)—Ore containing 1½ per cent U<sub>2</sub>O<sub>5</sub> and 5 per cent V<sub>2</sub>O<sub>5</sub>, sells for \$1.50 per lb. of U<sub>2</sub>O<sub>5</sub> and 75c. per lb. of V<sub>2</sub>O<sub>5</sub>; ore containing 2 per cent U<sub>2</sub>O<sub>5</sub> and 5 per cent V<sub>2</sub>O<sub>5</sub> sells for \$2.25 and 75c. per lb., respectively; higher U<sub>2</sub>O<sub>5</sub> and V<sub>2</sub>O<sub>5</sub> content commands proportionately higher prices.

Vanadium Ore—\$1 per lb. of V<sub>2</sub>O<sub>5</sub> (guaranteed minimum of 18 per cent V<sub>2</sub>O<sub>5</sub>), New York. Nominal.

Zircon—Washed, iron free, 3c. per lb.

Zirkite—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.

Furnished by Foote Mineral Co., Philadelphia, Pa.

#### Zinc and Lead Ore Markets

Joplin, Mo., Aug. 6—Zinc blende, per ton, high, \$23.70; basis 60 per cent zinc, premium, \$21; Prime Western, \$21@\$20; fines and slimes, \$19@\$18; average settling price, all grades of blende, \$21.73.

Lead, high, \$52.10; basis 80 per cent lead, \$50; average settling price, all grades of lead, \$47.95 per ton.

Shipments for the week: Blende, 5,428; lead, 868 tons. Value, all ores the week, \$159,580.

Market conditions are in no way satisfying, and the present rate of ore production is largely a matter of sentiment, producers maintaining a force of miners solely to provide employment, and many others have been given work on road improvement to prevent want among men of families that can find no other work. Producers realize they are producing beyond the demand and that their margin of profit often disappears in wages.

Platteville, Wis., Aug. 6—No market for zinc or lead ore. Shipments for the week, none. Shipments for the year: Blende, 11,461; lead, 978 tons. Shipped during the week to separating plants, 160 tons blende.

#### Non-Metallic Minerals

Asbestos—Crude, No. 1, \$1,500@\$2,000; No. 2, \$850@\$1,250; spinning fibers, \$350@\$850; magnesia and compressed sheet fibers, \$225@\$350; shingle stock, \$95@\$150; paper stock, \$55@\$70; cement stock, \$16@\$27.50; floats, \$8.50@\$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

One producer reports the demand for asbestos starting in again, with inquiries about 50 per cent greater than last month. He feels that there will be no material decrease in the prices of crudes and fibers for some time. The mines are either shut down entirely or working on short shift, and until the stocks on hand are consumed production will be small, with no overproduction and no surplus. The 5 per cent export sales tax has been removed.

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. South Carolina points. Foreign barytes, prime white material, \$25 per net ton, f.o.b. Atlantic seaports. Western grades are \$24.50. Crude quoted \$7@\$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite—French bauxite, \$8@\$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, \$8@\$10 per gross ton, f.o.b. shipping points; pulverized and dried, \$12@\$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, \$20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

**China Clay (Kaolin)**—Crude, \$6.50@ \$8.50; washed, \$9@ \$10; powdered, \$13@ \$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, \$13@ \$20, f.o.b. Virginia points. Imported lump, \$12@ \$20, f.o.b. American ports; powdered, \$35@ \$45, f.o.b. New York.

**Emery**—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

**Feldspar**—No. 1 soap grade, \$7@ \$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, \$6@ \$6.50; No. 2, \$5@ \$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, \$26 f.o.b. cars.

**Fluorspar**—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$20@ \$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, \$40@ \$55; ground, suitable for acid, chemical or enameling purposes, \$32@ \$35; lump, \$13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF<sub>2</sub>, \$30, New Mexico.

**Fuller's Earth**—16 to 30 mesh, \$21; 30 to 60 mesh, \$23; 60 to 100 mesh, \$19; 100 plus mesh, \$15, f.o.b. plants, Pennsylvania. California grades, \$15@ \$25, f.o.b. mines. Imported, English, \$24@ \$27, f.o.b. Atlantic ports.

**Graphite**—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¼@2½c.

**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**—Crushed, New York State shipping points, ¾ in. size, \$1.40@ \$1.75 per net ton; 1½ in., \$1.35@ \$1.70. Prices for other sizes practically the same. Agricultural limestone, \$2.50@ \$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

**Magnesite, Calcined**—Crude, \$12@ \$15 per ton. High-grade caustic calcined, lump form, \$30@ \$40 per ton. Plastic calcined, \$45@ \$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, \$60.

**Dead-Burned**—\$33 per net ton, Chewelah, Wash.; \$58@ \$64, Chester, Pa. Austrian grade, \$53.80 per ton, f.o.b., Chester, Pa. (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); ground roofing mica, \$25@ \$70, all f.o.b. New York.

