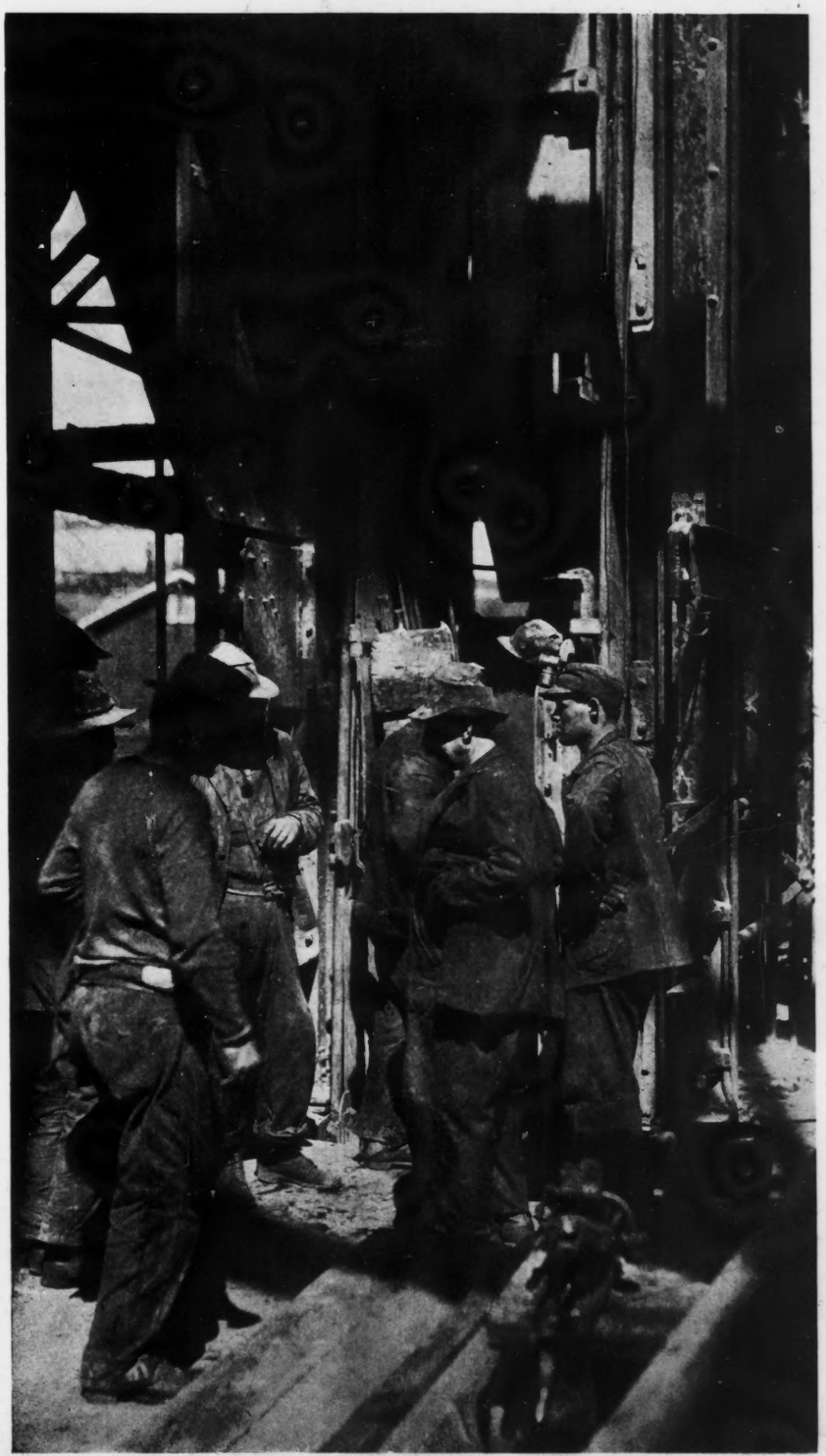
McGraw-Hill Co., Inc. November 12, 1921 25 Cents Per Copy

ENGINEERING AND MINING JOURNAL

A Weekly Journal of the Mining and Mineral Industries Largest Circulation of Any Mining and Metal Journal in the World



"Going Below" at One of the Butte District Mines

Chloridizing Volatilization
By Harai R. Layng

The Eubœan Magnesite Field
By H. C. Boydell

The Venezuelan Petroleum Industry
By Arthur H. Redfield

Europe's zinc industry is still unsettled, but is becoming more active. Zinc production hampered by high costs, according to The American Zinc Institute's correspondent's report on Page 798.

Following a recent examination of copper deposits in the Shetland Islands, opinions have been advanced contrary to those expressed in an earlier and more favorable report. See London letter.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 **New York, November 12, 1921** *Number* 20

Politics and Mines in Asiatic Turkey

THE RAPID OBSOLESCENCE of the theory and practice of mandates was marked when on Oct. 30 the French government ratified a separate treaty with the Turkish Nationalist government, which has its capital at Angora, in Asia Minor, and has no affiliations with the Turkish government at Constantinople. Under the League of Nations, France was given a mandate over Syria. Now by separate treaty with a new Turkish power, sprung up since that time, France fixes the boundaries of Syria, frankly ignoring the League of Nations and as frankly acting upon the assumption that Syria is French in every sense of the word.

This, of course, is not a new development. The British, for example, have never comprehended the word mandate, except as an equivalent for new British territory; and the typically American conception of a trust to be accounted for from time to time to the family of nations has fallen into desuetude on account of its being too advanced. It is further interesting from the League of Nations viewpoint to note that while France has recognized one government in Turkey, Great Britain has recognized an opposing government—that which accepted the first treaty—the now clearly weaker government at Constantinople.

Especially interesting to us is that along with this new treaty France gets a mining concession—one for ninety-nine years—to the iron, chrome, and silver mines in the valley of Harchite, in the northern part of Anatolia or Asia Minor, near the Black Sea, not within or near the French occupied territory of Syria. All this is part of the picture of the shattered Turkish Asiatic empire, which picture comprises the question of oil in Mesopotamia, considered by Great Britain conceded exclusively to British interests by the League of Nations mandate, a conception which the State Department at Washington has been endeavoring, with some little show of success, to shake; but not without some astonishment and resentment in London.

All this goes to show that the Disarmament Conference in Washington has not had its work already done by the League. It also points out the necessity of considering mineral questions and mining concessions as one of the basic features of the policy which is to be debated in Washington. Washington must not lose sight of the far-reaching significance of political and commercial geology in these vital questions of statecraft; and should have a properly qualified group watching this element and furnishing prompt and fair advice concerning it.

Stabilization of Foreign Exchange

EXCHANGE STABILIZATION is receiving attention from Washington. Hearings have been held before the House Committee on Banking and Currency on the subject, but despite the fact that it is one of the most absorbing and important economic topics before the world today, little enthusiasm has been aroused among Washington officials, who are reported to feel that the difficulties in the situation are well known and that any remedies or recommendations would lack the force requisite to their introduction and execution.

The countries that appear most concerned in exchange stabilization are not those whose currency has depreciated enormously, but seemingly those whose currency is at a great premium compared with that of other nations. Thus the depreciation of the German mark—it has no end—is perturbing many commercial and financial interests in the United States. Germany, however, does not seem to be worrying, and is reported thoroughly satisfied with her present fiscal policies and their practical results. A recent visitor to that country told us that he inquired of many influential bankers where they thought a continuation of the present state of affairs would lead. The reply was generally a shrug of the shoulders, accompanied by a remark of indifference as to the probable outcome.

Much space has been devoted by the press to the advantages and disadvantages of distorted exchange relationships. As a rule they resolve themselves into giving a temporary larger external purchasing advantage to the country with currency at a premium and a greater selling advantage to the country with currency at a discount. Germany is evidently satisfied with the ability she now possesses of being in a position to underbid rivals in the markets of the world. Possibly one of the underlying motives in her attitude is the attempt to recapture markets lost during the war, regardless of the cost and the destruction of her finances.

It is difficult for many to comprehend how Germany, in a greatly weakened financial state, and embarrassed by exchange, has been able to buy large quantities of copper and to maintain the position of the most important European copper-consuming nation. The answer is simple. Germany is paying cash. Exchange difficulties are subordinate, as the copper transactions are closed in a short space of time. The copper bought from American producers is fashioned into some copper utensil, or perhaps a motor, or some other electrical instrument, and promptly exported. Although exchange relations may have been adverse to Germany in the purchase of raw materials, they are favorable to her in the disposal of the finished product—a balance is almost struck. The net result of the steps is the manufacture and sale of an article in which cheap German labor has been used and in which exchange is a minor consideration. It must be admitted, however, that widely fluctuating exchange rates are a serious impediment to commercial intercourse between nations.

One of the thoughts in the mind of a Washington participant to the exchange hearings is a probability of the accumulation of a still greater quantity of the

world's gold in the United States and the possible repudiation of the gold standard by other countries, with disastrous consequences to American trade. Such a contingency is unlikely, as the gold which is coming to the United States is largely newly mined metal. The gold holdings of the Bank of England and the Bank of France are larger than they were before the war. Even Germany has a reserve that compares favorably with the pre-war supply. We may rest assured that these nations will cling tenaciously to their relatively slim metallic reserves, and rely on the simple expedient of a gold embargo to prevent a decrease. Some seem to have the impression that we cannot count upon our recent accretions of gold to become a basis of our credit and currency structure. This is strange reasoning, as practically all the gold that has swelled our stocks, heavy importations, has entered the vaults of the Federal Reserve Banks to become part and parcel of our credit and currency system. True, the recent accumulations may not be permanent, but we do not expect to see them disappear in such a short space of time that we cannot use them for credit and currency.

We are great believers in the natural working of economic law. Without the help of national and international agreements the situation in exchange will correct itself. Recommendations and carefully considered legislation can aid somewhat, but a stimulus to investment in foreign enterprises and a change of our trade balance are the natural remedial agencies. The best remedy is to let nature take its course; and above all, to beware of tariff obstructions.

Arbitration in Guanajuato

THAT ARBITRATION is the best way of straightening out all difficulties between capital and labor the world over is a principle that seems axiomatic, yet today there are many on both sides that are apparently more inclined to fight things out to a finish. Still it is far more generally accepted than it was, say twenty years ago, when it was a popular subject for debating societies, which was evidence of its lack of application then. Thus society is making progress toward a time when industrial harmony shall be the normal condition.

Last spring, in Mexico, the State of Guanajuato passed a law "of conciliation and arbitration," in accordance with which there must be established boards in each municipality, whenever occasion requires, for the purpose of settling the controversies that arise between capital and labor in the state. Three delegates compose a board, one elected by the employers, one by the workmen, and the third by the municipal government of the locality, the chairman being selected from the members by a majority of votes. The law also provides that there shall be a central board in the capital, composed of five members elected by the Chambers of Commerce, Industry, and Agriculture existing in the state; another five appointed by the Chambers of Labor and the General Labor Unions; and one representing the state executive. The chairman is elected by the members of the board. For selecting the government's delegate, the government is required to propose three candidates, one of whom the representatives of labor may elect.

The municipal board is empowered to decide a controversy by sentence or arbitration, if conciliation is not otherwise effected. The central board is empowered to review the decisions of the municipal boards, if requested, and to make decisions in doubtful cases.

There is some criticism of the law as it stands. Inasmuch as only those having full civil rights can become council members, a foreigner may not sit as such, so that a Mexican representative (of the companies) must be appointed, at, of course, a certain salary.

The chief point raised, though, is that the law gives powers of public authorities and judges to the council members. Our correspondent at Guanajuato says that lawyers there hold that under the Constitution no one but a qualified lawyer may be made a judge, and that the findings of the councils can be appealed to an ordinary civil court of law and there probably be annulled. The lawyers also say that the councils themselves are unconstitutional, as the Magna Carta of Mexico provides that all courts cover all civil and criminal proceedings and expressly forbids any special courts for the benefit of any particular class, except courts martial.

Some other points are interesting: The refusal of an employer to abide by the umpire's decision obligates him to pay to all the workmen involved the total of their wages for three months, the labor contract being annulled. However, if the workmen refuse, their contract is annulled, and the authorities will take the necessary measures to guarantee the employer's liberty to make new contracts and to prevent the workmen from hindering the new laborers in their work. Thus it is seen that it is a much more serious matter for the employer to refuse than it is for the employee.

The law is based upon certain sections of Article 123 of the Constitution of 1917, according to our correspondent, who says that many of the other states in Mexico are expected soon to pass similar laws.

In Kansas, we have the Industrial Court Law, functioning differently, and with the basic idea of settling disputes between capital and labor in the interest of the public welfare, rather than of simply protecting the workingman's rights, as the Guanajuato law seems to seek. The Kansas Industrial Court is not a court at all but an administrative body exercising part of the police power of the state. "A court cannot move until its process is invoked by an appropriate formula," said Senator F. Dumont Smith, of Kansas, at Denver last year. "This administrative body moves of its own initiative. It requires no complaint. It can move upon suspicion; it has broad inquisitorial powers. . . . The Kansas law starts by declaring that food, fuel, and clothing are the necessities of human life." It begins to function whenever any industrial disturbance threatens to impair the production or distribution of these necessities.

Our Biographical Sketches

"I HAVE READ with great interest the biographical sketches and have been glad to see the faces of so many old colleagues and friends in the pages of the *Journal*."

So writes a man we all know in response to our request for his portrait and biography. He likes to see his friends and read about how they have "arrived," and he is willing to give this pleasure to others by getting away from the shyness which is apt to characterize mining engineers and sending on his own biography and photograph. It is a friendly act, to us and to you. We like to read about people—real people—and thousands of our readers in many lands are grateful for the intimate glimpses of personality and the helpful and encouraging story of the lives of our friends and those whom we would be glad to know.

WHAT OTHERS THINK

Retailing Copper and Brass At Reasonable Prices

In an article published in *Engineering and Mining Journal* of Oct. 15 you state "We are going to give a lot of free advertising to the first copper or brass company to start a retail store with common-sense prices."

We do not want you to consider this letter as a bid for this free advertising, but if there is any free advertising to be had, we would be very glad to receive it.

In view of the continual controversy that seems to have been going on for some time as to the exorbitant prices charged by the metal jobbers, we would like to have you consider this letter as an invitation to anyone of your staff to visit our establishment, go over the situation with us, and let the writer of this communication show him exactly how the jobber is treating the consumer of brass and copper material.

In your article you lay considerable stress on the fact that it would be very desirable if a store were established where you could buy a sheet of copper for 25c. or 30c. per lb. If you will visit our store, we will show you we are daily selling large quantities of sheet copper, both in small and large lots, at a price very much under 25c. per lb. As a matter of fact, even if we were inclined to charge 25c. or 30c. per lb. it would be impossible to get a consumer to pay it, as most consumers today know about what the market prices are, and competition in our line is so keen as to make it impossible to secure these exorbitant prices even if we wished to do so.

We would like to inquire whether the writer of your article knows that in the autumn months of this year enormous quantities of copper conductor have been sold for building purposes, and that the prices at which this metal has been sold to the jobbing trade and in turn to the building trade are so close to the actual mill cost of raw material that any practical man would look at the figures in amazement and wonder how it could be done. It would also be a matter of interest to know whether the writer of your article knows that the manufacturers of copper and bronze mosquito netting have reduced their prices during the last summer to a point where this material was sold on a low level of price which has not obtained since long before the war.

We are wondering whether your writer knows that the large consumption of this material during the last season has been one of the outstanding features of the wire-netting trade. Does your writer know that it is a fact that this copper and bronze mosquito netting was handled by the jobbers at a profit of about ½c. per sq.ft. or approximately 5 per cent over the cost from the manufacturer?

Does your writer know that brass pipe is being sold to the plumbers today on a level that has not been reached since the lowest of the low pre-war prices were made? Does he know that the mills which are making brass pipe are unanimous in their claims that they are losing money on every pound of it that they are selling today, and does he know that the jobbers handling brass pipe are turning it over at 7 per cent profit?

These items are selected for comparison by your writer himself and it is therefore upon these that we have made our comment. We would like to repeat here our invitation to any of your staff interested in this matter to call on the writer of this letter for a frank discussion. We will be pleased to show you our orders, prices charged and any of the details which might be of value or interest in clearing up this matter. We would be pleased to give him a fairly complete list of these people and let him educate himself as to the real conditions by calling upon as many of them for interviews as he may find convenient to do.

We trust that you will not fail to give this matter some attention, as it is exceedingly unfair that statements such as are made in your article should go unanswered and undisputed.

J. J. WHITEHEAD,
Vice-president, Trumpbour-Whitehead Brass & Copper Co., Inc.
New York.

[We of course were glad to take advantage of Mr. Whitehead's offer. His warehouse, office, and store is at the corner of Canal, Mercer, and Howard Sts., in a section of the city not usually visited by the general public. It is similar to the store of the Rome Brass & Copper Co. in Chicago, mentioned in our editorial columns in the Nov. 5 issue. Several other manufacturers maintain similar outlets for their products, among these being, we understand, the Taunton-New Bedford Copper Co., C. G. Hussey & Co., the Scovill Manufacturing Co., the Detroit Copper & Brass Rolling Mills, and the Baltimore Copper Smelting & Refining Co. These warehouse stores are situated in New York, Chicago, or St. Louis, and possibly in other cities of the country.

Mr. Whitehead seemed interested in some of the examples which we cited of the extortionate prices charged small consumers by hardware and plumbing supply stores. These were, in his opinion, outrageous. Where the ordinary hardware store sells copper window screening for from 12 to 15c. per sq.ft., Mr. Whitehead is willing to sell anyone in any quantity at 6.75c. per sq.ft. The price of Monel metal screening is 12c. per sq.ft. We might also mention ⅜-in. copper tubing, so-called "hooch tubing," for which the store nearest this office now charges 18c. per ft. This can be obtained in even as small quantities as one length of 12 ft., for 33c. per lb., which is equivalent to about 3½c. per foot. Plainly, the manufacturers and their agents are not at fault in the prices which they charge, although it would seem advisable for them to make those prices known to the general public. The more highly manufactured forms of copper are still obtainable in small quantities only through the customary retail channels. We believe that either the retail dealers are profiteering or else there are unwarranted costs in merchandising. A few days ago the U. S. Department of Commerce made public a report which indicated that there are far too many stores in proportion to buyers. Possibly there are twice as many hardware stores in the country as is desirable; there are four in the small town in which we live, and we think from observation that all of the business could be as well done in two and with no increase in the sales force. We are pleased to know that so many copper products can be obtained at reasonable prices if one knows where to go, but the fact remains that the ordinary retail buyer pays more than he should and is firmly imbued with the idea that copper is a luxury.—EDITOR.]

Chloridizing Volatilization—Some Experiments and Their Practical Application

Tests Indicate That the Ore Should Be Heated Rapidly and That Care Must Be Taken To Add the Chloridizer at the Proper Time—Fifteen-Ton Furnace Eliminated Troubles From Accretions and Gave High Recoveries

BY HARAI R. LAYNG*
Written for *Engineering and Mining Journal*

IN MOST CHLORIDIZING volatilization work, a mixture of ore and chloridizer is fed to a revolving furnace fired at the discharge end. The chloridizer is usually salt, but occasionally calcium chloride is substituted, in part. Small experimental furnaces can produce good volatilization results on some ores, under certain conditions, by such methods. Large furnaces of the type mentioned could also produce good volatilization results on some ores by such methods, provided the ore could pass through the furnace. Even then, however, they would have to be fed so slowly that the process would be unprofitable.

When mixtures are fed to large practical-sized furnaces of the type mentioned, at practical rates, the mixture is slowly heated. The chloridizers usually melt at a temperature below their volatilization point, and unless there is an element or compound present which will decompose them at a temperature about or below their melting points, they will often stick to the ore and form a cemented mass. This will frequently stick to the walls of a revolving furnace and gradually build up a ring or series of rings in the furnace. My experience has been that these rings, if they form within a few hours, usually make the process impractical.

These methods, even when applied on a small scale, require excessive amounts of chloridizer, sometimes ten times the theoretical requirements. This leads to high fuel consumption, and, with many ores, to the formation of sintered material. Sintering hinders extraction and also causes rings to build up in a furnace. These sintered rings usually build up at a point further along in the furnace than those rings caused by cementation, and consequently are more difficult to remove. It is usually necessary to shut the furnace down and allow it to cool before they can be dug out.

With such a chloridizer as calcium chloride there are two distinct classes of cementation. Calcium chloride attracts water, in which it dissolves. The ore absorbs the solution, and on heating the mixture to a relatively low heat, the water of solution is driven off and the mixture is cemented. Further heating causes the $CaCl_2.6H_2O$ to be decomposed to $CaCl_2.2H_2O$, which latter, when heated to a higher degree, causes the mass to become still harder. These cementing tendencies of mixtures containing calcium chloride make it impractical to feed such mixtures to a revolving furnace by the ordinary means.

Slow heating of the mixture often causes other difficulties, such as coating the mineral with an impervious layer and the formation of non-volatile oxychlorides or oxides. With many ores, slow heating causes the chloridizer to be expelled from the mixture before some of the metals have been chloridized, or perhaps before the metal chlorides have been volatilized. I have discussed this subject in a previous article.[1]

Some ores, when heated with chloridizers like sodium or calcium chlorides, cause the chloridizer to be expelled from the charge so rapidly that by the time the ore is heated sufficiently to enable reactions or volatilization to occur to the desired extent, no chloridizer is present or, at least, not sufficient to accomplish the result. Such ores are usually those having a highly siliceous gangue and particularly those siliceous ores containing compounds of silica and alumina, which compounds, for lack of a better definition, I shall refer to as "silicate of alumina." Among the ores mentioned in Table I, ore No. 2 particularly, ore No. 1, and to a lesser extent ore No. 5 were of this type. Such ores also have a tendency to cement, especially when calcium chloride is used with them. Ore No. 1 showed the greatest tendency to cement, and ore No. 5 showed the least.

TABLE I. ANALYSES OF ORES

Ore Number		1	2	3	4	5
Loss on ignition..	total	.....	5.50	.....	.....	1.50
	H_2O	3.27	.....	24.99	13.57	.....
	CO_2	1.73	.....	.....	3.52	.....
"Insoluble".....	total	.....	82.34(a)	.....	10.40	44.80
	SiO_2	62.88	.....	14.00(b)	.....	.....
	Al_2O_3	15.00	.....	.....	.....	.....
	$BaSO_4$	.....	.....	.....	.....	21.50
SO_3		0.68	0.91	0.95	Present	1.35
CaO		0.83	3.65	19.93	1.10	3.25
MgO		Trace	1.43	.....	.....	None
$Fe_2O_3+Al_2O_3$		9.00	3.75	15.00	54.90	12.50
PbO		6.37	1.35	11.63	5.71	Trace
CuO		.....	0.58	1.38	0.25	Trace
Ag_2O		0.013	0.018	0.048	Present	0.014
MnO_2		Trace	0.15	Trace	Present	2.50
ZnO		Trace	Trace	12.07	4.70	6.83
As_2O_3		.....	.....	.....	Present	None
Sb_2O_3		.....	Trace	None	Present	None
Hg		.....	Trace	None	.....	.....
Ni and Co		None	None	None	None	.....
NaCl (water-soluble chlorides)		.....	0.24	.....	.....	Present
Total determined.....		99.77	99.92	100.00	94.15	94.24
Gold, oz. per ton		0.06	0.06	.....	0.41	Trace
Silver, oz. per ton		3.54	5.07	10.86	1.05	4.00
Copper, per cent		.....	0.46	.....	.....	Trace
Lead, per cent		5.9	1.25	10.00	5.3	Trace

(a) Mostly silica and alumina.
(b) Combined with CaO in ore.