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

<sup>1</sup>Foot Mineral Co., Philadelphia, Pa.

**Phosphate Rock**—Per long ton, Florida ports: 77 per cent tricalcium phosphate, \$11.65; 75 per cent, \$10.65; 75@ 74 per cent, \$10.15; 70 per cent, \$6.25; 68 per cent, \$5.75; 68@66 per cent, \$5.50.

**Pumice Stone**—Imported, lump, 3@ 40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

**Pyrites**—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

**Silica**—Glass sand, \$2.25 per ton; sand-blast material, \$2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, \$16@ \$30 per ton. Ganister, crude, \$2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, \$2.25@ \$3, f.o.b. Pennsylvania points. Market reported dull.

**Sulphur**—\$16@ \$18 per ton for domestic; \$18@ \$20 for export, f.o.b. Texas and Louisiana mines.

**Talc**—Paper making, \$11@ \$20 per ton; roofing grades, \$8.50@ \$13; rubber grades, \$11@ \$18; all f.o.b. Vermont. California talc, \$16@ \$35, talcum powder grade. Southern talc, powdered, carload lots, \$7.50@ \$11 per ton; less than carload, \$25, f.o.b. cars. Imported, \$35@ \$40; Canadian, \$20@ \$40 per ton.

#### Mineral Products

**Arsenic**—6c. per lb.

**Sodium Nitrate**—\$2.10@ \$2.30 per cwt. ex vessel, Atlantic ports.

**Sodium Sulphate**—For 95 per cent material, \$15@ \$17 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; \$22@ \$25 per ton, New York.

**Potassium Sulphate**—Powder, domestic, \$1.35 per unit, 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.

**Ferrocium**—Per lb., \$12@ \$15.

**Ferrochrome**—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

**Ferromanganese**—Domestic 76 to 80 per cent, \$65@ \$70, f.o.b. furnace; resale, \$90, delivered; English, \$65@ \$70, c.i.f. Atlantic seaports. Spiegeleisen, 18 @20 per cent, \$26@ \$25, f.o.b. furnace.

**Ferromolybdenum**—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2.50 per lb. of contained metal, f.o.b. works. Imported material, \$1.70@ \$2.

**Ferrosilicon**—For 10 to 15 per cent, per gross ton, f.o.b. works, \$40; 50 per cent, \$65; 75 per cent, \$135.

**Ferrotungsten**—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

**Ferro-uranium**—35 to 50 per cent U, \$6 per lb. of U contained, f.o.b. works.

**Ferrovandium**—\$4.25@ \$4.50 per lb. of V contained, according to analyses and quantity.

#### Metal Products

**Copper Sheets**—Current New York list price, 20½c. per lb.; wire, 14@14½c.

**Lead Sheets**—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

**Nickel Silver**—31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

**Yellow Metal**—Dimension sheets 16½c.; sheathing, 16½c.; rods, ¾ to 3 in., 13½c.

**Zinc Sheets**—\$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

#### Refractories

**Bauxite Brick**—56 per cent alumina, \$50 per ton; 76 per cent, \$90@ \$95 f.o.b. works.

**Chrome Cement**—40@45 per cent Cr<sub>2</sub>O<sub>3</sub>, \$30@ \$32 per net ton, and \$31 in sacks, carload lots, f.o.b. eastern shipping points.

**Chrome Brick**—\$55 per net ton.

**Fire Brick**—First quality, 9-in. shapes, \$35@ \$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, \$30@ \$35.

**Magnesite Brick**—9-in. straights, \$70 @ \$75 per net ton; 9-in. arches, wedges and keys, \$77; soaps and splits, \$98, f.o.b. works.

**Silica Brick**—9-in., per 1,000: \$35@ \$45 in carload lots, f.o.b. shipping points.

#### The Iron Trade

Pittsburgh, Aug. 9, 1921

Volume of demand on steel mills continues upward, but improvement is slow. That most clearly marked is in sheets, tubular goods, and merchant steel bars. There is heavy buying of sheets for box-car roof replacement and a little railroad buying for other purposes. The automobile trade is a fair buyer. Steel-ingot production has been at about 20 per cent of capacity, but may average 25 per cent for August, and a 40 per cent rate may be reached by late fall.

Steel prices are beginning to show steadiness. In sheets fractional prices are being quoted. Thus, when black sheets were openly quoted at 3.50c., not long ago, some quotations were made at 3.25c. Now, when the regular market is 3c., quotations are of 2.97½c., 2.95c., and 2.92½c., according to keenness of competition. Open prices continue at 1.75c. for bars and 1.85c. for shapes and plates, concessions of \$1 to \$3 a ton being common on attractive orders.