In some ores of this type, especially ore No. 1, the silver seems to be locked up in the silica and is in part combined either chemically or mechanically with the "silicate of alumina." The following screen analysis on ore No. 1 proves that the silver is associated with the harder particles of the ore:

SCREEN ANALYSIS, ORE NO. 1

Mesh Product	Weight, per Cent	Assay—Silver, Oz.	Assay—Lead, per Cent
— 10 + 20	39.1	4.52	6.51
— 20 + 30	9.5	4.10	....
— 30 + 60	17.0	3.30	....
— 60 + 100	8.9	2.74	....
—100 + 200	5.6	2.52	....
—200	20.0	2.34	6.0
Loss	0.9		

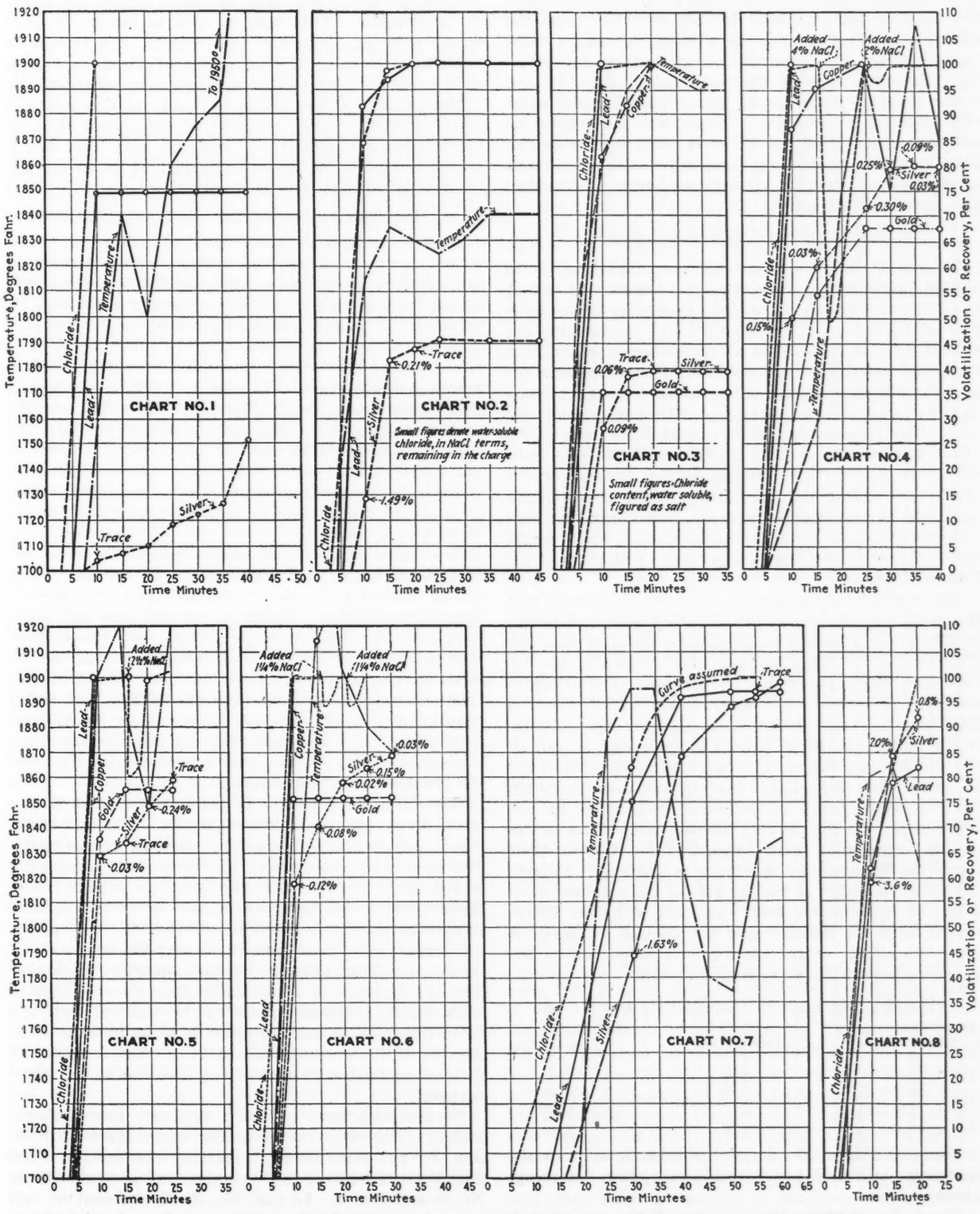
Calculated total assay: 3.594 oz. silver.

*The disclosures made herein are subject to patents allowed, pending and to be applied for by the author.

[1] "Chloridizing Processes," *Min. & Sci. Press*, Jan. 17, 1920.

Examination of the harder particles showed them to be mostly "silicate of alumina." Further proof is available from a concentration test which resulted in a recovery of only 7 per cent of the silver, whereas 66 per cent of the lead and 59 per cent of the gold were recovered. Additional proof is obtained by the fact that no appreciable amount of silver could be extracted by either salt or cyanide leaching, or by chloridizing roasting followed by amalgamation.

Small volatilization tests run in parallel on 200- and on 20-mesh ore gave 6.7 per cent more silver recovery from the 200-mesh ore than from the 20-mesh ore. That



CHARTS TO SHOW THE RESULTS OF THE EXPERIMENTAL WORK ON VARIOUS ORES

the silver may possibly be chemically combined with the "silicate of alumina" is indicated by the fact that 10 per cent more silver was volatilized from a test on a mixture of ore, water, chloridizer, and 1.10 per cent charcoal, heated in a crucible, than was obtained from the same mixture of ore, water, and chloridizer without the charcoal heated at the same time in a roasting dish. (Aluminum chloride forms under reducing conditions, and it is easily volatilized.) The residue from the charcoal test was considerably less than from the other test. The ore was of a sandy structure, with voids between the cemented grains, and cemented easily. Briquets made of the ore, calcium chloride, and water could be charged wet into a heated muffle without breaking or cracking. There was a tendency to sinter at about 1,850 deg. F. when calcium chloride was used and at a much lower temperature when salt was used. Calcium chloride always gave better results than salt in comparative tests.

Silver Held in a Resistant Mineral

To prove that the silver was not locked up in a simple quartz casing I ran two small tests. In test *A* the 20-mesh ore was heated in a muffle for thirty minutes at 1,600 deg. F., then cooled and mixed with the chloridizer. In test *B* the same amount of chloridizer was used and the other conditions were the same except for the preheating. The recovery in test *A* was 41.1 per cent of the silver and 92.2 per cent of the lead. The recovery in test *B* was 48.8 per cent of the silver and 100 per cent of the lead. These tests indicate that nothing could be gained by preheating the ore before adding the chloridizer. They also indicate that lead silicate formed and that the silver was held in a more resistant compound than quartz, which would have cracked at the high temperature and exposed the incased silver.

The rapidity of the expulsion of the chloridizer and the resulting effect upon the silver recovery are shown by Chart No. 1, which is the plotted result of test No. 1 on ore No. 1. This test consisted in mixing the 10-mesh ore thoroughly with 10 per cent of $CaCl_2.2H_2O$ and 10 per cent of water, screening through a ¼-in. square mesh screen, and charging the mixture into a muffle, previously heated to 1,800 deg. F. In all the muffle tests the charges were rabbled occasionally to insure even and quicker heating and even sampling. Samples were taken at intervals designated by the small circles on the charts. In this test, lead silicates or like compounds were formed. The rate of their formation is shown by reference to Table II. Column *A* shows the assays of the samples of the residues when 2 c.c. of hydrofluoric acid was used with the hydrochloric acid for decomposing the sample. Column *B* gives the results on the same sample when run by the usual methods without hydrofluoric acid.

TABLE II. FORMATION OF LEAD SILICATE IN NO. 1 ORE

Time of Treatment in Muffle in Minutes	"A" Lead, per Cent	"B" Lead, per Cent
12	1.65	1.3
17	1.65	0.7
22	1.65	0.1
25	1.65	0.05
32	....	Trace
37	1.65	Trace
42	1.65	Trace

The importance of adding hydrofluoric acid to the lead assay on volatilization residues is often not recognized.

Chart No. 2 shows the results of the second test on the same ore. Test No. 2 consisted in mixing the 10-mesh ore with 16.6 per cent $CaCl_2.2H_2O$ and water, molding the mixture into briquets having the shape of a 1¼-in. cupel, and charging them into a heated muffle. Briquets were removed at intervals for assay. The results also show the rapidity of the expulsion of the chloridizer. The use of a large amount of chloridizer insures the presence of some at least, at a time when the ore has been sufficiently heated to permit the silver to be attacked. This test, as well as others which I have conducted, disproved the common idea that it is necessary, from a chemical point of view, to expose each particle of ore to the oxidizing atmosphere of the furnace gases. It also indicated that it requires a longer time to expel a large quantity of chloridizer than to expel a smaller quantity. Compared with Test No. 1 it clearly shows the benefit to be derived by having the chloridizer present at the proper time.

Rapid Heating Gives Better Comparative Results

Laboratory tests on this ore ground to 20 mesh, mixed with 5 per cent of salt, and heated slowly, as it would be heated in an ordinary revolving furnace, for forty-five minutes at an average temperature of 1,771 deg. F., resulted in a recovery of 67.4 per cent of the lead and 15.9 per cent of the silver. On the other hand, in a large-furnace test with my methods on ore crushed to pass a 4-mesh screen, using about 4 per cent salt, and heating the ore to about 1,650 deg. F. in a few seconds, thence to about 1,770 deg. for about nine minutes, the recovery amounted to over 62 per cent of the silver and about 90 per cent of the lead. The temperatures were, of course, too low to produce a good silver recovery, but the comparison is decidedly favorable for the rapid-heating method.

The temperature in the large-furnace test never exceeded the stated degrees, whereas in the laboratory test it reached 1,850 deg. F. and averaged 1,830 deg. F. for fifteen minutes. Owing to limited time and facilities in conducting the large-furnace test, the furnace was not heated to the desired extent, nor was the desired kind or amount of chloridizer used. I feel certain that otherwise a complete recovery of the lead and a considerably higher recovery of the silver would have been realized. I may add that the large furnace was a green one. The bricks were not thoroughly dry, and the plant had not been adjusted.

Ore No. 2 was a sample of pan-amalgamation tailing which would all pass a 40-mesh screen. The "insoluble" was mostly "silicate of alumina." The silver was partly combined with manganese, and some was apparently locked up in the silicates; the rest was with the lead. Approximately 60 per cent of the silver was soluble in cyanide solution. About 61 per cent of the lead, but no copper, was recovered in twenty-five minutes by means of calcium chloride solution heated to 69 deg. C. The ore sintered at about 1,850 deg. F. when heated with sodium chloride, but showed no signs of sintering when heated with calcium chloride to as high as 1,950 deg. F. This ore cemented so badly that it would be difficult to feed it to a revolving furnace in the usual manner.

Parallel dish tests on No. 2 ore were heated slowly and progressively from a muffle temperature of 1,640 deg. F., five minutes after starting the test, to 1,850 deg. F. at the end of fifty minutes, and are called tests No. 3 and No. 4. In test No. 3, 12 per cent of salt was mixed with the ore, without water. In test No. 4,

12 per cent of $CaCl_2.2H_2O$ was mixed with the ore. Test No. 4 absorbed moisture from the atmosphere prior to placing it in the furnace. The results of these tests are given in Table III.

TABLE III. TESTS NO. 3 AND NO. 4 ON ORE NO. 2

	Weight, per Cent	Gold, Oz.	Silver, Oz.	Copper, per Cent	Lead, per Cent	Chloride, per Cent Water Soluble in Terms of NaCl
Feed.....	100	0.059	5.07	0.46	1.25	...
Residue No. 3...	96½	0.027	2.81	0.07	None	3.05
Residue No. 4...	95½	Lost	1.70	Tr.	None	0.36

The foregoing tests required about fifteen minutes thoroughly to heat the ore to about 1,745 deg. F. This rate of heating is perhaps a little faster than the rate at which it could be heated in a commercial-sized revolving furnace fired at the discharge end. The tests are typical of those showing the advantage of calcium chloride. When compared with the following tests on the same ore, No. 3 and No. 4 show the disadvantage of slow heating and also show that, even with excessively large quantities of chloridizer and longer treatment time, the results with slow heating are not so good as those with quick heating, even when smaller quantities of chloridizer are used in the quick-heating tests.

Chart No. 3 indicates the result of test No. 5 on ore No. 2. In test No. 5 the ore was mixed with 5 per cent of calcium chloride and 5 per cent of water and molded into briquets. These were charged into a muffle having a temperature of 1,800 deg. F. The temperatures on the chart were, in this case, muffle temperatures; obviously the briquets were not heated so quickly as the chart indicates. Briquets were removed periodically for assays. This test clearly demonstrates that no volatilization takes place after the chloridizer has been expelled.

Chart No. 4 indicates the result of test No. 6 on ore No. 2. In this test, the ore was mixed with 1 per cent of salt, 5 per cent of calcium chloride, and 5 per cent of water. The mixture was charged to a heated muffle and sampled periodically. Periodical additions of salt were made to the charge as the test progressed. This test shows the benefit of having a chloridizer present at a certain time and shows the better results over test No. 5, due to more rapid heating.

Chart No. 5 shows the results of test No. 7, made on ore No. 2. Test No. 7 was made on the same mixture as No. 6 but heated a little more rapidly, with smaller additions of salt. This shows the advantage of more rapid heating and also the lack of volatilization when no chloridizer is present.

Chart No. 6 applied to test No. 8 made on ore No. 2. Here the work consisted of mixing the ore with 1 per cent of salt; 6½ per cent of calcium chloride, and 5 per cent of water, and charging the mixture into a heated muffle with periodical additions of salt. This test clearly demonstrates the advantage of quick heating when a fair amount of chloridizer is present the while.

Ore No. 5 acted somewhat similarly to ores No. 1 and No. 2, but the chloridizer was not expelled from its mixtures so rapidly. This ore contained a manganese silver compound, with apparently some silver locked up in the "silicate." It was also a pan-amalgamation tailing. Over 52 per cent of the silver was recovered by treating with hot solutions of magnesium chloride. Tests using concentration, sulphidizing flotation, cyanidation, and combinations of these methods did not produce over 50 per cent recoveries, whereas the first and only chloridizing volatilization tests resulted in nearly 80 per cent recoveries on both tests.

The residues from the cyanide plants in which Tonopah ores were treated acted similarly to ore No. 2 when tested by chloridizing volatilization methods. This ore could probably be treated profitably by chloridizing volatilization, provided silver would remain at $1 per oz.

All of the aforementioned ores (Nos. 1, 2 and 5) are of the "rapid" type; that is, they have the property of rapidly expelling the chloridizer. This property I attribute to the "silicate of alumina," which apparently acts as a catalytic agent. All of them are subject to the troubles already outlined when treated by the usual methods of chloridizing volatilization in revolving kilns fired at the discharge end. The "rapid" type of ores are the most difficult of the oxidized ores to treat. Sulphide ores also cause the rapid expulsion of the chloridizer, owing to the sulphate formed by oxidization.

Ores of a more amenable type are illustrated by No. 3. Such ores have sufficient bases, such as lime or iron, to prevent the extremely rapid expulsion of the chloridizer. Although the chloridizer is quickly expelled from these ores when heated in the manner required to produce commercial results, the chloridizer is not so rapidly expelled as in the treatment of ores of the "rapid" type. However, these ores must be heated quicker than they could be heated by the usual methods to be efficiently treated on a commercial scale. I discussed this type of ore in my article to which previous reference was made.

Calcium Chloride Preferable to Salt

Ore No. 3 is a carbonate ore with most, if not all, of the silica combined with lime. About 14 per cent of the lead was in the form of a sulphate, with traces of sulphide. Cold saturated salt solution dissolved 14 per cent of the lead, whereas hot salt solutions removed 35 per cent. Hot calcium-chloride solutions dissolved 50 per cent of the lead, and hot magnesium-chloride solutions, practically 100 per cent. Only a trace of the silver was soluble in ammonium hydroxide; therefore only a little was in the form of chloride. This ore sintered easily at below 1,850 deg. F. when salt was used. It cemented to some extent with calcium chloride, but not nearly so much as ores Nos. 1, 2, or 5. Numerous parallel tests on this ore resulted in much better recoveries being obtained by the use of calcium chloride than by salt.

Chart No. 7 indicates the results of test No. 8 made on ore No. 3. In this test the 10-mesh ore was mixed with 11 per cent of 4-mesh calcium chloride ($CaCl_2.2H_2O$) and charged into a muffle having a temperature of 1,700 deg. F. Twenty minutes was required to heat the charge to 1,785 deg. F. This test clearly showed the retarding power of calcium carbonate on the rate of expulsion of the chloridizer.

Chart No. 8 shows the result of test No. 9 on the same ore. The 10-mesh ore was mixed with 9 per cent of ¼-in. calcium chloride and charged into a muffle having a temperature of 1,845 deg. F. The ore was thoroughly heated to 1,735 deg. F. in five minutes. This test, although run at a disadvantage when compared to test No. 8, because of the amount of chloridizer used and its mixture with the ore, clearly demonstrated the advantage of rapid heating and that the rate of volatilization diminishes as the amount of chloridizer present diminishes. This test showed also that the volatilization takes place as quickly as the ore can be heated. No zinc was volatilized.

The old residues resulting from the chlorination treatment of Mother Lode concentrates act similar to ore No. 3. Excellent results can be obtained on this material by my methods.

Ore No. 4, an earthy ore consisting mostly of iron oxides, may be called a "slow" type. Most of the iron is in the form of hydrated oxide. This ore does not sinter when heated to as high as 1,950 deg. F. with calcium chloride; neither does it cake or cement when mixed with this reagent. Complete volatilization of the gold and lead was obtained when quickly heated to a high heat, but only 71 per cent of the silver was volatilized. The recovery of the silver was retarded more than that of the gold and lead when slower heating was attempted. I did not run any slow-heating experiments comparable with the rate in a revolving furnace. The indications of my test were that the best recoveries would be obtained by rapid, or at least quick, heating. This ore is well suited to chloridizing volatilization methods, and I understand that the U. S. Bureau of Mines conducted a number of tests on it, not, however, securing as high recoveries as I was able to obtain.

Gold chloride, as is well known, is decomposed first to oxide, and then to metallic gold by heat. In the tests mentioned (see charts Nos. 3, 4, 5, and 6) the lack of a chloridizing atmosphere would certainly result in the decomposition of gold chloride. Tests Nos. 3, 4, 5, and 6 clearly prove that no gold was volatilized after the chloridizer was expelled, and they indicate that gold requires a stronger chloridizing atmosphere than does silver. It is possible, however, that the lack of water vapor may have had some bearing on the result.

Direct tests on copper chloride showed that copper oxide forms to an appreciable extent when volatilization is attempted in a dry atmosphere free from chlorine. In the early stages of my chloridizing volatilization work I made some direct tests on chlorides of copper, gold, silver, and lead, as well as on other chlorides. A test made with silver chloride, placed in a porcelain crucible and heated in a muffle, indicated that it could be decomposed by heat, a probability which I have not confirmed. At 1,530 deg. F. some fumes were visible. The volume of the fumes increased as the temperature was raised. At 1,717 deg. F. the test was fuming fairly strongly and some beads of metallic silver were forming. The rate of evaporation was slow, however, when compared with lead or copper chlorides.

Two grams of pure lead chloride was placed in a porcelain crucible just large enough to hold it and the test heated in a muffle to about 1,700 deg. F. After less than five minutes' volatilization, no lead chloride remained, but a small amount of non-volatile residue was left. A test with copper chloride was run at the same time in the same manner. All of the copper chloride, with the exception of a little copper oxide remaining, was volatilized in less than five minutes. The foregoing experiments indicate that a chloridizing atmosphere should be present while silver and copper chlorides are being volatilized. Further studies have shown that lead chloride can be decomposed, by heating in air, to chlorine and lead oxychloride.

These and other tests prove that the quicker the ore can be heated in the presence of a chloridizer, the quicker and the better the volatilization; that when once the ore is heated and the chloridizer expelled, further additions of the chloridizer have no effect upon remaining metals such as gold; and they indicate that the rate and extent of volatilization are not so rapid or complete when additions of chloridizers are made after the mixture has been heated to a high heat as when the chloridizer is present during the heating of the ore.

I have purposely omitted a discussion of the effect of water vapor, to avoid confusion. This subject was freely discussed in one of my previous publications, already mentioned.

Primary Considerations in Designing a Commerical Plant

When engaged to design a plant for experimenting with ore No. 1 on a large scale, I had to consider the following points:

1. The plant should be of sufficient size to insure that all of the methods to be used therein could be duplicated in a larger plant.
2. The ore should be heated quickly.
3. A chloridizer must be present when and where needed.
4. Calcium chloride will produce better results than sodium chloride.
5. The chloridizer must be cheaply recovered.
6. The fuel requirement must be reduced to a minimum.
7. A furnace in which cementing would interfere must not be used.
8. Water vapor should be present.
9. The furnace should be continuously fed and as nearly automatic as practicable.
10. The furnace should be of a design to allow the possible treatment of high-grade ore after experimental work on the low-grade ores had been completed.
11. I was ordered so to design the plant that its initial cost would be a minimum, even though the plant would have to be torn down and rebuilt after first trials.
12. The furnace and plant operations would have to be simple, because only inexperienced men would be available.
13. Costs must be as low as consistent with low-grade ore and expensive labor and materials.

The accompanying sketch of a fifteen-ton experimental chloridizing volatilization furnace shows the furnace which I designed to fulfill these conditions. This furnace was erected last winter under my supervision. The test referred to before as a large-furnace test was made in this furnace.

The feed screw is driven by cone pulleys. The screw also acts as a drive, through gears, not shown, to the distributor—a revolving perforated plate. (Where ore is ground in solution the distributor would consist of a screw and perforated plate closely resembling a meat chopper. This would feed the thickened pulp or cake into the furnace in the form of a number of thin streams). A spray device is installed in the tube below the distributor. Heating is done by means of a large burner as shown. The sloping base acts as a chute for conveying the charge into the short revolving furnace to which the vertical shaft is connected. The revolving furnace is kept hot by means of a small burner at the discharge end. The gases were removed from the top of the vertical shaft, the residual ore being removed from the discharge end of the revolving furnace.

The distributor fed the ore in a number of small streams throughout the area of the tube. The spray device wetted the ore with chloridizer solution as the ore passed through the spray. A little below the spray

device the tube was hot enough to vaporize some of the water of the chloride solution, this vapor then ascending the tube and condensing on the cold ore. These vapors, as well as the spray, agglomerated the dust of the ore into little balls, thus eliminating all dust in the flue gases. This is a valuable method of preventing dusting.

About the time the ore, chloridizer, and water reach the end of the tube, most of the water is vaporized and passes to the flue on the outside of the tube. At a few feet below the tube the chloridizing atmosphere surrounds the ore, and volatilization begins, the gases ascending the furnace toward the flue while the ore descends. The reactions and volatilization become much more rapid as the ore descends, finally falling out of the flame to the bottom of the shaft furnace. Before the ore reaches the bottom, most of the chloridizer has been vaporized or decomposed and ascends through and surrounds the downcoming ore. Most of the lead and silver, if not all, are volatilized by the time the charge reaches the bottom. The ore has then lost all tendency to cement, and it slides or rolls down the chute-like bottom into the short revolving furnace. This latter acts as a good discharging device, and would prove serviceable for prolonging the heat treatment of the ore if necessary. Any volatilization not completed in the shaft furnace is completed in the revolving furnace, provision being made for varying the time consumed in passing through the latter. In the test, nine minutes was consumed. The ore is then discharged through a small hopper, a counter-balanced gate being provided which discharges the residual ore when sufficient has accumulated to open it. Chloridizers can be added at any point along the path traveled by the ore.

In the test the little balls of dust retained their shape throughout the process. Seeing them in the revolving furnace caused me to suspect sintering, but examination of them proved otherwise.

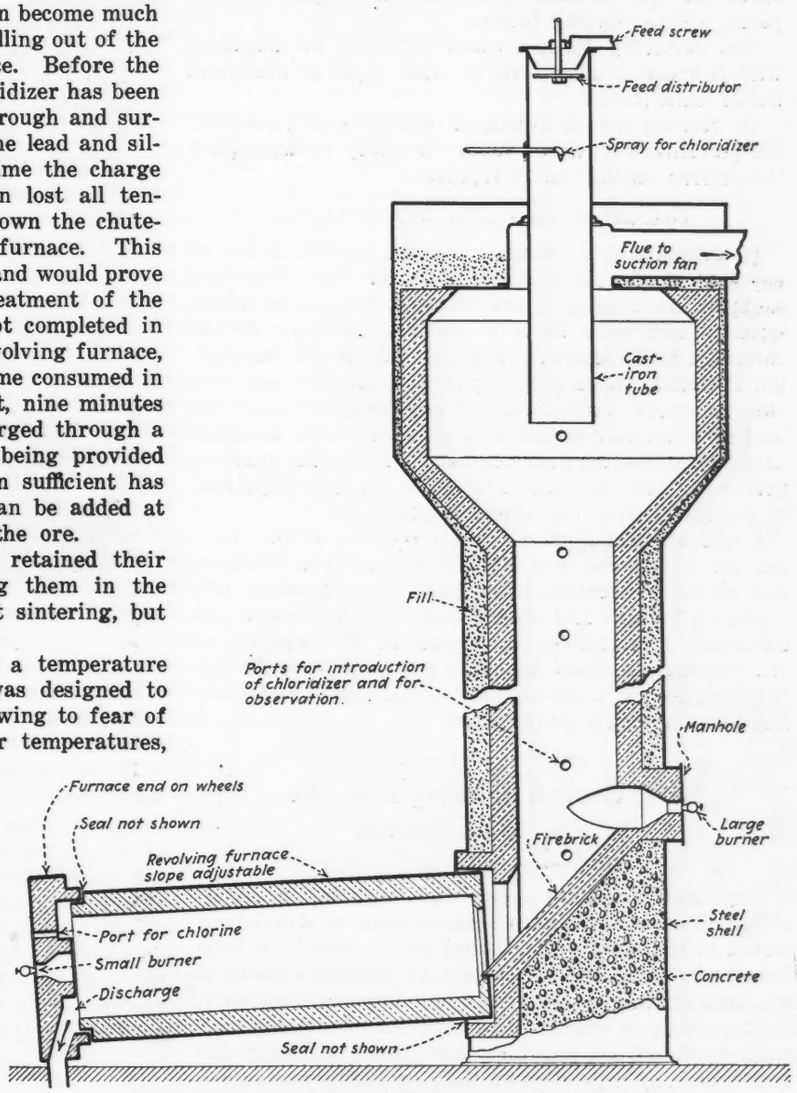
The furnace gases were emitted at a temperature of about 300 deg. F. The furnace was designed to let them go off at about 500 deg. F., owing to fear of condensation of lead chloride at lower temperatures, but, owing to lack of time, I could not heat the furnace properly before adding the ore. The indications were that the height of the furnace could be increased and the temperature of the discharged gases reduced thereby to about 300 deg. F. without danger of loss due to the precipitation of chlorides in the furnace. A low temperature of the gases assures low fuel consumption.

The gases passed through the flue to a fan which delivered them to the bases of towers filled with broken limestone. A spray of weak chloride solution was provided at the top of the towers. The ascending gases, on meeting the descending solutions and on contact with the limestone, were cleansed of their suspended metal chlorides and freed of their hydrochloric acid and chlorine vapors, which combined with the calcium of the limestone to form calcium chlorides. The valuable chloride solutions were drawn off from the bases of the towers while the gases, free of valuable constituents and chlorine compounds, escaped to the air at the top of the towers. During the test there was no measurable escape of either fume or chlorine from the towers; and consequently the recovery of both was complete. The solution, after removal of the metals which it is desired to recover, is sent to the spray device at the top of the furnace to treat other ore.

Conclusions From Large-Scale Test

No troubles occurred during the test which could not easily have been overcome by simple adjustments; such are naturally expected in any new plant, especially a new plant using a recently invented process.

The only plant trouble of importance was due to the back pressure of the limestone towers, which, owing to the limestone containing more fines when crushed



GENERAL DESIGN OF FIFTEEN-TON CHLORIDIZING VOLATILIZATION FURNACE

than I had looked for, was twice the amount I had expected. This could have been overcome at the expense of forty-eight man-hours' time expended in rescreening the limestone.

The fuel consumed during the trial was 10 per cent more than my calculations, but as I was using more fuel than would be necessary after the furnace had been dried and thoroughly heated, I believe that the normal fuel consumption will be considerably less than I had assumed.

This type of furnace will permit the treatment of ores containing considerable sulphur, as the chloridizer

need not be added until after much of the sulphur has been oxidized. It will also permit of the treatment of ores rich in lead, because most of the lead will be volatilized before the heated ore can come in contact with the walls of the furnace; therefore there would be little danger due to sintering.

The heat balance of this furnace is almost ideal. The novel method of dust prevention helps to make the furnace practical, although with my method of recovering the fume the dust would not be a serious item. Baghouses or electrostatic collectors could be used to recover the fume if desired, but they are expensive compared with scrubbing towers.

The revolving furnace could no doubt be dispensed with in treating some ores, or other types of discharge device substituted.

By feeding the chloridizer in the form of a solution, the percentage of water vapor necessary to accomplish the desired results can be regulated.

Operating Loss and Plant Costs

In estimating, I usually assume a loss of about 10 per cent of the amount of chloridizer fed. This loss could be made up with salt fed with the ore or otherwise. Small tests show a complete recovery of the chloridizer. In starting a plant, salt would be used, but it would gradually be replaced by the calcium chloride recovered. When electrolytic precipitation of the lead or other heavy metals is practiced with insoluble anodes, the chlorine produced can be fed to the furnace, preferably near the base or toward the discharge end, to replace in part the other chlorides.

I estimate that a plant to treat 100 tons of the No. 2 ore per day would cost $24,000 without the building, and the cost of treatment would amount to $1.20 per ton, including freight and selling costs of the bullion but excluding depreciation. Inasmuch as the capacity of the furnace increases as the square of its diameter, it is obvious that a 100-ton plant would cost considerably less per ton than a 50-ton plant.

Swift Growth of Manganese Ore

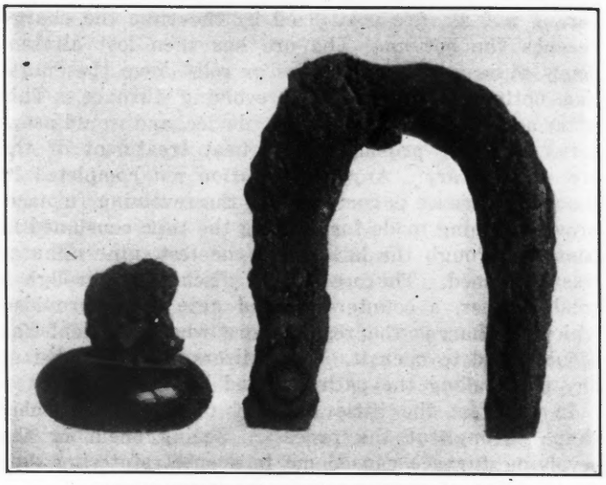
By A. K. Knickerbocker

Written for *Engineering and Mining Journal*

Engineers who have spent much time in the Batesville, Arkansas, manganese district have no doubt been struck by the number of old-time miners who have tales to tell of the marked enrichment or impoverishment of ore streaks and channels during what are, relatively, brief periods of time. Some of these men have been mining, off and on, for thirty-five years. As their success is entirely dependent on their own ability to search for ore and successfully follow it, they have developed an intimate knowledge of the various properties and workings.

An example is the story of the two men who, at the time of the closing down of a property twenty to twenty-five years ago, left a breast of good ore, marked their timbers so they would be able to identify the place, and caved the drift and shaft to prevent others at any time from having access to it. During the war these men thought of this place, sunk a new shaft, and, drifting in, discovered their old marked timbers and tools just as they had left them. The old breast, however, was now so poor in grade it did not pay to work it. Such stories are heard frequently, and tales of enrichment of barren clays to clays of merchantable value in the space that is covered by a man's normal working lifetime are just as common.

The deposits are, as is well known, derived from the decomposition of limestones and shales, and lie in pockets and channels in or disseminated through the residual clays derived from these rocks. That migration, concentration, and reconcentration are going on at the present time is beyond doubt, but it is somewhat startling to be confronted with evidence that these changes take place in what is, geologically, so short a time. I have been inclined to take such stories with some allowance, believing these Ozark hill-dwellers may be something as Mark Twain once described himself to his biographer, Paine: "I used to remember everything, whether it happened or not; now I am growing old, and soon I shall remember only the latter."



DEPOSITIONS OF MANGANESE ON IRON

That movement of ore does take place and concentration ensue under favorable circumstances in a short time is evidenced by the horseshoe and doorknob shown in the accompanying photograph. These articles were picked up some time ago, on a property near Cushman, after having been buried under a few inches of soil in the place where they were thrown probably not over fifteen or twenty years ago. Though the metallic iron no doubt exercised a potent influence in the ore deposition, this factor is more than balanced by the unfavorable, nearly barren clay in which the articles lay, and by the extremely thin covering of soil. The analysis of the ore accretions is shown in the accompanying table:

	Per Cent
Iron	20.86
Manganese	29.75
Combined metals	50.61
Silica	6.64
Alumina	3.73

The ore accretions would have run higher in manganese and lower in iron had it been possible to remove the accretions without vitiating the sample with more or less iron rust. Even so, they represent a good grade of manganiferous iron ore.

The photograph shows plainly the accretions, ore particles, and crystals, and is interesting as evidence that possibly some of the processes that have been associated with long periods of time may take place in a comparatively brief period.

The Eubœan Magnesite Field

A Description of Deposits and Operations on the Island of Eubœa, Greece—Economic Geology—Labor Supply And Climate—Information for Prospective Travelers

BY HARRY C. BOYDELL
Written for *Engineering and Mining Journal*

IN ADDITION to its unequaled emery, Greece provides from the island of Eubœa the world's purest magnesite. Eubœa lies west of the mainland and is separated from it at Chalkis, the largest town (population 8,000), by the Canal de l'Euripe only, which here, where it joins the Canal d'Atalanti, is not more than 150 ft. wide and is crossed by a bridge.

The magnesite area is north of the middle of the island and is reached by taking a train from Athens to Chalkis, a distance of 60 km., and then either the steamer to Limni or the road to Mantoudi, the latter being 60 km. from Chalkis. There is also a road between Limni and Mantoudi. Compared to some of those on the mainland, the roads in Eubœa are good, though this must be accepted in its relative sense by the prospective visitor.

The rail journey from Athens is uninteresting, but the trip from Chalkis to Limni by the small steamer, which takes two or three hours, is pleasant, and the road from Chalkis to Mantoudi passes through country that is rugged and picturesque. Eubœa is not rich in antiquities, but on the Ægean coast, in the magnesite area, there is the site of the ancient city of Kerinthos, at Mantoudi the vestiges of a Byzantine church, and at Chalkis, besides some classical ruins, the comparatively recent Turkish fort of Kara Baba.

MAGNESITE OCCURS IN SERPENTINE BELT

The magnesite field is included in a belt of serpentine, about 18 km. long, stretching from Limni, on the Canal d'Atalanti to the west, to Kymassi, on the Ægean coast to the east. The width of the belt is about 5 km. on the west side and 7 km. on the east, but is less in the middle.

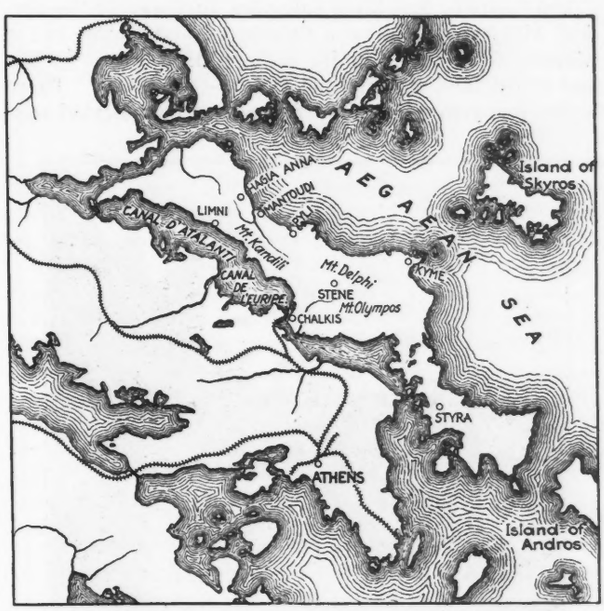
With regard to the geology, it will suffice to say that the magnesite occurs in serpentine which is intrusive into limestones of Cretaceous age, and is overlain in parts by a Tertiary covering of conglomerates, marls, and marly limestones. This serpentine area is the most fertile and best watered in the island, and forms a pleasing contrast in this respect with the typical "Karst" appearance of much of the surrounding country. The serpentine has been derived from the alteration of original peridotite, which consisted chiefly of olivine and bronzite (enstatite), two minerals rich in magnesia.

The highest ground in the vicinity is Mount Kandili (2,700 ft.) to the southwest, and Mount Mavrovouni (3,400 ft.) to the southeast, with Mount Delphi (5,250 ft.), the highest peak in the island, still further south. Generally speaking, the serpentine hills and ridges are well dissected by deep gullies, and the country is suitable for mining by adits.

MAGNESITE IN EUBŒA FIRST MINED NEAR MANTOUDI

The best-known magnesite deposits are those of Mantoudi, Daphnopotamous, Limni, Pyli, Afrati, and Hagia Anna. Work at Mantoudi is carried on by the Société Financière de Grèce, a Greek company with head offices in Athens. Operations are also carried on at Koofala (connected by aërial ropeway with the main works), and at Geroremma, in the same neighborhood, and also near Limni. The total area of the concession is 30,000 *stremmata* (1 *stremmata* = 100 sq.m.). The company's plant and offices are 1½ km. from Mantoudi and 2½ km. from Kymassi, the shipping point. It was on this property that magnesite was first mined in Eubœa, about forty-five years ago.

The main deposit is 1,800 ft. long and has a width in one part of 130 ft., though this dimension varies greatly, thus giving to the orebody the form of a series of connected lenses. It constitutes the largest known body of magnesite in Eubœa, the only other that can be compared with it being the Kakabos deposit. The strike is 10 deg. west of north with a dip of 35 deg. to the northeast.



MAP OF THE ISLAND OF EUBŒA, GREECE

MINING BY PILLAR AND FILL METHOD

The mine has been opened up by adits down to No. 7 level, below which a shaft has been sunk to No. 8, which is between 300 and 350 ft. vertical below the outcrop. The method of working adopted is by pillars and filling, the pillars being ultimately reclaimed. At the time of my visit, the filling in the old workings was being worked, and much magnesite recovered from it that had been carelessly buried in former years. In all, 1,500,000 tons of mineral has been mined, and at No. 7 level (No. 8 has been under water since the war), the deposit shows little indication of decrease in size.

No branch veins, similar to those at Daphnopotamous, have been found, and no faults are recorded, though it is likely, in my opinion, that some of the so-called irregularities of the deposit are due to faults that have not been recognized as such.

Hand Picking and Chipping Necessary to Remove Serpentine

The foot wall is generally well defined, but the hanging wall is very irregular. The deposit is by no means all pure magnesite, but contains numerous inclusions of serpentine of all sizes and in all stages of replacement. As only the purest mineral is of value, the serpentine is separated underground and used as filling. Hand drilling—that is, single jacking—is used. The only ore dressing practiced is hand picking and chipping to remove attached pieces of serpentine, this work being done by women of all ages.

A well-built narrow-gage line connects the mine with the works and the latter with Kymassi. Locomotives of the Decauville type haul side-dumping cars of one-ton capacity.

The company has three calcining furnaces of the vertical kiln type, holding a charge of sixty tons, crude mineral, fired with lignite and yielding seven to ten tons of calcined material per twenty-four hours. There is also one rotary gas-fired furnace of complicated con-

MAGNESITE OUTCROP ON COMMUNITY CONCESSION, AT LIMNI

struction for the calcination of fine material. At one time a good quality of refractory briquets was made at the plant, but this has been discontinued since the war.

Wages average 12 *drachmas* per day for miners. The contract price for drifts is from 100 to 140 *drachmas* per meter (in August, 1921, $1 was worth 18 *drachmas*) and that for shaft sinking (size 2 m. square) from 200 to 250 *drachmas* per meter, two men in such a shaft making a progress of from 15 to 25 cm. per shift of nine hours. Winzes cost about the same. Crosscuts and drifts in mineral require close timbering in most places, the cost averaging at present 1 *drachma* per meter. The timber used (local pine) decays rapidly, and impregnation might be tried with advantage.

The total number of hands employed in April was 180, with twenty more at Koofala and thirty at Gero-

STOCKPILE AND WORKERS AT DAPHNOPOTAMOUS

remma. In addition to its magnesite mine, the Société Financière de Grèce also owns a lignite deposit at Kumi, 50 km. to the south, from which it gets fuel for calcination purposes.

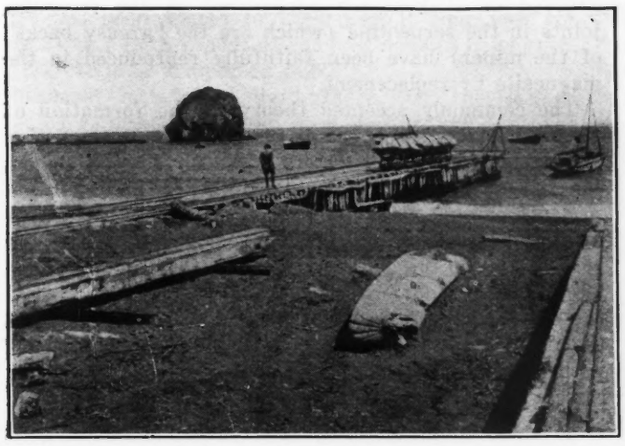
Purest Magnesite at Daphnopotamous

Daphnopotamous, which is really the name of a small stream, is also the name given to the magnesite workings near its mouth. The concession has an area of 1,500 *stremmata* and lies to the east of the Société Financière, about 5 km. from Mantoudi and 3 km. from Kymassi, south along the coast. It is controlled by A. Decilas and D. Papastratis.

The deposit outcrops along the east side of a ridge, and has been worked by open cuts and workings of a primitive kind for 1,500 ft. along the strike, which is 15 deg. east of north, with a steep dip to the east. There is an average width of 4 to 5 ft. of magnesite, which contains the usual inclusions of serpentine. The foot wall is well marked, but the hanging wall is very irregular.

Situated more or less perpendicular to and on the foot-wall side of the main deposit, but some distance from it, on the western side of the ridge, are a large number of veins of magnesite. These have a width of a few feet, a strike more or less at right angles to the main deposit, and dip either north or south. So far as they have been exploited, the magnesite in them is of irregular occurrence, and the workings have not been carried to their junctions with the main deposit, if such actually exist.

Daphnapotamous magnesite is of a high degree of purity and has the reputation locally of being the purest produced. It shows no sign of exhaustion at 60 ft. below the outcrop, the lowest point yet attained. The main workings are situated 450 ft. above sea level, and the magnesite is conveyed down hill by two aërial ropeways of home-made but effective construction. The stockpile is at the beach, shipment being effected by means of small, wooden lighters. Methods, working



ROADSTEAD OF KYMASSI WITH JETTY AND LIGHTERS (IN DISTANCE) OF SOCIÉTÉ FINANCIERE DE GRECE

conditions, and wages are much the same as at Mantoudi. About fifty men, women, boys, and girls are employed, and the output at present is 5,000 tons per year.

English Company Operating at Limni

The most important operations at Limni are carried on by the Anglo-Greek Magnesite Co., an English corporation with head offices in London. The concession, which has an area of about 5,000 acres, is called Galataki, after the convent situated near by which acts for the Greek government as custodian of the lands in the vicinity, a function common to many convents in the country. The company was incorporated in 1902, and has operated with profitable results. Its calcining plant, engineering shops, electric generating plant, and offices are situated on the Canal d'Atalanti, about 4 km. south of Limni. The mine workings are on the opposite side of a ridge that runs parallel to the coast, and are connected with the calcining plant and stockpile by an aërial ropeway about 5 km. long, as well as a narrow-gage railway with Decauville equipment.

The magnesite outcrops are scattered over a considerable area, but at the present time operation is confined mainly to deposits at Archangelos and Kakabos. The former is of irregular form, showing no semblance of walls, the magnesite merging imperceptibly into the serpentine along no general direction. The mineral is of the usual massive kind, with inclusions of serpentine of all sizes. It has undergone post-mineral fracturing, apparently without dislocation, with the result that surface waters have introduced lime-bearing minerals. In consequence of this, the lime content of the magnesite is higher than usual, and at the beginning of June work was about to be temporarily abandoned here on that account.

Kakabos Deposit Second Largest in Eubœa

The Kakabos deposit is, next to that of the Société Financière de Grèce at Mantoudi, the largest in Eubœa. In the past, mineral was obtained from an open cut whose dimensions (1,500 ft. long, 100 ft. wide and 50 ft. deep) bear evidence to the amount extracted. As the workings have gone deeper, real mining methods have had to be adopted, and at present all the magnesite is got from underground workings served by an incline shaft. The width in some places is as much as 90 ft., though this is not necessarily all magnesite, there being numerous and often large inclusions of serpentine.

The mineral is not continuous along the strike, but, as usual, forms a series of lenses more or less connected. The interval between one of these and the next showed, along the prospecting drift, a well-marked wall bearing signs of movement and carrying a light creamy-colored gouge of the consistency of very soft clay.

The foot wall is generally well defined, but in most places there is no definite hanging wall. Mining has been carried on to a depth of about 120 ft. below the outcrop without the size of the deposit becoming sensibly less. The method of working is by pillars and filling, the pillars being reclaimed afterward. The company makes use of a few rock drills in its open workings, jackhammers, of the Hardy Patent Pick Co.'s make, being used. They are driven by steam generated in disused locomotives.

The calcining furnaces are of several types, some of the old kiln form, some with mechanical arrangement for moving the charge, and include two gas-fired furnaces, one of which has a Morgan's producer. British coal is used, and in the most efficient type fuel consumption has been cut down to 18 per cent of the magnesite calcined. The kilns deliver on to picking belts, from which incompletely calcined material is separated and returned to the furnaces.

Workers Paid Partly in Bread

Conditions of work, contract prices, and wages are much the same as at Mantoudi, but the company pays partly in the form of bread, providing a better article at a lower price than can be obtained at the local bakers.

Close to the village of Trupi, and south of the Anglo-Greek boundary, near to the foot of Mount Kandili, is a large outcrop of magnesite that has a north-and-south strike and can be traced on the surface for some distance.

Adjoining the Anglo-Greek concession on the north is one which, previously held by Mr. Limbriadarious, has been recently acquired by a Dutch proprietorship. In June two calcining furnaces were being erected, but no other work was going on. An aërial ropeway conveys the magnesite from the top of the ridge to the shore.

DAPHNOPOTAMOUS, EUBŒA, FROM MINE. STOCKPILE ON BEACH IN FOREGROUND

Still further to the north lies a concession which, having had several holders in the past, now has its mining rights vested in the Community of Limni. This area contains numerous outcrops, the most promising of which, having a general strike of north 60 deg. east, a southeasterly dip, and showing a width of 50 ft., where surface workings have exposed it in one place, is visible for a considerable distance.

Pyli, Afrati, and Hagia Anna

Pyli is situated at the southeastern corner of the main serpentine area. Mining work is carried on by the Anglo-Greek company and Messrs. Raphael and Dapien, the former employing about seventy workers. I was informed by the manager of the former company that the magnesite occurred very irregularly.

At Afrati, in a small isolated serpentine outcrop in limestone, situated near Chalkis, the Anglo-Greek company, employing about 100 hands, is working a magnesite deposit which it is said resembles the deposits of other parts of the island. Near by, at Yerakeri, the Dutch proprietorship operating at Limni is working on a small scale.

Hagia Anna, which, as was the case with Pyli and Afrati, I did not visit, lies north of Mantoudi, the magnesite occurring in an outlying serpentine outcrop. Development work has been done by which it is claimed that a large quantity of mineral has been made available. The average width of the deposit is said to be 6 ft. The shipping point is Xeropotamous.

Quite outside of Eubœa, and situated near the town of Atalanti, in Lokris, on the mainland opposite Limni, and occurring in one of a number of serpentine outcrops in that region, is the magnesite deposit of Skender Agha. Mineral has been shipped from here in the past, but no work is being done at present.

Magnesite Deposited by Replacement

The magnesite does not occur generally throughout the serpentine, but has been deposited by replacement along fault or shear lines in that rock, which are generally parallel to lines of major faulting represented by the Ægean coast line on the east and the Canal d'Atalanti on the west. There is also a well-recognized direction of faulting roughly perpendicular to the preceding. The deposits can be divided into the following three classes:

1. Those with a general strike about 10 deg. east or west of north and a dip that is usually easterly. These are the most important as a rule.
2. Those with a strike approximately at right angles to that of (1), with a dip that may be north or south.
3. Those in which the magnesite has been deposited in veinlets through a large mass of serpentine so that a stockwork of the mineral has been formed. These deposits are not workable.

The deposits generally are characterized by the following:

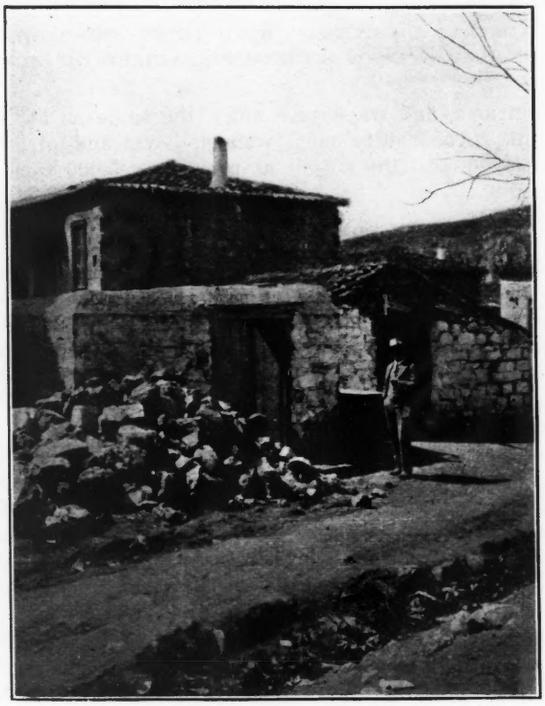
(*a*) An irregularity of the hanging wall, and consequently of width, which gives, to one and the same deposit, the appearance of a series of connected lenses.