**Pig Iron**—Basic, \$18; bessemer, \$20; and foundry, \$19.50, Valley furnaces.

**Semi-finished Steel**—Small lots of sheet bars have sold at \$30, Pittsburgh, a decline. Billets show no movement.

#### Coke

**Connellsville**—Furnace, \$2.75@ \$3; foundry, \$4@ \$4.50.

## Pittman Act Makes Silver Exports Light

Foreign Silver Only Being Sent Abroad—Market Fairly Steady at Sixty-Cent Level—Germany Is Using Silver as Collateral for an American Loan—India Has Large Silver Reserves—About One-Third Pittman Purchases Have Been Made

### EDITORIAL MARKET STUDY

**A**LTHOUGH the American silver producer is temporarily free from worry over silver prices, to say he is disinterested would be a gross misstatement, as the time is gradually but surely coming when American silver must be sold in an open market again. Foreign silver prices have remained fairly steady around 60c. per oz., at which level the market is quiet but not high enough, under present labor and supply costs, to induce a heavier production from foreign mines, particularly those in Canada and Mexico. In fact, production from foreign mines is declining. Decreased production, however, cannot help being ultimately beneficial to the silver-mining industry of the world, for, one of these days, treatment of silver as a "speculative football" will cease, a genuine consuming demand for the metal will appear, and mining can be resumed on a pre-war scale.

Unfortunately, silver, like gold, is inextricably linked with monetary systems and finance. Its industrial uses are secondary. Consequently, much depends upon the whims of governments as to how silver shall be handled. Of late, numerous examples leave no doubt as to how Europe, at least, is discarding silver. Much can be said for and against the European attitude of sending silver to the melting pot. For some countries desperation is the root of the trouble; for others it is the result of a disorganized paper and metal currency system.

On July 26, a shipment of silver from Germany valued at \$800,000 and consigned to a local bank was received in New York. This silver is part of a lot expected to total \$10,000,000 which the German government is shipping to the United States to obtain much-needed American credit. The silver shipments had caused the trade much perturbation, as it was thought that the German attitude might include a quick disposal of the metal, with the probable result of disorganizing the market. It will be recalled that Germany last year was a heavy seller of silver, with disastrous results to the market. However, it appears that the \$10,000,000 in silver to be shipped to the United States is to be used as collateral to secure a loan, and hence will not be pressed upon the market, except upon default of the loan. Had a procedure such as this been carried out last year, it is likely that the heavy and unprecedented decline in the silver market of 1920 would have been cushioned and much milder. The silver shipment is intimately associated with reparations, and it was originally planned to keep the silver in Germany as the basis for credit. This plan gave way to the one ultimately carried out—shipping the metal to the United States.

Although silver coinage has temporarily been abandoned by Europe, all European states prior to the war were regularly engaged in purchasing silver for purposes of coinage. According to the Director of the Mint, the silver coinage of the world for the five years prior to the war averaged about 120,200,000 oz. annually. World production

of silver for the same period (1909-1913) was about 221,600,000 oz., which gives some idea of the importance of coinage demands to the silver market. Although coinage of silver has fallen, production has also shown a large decrease, partially offsetting the decrease in coinage.

A British bullion broker calls attention to an important difference in the present position of silver coinage in India. Whereas, on July 31, 1914, India's silver reserves were about 116,500,000 oz. in coined rupees, the total is now about 227,000,000 oz., due to the great activity of the Indian mints in 1917, 1918, and 1919, and the extraordinary demand for silver during that period. This should have an important bearing on the demand in India for silver coinage. India obtains its greatest proportion of silver from London. North America, Shanghai, and other Asiatic ports, Australia, and Burma also send their treasure to the Indian market. Despite the large accumulations of silver in India, the imports of silver into that country during the first four months of the year were about 31,500,000 oz., compared with some 100,000,000 oz. annually before the war, indicating a rate of importation slightly less than that before the war. This situation is ascribed to the still pronounced prosperity of the country.

Exports of silver from the United States are confined to foreign silver, as domestic silver is being sold to the Government at \$1 per oz. under the provisions of the Pittman Act. The outward-going volume of silver has reached small proportions, and imports are also light. Great Britain, China, and Hongkong are the chief destinations of the exported silver. Mexico is by far the heaviest contributor of silver imported into the United States. From June 1, 1920, to July 1, 1921, about 66,000,000 oz. of silver was imported into the United States, compared with 57,000,000 oz. exported, confirming the impression that domestic industrial consumers of silver are obtaining supplies from cheaper foreign deposits rather than high-priced domestic silver.

Purchases of silver under the Pittman Act now total over 66,000,000 oz., not quite one-third of the 207,000,000 oz. which will make up the total purchases. The price of foreign silver is far from that of domestic, and there is nothing visible which would make it appear that silver will rise above one dollar again before the purchases have been completed. Criticism of the Pittman Act, which was particularly violent last winter, has momentarily abated, but as another wave of criticism may roll in at any moment, it behooves all silver producers interested in the welfare of their industry to be ready promptly to combat any uncalled-for claim for repeal of the act. Eternal vigilance is the price of safety. The silver miners have nothing to be ashamed of in the Pittman Act. On the contrary, the fullest publicity cannot fail to inform the unprejudiced observer of the eminent fairness of the legislation, and the just reward silver is receiving for the signal service it rendered during the war.