(*b*) The presence of inclusions of serpentine in the magnesite, which are always rounded, never sharp or angular.

(*c*) The magnesite is always dense, not spongy or vesicular, and cavities of all kinds are absent.

All of these are indications of replacement. A peculiar feature is that the smooth, greasy, and often grooved or slickensided appearance of the irregular joints in the serpentine (which are the "greasy backs" of the miner) have been faithfully reproduced in the magnesite by replacement.

The commonly accepted theory of the formation of magnesite from serpentine is that it is due to the action of percolating meteoric waters in the surfaces or shallow zone. This gives to the magnesite a possible extension in depth of only a few hundred feet at most. The lowest point attained, on the Eubœan field, up to the present, is in the mine of the Société Financière de Grèce at Mantoudi, where, at No. 7 level, 225 ft. below the outcrop, but little apparent decrease in the size of the deposit is noticeable. The amount of water met with in underground work is not large and most of it comes down from open workings along the outcrop.



A TYPICAL GREEK HOUSE AT MANTOUDI, EUBŒA

At Mantoudi, where the No. 8 level is flooded at present, the volume of water is small.

Usually, Eubœan magnesite is described as being amorphous, but micro- or crypto-crystalline would be the better term to use. It is generally pure white, but is sometimes slightly green or red or yellow, due to admixture of serpentine or ferruginous material derived from it. The hardness ranges from 3.5 to 4.5, but where more than the usual amount of lime is present the mineral becomes softer. Greater hardness, on the other hand, shows a higher silica content. The magnesite as shipped is generally guaranteed to have a minimum of 94 per cent of magnesium carbonate and quite commonly contains 96 to 97.5 per cent of it.

Entire Product of Mines Exported

All the mineral mined is exported, none being used in Greece. It is shipped either crude or calcined. Of the latter, there are two grades: (*a*) Caustic burned or plastic magnesite which has been heated to a temperature of about 800 deg. C. and absorbs CO_2 from the air; and (*b*) dead burned, sintered or ferromagnesite,

which has been heated to 1,500 deg. C. and does not absorb CO_2. Both grades of calcined have to be bagged, but the crude is shipped in bulk.

Shipment is affected by lighters. On the Ægean coast of Eubœa there is no good harbor, and the open roadsteads available are too exposed to permit of wharves being erected. With the present arrangements at Daphnopotamous, where the ship lies about 400 ft. from the beach, 220 tons can be loaded in nine hours. At Kymassi, with 800 ft. between ship and shore, 300 tons can be loaded in the same time. At Galateki (Anglo-Greek) it is said that as much as 1,000 tons has been loaded in a day, but 500 tons is nearer the average.

At present, owing to the fact that so many men are serving in the army, the labor supply is short, this applying particularly to experienced miners. Much of the surface work is done by women, but not, it must be said, with efficiency, there being a marked tendency on their part to substitute small baskets (carried on the shoulder) for wheelbarrows and hands for shovels.

A feature of working in Greece generally is the large number of holidays (saints' days), which are so numerous that there remain not more than 250 working days in the year. Incidentally, it may be mentioned that there are no birthdays, individuals celebrating their "name day" on the day of the saint whose name they bear. Thus, all the Georges celebrate their name day on St. George's day. Whether a man with a double-barreled name like George James would celebrate two name days, I do not know, and, in any case, double-barreled names are not common in Greece.

Boundaries of Concessions Often Vague

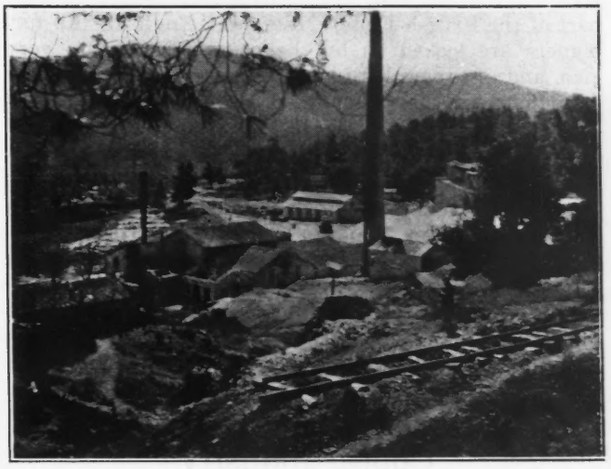
Mining concessions are granted by the Greek government, but, owing to the backward state of the survey (the major triangulation not being completed), the boundaries are not marked by monuments but by reference to some local feature, such as a hill. As the names of these are by no means certain, boundaries are likely to be a little elastic, and visits of inquiry and confirmation by government officials are made. During one of these, recently held at Limni, witnesses ninety years old were produced to testify to certain landmarks. It would seem that Greece had, in this direction at least, set an example to other countries in providing legitimate occupations for its oldest local inhabitants. Whether they are more reliable than the oldest inhabitants elsewhere in reference to old mines, I do not know, but I hope so.

Eubœa being situated between parallels 38 deg. and 39 deg. of latitude, and the air being very clear, the summer is hot, days when the temperature is 90 deg. or over being common. Usually, however, movement of the air provides relief in the shade. At Mantoudi there is a little malarial fever in August, but not much. In winter, although there is no snow in the lower lying country and but little frost, the northeast wind that prevails from October to March is penetratingly cold. Warm bed clothing is necessary for most of the year, as the nights are cold even in spring and autumn.

Traveler Should Provide His Own Comforts

Greece and its conditions not being well known, a few words as a result of my recent experience there may be useful to future visiting engineers and geologists. Outside the larger towns (and there are few of those), acceptable hotel accommodations are not to be had. Rooms of sorts may be got, but the beds are always suspect, Grecian vermin being both ubiquitous and extremely aggressive. So much is this the case that I am inclined to regard them as the most energetic inhabitants of the country. For this reason it is advisable to take sleeping bags when going into the country districts.

The cafés, which are to be found even in the smallest villages, provide nothing more than Turkish coffee served as demi-tasse and often very thick. Meals can be obtained in some places, but for a stay of more than a few days, to avoid the feeling of never having what he likes to eat, the visitor is advised to take food with him and to be prepared to do his own cooking in order to have it to his taste.



PLANT OF SOCIÉTÉ FINANCIERE DE GRECE AT MANTOUDI, EUBŒA

Meat, bread (black), chickens and *giaourti* are nearly always obtainable. The latter, a Turkish dish made from goat's milk, resembles junket with the fermentation carried further, and is very palatable to most people. Much the same article, but made from cow's milk, is the so-called "Bulgarian sour milk." The meat is usually immature kid or lamb, and like the Chicago hog, practically every part of the beast is used except the bleat. Fish is fairly plentiful on the coast and is often very good, though local favorite varieties, such as octopus, are not likely to suit the visitor.

Wine is always obtainable, but is the native *retsina*, which is made by adding resin (got from local pine trees) to new wine for preservation purposes, and it has a taste something between turpentine and preserved ginger. A little time is required to get used to it. Wa'er is scarce in Greece, but is always obtainable near villages, and, being commonly from springs or mountain streams, is good.

Animal Transportation Main Reliance

But few of the roads are suitable for automobiles, and the usual means of getting about in the country districts is by mules. For much riding, it is advisable to take a proper riding saddle, as anyone who has had the painful experience of a long day's riding on a pack saddle will readily understand. The general charge for a mule and guide at present is 20 to 25 *drachmas* per day. If required for any length of time it would be better and cheaper to buy animals and sell them again when finished with them.

The difficulty of language may give some trouble at

first, but the few words needed to satisfy human requirements are soon picked up, and these, combined with suitable signs, a firm attitude, and fair dealing, will suffice in most cases. French is not spoken by the peasants, though it is the *lingua franca* in Athens and the larger towns.

Telegrams can be sent in English from most country post offices, and in nearly all villages will be found returned natives who, having lived in America or some part of the British Empire, can speak English. All foreigners are looked on by the peasants as being very rich, and are regarded in consequence as fair game for extortion; on this account, therefore, most prices or demands can be reduced by bargaining. An air of indifference, too, tends to curb the same tendency.

In conclusion, I would add that it is always advisable for the visitor to give personal attention, before starting in the morning, and also at other times, to his automobile, mule, saddle, equipment and all details generally, as local assistants or attendants are prone to be neglectful in the way of that careful preparation and foresight that makes for safety, efficiency, and freedom from annoying incidents.

Early Records of the Michigan Copper Industry

Native Copper Deposits of the Lake Superior District Were Exploited by the Indians Before the Coming of the White Man

BY CHARLES R. KEYES
Written for *Engineering and Mining Journal*

THE CULTURAL STAGES of mankind, as is well recognized, are not contemporaneous over all parts of the world. Whereas metal first began to replace stone for tools in ancient Elam, Accad, and Egypt at so remote a period as eight to ten thousand years ago, in North America, for instance, the Stone Age persisted until long after the arrival of Columbus. There are extant some curious accounts of eyewitnesses to these conditions.

Before the rudiments of metallurgy were acquired, man could only work such fragments of native metals as he chanced to pick up. Of these, gold, copper, silver, and meteoric iron appear to have received first attention. In America, however, copper stood foremost. Long prior to the discovery of the New World, native copper of Lake Superior found its way to the farthermost ends of the continent; in the form of simple tools and ornaments it was bartered throughout the land.

In London not long ago was unearthed from under the accumulated dusts of more than two and a half centuries a manuscript account of an early visit by Europeans to the Lake Superior copper country. These bold voyageurs were Pierre Esprit Radisson and Médard Chouard, Sieur des Groseilliers, sometimes in the service of the French and sometimes with the English, as self-interest dictated.

The French had already known of the existence of copper in the Upper Lake country for more than a century; and Radisson had made several trips to the region. Setting out with Groseilliers in August, 1661, for the last time, he skirted the south shore of Lake Superior and arrived at Keweenaw Bay on the fifteenth of October. There he left Père Ménard and the other Frenchmen with the Ottawas who had come with them, while he and Groseilliers pushed on to the west. Portaging across the great Keweenaw Point, they visited the Christinos, a few miles northeast of what is now called the Montreal River. While there they learned of extensive copper deposits which had long been worked and were then being exploited by the Indians. The metal was pounded smooth with stones, and finished with much skill into a great variety of curious implements, which, with those of stone, were soon afterward discarded when the spread of the French fur-trade enabled the savages to secure European iron implements at far less expenditure of labor. In Radisson's words:

"The wildmen . . . their ears have ordinarily five holes, where one may putt the end of his finger. They use those holes in this sort: to make themselves gallant they pass through it a skrew of coper wth much dexterity, and goe on the lake in that posture. When the winter comes they weare no capes because of their haire tourned up. They fill those skrews wth swan's downe, & wth it their ears covered; . . . Here we found a small river. I was so curious that I inquired my dearest friends the name of this stream. They named me it Pauabickkomesibs, wch signifieth a small river of copper. I asked him the reason. He told me, 'Come, and I shall shew thee ye reason why.' I was in a place wch was not 200 paces in ye wood where many peeces of copper weare uncovered. Further he told me that the mountaine I saw was of nothing else. Seeing it so faire & pure, I had a minde to take a peece of it, but they hindered me, telling my brother there was more where we weare to goe. Having passed that place we made carriage through the land for 2 leagues. The way was well beaten because of the commers and goers, who by making that passage shortens their passage by 8 dayes by tourning about the point[1] that goes very farr in that great Lake; that is to say, 5 to come to the point, and 3 for to come to the landing of that place of carriage. In the end of that point, that goeth very farre, there is an isle[2], as I was told, all of copper. This I have not seene. They say that from the isle of copper, which is a league in ye lake when they are minded to thwart it in a faire and calme wether, beginning from sun rising to sun sett, they come to a great is'and[3], from whence they come the next morning to firme lande att the other side; so by reason of 20 leagues a day that lake should be broad of 6 score and 10 leagues. The wildmen doe not much lesse when the weather is faire. . . . They have yallow waire that they make wth copper, made like a starr or a half moone & there hang it. [in ears.] . . . The circumjacent nations goe all naked when the season permitts it. But this have more modestie, ffor they putt a piece of copper made like a finger of a glove, which they use before their nature."

A "stone" having such wonderful properties as copper could not fail to excite the cupidity of the natives as widely as did catlinite, the peculiar hardened clay from which they made their peace-pipes. Even at the time of the discovery of America, the Pueblo Indians of Arizona and New Mexico seem to have known of the location of the Lake Superior copper. This may have been really the Gran Quivira (French *cuivre*?) the mystical place in the north which Coronado mistook for a great city of wealth or a second Mexico or Peru, and which he vainly tried to find, in the summer of 1541, by a journey from the Rio Grande to the Missouri River.

New Method of Analyzing Sponge Iron

A new method has been developed at the Northwest station of the U. S. Bureau of Mines at Seattle, Wash., for the determination of metallic iron in sponge iron, which has been found to be more accurate, simpler, and more rapidly performed than any of the existing processes.

[1]Keweenaw Point. [2]Manitou Island. [3]Isle Royale.

BY THE WAY

What Is It?

What does the accompanying cut represent? A box of Chiclets is offered for the best answer received in the next ninety days. Our own guess is that it represents a mucker before he acquired common sense enough to use a long-handled shovel. That would account for his condition of curvature of the spine. However, we shall not be prejudiced in our own favor, as we have

"THE ENGINEER" AS SEEN BY MRS. WHITNEY

three boxes of Chiclets on hand right now. Mrs. Harry Payne Whitney calls it "The Engineer," and she ought to know, for she created it. We don't think she does know, however. The figure is part of a recent exhibit of the National Association of Women Painters and Sculptors. Another query that we are led to put is: Do not muckers wear overalls over their union suits?

Something Dreamy

The presence of "iridium, platinum," and the "platinic metals gold, silver" at Nepera Park and Hastings, N. Y.—at New York City's back door, so to speak—has been proven. Now let us hope that there will be a real stampede of all the hoboes in Bryant Park and elsewhere. It is difficult, however, to stir up popular enthusiasm in actual mining in this part of the country, even among the unemployed. The public, for the most part, knows only the mining that is done in offices, on paper, and in the imagination.

The *Yonkers Statesman* is doing its best to help the promoters by accepting flamboyant advertising of this fake, wildcat scheme from the "Iridio-Platinum Gold Co., Inc.," which gives its address as Room 315, Proctor Building, Yonkers, N. Y. Undoubtedly the *Statesman* does not realize what it is doing. It should know, however, for it has an honorable reputation to protect. "Bulletin No. 2," entitled "Yonkers Gold Mines," has already appeared in its pages, with possibly more on the way. The proposition is so ridiculous that we are tempted to joke about it, but we refrain, because some simple-minded person always takes us to be in earnest.

Statements from some of the greatest authorities in the country regarding the property are to be seen in its offices, the company declaims. These men "have given a year or more of their time to make the inspection and experiments," it says. "Their word, therefore, cannot be disputed." Truly it must be a great property that takes so long to examine, and the expense in the way of experts' fees must have been enormous.

"We have written *guarantees* that each ton of rock will yield between $200 and $600," the company advertises . . . "The maximum cost to mine each ton is $10. Mills, crushers, and pulverizers sufficient to begin operations on a large scale are immediately needed. Also a smelter. The railroad runs through our property. Hence the haulage expenses will be low . . . The executive overhead will be meagre (it usually is, of course). *Our product is money itself* (gold producers and Mr. McFadden take notice). The U. S. Government will give us their check direct according to the weight of our metals. No middleman. No salesmen. *No advertising.* No showrooms. No competition." To which we add: "No platinum. No iridium. No brains, or, if brains, then no honesty."

Incidentally, it will interest many to know that this is part of the country originally prospected by Rip Van Winkle. Rip never found a gol-darned thing except a lot of hootch. We have his word for it sent by ouija.

Via Wireless

New York daily papers announced on Nov. 3 that the United Verde Extension Mining Co. had shut down. This reminds us. We take pleasure in announcing that Columbus discovered America; that Mary Pickford married Doug. Fairbanks; and that Benjamin Franklin flew his kite successfully. Our news is always up to the minute. And we take this opportunity to point out that if Ben had used a copper wire instead of a silken string he probably would have been even more successful. Make it of copper, boys; make it of copper!

Blowing Bubbles

California's latest bonanza discovery is a soap mine near Barstow, which is being worked in much the same manner as some small coal mines of the Mississippi Valley are worked, according to a St. Louis paper. "All that is required," says the *Star*, "once the soap is brought to the surface, is to put it in tins and cart it away for shipment." The story runs that the mine was discovered by a Mexican, who took some of the lumps resembling plaster of paris to a Los Angeles laundryman. The result was so successful that the laundryman, aided by financial backers, purchased the ranch, together with a strip of land five miles long believed to include the entire vein of soap. At the laundry many pounds of the soap were consumed in a month. The employees say it not only cleans well but removes stains, which gives it additional value over ordinary laundry soaps.

Question No. 1: How much of this is a lye? Question No. 2: What made the Mexican think it was soap in the first place? Had he ever seen soap before? Final question à la Edison: What is the monthly clean-up at a mine of this capacity? At any rate, a field scout writes: "Woe unto Procter & Gamble! Surely they have met their Waterloo!" To which we add, Woe unto Pears, unto Colgate, the Palmolive outfit and others, including Babbitt, Kirkman and Fairbanks! For in the face of such competition their product is doomed to dissolution.

HANDY KNOWLEDGE

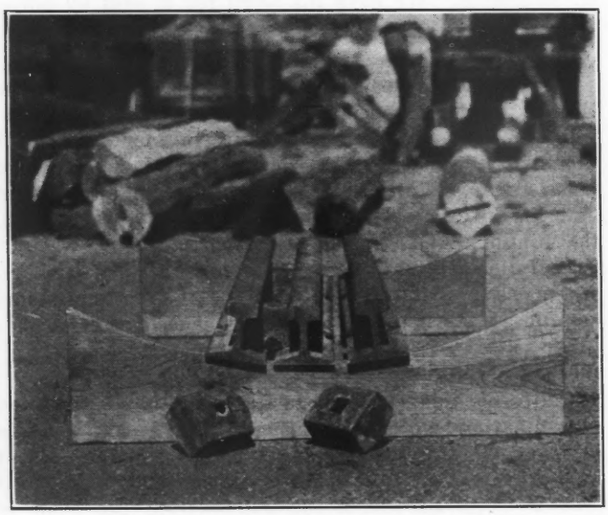
Railroad Rails for Ball-Mill Linings

BY PERRY G. HARRISON
Written for *Engineering and Mining Journal*

Recently there has been developed at the mill of the Cia. Minera del Mirasol, S. A., situated at Cusihuiriachic, Chihuahua, Mexico, a ball-mill lining made of standard 60-lb. steel rails that has reduced the cost of shell linings to about one-tenth of the cost of standard manganese steel liners in similar service.

Although ball mills are almost universally lined with solid white castings of manganese steel forgings, it is worthy of note that many years of experiments with pebble-mill linings have resulted in the very general adoption of some form of what may be called a protective type of lining, such as the El Oro or Globe, where a large proportion of the grinding wear is taken up on pebbles wedged between ribs of the metal lining proper.

The rail lining developed at the Mirasol mill is of this so-called protective type, in that the rails are so spaced



RAILS AND WASHERS IN POSITION SIMILAR TO THAT OCCUPIED IN LINING

as to allow slightly worn grinding balls to wedge between them and thus become a part of the wearing surface of the lining. The success of this lining indicates that a properly adapted form of protective lining is as useful in ball-mill service as is the El Oro lining in pebble-mill work.

The grinding equipment of the Mirasol mill consists of a No. 5 K. Gates gyratory breaking to 2 in.; a 24-in. Symons disk crusher reducing 2-in. feed to minus ⅝-in.; a Chalmers & Williams 6 x 4½-in. open-and-discharge ball mill operating in open circuit and followed by two Chalmers & Williams 5 x 10-ft. trunnion-type ball mills operating in closed circuit with a Dorr classifier. Grinding is carried to about 65 per cent minus 200 mesh.

The capacity of the Mirasol mill is limited by the tonnage that can be forced through the 6 x 4½-ft. ball mill, which is about 260 tons per day. To get this high tonnage it is necessary to run the mill on minus ⅝-in. feed, using an excessive amount of water. The combination of excessive water, 4-in. grinding balls, finely crushed feed and open-end discharge results in short life of linings.

The Mirasol rail lining was designed for use in this service. The cost of a set of this lining is about $155. It will grind 16,000 tons at a grinding cost of about 1c. per ton ground. The standard 2-in. manganese steel lining which has been replaced by the rail lining costs $1,219. It has a life of 11,000 tons and costs 11c. per ton ground.

COST OF LINING OF CHALMERS & WILLIAMS 6 x 4½-FT. BALL MILL

Manganese Steel Lining		Mirasol Rail Lining	
Weight, lb.	6,075	Rail weight, lb.	4,080
Cost Chicago	$948	Washers, 96 lb.	960
Cost delivery	271	Total weight, lb.	5,040
Total	$1,219	Rails, cost, @ 3c. lb.	$122
		Washers and bolts	66
			$188
Tons life	11,000	Washers and bolts good for two sets lining, credit	33
Cost per ton ground	11c.		$155
		Tons life	16,000
		Cost per ton ground	1c.

Manganese steel linings for the 5 x 10-ft. ball mills cost $2,170. They have a life of 21,000 tons and cost 10c. per ton ground. No grinding data are as yet available for rail lining in these mills, but as this lining costs only about $250 and the wear is less severe than in the 6-ft. mill, there is certain to be a considerable reduction in grinding cost.

The railroad rail lining is made in the mine shops. Full length second-hand rails are used. They are cut to length, and bolt notches are started in the flanges with a power hacksaw. The washers which hold the rails in place are cast from scrap manganese steel which is melted down in a home-made cupola furnace. A set of ninety-six washers, weighing 960 lb., is molded and cast in three shifts. One set of washers will wear out two sets of rails.

The rails are cut so as to leave 2 in. between the rail ends and the end liners of the mill. This allows replacing end lining without removing the shell lining. The washers, which are about 4 in. long, and fill the space between the rails less $\frac{1}{16}$ in. clearance, are of proper width to hold the rail balls, which face the center of the mill, about 2½ in. apart. There is a bolt hole and deep countersink cast in each washer, through which passes the ¾-in. machine bolt that holds the lining to the shell of the mill. Two washers are ample for a 4 or 5-ft. rail length. An Ingersoll-Rand Little David air drill is used for drilling the many new holes through the shell required for the rail lining. Lock washers similar to regular washers, but cast in halves, are used for putting in the last rail of a set of lining. The bolt going through the two halves of a lock washer holds them from slipping.

Although it is often almost impossible to remove the first section of a worn-out manganese steel lining, this difficulty is never great with the rail lining. A mill can be unloaded, lined, and reloaded in less than twenty-four hours. The rail lining can be put in full operating service as soon as the last rail has been bolted in place

and the mill filled with balls. It is not necessary to hand-fill the space between the rails, as the regular operation of the mill will solidly pack the rails in a mixture of partly ground pulp and worn balls, which becomes a part of the lining and affords protection to the rails from breaking down under the blows of the grinding load.

The Mirasol rail lining is easily changeable, is made of standard, low cost, easily obtainable material, and has effected a substantial reduction in grinding cost where it has been tried. Any mill can easily be adapted to its use. Its success offers a promising field for experimentation in other mills where the cost of steel is a serious item of operating expense.

A Portable Acetylene Generator for Welding

By Robert C. Baker

Written for *Engineering and Mining Journal*

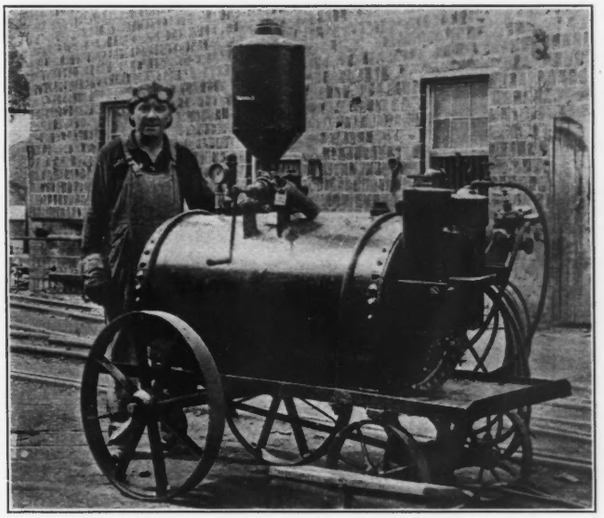
A great deal of difficulty is often experienced at outlying mining camps in obtaining tanks of acetylene gas for use in oxy-acetylene welding. This causes a great loss of time and many times seriously delays important work. To meet this difficulty at the Moctezuma Copper Co., Nacozari, Sonora, Mexico, the generator here described was devised and built. It is in service at present and giving satisfaction. Credit for the design and construction of this machine is due Joseph P. Flynn, who is looking after the welding at the plant.