### MOVEMENTS OF SILVER TO AND FROM THE UNITED STATES

		In Ounces						
		EXPORTS						
To	Average Monthly (1913)	Average Monthly (1920)	January, 1921	February, 1921	March, 1921	April, 1921	May, 1921	June, 1921
China and Hongkong.....	829,400	7,185,000	3,164,320	1,833,460	738,030	487,630	1,108,100	.....
India.....	152,740	53,500	667,800	295,090	553,090	100,000	.....	.....
Great Britain.....	3,943,700	410,300	1,370,150	1,606,470	765,400	1,008,800	1,039,490	.....
Canada.....	68,000	588,400	259,990	234,090	224,770	266,200	145,800	.....
Mexico.....	.....	270,000	449,800	184,930	112,680	361,900	53,600	.....
All countries.....	5,597,000	9,468,000	6,690,750	5,336,880	2,918,530	2,318,800	2,352,600	1,424,010
		IMPORTS						
Mexico.....	2,130,700	4,433,100	3,390,600	3,237,400	2,375,300	2,023,700	4,523,400	.....
Peru.....	180,400	999,200	529,800	268,000	539,100	451,400	648,100	.....
Canada.....	806,800	315,700	242,300	611,200	451,000	261,562	171,900	.....
Central America.....	122,000	599,900	136,300	161,500	89,500	270,800	274,800	.....
All countries.....	3,440,000	7,338,300	4,838,900	4,862,100	3,872,000	3,299,750	6,956,000	3,627,300



# COMPANY REPORTS

## New York & Honduras Rosario Mining Co.

A report of the operations of the New York & Honduras Rosario Mining Co. for 1920 gives production as follows:

PRODUCTION			
	1920	1919	
Dry tons treated	140,100	133,900	
Ounces silver produced	1,711,349	1,584,379	
Ounces gold produced	8,001	10,200	
Ratio of silver to gold	214	155	
Bars doré bullion	1,097	1,014	
Bullion fineness	968.44 Ag. 4.53 Au.	979.94 Ag. 6.31 Au.	

A net profit of \$211,667.54 was realized by the year's operations, and dividends totaling \$320,000 were paid in 1920, surplus being reduced from \$2,657,455 to \$1,403,204 as the following statement shows:

Production of gold and silver	\$1,568,612.32	
Less: Freight and expenses on bullion	56,877.31	
Operating income	\$1,511,735.01	
Operating expenses	1,125,196.19	
Operating profit	\$386,538.82	
New York administrative expenses	67,498.26	
Net income from operating	\$319,040.56	
Other income	34,895.52	
Total income	\$353,936.08	
Deductions from income	107,232.82	
Net profit for period	\$246,703.26	
Appropriated for reserves:		
Fire insurance	\$4,123.52	
Reducing Liberty bonds to market value	30,912.20	35,035.72
Profit and loss balance carried to surplus		\$211,667.54

SURPLUS			
Surplus Jan. 1, 1920	\$2,657,455.42		
Deduct: Reserve for depletion of mine, 1920	\$350,250.00		
Dividends paid in 1920	320,000.00		
Amortization paid 1920	80,000.00		
Amortization distributions previously charged to reserve for depletion	500,000.00		
Reserve for advances to Sabana Grande Honduras Mining Co., previously charged to reserve for depletion	200,063.86		
Increasing reserve for contingencies	15,604.71	1,465,918.57	1,191,536.85
Surplus Dec. 31, 1920			\$1,403,204.39

Reserves of ore are estimated to amount to 211,780 tons containing 3,455,530 oz. of silver and 14,194 oz. of gold. The realizable value of the company's product was \$1,568,612.32, compared with \$2,115,158.25 for 1919. The per ton operating expense was \$8.51, compared with \$9.50 for 1919. The net cost of producing silver was 63.46c. per oz.

Operations were affected by the fall in price of silver, rate of exchange and cost of supplies, besides injuries to the property through storms.

The company's concession from the Honduras government was renewed by special act of the National Congress of Honduras for twenty years. The company agrees to perform certain public work at its own expense in return for the concession.

Capitalization, 200,000 shares of a par value of \$10 each.

## The New Jersey Zinc Co.

A report of The New Jersey Zinc Co. for the quarter ended June 30, 1921, follows:

Income (including dividends from subsidiary companies) after deductions for expenses, taxes, maintenance, repairs and renewals, betterments, depreciation and contingencies	\$637,440.16
Deduct: Interest on first mortgage bonds	40,000.00
Net income	\$597,440.16
Deduct: Accrued interest on stock subscriptions	\$13,512.63
Surplus for the quarter	\$583,927.53

A dividend of 2 per cent was declared from surplus, payable Aug. 10, 1921.

## Poderosa Mining Co.

Copper; Chile

The twelfth annual report of the Poderosa Mining Co., Ltd., for the year 1920 states that the net receipts from sales of ore, interest, and transfer fees amounted to £112,303 8s. 9d., and after providing for mining, management, and general expenses in Chile, London office expenses, depreciation of investments, and income tax, amounting to £76,799 8s. 6d., there remains a balance of £35,504 0s. 3d., out of which the sum of £17,154 8s. 7d. has been allocated as follows:

	£	s.	d.
Depreciation of buildings, machinery and plant, etc.	3,086	10	4
Mine development	11,521	14	11
Bolivian property	2,546	3	4
	£17,154	8	7

This leaves a net surplus of £18,349 11s. 8d. to be carried to the balance sheet. Adding the balance of £7,289 9s. 2d. brought forward from 1919, the net balance is £25,639 0s. 10d., which the directors recommend should be dealt with as follows:

	£	s.	d.
To pay a dividend of 2s., 6d. per share, less income tax	8,750	0	0
And to carry forward (subject to corporation profits tax) the sum of	16,889	0	10
	£25,639	0	10

During the period under review, 5,011 tons of copper ore, of an average assay of 30.13 per cent copper and 15.16 oz. silver per ton, has been shipped to the smelters, as compared with 1,498 tons, assaying 31 per cent copper and 12.97 oz. silver, respectively, for 1919.

Production from the various units of the property was as follows:

	Tons	Per Cent	Fine Copper, Tons
Poderosa mine	4,434.8	28.45	1,261.9
Rosario mine	124.1	24.48	30.37
San Carlos mine	715.0	25.01	178.75
Concentration			
Totals	5,273.9	28.07	1,471.02

Costs per ton are given as follows in pounds sterling:

	Working Expenses	Prospecting and Development	Capital Expenses	Total
On cars at mine	9.43	2.18	6.94	12.55
Fine copper at mine	33.58	7.76	3.32	44.66

## Mining Dividends for July, 1921

The following dividends were paid by American mining and metallurgical companies during July, 1921:

Companies in the United States	Situation	Per Share	Totals
American Smelters pfd. "A"	U. S.	\$1.50 Q	\$146,071.00
American Smelters pfd. "B"	U. S.	1.25 Q	39,855.00
Bunker Hill & Sullivan, l.s.	Idaho	0.25 M	81,750.00
Eagle-Picher Lead, pfd.	Mo., Okla.	1.50 Q	15,000.00
Great Northern Ore, etc.		2.00	300,000.00
Homestake Mining, g.	S. D.	0.25 M	62,790.00
Phelps Dodge Corporation, c.	U. S. & Mex.	1.00 Q	450,000.00
Tintic Standard, s.c.l.	Utah	0.50 Q	58,735.00
Tonopah Extension, g.s.	Nev.	0.50 Q	64,636.00
United Eastern, g.	Ariz.	0.15 Q	204,455.00
U. S. Smg. Ref. & Mng., pfd.	U. S. & Mex.	0.875 Q	425,556.00
Companies in Canada, Mexico and South America			
Asbestos Corporation	Canada	\$1.50 Q	\$45,000.00
Asbestos Corporation, pfd.	Canada	1.75 Q	70,000.00
Dome Mines, g.	Canada	0.25 Q	119,166.75
Hollinger Consolidated, g.	Canada	0.05 4 wks.	246,000.00
Kerr Lake, s.	Canada	0.125 Q	75,000.00
Lucky Tiger Comb., s.	Mexico	0.13 MX	92,994.00
Nipissing, s.	Canada	0.15 Q	180,000.00
Poderosa Mining, c.	Chile	2/6 K	£1,250
St. John del Rey, g.	Brazil	3d. SA	£6,250
St. John del Rey, pfd. g.	Brazil	1 sh. S.A.	£5,000

K, irregularly; M, monthly; Q, quarterly; X, extra; SA, semi-annual; c., copper; g, gold; l, lead; s, silver.