The machine, as seen in the accompanying photograph, is of the carbide-to-water type. The carbide is placed in the hopper-bottomed, cylindrical container shown. The filler is a 3-in. pipe sleeve, welded into the top of the container and hermetically sealed by a 3-in. pipe plug, which prevents the escape of gas. The container is made from a piece of 10-in. pipe, about 12 in. high, and contains about 35 lb. of ¼-in. carbide. Feeding into the water chamber is effected by means of a hand crank and worm, similar to the arrangement in an ordinary kitchen meat chopper. A 2½-in. tee is connected to the bottom of the container with a close nipple, and this tee is in turn connected to a 2½-in. cross. The worm shaft enters the tee in this machine through a bearing with a packed gland improvised from a discarded valve top. Two plugs are provided for cleaning.

The water chamber, which is made from a discarded locomotive air tank, is about 24-in. in diameter by 40-in. long. A safety valve, set to pop at 20 lb., and a pressure gage is placed on top of the tank. A 2-in. sleeve and plug is welded into the top of the tank to provide for filling and washing out, and a 2-in. clean-out valve at the bottom. A ⅜-in. petcock is placed about three-fourths of the distance up, in the end of the tank for determining the water level. The gas passes from the main chamber by means of a ¾-in. pipe, connected into the bottom of the first auxiliary tank, which is also three-quarters filled with water, the level being determined by means of a ⅜-in. petcock. The upward passage of the gas in this first chamber is for the purpose of purifying and washing. This also acts as a safeguard against "flash back" and prevents ignition of the gas in the main chamber in case of backfire. This tank is made from 6-in. standard pipe 18-in. high, and is provided with a ¾-in. plug at the top for filling and washing, and a ⅜-in. petcock at the bottom for draining.

The washed gas passes from the top of this first auxiliary tank to the bottom of a second auxiliary tank by means of ¾-in. piping. At the bottom of this second tank, a 3-in. gas chamber is maintained by means of a small stand covered with fine mesh screen. The gas passes upward through a 12-in. layer of ½-in. coke to another 3-in. gas space at the top of the tank. This is for the purpose of drying the gas. This tank is also 6-in. in diameter by 16-in. high and is covered at the top with an ordinary 6-in. pipe cap for filling and renewing the coke, and is also provided with a ⅜-in. petcock at bottom for draining off the collected moisture. A fine-mesh screen is also placed in the top of this tank to prevent the egress of fine particles of coke. The gas passes from the top of this tank directly to the hose, through a ¼-in. pipe provided with a valve. In this apparatus the gas pressure is regulated by the amount of carbide introduced into the water chamber by means of the crank and worm, so that no acetylene regulator is required at this point.

A cradle for holding a tank of oxygen is placed on the side of the apparatus and the regular procedure is followed from this point. The whole apparatus is mounted on a small wagon as shown, for convenience in moving about the work. The hand crank is removed when the apparatus is not in use, and the shaft covered with a pipe cap locked in place to prevent anyone from feeding carbide into it and possibly causing accident to the apparatus.



MOCTEZUMA COPPER CO.'S PORTABLE ACETYLENE GENERATOR FOR WELDING

The entire water chamber should be washed out and the carbide sludge removed each time the apparatus is charged.

The principal advantages of this device are: First, convenience, and the ability to manufacture gas in places where it is difficult to obtain tank service; second, cheapness, it being possible to manufacture gas for about one-third of the price of that purchased in the tanks; and third, the extreme simplicity and practicability of the outfit.

The gas pressure, as mentioned above, is controlled entirely by the amount of carbide fed into the water chamber with the hand crank, and any pressure desired by the welder can be maintained at will. About 400 cu.-ft. of gas can be made with 100 lb. of carbide. This figure, however, is quite conservative, and ordinarily about 450 cu.-ft. will be more nearly correct.

THE PETROLEUM INDUSTRY

The Venezuelan Petroleum Industry in 1920*

BY ARTHUR H. REDFIELD
Written for *Engineering and Mining Journal*

THE YEAR 1920 in the Venezuelan oil fields was characterized by far greater activity in the speculative than in the producing phase of the industry. Though a feverish activity was manifested in the taking out of concessions, chiefly for speculative purposes, the actual work of drilling for oil was conducted by only four companies. Commercial production remained as before, in the hands of a single enterprise. In a field somewhat removed from the consuming centers, where primitive conditions of transportation hinder the procuring of necessary equipment for drilling and for the shipment of oil when obtained, it is not surprising that more interest should be manifested in speculation in oil lands than in the prosaic and often discouraging task of drilling for oil.

NEW LAW REVIVES INTEREST IN CONCESSIONS

The enactment of the new petroleum law, which went into effect June 30, 1920, was followed by considerable activity in taking out concessions. A greater number of concessions, covering nearly three times as great an area, were awarded to individuals in the latter half of 1920 than in the entire period from 1878 (the year of the concession to the Compañia Petrolia del Táchira) to June 30, 1920.

Production of crude oil was increased by the Caribbean Petroleum Co. Drilling, however, has languished with all companies concerned. A more vigorous campaign of drilling is hardly to be expected in Venezuela until roads can be built, tractors can be obtained, tanks erected, and the facilities assured which will permit the profitable handling and marketing of the oil obtained.

The fate of the vast concession of the Colon Development Co., Ltd., which hung in the balance during the progress of the suit in equity instituted by the Venezuelan government for the annulment of the concession, was settled by a compromise out of court. This disposition of the case affects favorably several other British-controlled concessions, whose titles stood in the same doubtful relation toward the Venezuelan government.

For further and more detailed information on the operations of the oil companies, the location, extent, and terms of the concessions granted, and developments in the petroleum industry of Venezuela than is given in this paper, the reader is referred to the annual report of the Ministerio de Fomento to the Venezuelan Congress in 1921. This report includes the annual statements required to be made by the oil companies, in which geologic as well as development data occur.

No fewer than 176 concessions, covering 2,463,911 hectares (6,085,900 acres) were taken out in the latter half of 1920 under the provisions of the new Venezuelan petroleum law. The distribution of these concessions by states is shown by the following table:

CONCESSIONS TAKEN OUT IN VENEZUELA IN 1920 UNDER THE PETROLEUM LAW OF JUNE 30, 1920

State	Number of Concessions	Area Covered, Hectares	Acres
Zulia	53	746,350	1,843,500
Monagas	29	445,992	1,101,600
Trujillo	11	317,255	783,600
Táchira	20	265,562	656,000
Mérida	15	210,900	520,900
Ty. Delta-Amacuro	14	197,000	486,600
Falcón	6	80,550	199,000
Sucre	6	89,500	221,000
All other states	22	110,802	273,700
Totals	176	2,463,911	6,085,900

These concessions have been taken out by various Venezuelan citizens who are in most instances holding them either for speculative purposes or are acting in the interests of foreign oil companies.

The concessions for the exploitation of petroleum and asphalt granted prior to the petroleum law of 1920 number 74 and cover 827,861 hectares (2,044,800 acres). The principal holders of these are the Caribbean Petroleum Co., 122,251 hectares (302,000 acres); Araguao Exploration Co., 40,000 hectares (99,000 acres); Urdaneta Exploration Co., 55,263 hectares (136,500 acres); Venezuelan Oilfields, Ltd., 80,000 hectares (198,000 acres); Perijá Exploration Co., 75,000 hectares (185,000 acres); Paez Exploration Co., 73,680 hectares (182,000 acres); Miranda Exploration Co., 79,420 hectares (196,000 acres); Mara Exploration Co., 75,000 hectares (185,000 acres); Addison H. Mackay, 38,000 hectares (93,900 acres); and Hector Aranada, 87,500 hectares (216,000 acres).

It is noteworthy that, with the exception of the Caribbean Petroleum Co., the companies which have been most active in efforts to obtain commercial production have contented themselves with small acreages. For instance, the Venezuelan Oil Concessions, Ltd., holds only 490 hectares (1,200 acres); British Controlled Oilfields, Ltd., only 50 hectares (125 acres); and the Bermudez Co., only 4,500 hectares (11,100 acres). Moreover, the Caribbean Petroleum Co. has been steadily reducing its holdings, by surrendering to the Venezuelan government areas which it has found unproductive. The princely domain formerly held by the Colon Development Co., Ltd., under the Vigas concession, which covered about 2,000,000 hectares (5,000,000 acres) has now been cut to a mere 800 hectares (2,000 acres).

The Caribbean Petroleum Co. was the only commercial producer of petroleum in Venezuela during 1920. Production was confined to the Mene Grande field, in the district of Sucre, State of Zulia, on the eastern shore of Lake Maracaibo. The Caribbean Petroleum Co. is a subsidiary of the Royal Dutch-Shell group and of the General Asphalt Co., of Philadelphia, through the Burlington Investment Co., of London.

*Published by permission of the Director, U. S. Geological Survey.

The production of crude petroleum in Venezuela during 1920, by months, is shown in the following table:

CRUDE PETROLEUM PRODUCED IN VENEZUELA
January-December, 1920

	Metric Tons	Barrels
January	1,775	11,642
February	3,151	20,667
March	5,620	36,862
April	6,440	42,240
May	7,447	48,845
June	5,452	35,760
July	7,652	50,189
August	6,221	40,804
September	7,850	51,488
October	4,721	30,965
November	7,534	49,416
December	5,676	37,228
Totals	69,539	456,106

Of the 69,539 metric tons (456,106 bbl.) extracted by the Caribbean Petroleum Co. from its Mene Grande wells, 2,345 tons (15,381 bbl.) was used by the company as fuel at the wells, and 67,193 tons (440,719 bbl.) refined at San Lorenzo.

The sales in Venezuela during 1920 of refined oils produced at the San Lorenzo refinery are illustrated by the following table:

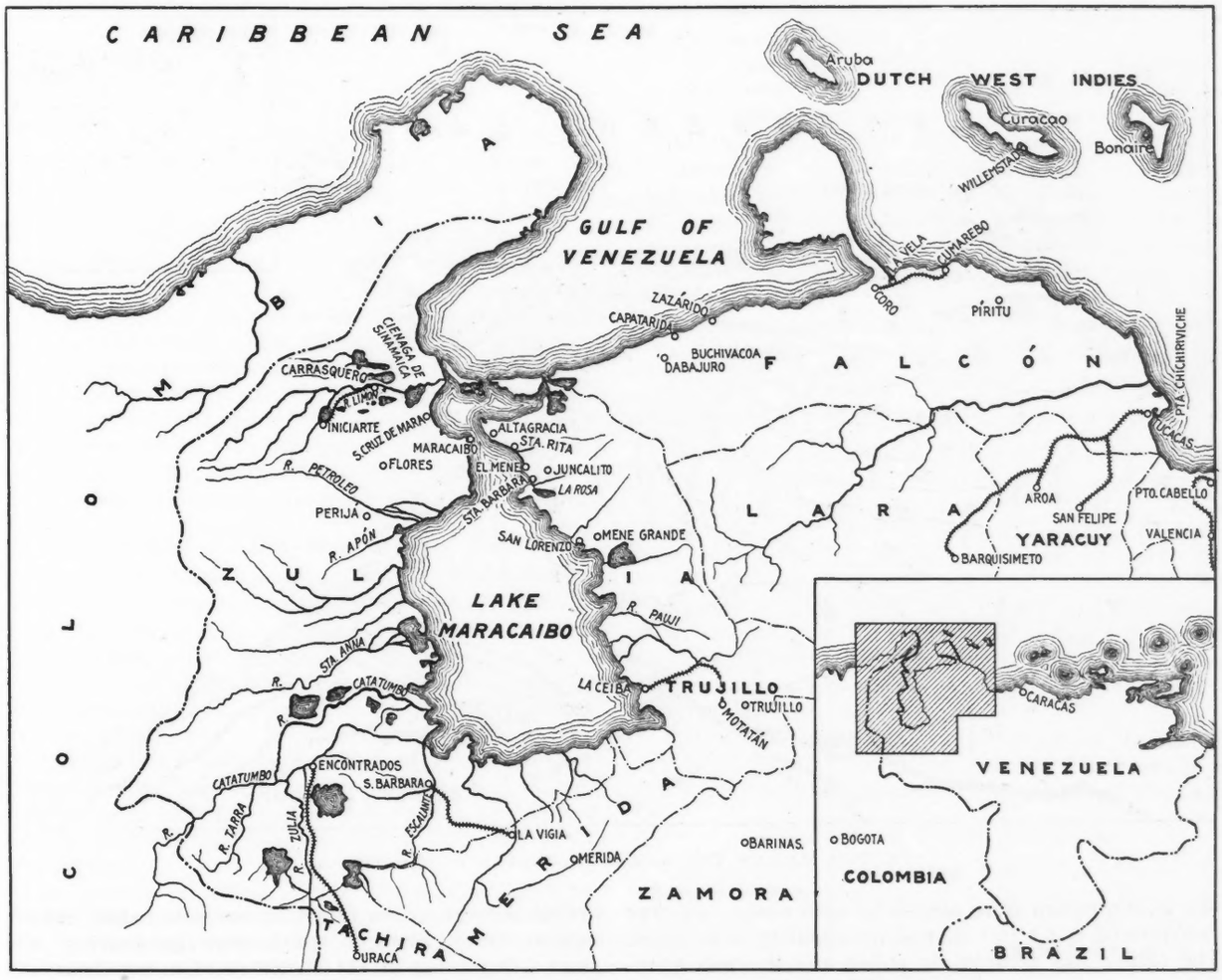
SALES OF DOMESTIC REFINED OILS IN VENEZUELA, 1919–1920

	1919		1920	
	Liters	Barrels	Liters	Barrels
Gasoline	3,323,086	20,902	3,588,704	22,608
Kerosene	2,186,271	13,751	2,692,478	16,962
Mineral turpentine	1,350	8½	2,646	17
Benzine	306	2	1,296	8

In addition, the Caribbean Petroleum Co. sold 14,949 tons of fuel oil and 116 tons of gas oil in 1920.

For the shipment of its products, the Caribbean Petroleum Co. obtained during 1920 three tank barges, in addition to the four already in service. Steps were taken to obtain four more. With the additional transport facilities at its disposal, the company was able to begin the exportation of fuel oil which had accumulated in the storage tanks at San Lorenzo for lack of means of shipment. The exports of fuel oil during 1920 were 41,869 metric tons.

Two additional steel storage tanks, of 8,000,000 liters (50,400 bbl.) each, were built at San Lorenzo, and one of equal capacity was ordered from the United States, to be erected at Mene Grande. Storage facilities for light oils are being prepared at Caracas, and a system of distribution is being worked out. Two railroad tank-cars have been imported from the United States, to be used on the railroad between La Guayra and Caracas. Two steel tanks of 1,200 metric tons' capacity, to be erected at Puerto Cabello and at Maracaibo respectively, have been bought in the United States. At La Guayra the company has installed a large pump for supplying steamers with fuel oil.



SKETCH MAP OF THE MARACAIBO OIL DISTRICT, VENEZUELA

Activities in the Maracaibo District

In the Mene Grande field the Caribbean Petroleum Co. continued drilling on wells Zumaque No. 2, Zo No. 1, Zo No. 2, Zumbel No. 2, Zumbador No. 2, and Zumbador No. 3.

Well Zumaque No. 2 was drilled during 1920 by the cable system from a depth of 1,079 ft. to 1,141 ft., chiefly through sandy shale. Numerous shows of oil were struck, but in small quantities and of inferior quality. Water was struck at 1,102 ft. and at 1,135 ft. At 1,099 ft. the well was plugged, and a test of production was made. The quantity of petroleum obtained was very small. The well was finally plugged with cement at 1,053 ft., the casing pulled, and the hole abandoned.

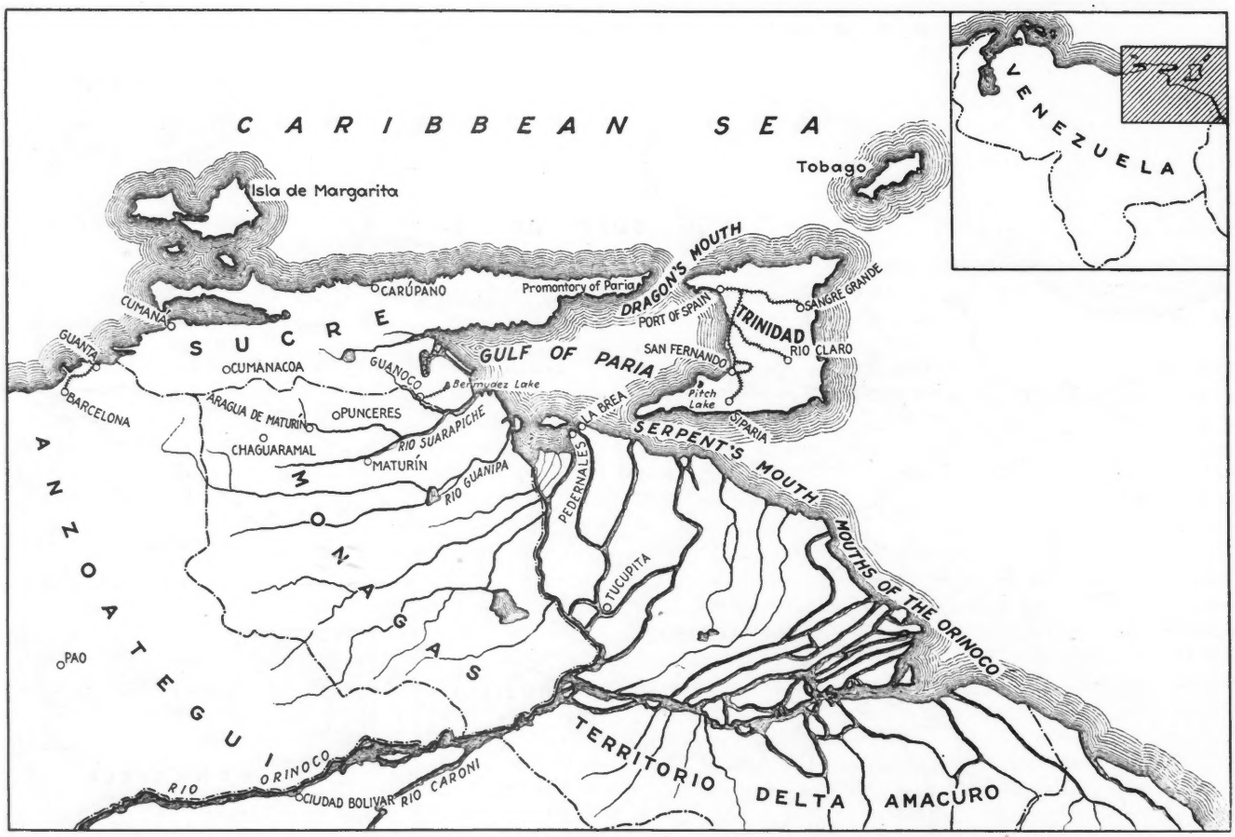
Well Zo No. 1 had been advanced from 968 ft. to 991 ft., and the 21-cm. casing carried to 987 ft. From 968 ft. to 981 ft. the strata were sandstone, and from 981 ft. downward were sandstone with shale. Oil was encountered, but a test showed the quantity to be small. The casing was accordingly pulled and the well abandoned.

Well Zo No. 2 was begun during the year and sunk to 636 ft. The formations met were chiefly sandy shale, shale and sandstone. A heavy oil was struck in small quantity at 544 ft. in a sandstone formation, 23 ft. thick. Between 626 ft. and 636 ft. oil was found in good quantities. The initial production reached 110 metric tons a day, but fell off to an insignificant quantity. Drilling has been continued.

Well Zumbel No. 2 was drilled to a depth of 784 ft. by the rotary system, and from 784 to 1,765 ft. by the cable system. The formations encountered were chiefly alternating sands and clays. Shows of heavy oil occurred between 820 ft. and 918 ft. and between 1,410 ft. and 1,722 ft., accompanied by gas. Drilling has been continued on this well.

Well Zumbador No. 2, begun July 28, 1920, was drilled to 134 ft. by the rotary system and from 134 ft. to 817 ft. by the cable system. Several asphalt sands were encountered between 125 ft. and 459 ft., and asphalt sands with gas from 459 ft. to 485 ft. and from 502 ft. to 525 ft. Oil sand with gas was struck at 813 ft. Work on this well was being suspended at the end of the year to bring up to the well a special perforated casing and penetrate the oil-bearing stratum to a greater depth.

Well Zumbador No. 3 was drilled through sands and clays to 216 ft. by the cable system, and from 216 ft. to 751 ft. by the rotary system. The formations drilled through by the rotary system alternated between asphalt sands, some of which were gas-bearing, and clays. Beginning at 121 ft. shows of a very heavy oil were numerous. An oil sand was struck at 751 ft., with little oil but with gas under considerable pressure. The casing had to be withdrawn from a depth of 728 ft. to 676 ft. Work is being continued on this well.



SKETCH MAP OF THE PARIA OIL DISTRICT, VENEZUELA

Production in the Mene Grande field during 1920, with comparative figures for 1919, is given in the following table:

CRUDE PETROLEUM PRODUCED IN THE MENE GRANDE FIELD 1919–1920

	1919		1920	
Well	Metric Tons	Barrels	Metric Tons	Barrels
Zumbador No. 1	36,862	241,775	51,448	337,448
Zumba No. 1	6,592	43,236	9,730	63,819
Zumbel No. 1	336	2,202	1,546	10,140
Zumaque No. 2	102	670	532	3,489
Zumacaya No. 1	528	3,463	524	3,436
Zumaya No. 1	19,068	125,066	3,753	24,617
Zo No. 1	1,140	7,483	2,006	13,157
Totals	64,628	423,895	69,539	456,106

The specific gravities of the oils obtained from the Mene Grande wells are shown by the following table:

DENSITIES OF CRUDE OILS EXTRACTED FROM MENE GRANDE WELLS

Well	Specific Gravity	Degrees Baumé
Zumaque No. 1	0.9650	15.08
Zumacaya No. 1	0.9620	15.53
Zumaya No. 1	0.9540	16.75
Zumba No. 1	0.9580	16.14
Zumbador No. 1	0.9600	15.83
Zumbel No. 1	0.9600	15.83
Zo No. 2	0.9600	15.83
Zambapalo No. 2	0.9700	14.33

Principal Producing Areas

Miranda Field—In the district of Miranda, State of Zulia, the Caribbean Petroleum Co. finished the construction of a wagon road from La Rosa to Quiroz, built the dwelling houses necessary for a camp, and made preparations for drilling in this field.

Perijá Field—Two areas in the municipality of Rosario, district of Perijá, State of Zulia, known as Zanca and Zancada, of 500 hectares (1,250 acres) each, were renounced by the Caribbean Co. in 1920. Only one area of 500 hectares, known as Zambapalo, remains to the company.

Las Sierritas Field—West of Lake Maracaibo the Caribbean Petroleum Co. concluded in 1920 the drilling of Well Zablación No. 2 in the Las Sierritas field, district of Mara, State of Zulia. This well was drilled by the cable system from a depth of 1,168 ft. to 2,719 ft. through formations chiefly of shale and sandy shale. At 1,968 ft. shows of petroleum were obtained, but not in commercial quantity. At 2,709 ft. salt water was encountered. For this reason drilling was stopped at 2,719 ft., the casing was pulled, and preparations were made to transfer operations to another place.

British Controlled Oilfields, Ltd.

In Eastern Buchivacoa, the British Controlled Oilfields, Ltd., after geologic examination of the territory, decided to begin drilling near Bernardino and Monte Claro. The harbor of Gutiérrez, near Puerto Zazárida, was chosen as a temporary landing place for drilling material and supplies, and the town of Dabajuro as field headquarters. A Holt tractor, two Ford trucks, two automobiles, and six trailers supply the company's transportation needs. Drilling material and supplies were shipped from Maracaibo via Gutiérrez to Dabajuro, and a few buildings were erected at Dabajuro and at the oil fields.

In western Buchivacoa, the British Controlled Oilfields, Ltd., continued drilling by the cable system on the test well at El Mene, begun by its predecessor, the Venezuela-Falcón Syndicate, Ltd. Before long, a water-bearing stratum was encountered, giving 40,000 liters (250 bbl.) of water a day. Although the water would have been quite useful for the boilers, it was cased out with cement and drilling was continued. At a depth of 630 ft. petroleum was struck under sufficient gas pressure to make a flowing well. The oil was of a paraffine base and of good quality.

The first well in the El Mene field, sunk in the expectation of obtaining oil, was begun in June, 1920, and was drilling during the year to a depth of 1,380 ft., through formations consisting chiefly of dark clays and shales. Traces of gas were found. The drilling was considerably delayed through an accident to the tractors which hindered the transport of the necessary casing pipe. Drilling was by the cable system.

Geologic exploration occupied the attention of the Venezuelan Oil Concessions, Ltd., during 1920. At the close of the year a drilling site was selected in the La Paz field, district of Maracaibo, State of Zulia. Drilling was to be begun in the early months of 1921.

Drilling in the company's proved fields in the Maracaibo and Bolivar districts of Zulia was not continued in 1920, as the problem of transporting the oil from the wells to the coast is by no means solved. Efforts are being made by the Venezuelan Oil Concessions, Ltd., to provide shipping facilities for its wells.

The Venezuelan Oil Concessions, Ltd., like the Caribbean Petroleum Co., is a subsidiary of both the Royal Dutch-Shell group and the General Asphalt Co., of Philadelphia, through the Burlington Investment Co., which holds 65 per cent of the shares of the Venezuelan Oil Concessions, Ltd.

The Colon Development Co., Ltd., a Burlington subsidiary, continued the drilling of Well Techo No. 3, formerly known as Well No. 6. From a depth of 328 ft. at the beginning of 1920 the well went through formations of chiefly sandy shale, with intercalated shale and sandstone, to a depth of 1,404 ft. at the end of the year. Considerable delay was occasioned by the jamming of the tools in the well. Only a small quantity of very heavy petroleum, of no commercial value, was encountered. Drilling was to be continued in 1921.

The company is devoting much attention to the problem of transportation. The attacks of the hostile and savage Motilones Indians continue to be a menace.

North Venezuelan Petroleum Co., Ltd.

The North Venezuelan Petroleum Co., Ltd., made preparations during 1920 to exploit its concession at El Pozón, in the district of Acosta, State of Falcón. A road was built from the company's harbor on Point Chichiriviche to El Pozón, a distance of thirty-five miles. Drilling equipment, shipped from the United States via Puerto Cabello, was hauled by a Holt caterpillar tractor over this road to the oil field. The heavy rains of the wet season hindered haulage over the company's road considerably. An aqueduct was built to bring water from Rio Tucurere.

Test drilling was begun at Antoncoro in the municipality of Piritu, district of Zamora, Falcón, with a small rig. Geologic examination was made of this field.

Activities of Other Companies

The activities of the Paez Exploration Co. in the district of Perijá, State of Zulia, and of the Sucre Exploration Co., in the district of Miranda, State of Zulia, did not go far beyond geologic exploration of their concessions. The Miranda Exploration Co.'s drill rig and equipment arrived at Maracaibo during the year, and were shipped to Altagracia on their way to La Victoria, to the east, where a 100-ft. derrick was built. The Mara Exploration Co. had its rig up and had brought its equipment to Maracaibo, preparatory to drilling near Perijá.

Activities in the Paria District

The New York & Bermudez Co., operating under the name of the Bermudez Co., continued exploration in the Guanoco field and complied with the formalities necessary to keep its concessions in the district of Benítez, State of Sucre. So far petroleum has not been found in commercial quantities.

The Caribbean Petroleum Co. continued operations in its eastern fields, at Chapapotal, fourteen miles north-

west of Maturín, at El Hervidero, near Chaguaramal, and on Rio Guanipa. Eight wells have been drilled to depths varying from 164 ft. to 275 ft. No indications of the presence of oil in commercial quantities were encountered to the end of the year.

Cost Data of the Industry

Estimates of the probable cost of drilling oil wells in the district of Democracia, State of Falcón, were given in the annual report for 1921 of the Ministerio de Fomento to the Venezuelan Congress. The source of the estimates is not stated.

The general physical conditions of the district of Democracia are typical and its distance from the coast is roughly about the average. Thus the following calculations on the cost of drilling for six months with a portable drill rig in the district of Democracia may be considered as representative:

ESTIMATED COST OF DRILLING 920-FT. WELL IN DISTRICT OF DEMOCRACIA, STATE OF FALCON

Items	Cost	
	Bolivares	U. S. Currency (a)
Portable drill rig and tools at La Vela	30,000	$5,800
365 ft. of 10-in. casing	6,800	1,300
730 ft. of 20-in. casing	11,200	2,150
915 ft. of 6-in. casing	8,000	1,550
Two drillers	32,000	6,200
Twelve laborers	15,000	2,900
Miscellaneous charges	50,000	9,650
Totals	153,000	$29,550

(a) All conversions made from bolivares at par value of bolivar in U. S. currency, $0.193.

The miscellaneous charges include the construction of houses for the workmen, maintenance of personnel, and provision of water in the dry season, on the assumption that no especial installations will be necessary. Though not specifically mentioned, the cost of transporting the equipment from the port to the oil field is probably included in the miscellaneous charges.

The cost of a 750-m. (2,460-ft.) well, drilled by the standard cable-tool system, in the same district was estimated as follows:

ESTIMATED COST OF DRILLING 2,460-FT. WELL IN DISTRICT OF DEMOCRACIA, STATE OF FALCON

Items	Cost	
	Bolivares	U. S. Currency
Wooden derrick 82 ft. to 115 ft. high	60,000	$11,600
Boiler and engine	20,000	3,850
Tools	50,000	9,650
545 ft. of 16 -in. casing	15,000	2,900
920 ft. of 12½-in. casing	21,000	4,050
1,750 ft. of 10 -in. casing	27,200	5,250
2,395 ft. of 8 -in. casing	34,000	6,550
2,755 ft. of 6 -in. casing	30,000	5,800
Tractor and trucks for transport	60,000	11,600
Transport of material	150,000	28,950
Miscellaneous charges	73,000	14,100
Two drillers for eighteen months	96,000	18,500
Twelve laborers for eighteen months	46,800	9,000
Totals	683,000	$131,800

If oil should be struck at 280 m. (920 ft.) the foregoing costs may be reduced by the following items:

DEDUCTIONS TO BE MADE FROM FOREGOING FOR 920-FT. WELL

Items	Cost	
	Bolivares	U. S. Currency
Casing, 16, 12½, 10, 8 and 6 in. sizes	91,200	$17,600
Two drillers for twelve months	64,000	12,350
Twelve laborers for twelve months	31,200	6,000
Costs of maintaining camp	73,600	14,200
Totals	260,000	$50,150

The cost of a 280-m. (920-ft.) well would accordingly be 423,000 bolivares ($81,650). The unused casing could be utilized in drillnig another well. Tools to the value of 120,000 bolivares, ($21,320) would also remain for further use.

Estimates of the cost of storing, pumping, and shipping the oil and of the pipe-line from the wells to Puerto Zazarida are as follows:

ESTIMATED COST OF STORING, PUMPING, AND SHIPPING OIL FROM WELLS TO COAST

Items	Cost	
	Bolivares	U. S. Currency
Steel tanks (8,000 tons' capacity)	150,000	$28,950
Pumping station		
Steel building	35,000	6,750
Two boilers, 200 hp. each	104,000	20,100
Two pumps	35,000	6,750
Pipe line, 6 in., length 45 km., at $2,300 per km.	540,000	104,200
Pumping station for loading on shipboard		
Steel building	35,000	6,750
Two boilers, 150 hp. each	90,000	17,400
One pump	40,000	7,700
Two steel tanks	300,000	57,900
Pipe line for loading on shipboard, 12 in. 5 km. at $3,860 per km	100,000	19,300
Dwellings and plant	25,000	4,800
Totals	1,454,000	$280,600

These figures include transportation and labor.

The experience of the Caribbean Petroleum Co. in the actual cost of drilling wells is given in the following statement:

ACTUAL COST OF WELLS DRILLED BY CARIBBEAN PETROLEUM CO.

Well	District	State	Depth in Feet	Cost	
				Bolivares	U. S. Currency
Zancada No. 1.	Perija	Zulia	2,240	530,000	$102,300
Zilfona No. 1.	Perija	Zulia	1,915	680,000	131,250
Molestia No. 2.	Piar	Monagas	3,240	680,000	131,250
Zablacion No. 2.	Mara	Zulia	2,750	560,000	108,100

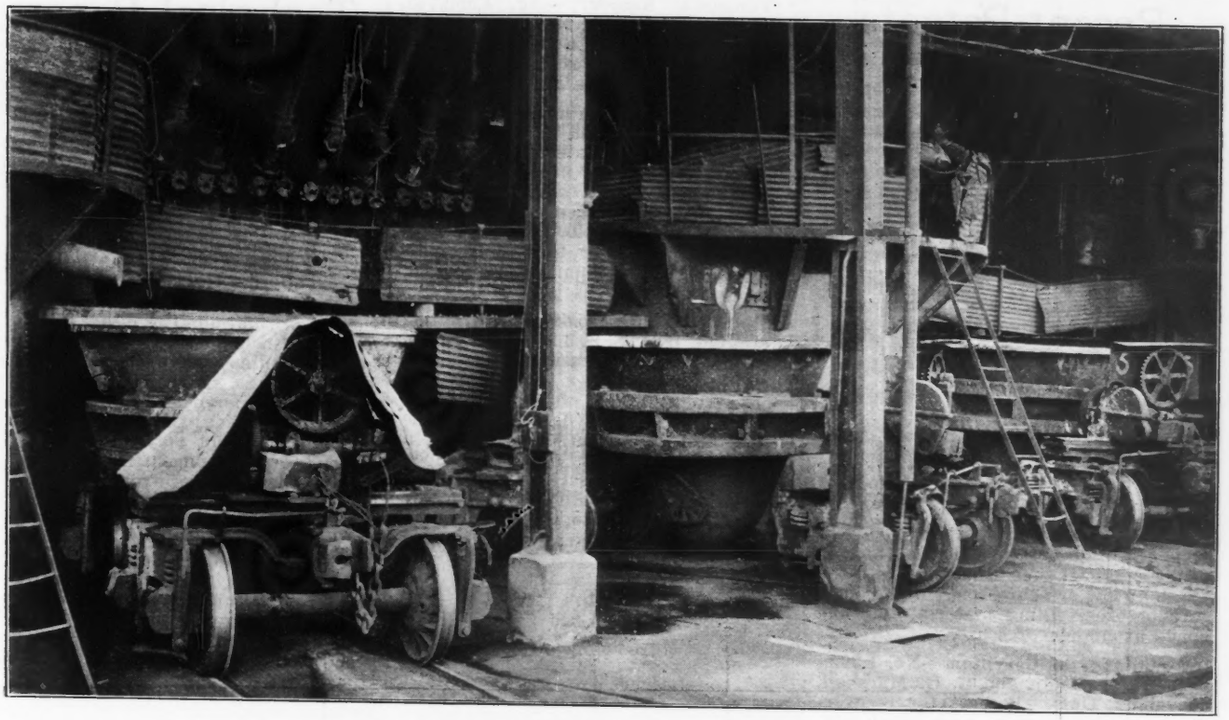
From the legal standpoint the two most noteworthy events of 1920 in the Venezuelan petroleum industry were the going into effect of the new petroleum law and the settlement of the Colon Development Co. suit out of court. An excellent translation of the Venezuelan petroleum law of June 30, 1920, is given in a recent bulletin of the Bureau of Mines.[1] The Colon Development Co.'s suit may be briefly reviewed. Its significance lies not so much in the legal principles involved as in the vast area of the concession the title to which was in dispute.

In the suit in equity which was instituted by the Ministerio de Fomento against the Colon Development Co., the Venezuelan government asked the annulment of the Andrés Jorge Vigas concession, acquired in 1913 by the company, to 5,000,000 acres, covering practically the entire Colon district, State of Zulia. The original concession, granted Jan. 31, 1907, was for fifty years, and carried with it a yearly rental of 16c. per acre. This rental, the Venezuelan government claimed, was never paid. The government alleged, moreover, that the Colon Development Co. had entered upon only 2,000 acres of the concession and that for thirteen years no active operations had been prosecuted.

By the terms of the compromise, the Colon Development Co. engages to select within five years' time certain areas of the district of Colon for exploration, surrendering the remainder of the original concession area to the Venezuelan government for its free disposal. At the end of the five years the company will pay to the government a quarterly rent of 0.20 bolivares per hectare ($0.015 per acre). At the end of a second term of five years the Colon Development Co. must make a final selection of certain areas for development, surrendering the remainder of its holdings to the government. The payment of 0.20 bolivares per hectare will not be required for those areas definitely selected for development within the first term of five years; only the ground rent named in the original concession will be exacted.

The Vigas concession is recognized as existing in full force, subject to certain modifications made by the Ministerio de Fomento on May 12, 1921. It is considered valid, however, for only the 800 hectares (2,000 acres) actually entered upon by the company.

[1] Thompson, J. W., "Petroleum Laws of All America." Bureau of Mines Bulletin No. 206, pp. 604-643, Washington, 1921.



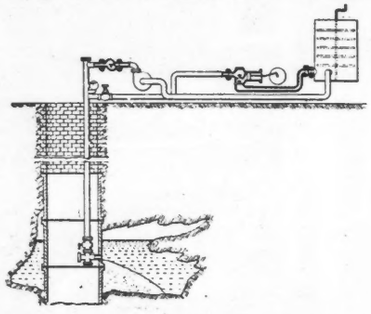
BLAST FURNACE SLAG REMOVAL AT COPPER QUEEN SMELTER, DOUGLAS, ARIZ.

Copper Smelters in the Southwest

CONVERTERS AT THE CALUMET & ARIZONA SMELTER, DOUGLAS, ARIZ.

Recent Patents

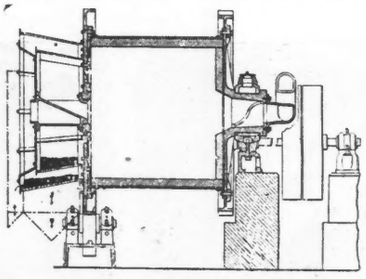
Sealing Off Water—No. 1,391,678. Albert Francois, Doncaster, England. A method of consolidating and shutting off underground water, which consists in drilling small-diameter boreholes to the space to be filled, lowering pipes



into these holes which are connected to low- and high-pressure pumps, forcing filling material such as cement into the space at low pressure, and subsequently forcing other filling material into the space at higher pressure.

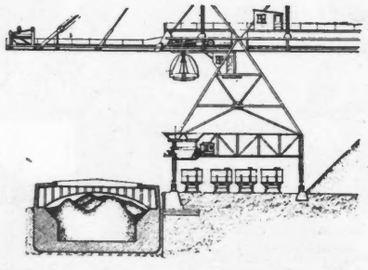
Metallurgy of Beryllium—No. 1,392,045. H. S. Booth and G. G. Marshall, Cleveland, Ohio. Process for recovering beryllium from its ores which consists in preparing a furnace charge of the material to be treated, in crushed form, adding a halogen salt of an alkaline earth metal or alkali metal, heating, and recovering the beryllium as a haloid of that metal. Patent No. 1,392,046 covers the same process, using a halogen instead of a halogen salt.

Ball-Mill Discharge—No. 1,392,887. J. R. Broadley, London, England. A method of exterior screening on a ball mill in which the oversize material is



returned to the interior of the mill for further grinding, substantially as shown in the accompanying illustration.

Ore Bridge—No. 1,392,382. C. S. Williamson, Chicago, Ill. An apparatus for handling ore, coal, and other ma-



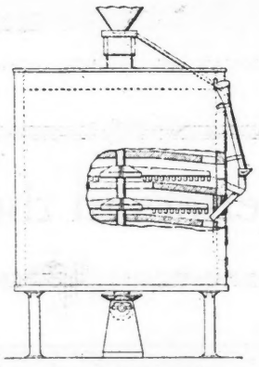
terial using a combination of a bridge supported on tracks, receiving hopper, lifting bucket, weighing lorry, and means for discharging from the weighing lorry.

Vanadium Recovery—No. 1,392,745. L. S. Copelin, Millers, Nev. The patent covers the addition of a magnesium salt in the treatment of solutions for the recovery of vanadium.

Metallurgy of Aluminum—No. 1,392,043. H. S. Booth and G. G. Marshall, Cleveland, Ohio. Material containing aluminum and silica is mixed with a chloride and heated to form chloride of aluminum, which is then volatilized and collected. Patent No. 1,392,044 employs a haloid under the same conditions, but the aluminum haloid, instead of being volatilized, is leached.

Flotation of Oxidized Ores—British Patent No. 168,098, 20.4.20. L. A. Wood and Minerals Separation, Ltd. The finely divided ore—e. g., tin ore or carbonates, or silicates of lead or zinc—is treated in a froth flotation machine with a frothing agent consisting of a fatty acid or one of its compounds, such as soap, in the presence of carbon dioxide as a gangue modifying agent. The gas is introduced into the pulp during agitation or aeration. — *Journ. Soc. Chem. Ind.*

Roaster Feed—No. 1,378,068. W. F. Weeks, Linwood, Pa., assignor to General Chemical Co., New York, N. Y. A method of introducing material on to



the various hearths of a multiple-hearth roasting furnace by means of chutes, as shown in the accompanying cut.

Smelting Furnaces—No. 1,394,471. H. L. Charles, New York, N. Y. Means for varying the widths of abutment walls between adjacent furnaces of the reverberatory type, at that portion adjacent the ends of the arch roofs. Patent No. 1,394,472 refers to means for changing the relative specific gravities of matte and slag after reverberatory smelting, to insure a better separation. Patent No. 1,394,473 covers the design of a water-jacketed charge hole in the side-charging of reverberatory furnaces. Patent No. 1,394,474 covers means for absorbing some of the heat from the walls at the flue end of a reverberatory furnace. This consists essentially in embedding water pipes in the brick.

Flotation—German Patent No. 338,845, 9.11.19. K. Schlitzberger. Ore pulp is contained in a funnel-shaped container and is fed to the settling device along with a current of air flowing in the same direction and holding oil in suspension, this current being delivered to the narrower end of the funnel-shaped container by means of an injector pump. An intimate mixture of oil, ore, and gas is thus obtained. The froth is recovered in the usual manner. —*Journ. Soc. Chem. Ind.*

Technical Papers

Western Milling Plants—In 1912 an investigation was made by the U. S. Geological Survey as to the number of reduction mills in the various western states, with details of their equipment, and the results were published in the "Mineral Resources" report of that year. This list has now been revised. Strict accuracy in details is not claimed for the present list, as in the limited time at disposal it was not always possible to send for corrections or additional information. The figures of daily capacity include those of the direct milling, tailing, cyanide, flotation, and smelting plans. Although gold dredges are not considered as reduction plants in the lists given, they really perform that function, not only of digging the gravels, but of concentrating and separating the gold therefrom, and may be considered the most important of the mechanical appliances of placer-gold mining. There were forty of these dredges operating in California in 1920, four in Oregon, three in Idaho, three in Montana, and one in Nevada. For purposes of economy, the list for each state has been bound separately and given a subtitle, and the following are available:

Serial	
2287-A	California
2287-B	Oregon
2287-C	Washington
2287-D	Idaho
2287-E	Utah
2287-F	Montana
2287-G	Nevada
2287-H	Arizona

Copies of these may be obtained by writing to the Director, Bureau of Mines, Washington, D. C. Lists for other western states will also be published by the Bureau of Mines as soon as these are available. Notice will be given in this column.

Corrosion — *Factory* is running a series of articles on the subject of corrosion. (A. W. Shaw Co., Chicago, Ill.; price 25c.) The first article, which appears in the November number, presents some principles that will help one to understand why iron rusts. The hydrogen-peroxide, the carbonic-acid, and the electrolytic theory are presented, the electrolytic theory offering a satisfactory explanation for a greater number of observed facts than do either of the others, according to the author, G. A. Van Brunt.

Sintering—The new sintering equipment of the Cambria Steel Co. at Johnstown, Pa., composed of two Dwight & Lloyd machines with a combined capacity of about 1,000 tons of flue dust per day, is described in detail with several illustrations in *The Iron Age* for Nov. 3. (New York; price 50c.) Apparently the same article, only not so well edited, is also published in *The Iron Trade Review* for Nov. 3. (Cleveland, Ohio; price, 25c.)

Queensland Mining—The annual report of the Under Secretary for Mines, Queensland, for 1920 has been issued, and may be obtained for 4s. from the Government Printer, Brisbane. The report is of 166 pages and covers all mining activities for the year, with statistics in the usual form.

ECHOES FROM THE FRATERNITY

Accidents in Mining Industries Show Decrease in 1920

Accidents in 1920 at all mines, quarries, coke ovens, and metallurgical plants (except iron-blast furnaces) in the United States caused the death of 2,973 employees and the injury of 206,000 others, according to the U. S. Bureau of Mines. In these industries 1,088,000 men were employed last year, who worked a total of 279,400,000 shifts, an average of 257 working days per man. Accident rates based upon a standard of 300 working days to the year show that for every thousand men employed 3.19 were killed and 221.25 were injured. For 1919 the corresponding rates were 3.63 killed and 219.33 injured. These figures do not take into account the large number of slight injuries causing a loss of time of less than one day.

The coal-mining industry employed 4,000 more men in 1920 than in the preceding year. The copper-mining industry employed 4,000 fewer men and in the iron-mining industry there was a loss of 1,700. In the gold and silver mines 2,200 fewer men were employed in 1920 than in 1919. A loss of 1,300 employees occurred in the lead, zinc, and fluorspar mines in the Mississippi Valley states. The quarries of the country gained 11,000 employees. There was a loss of 4,200 employees at metallurgical plants and 600 at coke ovens.

In 1920 all employees averaged a larger number of working days than in 1919. The gain among workers in metal mines averaged 15 days per man.

Movies of Carnotite Mining Shown

The New York section of the Illuminating Engineering Society, at a meeting held the evening of Oct. 20, included a paper "Radio-Luminescence and Its Application," by Dr. V. F. Hess. Dr. Hess touched on the sources of phosphorescence in general and demonstrated the difference between the normal phosphorescing, as developed by ordinary light, and that produced by rays of the radioactive substances. He accompanied his paper with a motion-picture film showing the process by which radium is extracted from the ore and how luminous materials are prepared for practical applications.

MEN YOU SHOULD KNOW ABOUT

P. G. Spilsbury is visiting the Clifton-Morenci district.

Hugh F. Marriott sailed from London for South Africa last week.

C. M. Weld has returned to New York from a two weeks' trip in Kentucky.

M. C. Lake is on the Gogebic Range on geological work for M. A. Hanna & Co.

L. E. Foster has been making examinations in the Steins Pass, N. M., country.

George J. Young, Western Editor of the *Engineering and Mining Journal*, is in New York.

Guy S. Weston has joined the forces of the Great Eagle Fluorspar Co., at Lordsburg, N. M.

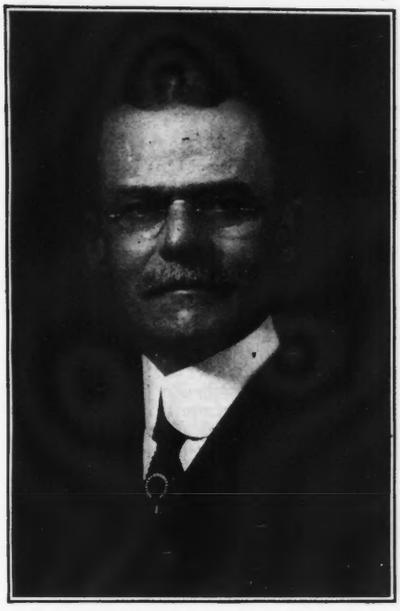
Edward Thornton is consulting engineer with the Bishop Creek milling Co., at Bishop, Cal.

Walter J. Eaton has been appointed mine superintendent at the Smuggle Union, Telluride, Col.

J. H. McLean and **J. Uno Sebenius** recently made an inspection trip of the Gogebic and Menominee ranges.

A. G. McGregor has been elected president of the newly reorganized chamber of commerce of Bisbee, Ariz.

Arthur L. Walker, professor of metallurgy in the Columbia School of Mines, has been elected a member of the board of Engineering Foundation. Professor Walker succeeds Dr. Joseph W. Richards, of Lehigh University, who died recently.



ARTHUR L. WALKER

K. Yoshizawa, chief mining engineer for the Mitsui Mining Co., of Japan, recently completed a tour of the Mesabi iron range.

S. L. Willis, formerly with the Federal Trade Commission at Washington, D. C., recently sailed for Europe in the interest of the Corning Glass Works.

L. D. Davenport, formerly chief engineer for the Oliver Iron Mining Co. at Hibbing, Minn., is visiting on the Mesabi Range.

Julien Raick, an engineer of Leige, Belgium, is in Butte studying mining conditions. From there he will go to Kellogg, Idaho.

Carlos Duz de Medina, of Bolivia, arrived recently in San Francisco from China, where he has been examining tin mining methods.

D. D. Muir, Jr., manager of mines in Utah for the United States Smelting, Refining & Mining Co., is making a short visit to Boston.

Reginald M. Banks sailed for South America on Oct. 26. He will visit Peru, Bolivia, and Chile, and expects to be gone about four months.