# MINING STOCKS

Week Ended August 6, 1921

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.	
<b>COPPER</b>						<b>GOLD</b>						
Almeek.....	Boston	48	48	48	Sept. '20, Q	\$0.50	Alaska Gold.....	New York	12	12	12	
Alaska-Br. Col.....	N. Y. Curb	*37	*35	*36			Alaska Juneau.....	New York	12	12	12	
Allouez.....	Boston	*18	*18	*18	Mar. '19	1.00	Carson Hill.....	N. Y. Curb	13	13	13	
Anaconda.....	New York	37 1/2	35 1/2	35 1/2	Nov. '20, Q	1.00	Cresson Consol. G.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	June '20, Q
Arcadian Consol.....	Boston	2	1 1/2	2			Dome Extension.....	Toronto	*65	*65	*65	
Ariz. Com'l.....	Boston	8	7 1/2	7 1/2	Oct. '18, Q	.50	Dome Mines.....	New York	17 1/2	17	17 1/2	July '21, Q
Big Ledge.....	N. Y. Curb	*27	*22	*24			Florence Goldfield.....	N. Y. Curb	*43	*40	*42	
Bingham Mines.....	Boston	9 1/2	9 1/2	9 1/2	Sept. '19, Q	.25	Golden Cycle.....	Colo. Springs	4	4	4	June '21, Q
Calumet & Arizona.....	Boston	48 1/2	46	46 1/2	June '21, Q	.50	Hollinger Consol.....	N. Y. Curb	*6	*6	*6	Dec. '19
Calumet & Hecla.....	Boston	224	219	219 1/2	June '20, Q	5.00	Homestake Mining.....	Toronto	7.20	7.06	7.15	July '21, M
Canada Copper.....	N. Y. Curb	*35	*30	*30			Kirkland Lake.....	New York	56	56	56	July '21, M
Centennial.....	Boston	8 1/2	7 1/2	7 1/2	Dec. '18, SA	1.00	Lake Shore.....	Toronto	*40	*35	37	
Cerro de Pasco.....	New York	27	24 1/2	24 1/2	Mar. '21, Q	.50	McIntyre-Porcupine.....	Toronto	1.20	1.15	1.19	Jan. '21, K
Chile Copper.....	New York	10 1/2	10	10			Porcupine Crown.....	Toronto	1.96	1.90	1.95	May '21, K
Chino.....	New York	23 1/2	22 1/2	22 1/2	Sept. '20, Q	.37 1/2	Portland.....	Colo. Springs	*15	*13 1/2	*14	July '17
Columbus Rexall.....	Salt Lake	*28	*27	*27			Reorgan. Booth.....	N. Y. Curb	*44	*43	*43	Oct. '20, Q
Con. Arizona.....	N. Y. Curb	1 1/2	1	1 1/2	Mar. '18, Q	.05	Silver Pick.....	N. Y. Curb	*13	*11	*13	May '19
Con. Copper Mines.....	N. Y. Curb	32	31 1/2	31 1/2	Sept. '20, Q	.50	Teck Hughes.....	Toronto	*15	*13	*15	
Copper Range.....	Boston	*38	*33	*38			Tom Reed.....	Los Angeles	1	1	1	Dec. '19
Crystal Copper.....	Boston Curb	6 1/2	6 1/2	6 1/2	Mar. '20, Q	.25	United Eastern.....	N. Y. Curb	2 1/2	2 1/2	2 1/2	July '21, Q
Davis-Daly.....	Boston	8	7 1/2	8	Dec. '19, A	.50	Vindicator Consol.....	Colo. Springs	1	1	1	Jan. '20, Q
East Butte.....	Boston	*54	*52	*52	Feb. '19, SA	.15	West Dome Consol.....	Toronto	*8	*7	*7 1/2	
First National.....	Boston Curb	2 1/2	1 1/2	2 1/2			White Caps Mining.....	N. Y. Curb	*5	*4	*5	
Franklin.....	Boston	17 1/2	16 1/2	17	May '19, Q	1.25	Yukon Gold.....	N. Y. Curb	1 1/2	*90	*95	June '18
Gadsden Copper.....	N. Y. Curb	21 1/2	20	21 1/2	Nov. '20, Q	.50	<b>SILVER</b>					
Granby Consol.....	New York	2 1/2	2 1/2	2 1/2	Jan. '21, Q	.05	Arizona Silver.....	Boston Curb	*21	*18	*18	Apr. '20, M
Greene-Cananea.....	New York	33 1/2	32 1/2	32 1/2	Oct. '20, Q	1.00	Batopilas Mining.....	New York	*29	*26	*27	Dec. '07, I
Hancock.....	Boston	5 1/2	5 1/2	5 1/2	Sept. '20, K	.25	Beaver Consol.....	Toronto	1.65	1.65	1.65	May '20, K
Howe Sound.....	N. Y. Curb	19 1/2	19	19 1/2	Sept. '19, SA	.50	Coniagas.....	Toronto	*10	*8 1/2	*9	May '21, Q