Colonel William Boyce Thompson will be among the members of the Advisory Committee at the Disarmament Conference at Washington.

Sidney Jennings has been in Salt Lake City making an inspection of the mines and smelters of the United States Smelting, Refining & Mining Co.

Jerome Drumheller, who has been connected with operations of the Tidewater Copper Co., on the northern British Columbia coast, has returned to Spokane and opened offices there.

E. F. Nieman and **J. F. Inglis**, of Salmon, Idaho, have recently completed an examination of the Bluster and Success groups at Jarbridge, Nev., for Salt Lake and Chicago interests.

Howard R. Ward, eastern representative, and **Errol Mac Boyle**, vice-president, of the International Minerals Syndicate, are at Alamo, Lower California, Mexico, in the interest of that organization.

C. H. Munger, general manager of Pickands, Mather & Co., has completed a tour of inspection of the company's properties in the Lake Superior district. He was accompanied by **W. P. Chinn**, assistant general manager, and **W. A. Rose**, chief mining engineer.

John A. Elton, formerly assistant general superintendent of the Great Falls smelter of the Anaconda Copper Co., has been appointed manager of the International Co.'s smelter at Tooele, Utah., and of that company's zinc oxide plant at East Chicago, Ind., also of the Walker mine, at Portola, Cal. **R. B. Caples**, superintendent of the Great Falls zinc plant, succeeds to the position vacated by Mr. Elton.

OBITUARY

Major Clem Webb, managing director of the *South African Mining and Engineering Journal*, died recently in Johannesburg after several operations.

Kennedy J. Hanley died Oct. 31 at Losa Gatos, Cal. Mr. Hanley operated mines in Pioche, Nev., in the early 70's, later at Coeur D'Alene, Idaho, and also in the silver reef district of Utah.

Charles T. Atkins died in Los Angeles on Oct. 22, at the age of fifty years. Mr. Arkins was a graduate of the Colorado School of Mines, and was employed first by the Guggenheim Exploration Co. Later he was recognized as an authority in cyanidation.

George Dacre Kislingbury was killed by a Mexican on Sept. 24, at the Delores mine, Chihuahua, Mexico. He was the son of George Kislingbury, who for many years was examining engineer for Captain De Lamar. Mr. Kislingbury's mining career began at the age of sixteen, with the Mercur Consolidated Mining Co., at Mercur, Utah. From there he went to Gold Roads, Ariz., then to Minas del Tajo, Sinaloa, Mexico. During the war he opened up a large tungsten deposit at Hereford, Ariz. More than a year ago, he went to the Dolores mine, in Chihuahua, as superintendent of construction, where he met his death. Mr. Kislingbury is survived by a wife and four young daughters.

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

The proposed revision of the mining law is exciting considerable comment. Replies of operators to a questionnaire on the subject sent out by the Colorado Metal Mining Board are given in this issue. Utah operators have also discussed the matter.

Questions of mine taxation are bothering mine owners in Canada as well as in the United States. The matter is discussed on pp. 791-92 by our correspondents in Ontario and British Columbia.

The suit over the proposed deal involving the operation of the Star mine in the Coeur d'Alene district of Idaho is to be tried on Nov. 21.

Discovery of copper ore in the Shetland Islands some time ago was widely heralded as of importance. The reverse is indicated by the results of a recent examination which are set forth in the news from London this week.

Conditions in the Joplin-Miami district continue to improve. Last week the American Metal Co. suddenly entered the local market there, buying 6,000 tons of zinc ore.

Little has been said of the results obtained thus far from the geological survey being made of its properties in northern Michigan by the Calumet & Hecla Mining Co. Some benefit is being derived, however, according to our Houghton correspondent.

Americans To Mine Asbestos in Siberia, Perhaps

Washington B. Vanderlip Not Connected With Enterprise

A wild but interesting tale, which may yet prove to be true but probably will not, was contained in an Associated Press dispatch dated Nov. 4 from Moscow, which stated that the Allied Chemical & Dye Corporation would undertake to operate asbestos mines in the Ural Mountains north of Ekaterinburg, in Asiatic Russia. It was said that Dr. Armand Hammer, now a convict in Sing Sing prison, New York, had acted as representative of the company in making the necessary arrangements with the Soviet authorities. Dr. Hammer, prior to his conviction for malpractice, had become prominently identified as a Lenine-Trotzky propagandist. According to the dispatch, the company receives no territorial rights, agrees to settle all differences in Russian courts and meet other Soviet requirements. It also agrees to deposit $50,000 in a Soviet government bank as guaranty and to produce 80,000 lb. of asbestos annually.

Britannia Beach Seriously Damaged by Cloudburst

Attendant Loss of Life, However, Worst Feature of Disaster

The New York office of the Howe Sound Co., which controls the Britannia Mining & Smelting Co., at Britannia Beach on Vancouver Island, B. C., the mining town that was recently damaged seriously by a cloudburst, reports that, according to word received from there, the damage is estimated at $35,000. Thirty-six lives were lost. Practically all the dwellings on the beach, constituting the lower town, were destroyed. The upper town at the mouth of the mine tunnel is unharmed.

Following the catastrophe all work at the mine was suspended. The only operations consisted of development work, upon which forty men were employed. The mill, which is being built to replace the one destroyed last spring, will not be ready before next summer.

Operators State Attitude on Mine Law Revision

The Colorado Metal Mining Board, in an effort to obtain the sentiment of mine owners and operators of the state regarding a proposed codification and revision of Federal mining laws, as embodied in H. R. No. 7,736, now pending in Congress, recently sent out a digest including arguments for and against the measure, and accompanied with a questionnaire in which mine owners were invited to indicate their views regarding the enactment of the bill, or any of the proposed changes.

A return of thirty-five questionnaires shows the following direct replies:

Do you think there is a necessity for material changes in the present Federal mining laws? Yes, 13. No, 21.

If you favor a revision of the present laws, do you think H. R. No. 7,736 embodies the desired changes? Yes, 6. No, 25.

If opposed to the enactment of H. R. No. 7,736 as it stands, would you favor it if so amended as to apply only to new districts, leaving existing districts subject to the operation of present laws? Yes. 6. No, 23.

Do you think H. R. No. 7,736 might be used as the basis of a desirable bill? Yes, 11. No, 20.

Do you favor the abolishment of extralateral rights? Yes, 14. No, 17.

Do you think discovery requirement, as a prerequisite to location, should be abolished? Yes, 8. No, 23.

Do you favor the proposed change in size of claims? Yes, 6. No, 27.

Do you think the boundaries should conform to legal subdivisions of the public survey? Yes, 2. No, 30.

Do you favor the option of a cash payment in lieu of annual assessment work? Yes, 6. No, 25.

East Pool & Agar To Sink Shaft

By Cable From Reuters to "Engineering and Mining Journal"

London, Oct. 31—Directors of the Eastpool & Agar Tin Mining Co. of Cornwall have approved plans for the sinking of a new shaft. Operations will start at once.

White Miners on Rand Reported To Have Threatened Strike

Object to Increasing Proportion of Native Workers at Properties

By Cable From Reuters to "Engineering and Mining Journal"

Johannesburg, Nov. 11—A crisis has arisen in the gold-mining industry. The miners threaten to strike against the government's proposal to effect economies in the working of the mines by increasing the efficiency of native labor.

The miners declare that the proposal means the abolition of the color line, which would bring about a decrease in the number of whites employed.

Press dispatches dated Nov. 5 from Johannesburg report that a general strike of the white employees at the gold mines on the Rand was threatened on Nov. 5 if the Government of the Union of South Africa should put into force its proposals providing for a slight increase in the percentage of native labor employed. The threats were made in the course of negotiations between representatives of the Government and the white miners. The miners' secretary told the premier, Jan C. Smuts, that the white miners would leave the workings within forty-eight hours after getting the proposals.

Premier Smuts, after pointing out that the present prosperity of the industry was due entirely to the existing premium on gold, declared that the mines should be more thoroughly exploited, and that he was convinced the plan would, in the end, bring about an increase in the employment of white labor.

France May Obtain Concession in Angora

By Cable From Reuters to "Engineering and Mining Journal"

Paris, Nov. 2—The Angora government is reported to favor a proposal to grant a concession for ninety-nine years to a French financial group for the exploitation of iron and chrome-silver mines in the Marckin Valley.

Supreme Court Affirms Decision on Hibbing Removal

Holds Business Men Not Entitled to Damages for Losses Suffered

The Minnesota Supreme Court on Oct. 21 affirmed the decision of the St. Louis County District Court in the case of H. P. Reed and seventy-two others against the village of Hibbing, the Oliver Iron Mining Co. and the Duluth, Missabe & Northern Ry. in holding that the plaintiffs are not entitled to damages of $500,000 sought. The defendants were charged with a conspiracy to move the village of Hibbing, thereby leaving the plaintiffs' property with a diminished business.

Peterson Lake Issues Silver Certificates

The Peterson Lake Silver Cobalt Mining Co., of Cobalt, Ont., has adopted a new scheme of financing, and is issuing silver certificates in denominations of $100 or multiple thereof, to raise $100,000 to enable it to continue operations. The company pledges its entire silver reserves as security for the payment of these certificates, which it purposes to redeem from time to time, with two years' interest, at 10 per cent, as soon as sufficient funds are available from the sales of silver.

The profits from the company's operations will not go into the treasury until the certificates have been redeemed. It is stated that the mill will be started when between $10,000 and $20,000 has been subscribed.

Bauxite Order Canceled

By Cable From Reuters to "Engineering and Mining Journal"

Paris, Oct. 15—The order relating to the prohibition of export of bauxite (aluminum ore) and establishing export duties on it has been cancelled.

Why Cornish Tin Mines Suspend

By Reuters Agency

London, Oct. 23.—In a written reply to Sir Edward Nicholl, Mr. Bridgeman states that he is aware of the present deplorable condition of the Cornish mining industry, though he cannot accept Sir Edward Nicholl's version of its cause, and it is receiving careful attention in connection with the government's general proposals for the relief of unemployment.

Sir Edward Nicholl, in his question, stated that the suspension of the Cornish tin mines was due mainly to the controlled high price of coal; that these mines had to sell tin at a fixed low price because the government was buying cheap copper from, and selling cheap tin to, America; and that in meeting government requirements during the war the Cornish mines could neither devote men nor money to exploratory work. He suggested a special grant for Cornish mines and miners.

Gold Strike in New Mexico Near Monticello

A new gold strike is reported to have been made about tweny-four miles southwest from San Marcial, on the El Paso branch of the Santa Fe, in Socorro County, N. M. The gold-bearing area lies on the southeastern slope of the San Mateo Mountains and is six miles from Monticello, the nearest town. A number of quartz veins bearing free gold have been opened, and a few shallow holes, the deepest being 20 ft., have been put down. These quartz veins seem to be numerous and vary from 2 to 20 ft. in width. There are practically no accommodations on the ground at present, though plenty of wood and water is convenient. The roads from either San Marcial, Engle, or Deming are good.

Litigation Over Star Deal To Be Tried Nov. 21

Following the filing of the second amended complaint in the Superior Court at Spokane, Wash., on Oct. 4, of Eugene Day and Mrs. Sarah Smith, minority Hecla stockholders in the litigation over the Star negotiations, jurisdiction was accepted by the Spokane County courts and date of trial set for Monday, Nov. 21. A detailed account of this case was published on p. 745 of *Engineering and Mining Journal* of Nov. 5. Further particulars are given on p. 795 of this issue.

Inventor of a Flotation Process Gets $600 Damages

A suit brought by J. D. Wolf, an inventor, against William M. Baldwin, a capitalist, for $100,000 damages for breach of contract to finance a patent for treating ore by an oil flotation process, was recently heard in New York City before Supreme Court Justice Whitaker. The jury awarded Wolf $600. Justice Whitaker ruled that the evidence did not justify a determination as to the total damage sustained. It was said that another action would be brought.

Northport Smelter Defendant in Smoke Suit

Herman Pfeiffer, of Northport, Wash., has brought suit in the Superior Court against the Northport Smelting & Refining Co. to recover alleged damages of $4,557. The damages are stated to have been caused by fumes and dust from the smelter settling upon his land and destroying crops, fruit trees, and seven head of stock. The smelter is equipped with a Cottrell fume precipitating plant and until very recently there has been but little complaint about fume or dust damages.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Presence of Potash Beds Likely In Southwest, It Is Held

Core Drilling at Public Expense Warranted, in Opinion of George Otis Smith

Discovery of potash-bearing beds in the Southwest fully justifies core drilling at public expense in the further prospecting of the Permian Red Beds region, in the opinion of **Dr. George** Otis Smith, director of the U. S. Geological Survey. In the region where small lumps of potash-rich salts, including polyhalite, were found, very little drilling for oil is likely, and it seems improbable that private initiative will undertake this prospecting work.

It has long been contended by the Geological Survey that the Red Beds offer conditions favorable to the occurrence of potash. The discoveries at the Burns and Bryant wells in Dawson and Midland counties of Texas and in the salt crusts found in the slush pool of the River well near Barstow, Tex., have vindicated the scientific deduction. Whether or not these deposits are of workable thickness remains to be proved. Indefinite evidence, however, suggests that the beds may be of greater thickness than is indicated by the samples recovered.

Survey's Division of Geology Has Eleven Sections

The division of geology of the U. S. Geological Survey is at present employing a total of 130 technical men, of which eighty-five are geologists. The division is organized in sections as follows: section of eastern areal geology, Arthur Keith, geologist in charge; section of western areal geology, Sidney Paige, geologist in charge; section of coastal plain investigation, T. W. Vaughan, geologist in charge; section of glacial geology, W. C. Alden, geologist in charge; section of paleontology and stratigraphy, T. W. Stanton, geologist in charge; section of geology of metalliferous deposits, F. L. Ransome, geologist in charge; section of petrology, E. S. Larsen, Jr., geologist in charge; section of geology of iron and steel alloy metals, E. F. Burchard, geologist in charge; section of the geology of non-metalliferous deposits, H. S. Gale, geologist in charge, prior to his resignation, succeeded by G. R. Mansfield; section of the geology of coal fields, M. R. Campbell, geologist in charge; section of the geology of oil and gas fields, K. C. Heald, geologist in charge. The work is under the immediate charge of David White, chief geologist.

To Sell Sodium Nitrate

Sodium nitrate to the extent of 81,000 tons is to be sold by the War Department to the highest bidder on Nov. 30. The minimum bid to be accepted must be for 100 tons.

The purchases of silver by the Bureau of the Mint during the week ended Nov. 5 amounted to 205,000 fine ounces, bringing the total to 79,803,863 fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Yuill Report on Shetland Copper Discovery Exact Reverse of Optimistic One by Dr. Garbe—Development at Geduld Mine Unsatisfactory

BY W. A. DOMAN

London, Oct. 25.—A few weeks ago I mentioned that the syndicate busying itself with a copper proposition in the Shetlands was entertaining doubts as to whether the business was of that profitable character which it had been led to expect. To confirm or remove their doubts the directors engaged Colonel Yuill, of Messrs. Bainbridge, Seymour & Co., to make an independent investigation. He has now reported, and his conclusions are not favorable. The original report was made by Dr. J. B. Garbe, and the results of the investigation by the two experts are of so diametrically opposed a character that a little further notice of the matter is justified. To put it plainly, Dr. Garbe was distinctly optimistic, and Colonel Yuill the very reverse. I have had an opportunity of perusing both reports.

Dr. Garbe says there are roughly 369,000 tons of ore in sight, fully developed and ready for immediate mining. He adds that the section of 500 ft. actually opened up represents only one-sixth of the lode existing between Sandwick and Sand Lodge, and only one-twenty-fifth of that which exists between Noness and Setter. "From the foregoing it will be clearly seen that the mine is fully proved and developed, and is ready for immediate stoping, with an immediate production of at least 1,000 tons of ore per week. A production of 500 tons per week could be proceeded with almost at once, and the tonnage produced increased 1,000 per week as soon as the equipment now being erected and prepared is completed. The mine can be worked at a very low cost." Also, "I am fully convinced that once the mine is working regularly the cost will not exceed 15s per ton." From this he estimates a gross profit of £1,200 per 1,000 tons of ore mined and treated per week.

Now for Colonel Yuill. He says: "There is no ore developed and available for stoping in the present workings, and there are no indications that further exploratory and development work would open up ore higher in average value than 1 per cent copper In a general way it can be said that it would take ore carrying 3 per cent copper to cover expenses. There is no ore carrying payable values in copper in the Sand Lodge mine, and no mineral occurrences exposed in the underground workings or on the surface which indicate that payable ore would be disclosed by exploration work should it be undertaken. We regret to have to advise you strongly that you are not justified, by the results of the systematic sampling of the lodes, in making any further expenditure on this mine." As a result of this check report the syndicate has decided to cut its loss.

With one exception recent development work at the Geduld mine has not proved over-satisfactory. The exception is in the area served by the No. 7 Shaft, which is opening up virtually a new mine in the southern portion of the property. At the annual meeting of shareholders the chairman, referring to this area, said there were good grounds for the expectation that a further large ore tonnage of high value would be disclosed. His views are being borne out. To date, about 5,770 ft. have been sampled, of which 62 per cent is payable, giving for the Rand the very high assay value of 16 dwt. over 66 in., or, as calculated in Johannesburg, 1,056 dwt. in. The exact width of the reef is not stated, as the figure of 66 in. is the stoping width. If allowance be made for 18 in. on each side, the reef itself is 30 in. thick. This is an excellent result. Taking the whole of the development footage on the reef in the September quarter, 35 per cent was payable, averaging 17.5 dwt. over 44 in., or 770 dwt. in. In the June quarter the percentage payable was 37 per cent and in the March period 35 per cent.

Broken Hill Concentrates Coming to England

By Reuters Agency

London, Oct. 25.—The Board of Trade announces that it has instructed its agents in Australia to ship a supply of Broken Hill zinc concentrates to England, and will be prepared, if desired, to maintain supplies to meet the immediate requirements of smelters in the United Kingdom. To enable smelters to restart their works and provide employment, the board will be prepared to consider offers for these concentrates delivered at works. Offers for future deliveries over a period will also receive consideration.

Johannesburg Letter

Government Engineer's Report Out—Development of Barberton Asbestos Deposits Successful

BY JOHN WATSON

Johannesburg, Sept. 20—The annual report of the government mining engineer for 1920 has recently been issued. Attached to it are extracts from the various district inspectors. Tudor G. Trevor, inspector of mines, Pretoria, says: "During the last ten years, several very rich if small gold mines have been discovered, mostly by accident, and in places which were supposed to be worthless. The small attention which has been directed to the base metals and non-metallic minerals has been so successful that I have every confidence that in the future, as more attention is paid to the matter, the advance of the last ten years will not only be maintained for an indefinite period, but greatly excelled. In fact, the longer experience one has of this inspectorate the more optimistic one becomes of its future. It is a curious fact, however, that the discovery, exploitation, and proving of the value of nearly all the minerals placed on the list during the last ten years, or even twenty years, has been left to private individuals of no, or very little, financial standing, who have usually received no encouragement, but often have had very severe opposition to overcome before attaining success. It is astonishing to note what little success the big land companies and mining corporations have met with and of what little use they are in the initial stages of the development of any industry."

The development of the asbestos deposits in the Barberton district, particularly at Kaapsche Hoop, has, according to an official report, been successful. Trials show that the mineral extends over a large area and its quality is equal to any asbestos found in the Union.

A nugget of gold weighing 21 oz. was recently found at the alluvial diggings at Finesbury, near Mount Anderson. This is said to be a record for these diggings, one of 20 oz. having been discovered some time ago.

The development of the oil sites at Island View is reported to be steadily proceeding. The Vacuum Oil Co. has two tanks on the site, each having a capacity of 9,000 to 9,500 tons of oil. The Anglo-Persian Co. has one oil tank erected and another planned. The British Imperial Oil Co. has just imported a tank in sections ready for erection on the company's site. The Texas Oil Co. has secured a site, also, and will soon erect storage tanks.

The Inspector of Mines for the East Rand district, (Col. Bottomley), writes in his annual report: "The expansion of the Far East has, if anything, received a slight check during the last year, owing to the stoppage of most of the development ends on the Daggafontein mine and the poor results of the development in Springs West. The results so far achieved on these two outlying mines are distinctly discouraging, and are certain to influence opinion in connection with the long looked-for expansion of the Far East and the development of the large unworked areas between Springs and Nigel.

"It is apparent that the zones of enrichment, or lenses, are further apart and the reefs narrower going south from Springs. On the other hand, we have the splendid example of the Nigel, which was a prominent producer and dividend-earner for many years."

The Nigel mine is situated eight miles to the south of Springs, and it is more than probable that similar large patches of rich ground should be found between these two points. The difficulty lies in their location. The deep shafts on the Springs West, New State areas, Brakpan, and Geduld have now approached the Main Reef horizon, the New State having actually encountered the reef, and the coming year will witness a program of development hitherto unprecedented on these fields. Owing to the large claim areas involved, first consideration is being paid to rapid and easy transportation of ore by laying out the drives and main haulages on capacious lines. The question of ventilation is receiving every possible consideration, and the wide drives already mentioned will materially assist in this direction.

The North shaft of the New State Areas was sunk to the reef—a depth of 3,760 ft.—without a fatal accident. It has been decided that the two circular shafts of the Brakpan Mines which are now in their last stages—No. 4 having already reached the reef—are to handle the work during the development period without their permanent equipment. This means that wire-guides will continue to be used without any other steadying factor than their own weight and what is added to them for stabilizing purposes. Colonel Bottomley feels that the extra tonnage hauled will be a severe test on the conditions mentioned. The sinking of the two shafts has been a nightmare to the managers up to the present, and it is more than likely that their troubles are not yet over. It is felt that insufficient data are available in connection with the handling of a large tonnage on rope guides over a shaft depth of 4,000 ft.

AUSTRALIA

Queensland

New Discoveries of Gold and Mica Reported

By Our Special Correspondent

Brisbane, Sept. 25—In mining matters history is repeating itself in Queensland. In times of depression, when the ranks of the unemployed are swollen, and especially when miners are thrown out of work through the production of minerals becoming unremunerative, there are more men who go prospecting and "fossicking" for other minerals for which there may be a profitable demand, with the result that finds are often made that become valuable to the state. Already a promising cobalt mine and a gold mine have been started in the Cloncurry district, where previously it was thought there was no commercial mineral except copper. Now the warden at Cloncurry advises that mica of really good quality has been discovered sixty miles northwest of Argylla and in the neighborhood of Camooweal, near the northwestern boundary of the state. Samples received by the government assayer, at Cloncurry, were forwarded to Sydney for the purpose of obtaining the opinion of the manufacturers using mica as to the commercial value of the specimens sent. The samples were found to be as good in quality as mica produced in any other part of the world for certain classes of manufacture. It is understood that all arrangements have been made for the financing of operations, and a trial parcel of one ton is being sent to Sydney.

Also, what promises to be an important find of gold has been made six miles from Cooktown. One party operating on three lines of reef at a shallow depth, obtained a return, from a bulk sample of five tons of ore sent to Chillagoe for treatment, of 4.1 oz. of gold per ton; and three samples (one each from three shafts) sent to Brisbane by the warden and analyzed by the government analyst, gave results respectively of 3 oz. 14 dwt. 5 gr., 4 oz. 10 dwt. 5 gr., and 13 dwt. 9 gr. of gold per ton. The find has been visited by a government geologist, whose report on it is expected soon.

Another parcel of cobalt ore, consisting of 50 tons, has been dispatched from Mount Cobalt, in the Cloncurry district, for shipment to England.

CANADA

British Columbia

Operators Consider Present Tax Levies Excessive

BY ROBERT DUNN

Victoria—Mine operators of British Columbia are making strong representations to the government in regard to what are termed the present excessive taxation levies. A delegation of representative coast mining men waited upon the provincial executive recently in this connection, and there is to be another discussion of the matter at an early date between the government and those identified with mining in the interior of the province.

One of the chief concessions sought is that a greater allowance be made for depreciation of property when the annual assessments are prepared. Valentine Quinn, of the Granby Consolidated Mining & Smelting Co., voices the views of mining men when he says: "There is no reason why the same procedure with regard to other tax reductions cannot be ruled with regard to development, depreciation, and depletion in the mining industry. If we are going to be taxed it is better to tax us on our real income. If the assessment is made up on the true income of any company there is no objection. What we do object to is the withholding of our right of appeal if our determination does not agree with that of the Finance Minister. We feel that we have a right of appeal and should be able to establish our protest in the court if necessary."

John Hart, Minister of Finance, said that he had no objection to appeals being made. This intimation was received with marked appreciation.