Inspiration Consol.....	New York	19 1/2	18	19 1/2	Sept. '19, SA	.50	Crown Reserve.....	Toronto	*21	*15	*18	July '21, Q
Iron Cap.....	Boston Curb	12	11	12	Dec. '20, Q	.50	Kerr Lake.....	N. Y. Curb	*20	*18	*18	Apr. '18
Iso Royale.....	Boston	1 1/2	1 1/2	1 1/2			La Rose.....	Toronto	*10	*10	*10	Oct. '20, Q
Kennecott.....	New York	17 1/2	17 1/2	17 1/2	Jan. '19, Q	.50	McKinley-Dar-Sav.....	Toronto	1.25	1.15	1.15	Sept. '20, Q
Keweenaw.....	Boston	17 1/2	17 1/2	17 1/2	Jan. '19, Q	.50	Mining Corp. Can.....	Toronto	4 1/2	4 1/2	4 1/2	July '21, Q
Lake Copper.....	Boston	17 1/2	17 1/2	17 1/2	Jan. '19, Q	.50	Nipissing.....	N. Y. Curb	3 1/2	3 1/2	3 1/2	Jan. '19, Q
La Salle.....	Boston	17 1/2	17 1/2	17 1/2	Jan. '19, Q	.50	Ontario Silver.....	New York	3 1/2	3 1/2	3 1/2	Jan. '19, Q
Magma Chief.....	N. Y. Curb	17 1/2	17 1/2	17 1/2	Jan. '19, Q	.50	Ophir Silver.....	San Francisco	*5	*4 1/2	*9	Jan. '12
Magma Copper.....	N. Y. Curb	*7	*6	*7			Peterson Lake.....	Toronto	*23	*22	*22	Jan. '17
Majestic.....	Boston Curb	1 1/2	1 1/2	1 1/2			Temiskaming.....	Toronto	*15 1/2	*12	*12	Jan. '20, K
Mason Valley.....	Boston	21 1/2	20 1/2	20 1/2	Nov. '17, Q	1.00	Trethewey.....	Toronto	*15 1/2	*12	*12	Jan. '19
Mass Consolidated.....	Boston	21 1/2	20 1/2	20 1/2	Nov. '17, Q	1.00	<b>GOLD AND SILVER</b>					
Miami Copper.....	New York	49	47 1/2	47 1/2	Nov. '20, Q	1.00	Barnes-King.....	Butte	*60	*60	*60	Aug. '20, Q
Michigan.....	Boston	10 1/2	10 1/2	10 1/2	May '21, Q	.50	Boston & Montana.....	N. Y. Curb	*75	*65	*68	
Mohawk.....	Boston	10 1/2	10 1/2	10 1/2	May '21, Q	.50	Cash Boy.....	N. Y. Curb	*6	*5	*5	
Mother Lode Co.....	N. Y. Curb	10 1/2	9 1/2	10 1/2	Sept. '20, Q	.25	Consol. Virginia.....	San Francisco	2 1/2	2 1/2	2 1/2	
Nevada Consol.....	New York	14	13 1/2	13 1/2	Aug. '20, K	.25	Dolores Esperanza.....	N. Y. Curb	*21	*20	*21	
New Baltic.....	Boston Curb	9 1/2	9 1/2	9 1/2	Oct. '18, Q	.25	El Salvador.....	N. Y. Curb	*27	*20	*21	
New Cornelia.....	Boston	14	13 1/2	13 1/2	Aug. '20, K	.25	Jim Butler.....	N. Y. Curb	*8	*7	*8	Aug. '18, SA
North Butte.....	Boston	14	13 1/2	13 1/2	Aug. '20, K	.25	Jumbo Extension.....	N. Y. Curb	*4	*4	*4	June '16
North Lake.....	Boston	14	13 1/2	13 1/2	Aug. '20, K	.25	Louisiana Con.....	N. Y. Curb	*17	*15	*17	May '10
Ohio Copper.....	N. Y. Curb	14	13 1/2	13 1/2	Aug. '20, K	.25	MacNamara M. & M.....	N. Y. Curb	*17	*15	*17	May '10
Old Dominion.....	Boston	23	22	22	Dec. '18, Q	1.00	N. Y. Houd. Rosar.....	Open Mar.	4	4	4	Jan. '21, Q
Osceola.....	Boston	26 1/2	23	23	June '20, Q	.50	Tonopah-Belmont.....	N. Y. Curb	*8 1/2	*7 1/2	*7 1/2	Apr. '21, Q
Phelps Dodge.....	Open Mar.	155	145	145	July '21, Q	1.00	Tonopah-Divide.....	N. Y. Curb	*8 1/2	*7 1/2	*7 1/2	Apr. '21, Q
Quincy.....	Boston	37	36	36	Mar. '20, Q	.25	Tonopah-Extension.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	July '21, Q
Ray Consolidated.....	New York	12 1/2	12 1/2	12 1/2	Dec. '20, Q	.25	Tonopah Mining.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	Apr. '21, SA
Ray Hercules.....	N. Y. Curb	*30	*26	*28			West End Consol.....	N. Y. Curb	*75	*70	*70	Dec. '19, SA
St. Mary's Min. Ld.....	Boston	31	31	31	June '20, K	2.00	<b>SILVER-LEAD</b>					
Seneca Copper.....	Boston	17 1/2	16 1/2	16 1/2	Nov. '17, Q	.25	Caledonia.....	N. Y. Curb	*9	*8	*9	Jan. '21, M
Shannon.....	Boston	*85	*85	*85	Nov. '17, Q	.25	Cardiff M. & M.....	Salt Lake	1.20	1.20	1.20	Dec. '21
Shattuck Arizona.....	New York	7	6 1/2	6 1/2	Jan. '20, Q	.25	Chief Consol.....	Boston Curb	2 1/2	2 1/2	2 1/2	Aug. '21, Q
South Lake.....	Boston	1	1	1			Consol. M. & S.....	Montreal	15 1/2	15 1/2	15 1/2	Oct. '20, Q
Superior Copper.....	Boston	3	3	3	Apr. '17	1.00	Daly Mining.....	Salt Lake	15 1/2	15 1/2	15 1/2	Oct. '20, Q
Superior & Boston.....	Boston	7 1/2	7 1/2	7 1/2	May '18, I	1.00	Daly West.....	Boston	12 1/2	12 1/2	12 1/2	July '20, Q
Tuolumne.....	Boston	*48	*38	*38	May '13	.10	Eagle & Blue Bell.....	Boston Curb	12 1/2	12 1/2	12 1/2	Dec. '20, Q
United Verde Ex.....	Boston Curb	23 1/2	22	22 1/2	May '21, Q	.25	Electric Point.....	Spokane	5	5	5	Apr. '21, SA
Utah Consol.....	Boston	4	3 1/2	3 1/2	Sept. '18	.25	Eureka-Croesus.....	N. Y. Curb	*50	*39	*45	May '20, K
Utah Copper.....	New York	48 1/2	46 1/2	46 1/2	June '21, Q	.50	Federal M. & S.....	New York	19	16	7	Jan. '09
Utah Metal & T.....	Boston	1 1/2	1 1/2	1 1/2	Dec. '17	.30	Federal M. & S., pfd.....	New York	22	21 1/2	21 1/2	June '21, Q
Victoria.....	Boston	11 1/2	11 1/2	11 1/2			Grand Central.....	Spokane	*11	*11	*11	Apr. '19
Winona.....	Boston	11	10	10			Hecla Mining.....	Salt Lake	*29	*29	*29	June '20, K
Wolverine.....	Boston	11	10	10			Iron Blossom Con.....	N. Y. Curb	4 1/2	4	4	June '21, Q
<b>NICKEL-COPPER</b>						<b>ASBESTOS</b>						
Internat. Nickel.....	New York	14 1/2	13 1/2	13 1/2	Mar. '19	.50	Asbestos Corp.....	Montreal	77	76 1/2	76 1/2	July '21, Q
Internat. Nickel, pf.....	New York	14 1/2	13 1/2	13 1/2	Aug. '21, Q	1.50	Asbestos Corp., pfd.....	Montreal	77	76 1/2	76 1/2	July '21, Q
<b>LEAD</b>						<b>MINING, SMELTING AND REFINING</b>						
National Lead.....	New York	75 1/2	74 1/2	74 1/2	June '21, Q	1.50	Amer. Sm. & Ref.....	New York	37 1/2	35 1/2	35 1/2	Mar. '21, Q
National Lead, pfd.....	New York	103	103	103	June '21, Q	1.75	Amer. Sm. & Ref. pf.....	New York	72	71	72	June '21, Q
St. Joseph Lead.....	New York	11	11	11	June '21, Q	.25	Amer. Sm. pf. A.....	New York	70	66	67 1/2	July '21, Q
<b>QUICKSILVER</b>						<b>U. S. Sm. R. &amp; M.....</b>						
New Idria.....	Boston	150	150	150			U. S. Sm. R. & M.....	New York	30	30	30	Jan. '21, Q
<b>ZINC</b>						<b>U. S. Sm. R. &amp; M. pf.....</b>						
Am. Z. L. & S.....	New York	8	8	8	May '20	1.00	U. S. Sm. R. & M. pf.....	Boston	37 1/2	37 1/2	37 1/2	July '21, Q
Am. Z. L. & S., pfd.....	New York	8	8	8	May '20	1.00						
Butte C. & Z.....	New York	4 1/2	4 1/2	4 1/2	June '18	.50						
Butte & Superior.....	New York	13	12 1/2	12 1/2	Sept. '20	1.25						
Callahan Zn-Ld.....	New York	4 1/2	4 1/2	4 1/2	Dec. '20, Q	.50						
New Jersey Zn.....	N. Y. Curb	117	115 1/2	116 1/2	May '21, Q	2.00						
Success.....	N. Y. Curb	*2	*2	*2	July '16	.03						
Yellow Pine.....	Los Angeles	1	1	1	Sept. '20, Q	.03						

\*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