Dealing with the matter of taxation, W. R. Esling, member for Rossland in the provincial Legislature, maintains that the municipality of Rossland should be given the money it would receive were it permitted to tax the lands and improvements of mining companies. These companies pay a 2 per cent tax to the province on ore mines, and are exempted from municipal levy. He said that the producing mines had yielded in the last few years in excess of $18,000,000, and had paid into the provincial treasury $700,000. In return for the loss Rossland sustained, the provincial government handed back in special grants $140,000, or much less than could have been collected by the city from the lands and improvements of the mines.

There is no doubt that more will be heard of this question of the taxation of mines during the present session of the provincial Legislature. The problem of taxation in all its phases is to be before the legislators, it being the intention of the government to take some action toward relieving the financial embarrassment of the municipalities by granting them a greater share of the sources of provincial revenue. As to mining, the government is being assailed on the one hand by the mine operators, who are endeavoring, quite naturally, to obtain improved reductions, and on the other by the municipalities, which are insisting that their coffers shall be more adequately filled by the diversion of provincial funds. The situation is one not easily solved to the satisfaction of all, but there is no doubt that the government realizes the need of encouraging the mining industry and it is equally certain that the representations of those identified with it will have every consideration.

Bunker Hill Smelter Gets Ainsworth Ore

Ainsworth—Four hundred tons of accumulated ore, nearly all of which was taken out by leasers of the Florence mine, and some on company account, has been purchased by the Bunker Hill smelter, and is being shipped across the line for treatment.

Trail—Ore shipments received at the Consolidated smelter Oct. 22-31 totaled 10,963 tons, coming from the following shippers:

Josie, Rossland, B. C., 92 tons; Knob Hill, Republic, Wash., 217 tons; Rosebery Surprise, New Denver, B. C., 182 tons; Rambler Cariboo, Rambler, B. C., 30 tons; Silver Bell, Zwicky, B. C., 46 tons; Silver Standard, New Hazelton, B. C., 30 tons; Utica, Adamant, B. C., 47 tons; company mines, 10,319 tons.

Stewart—The sudden flooding of the Salmon River, as well as of other rivers and creeks in the Portland Canal district, has done much damage to roads and trails serving mining properties. Repairs will be necessary in a number of sections to permit ready access to some of the well-known mines and prospects of the country.

Ontario

First Dominion Report Shows Decrease In Mineral Output—Northern Ontario Feels Oppressed by Taxes—Enough Water For Porcupine Power Until April

Ottawa—The first semi-annual report of Dominion mineral production ever issued by the Ottawa Department of Mines, covering the first six months of 1921, shows a big falling off in value. For the full year of 1920 the value of the metallic production was $75,700,000, though for the first six months of the present year the value is only $24,300,000.

The leading metal, from the point of view of production during the six months, was gold, with a value of $8,194,000, which is an increase over the previous year. The next most important one was nickel, with a value of $5,360,000. This shows a severe decline, as the value of the twelve months' production in 1920 was $24,500,00. Silver production, at $3,915,000, also shows a falling off. The value of the copper production for the six months was $3,213,000, as compared with $14,244,000 for the whole of 1920. Lead, valued at $1,184,000, shows a slight increase, and zinc valued at $1,369,000 shows a falling off. The report states that large quantities of nickel and cobalt are held in stock, and that the immediate prospect for the future of the industry is not bright.

Cobalt — For some time there has been a great deal of ill feeling in northern Ontario over the treatment which it believes it is receiving from ruling authorities in the older part of the province. The people of northern Ontario believe that the government officials look upon this territory simply as a source of revenue to provide for extravagant expenditures in old Ontario. Government officials retort that more is being spent in the country than is being taken out in revenue.

Figures recently received for the year ended Oct. 31, 1920, show total expenditures of $5,624,000, as against a revenue of $4,642,000. Included in the expenditures, however, is a total of over $3,800,000 for lands and forests, including colonization and northern development, public works, and public institutions, a large part of which, under ordinary business methods of bookkeeping, would be charged to capital account. It is interesting to note, however, that the revenue from the mining industry was $990,000, as against an expenditure of $99,000, or a return of 1,000 per cent. For agriculture the revenue was only 9c. for each $1 expended. The mining industry feels that the interest displayed by the government in mining and agriculture is in inverse proportion to the returns. The industry is convinced that if it is not expedient to place at the head of the department of mines a man who is familiar with the industry, it is at least entitled to have a business man of sufficiently high calibre to comprehend its requirements.

Coniagas has taken options on claims in the Larder Lake district, embracing three hundred acres. Some of these claims adjoin those at present under option to the Crown Reserve and it is expected that the company will diamond drill them this winter.

Another discovery of importance has been made by the Keeley mine, in South Lorraine, on the 400 level. Where first encountered the vein was about one foot wide and of high-grade ore.

The annual report of the Hudson Bay for the year ended Aug. 31 shows a revenue of $17,498.00, against an expenditure of $37,765.00. The Cobalt property is practically exhausted, but the company places a considerable value upon its claims in Gowganda and Kirkland Lake. The company also announces that negotiations are under way for the amalgamation of the Dome Lake property, in Porcupine, which it controls, with the West Dome. The Hudson Bay has advanced about $350,000 to the Dome Lake.

During September there was shipped from Cobalt, over the T. & N. O. Ry., 230 tons of ore, of which 113 tons went to Canadian smelters and 117 tons to American smelters. This tonnage was supplied by the following companies: Bailey, 42 tons; Coniagas, 44; Hudson Bay, 32; O'Brien, 71; Keeley, 42. During the month the price of silver ranged from 62½c. to 71⅝c. an ounce.

Porcupine—The officials of the Northern Canada Power Co., which supplies this district, report that they now have enough water in storage to supply the Porcupine mines until the end of next March, with the same amount of power that the mines are now using. It is also stated that negotiations are under way to provide for the future needs of the camp. A greater water supply is to be secured by the diversion into the Metagami River of other streams. The company is also considering the possibility of the development of other sources of power.

General development at the Dome continues to be satisfactory. During October the mill heads ran approximately $7.50 a ton. The orebody found on the 7th level has proved to be of considerable size, and diamond drilling has indicated a depth of at least 150 ft. below the 7th.

MICHIGAN

The Copper Country

Results To Date of Calumet & Hecla's Geological Survey "Negative" — Centennial Unpromising — Operations at White Pine—Copper Shipments

By M. W. YOUNGS

Houghton — Progress is being made with the rather unusual geological survey being conducted by a number of eminent geologists for the Calumet & Hecla Mining Co. The purpose of the investigation is to discover, if possible, the origin of copper and how it came to be laid down in this district in native form in lodes or veins, rich in some portions and barren in others. The results to date, however, may be described as "negative." That is, if the survey were to stop now, the data available would enable a company seeking new copper deposits to determine whether to proceed with the work or stop it altogether when certain combinations of conditions were encountered. No results have yet been obtained that would lead the miner directly to the copper in the lode without chance of failure, and it is toward that goal that the survey will be continued in the hope it ultimately will be productive of positive results. The work to date is distinctly encouraging, and it has more than justified the expenditure. It has overturned some pet theories and established facts which may be depended upon. A big saving will be made in the long run by means of this original research.

Interest is manifested in mining circles here in the reported negotiations between the Anaconda and the American Brass Co. Should Anaconda obtain control of American Brass, it would be, in the opinion of prominent mining men in the Lake district, the most startling development, as well as the most constructive step yet taken, in the copper industry. It is freely admitted that such a development would mark a new era in the mining and manufacture of copper. It would, it is believed, affect copper-mining companies outside of Anaconda adversely and force them into the business of manufacturing their own product. It has been evident for some time that the trend of affairs has been toward a combination of the mining and manufacture of copper.

Centennial probably will be one of the last of the Calumet & Hecla subsidiaries to reopen. This property is one of the least promising. Its production costs during the six months it operated in 1920 were 32c. per lb., not including depreciation, depletion, smelting costs, eastern office expense and corporation taxes, which brought the total up to 36c. The rock treated in 1920 was about 2 lb. lower in copper content than that milled the previous year, running only 13½ lb. to the ton, and the character of all new ground was discouraging. The rock disclosed in the new bottom openings of No. 2 shaft, the only one in which any work was done in 1920, was somewhat below average in quality for the mine.

At White Pine, Calumet & Hecla's subsidiary in Ontonagon County, work is confined to the operation of bailers in No. 4 shaft, into which water seeps from Nos. 2, 3 and 4. Eventually some interesting geological problems must be solved in this property, as a badly faulted area has been encountered at a depth of about 1,100 ft. in No. 3 shaft. No. 4 shaft, however, will get down to 1,600 ft., it is estimated, before it encounters the fault. No. 5, farther west, may reach a depth of 3,000 ft. or more before the lode disappears, and it therefore will probably become the principal shaft. There is still considerable work to be done in No. 3 before it will be necessary to suspend operations in the shaft until contact with the lode is re-established. For upward of a year, No. 5 had been deepened by raising upward from the levels extending westward from No. 4, and only a comparatively short stretch of ground remains to be drilled before the entire shaft is holed through.

White Pine is operating on the Nonesuch series, which consists of a sandstone bed 7 ft. thick, below which is a slate formation about 6 ft. thick and containing copper in very small particles. Beneath the slate is another sandstone vein from 5 to 8 ft. thick and at the very bottom is a sandstone formation 50 ft. in thickness.

A rather extensive program of drifting and stoping is under way in all four Mohawk shafts, with the rock averaging well up to 23 lb. to the ton. Although the character of the ground tributary to No. 1 in the lower levels does not measure up to that of the south end of the mine, the results are quite satisfactory and the rock is yielding a small profit. Mohawk is using both level and drift scrapers with a large measure of success, the devices being particularly effective in the levels, where the cost of rock handling has been reduced almost 50 per cent. Both Mohawk and Wolverine will continue operations throughout the winter.

Less than another month remains of the Lake season of navigation, and to date there has been shipped, by boat, out of this district, a total nearly 41,000,000 lb. of copper. Estimated rail shipments for the same period are 10,000,000 lb., making 51,000,000 in all.

October metal shipments by water were, as expected, the largest of the season, totaling 10,840,000 lb. This compares with 7,028,000 for the preceding month, 5,176,000 for August, and 8,322,000 for October, 1920. Rail shipments last month are estimated at 2,000,000 lb.

Shipments of copper by water have been as follows this year: May (including a few days in April), 5,310,000 lb.; June, 5,850,000; July, 6,536,000; August, 5,176,000; September, 7,028,000; October, 10,840,000.

The increase shown by September shipments is attributed largely to an improved demand for the metal rather than any particular desire to take advantage of the lower freight rates via the water route.

Gogebic Range

Oliver Iron Mining Co. Stops Shipping for the Season

By Our Special Correspondent

Ironwood, Mich. — The Oliver Iron Mining Co. has closed its shipping season, having shipped about 1,350 000 tons through Ashland. The Steel & Tube Co. is shipping two cargoes in vessels that brought up coal.

The Oliver company has sold to the Seneca Copper Co. the steam hoist formerly in use at the Curry shaft of the East Norrie mine. It is a Bullock Corliss, duplex, first-motion hoist, with cylinders 24 x 48 in. and two clutched drums 8 ft. in diameter and with 9 ft.

faces grooved for 1¼ in. rope. It is being sent to Mohawk, Mich. The Curry shaft was for several years a very large producer, but owing to caving ground, was abandoned two years ago, having been replaced by a new foot-wall shaft with electric hoists.

The three 400-gal. Prescott-Menominee pumps on the 2,600 ft. level of No. 1 Davis shaft are erected and ready for operation as soon as the electrical apparatus is installed. With these pumps nearly ready for operation, it is deemed safe to begin opening up this level, and the work has started. Practically all work will be done west of the shaft toward the Newport orebody, and that is expected to be a wet district. In the Davis engine house the old 4,000-ft. compound, two stage air compressor is being replaced with modern electric-driven equipment.

The M. A. Hanna Co. have made an agreement with the Hayes Mining Co. under which the Germania property in Wisconsin will be explored underground from the workings of the Ashland. It is understood that work will be started as soon as possible. The Germania has been idle for some years, but is promising ground for exploration, lying between two good producing areas. The Ashland should be benefited also by discovery of ore on its western boundary.

Pence, Wis.—The Republic Iron & Steel Co. is sinking the Plumer shaft to the 17th level in expectation of developing a body of ore shown up by drilling. The company has been conducting a competitive test of various makes and types of sinking drills, the results of which will be used at all its properties. The shaft has three compartments and is about 7 ft. x 19 ft. 8 in., outside of sets, which are of steel. It is in the foot-wall slates and is inclined at 61 deg.

Palmer—The open-pit mines on the Cascade Range have been closed for the season. The Isabella mine, an underground property, is the only mine now being worked, and only development work is being carried on there. The pits, of which there are several, sent out very little ore in 1920, the Richmond and the Maitland being the only ones to fill contracts.

Menominee Range

West Chapin Starts Work on New Blast Furnace

(By Our Special Correspondent)

Iron Mountain — The West Chapin Mines Co. has started work on the blast furnace which is to be operated in connection with the mine. The foundations are now being put in place. A chemical plant is also planned. Local and eastern capital are back of the venture.

Iron River—The Cleveland-Cliffs Iron Co. recently received an order to ship out 35,000 tons from Spies mine. The loading is now in progress. This will be the last ore to go forward from the Menominee Range this year.

Marquette Range

Ford's Imperial Mine To Begin Operations Soon

Michigamme — The water has been removed from the west shaft of Henry Ford's Imperial mine, and it will be only a few days before the east shaft will be free of water. Mining operations will start at an early date. The construction of a 55 x 160-ft. combined carpenter shop, blacksmith shop, and warehouse is under way. Twelve dwellings for men and a house for the superintendent are being erected. There are also several other new buildings at the mine. A power house remains to be constructed. About 125 men are now employed, and many of these will take places underground when mining starts. Men are being paid $6 per day after being on the payroll for a month, the wage scale being the same for all classes of labor.

MINNESOTA

Mesabi Range

Trout Lake Washing Plant Suspends—Hill Annex To Have Screening Plant

Coleraine—The Trout Lake washing plant of the Oliver Iron Mining Co., has suspended operations for the season. In the open pits all ore operations have ceased in this district, and at present five steam shovels are at work stripping in the Canisteo pit, a property of the same company.

Marble—Plans for a screening plant to serve the Hill-Annex mine, of the Interstate Iron Co., have been drawn and it is expected that work will start soon.

Nashwauk—The mining of ore by steam shovels at the Patrick pit is to continue until winter weather prevents, according to the plans of Butler Bros., the operators. The ore, which is a washable product, will be stockpiled after it has been run through the Patrick concentrator. To meet these requirements a stockpile area is being prepared and tracks are being laid to it.

Chisholm—A fire on one of the sub levels of the Leonard No. 2 mine, operated by the M. A. Hanna Ore Co., caused the suspension of all underground work for a short time but did little damage. It is supposed to have been caused by a carbide lamp left burning on a post. It was extinguished by bulkheading the drift leading to the workings and attacking it from the sublevel above.

JOPLIN-MIAMI DISTRICT

American Metal Co. Buys Zinc Ore—Report of Unemployment in District Greatly Exaggerated—Ore Thieves Busy at Webb City

BY P. R. COLDREN

Joplin.—The outstanding feature in the Tri-State zinc and lead field for the week ended Nov. 5 was the unexpected entrance of the American Metal Co. into the market for zinc ore. A week before a total of less than 3,600 tons of concentrates was purchased, but early last week the American Metal Co. entered the market and in the first few days bought slightly in excess of 6,000 tons of ore, paying $25, as against the $23 and $24 prices paid the previous week.

It is unofficially reported that the discovery of a fresh supply of natural gas near the Blackwell smelter of the American company is responsible for this buying move, but it is also commonly believed here that the heavy purchase is an indication of an upward swing in ore prices.

Considerable interest has been taken locally in a report sent out from the national conference for unemployment to the effect that there are 15,000 idle miners in Joplin. There are virtually no idle miners in Joplin, and nowhere near this number are idle in the entire district. In fact, it is estimated that the total number of miners employed at the peak of mining activity in this field a few years ago was little in excess of 15,000. Today about fifty-five of the largest mines are operating at least a part of the time, which means probably 40 per cent normal activity, at the least. And a very large per cent of the miners who lost their positions last summer and fall have either obtained work elsewhere or are working at other occupations in this district. Richard Jenkins, secretary of the Tri-State branch of the American Zinc Institute, estimates that no more than 3,500 miners were out of work at the worst period of the slump last winter, and he and others who work with him believe that the mines now operating will be able to take care of the miners now in the field during the coming winter.

It seemed like old times last week when petty ore thieving was reported from Webb City, Mo. A few miners are operating small mines in the older Missouri camps just now, or working large mines on a small scale, mostly gouging for lead ore, and it is these that suffered from the thieves. All the junk dealers in the district have been notified, and it is believed the persons who got the ore will have hard work in disposing of it. There was formerly much petty thievery of this sort, but it has almost entirely disappeared during the last two years.

COLORADO

The Canterbury Hill Project—Other Operations at Leadville

Leadville—In the effort to bring about a revival of mining activity, much attention has been given to exploration and development work in outlying districts. Early in the year a project was financed by Leadville people to drive a tunnel into Canterbury Hill. The project was backed by the Leadville Chamber of Commerce, and monthly subscriptions were secured to carry on the work.

The bore will cut at great depth a territory which, in early days, made a considerable production from surface workings, which are now filled with water and unworkable. The tunnel has been driven over 600 ft., and it is expected will reach the Leadville formation within the next 1,000 ft. Denver mining men and former residents of Leadville have recently come forward with liberal subscriptions to hasten the work, and Leadville is confidently looking forward to the opening up of a new and productive mining district in 1922.

On the Mosquito Range, development work on the Killarney and O'Connell groups gives promise of a good production the coming year. On the west, a good strike was recently made on the Fidelity group on the Saguache Range. In the St. Kevin district, an increase in operations on the Griffin properties has revived the old camp, where mining activity is greater than for many years. Much attention is being given properties in Big Evans Gulch, South Evans and Weston Pass, where arrangements are being perfected for a resumption of activity by several old properties.

ARIZONA

International Smelter To Start Ore Furnace on Miami Concentrates—Seek to Merge Arizona & N. M. Road With E. P. & S. W.

BY JAMES H. MCCLINTOCK

Phoenix—One of the reverberatory furnaces of the International Smelting Co. at Miami is to be blown in about Nov. 20. It is understood that this is not be considered in any degree due to resumption of copper demand, but is simply to clear the bins of about six months' accumulation of concentrates from the Miami Copper Co.'s concentrator, which has been the only copper mill in operation within the state. The only reduction plant available for Arizona smelting ores has been at El Paso, where the smelter operated one furnace during the summer, added another in September, and will add a third this month. No copper ores have been handled at El Paso.

The smelting work at Miami will give employment to about 200 men. Inspiration will employ 100 more men on the Inspiration and Live Oak mines and will sink a working shaft on the newly acquired Porphyry property.

J. Parke Channing, vice-president and consulting engineer of the Miami Copper Co., recently visited the company's property. He states that the company "has no intention of closing down or of curtailing production," adding expression of appreciation of the manner in which the employees accept neccessary cuts in wages, the company thus being enabled to keep the mine and mill running and to retain over 1,000 men. Mr. Channing expressed the opinion that copper companies of Arizona would reopen next spring, though it would take six months more to reach the pre-war scale of operations.

A carload of ore shipped to El Paso by the Superior & Boston Copper Co., of the Globe district, returned an average of 195 oz. silver to the ton.

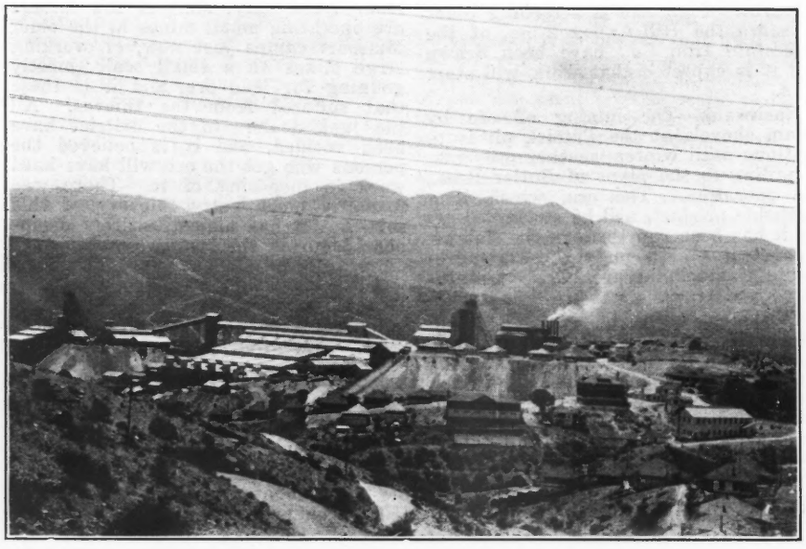
Old Dominion at Globe is furnishing the entire water supply of the municipality of Globe, taking it from a part of the mine where the flow is of unusual purity, without copper or other contamination.

A step in the transfer of the Arizona Copper Co.'s property to the Phelps Dodge Corporation is noted in an application filed with the Arizona Corporation Commission for the scale of the Arizona & New Mexico R.R. to the El Paso & Southwestern system. The line is 121 miles long from Hachita, on the Southwestern, through Lordsburg, on the Southern Pacific, to Clifton. Outstanding capital stock of $2,770,000, with 1,330 $1,000 bonds outstanding is to be conveyed. It is stated that the consolidation is desired in the interest of economy, the branch to be operated as a part of the Southwestern's main line.

By its purchase of the Arizona Copper property, the Phelps Dodge Corporation will secure a remarkable position in paying about 92 per cent of the taxes of Greenlee County.

Kingman—Near the old Pittsburgh mine, in the Chimehuevis valley, a new find of rich silver-lead ore, in a 4-ft. vein, has been made.

At the Dean mill, in the Wallapai range, thirty miles from Kingman, a new filter press and thickener are being installed. The plant has seventy tons' daily capacity and is handling ore sampling $21 a ton in silver and gold. It is expected that the average output will be three carloads a month of concentrates running $250 a ton.



MINE SURFACE PLANT AND MILL OF MIAMI COPPER CO., MIAMI, ARIZ.
One of the Two Copper Companies Now Producing in Arizona.

The 200-ton mill of the Highland Mining Co. is nearing completion, the work being under C. B. Bell. The plant is claimed to be one of the most modern and most efficient in the Southwest. The company's main property is the old Golconda.

The Katherine Extension is driving a crosscut on the 250 level, with expectation of picking up the Katherine vein.

The Revenue Mines Co., in the Katherine section, has installed new shaft equipment and has built its own camp of offices and living quarters.

Humboldt—With reference to the statement from Phoenix appearing on p. 713 of the issue of Oct. 29, G. M. Colvocoressess, president of the Swansea Lease, Inc., writes:

"The lease on the property of the Swansea Consolidated Gold & Copper Mining Co. was not held by the Consolidated Arizona Smelting Co. This lease is held by the Swansea Lease, Inc., a concern in which the Consolidated Arizona Smelting Co. held a certain amount of stock. The Consolidated Arizona Smelting Co. is now in receivership and not in bankruptcy, and the Swansea Lease, Inc., is not involved in any financial difficulties, nor in any respect in default in regard to its lease.

"The errand of M. de Guerin is of a different character than that indicated, and no question has arisen in regard to the continuation of the rights of the Swansea Lease, Inc."

Mr. Colvocoressess states also that the application made by the Arizona & Swansea railroad for permission to dismantle is being opposed by all of the mining interests normally served by it, but which at present are inactive owing to market conditions. A revenue was derived by the railroad company from the operation of its line until last December, when the Humboldt smelter closed. There is every reason to expect that the railroad will be put in operation again, according to Mr. Colvocoressess, whenever the mines are ready to resume.

NEW MEXICO

Demand for Silver Properties Not So Much in Evidence

BY JAMES P. PORTEUS

Lordsburg—Dollar silver does not seem to have encouraged investments in mining enterprises in this section, as might have been expected. Interest started off nicely, but there has been a "hitch." Some lay it to the rush for 6 per cent tax-free bonds and claim the Government is getting all the surplus profits of the nation, the floating capital that has always shown a willingness to take a chance on a development enterprise. Others hold that excessive costs of operation, high freights, smelter charges and material costs are to blame and are quite outspoken in their disappointment that the threatened railroad strike was not called, holding the conviction that there cannot be a return of complete prosperity for silver mining until there is a reduction in freight costs, and that these cannot be brought about until there is a very considerable reduction in operation costs for the railroads.

It would seem that the drag on silver production that has interfered with the investment of new capital in the opening of new properties must be due to excessive taxes and surtax rates to a greater extent than to excessive operation costs. The price of silver and the demand for it are good. There are no surplus stocks of consequence on hand.

Silver production by the copper mines will not be a factor for a long time, so the silver miner has a clear field before him and an assured market at satisfactory prices for a long time, yet the demand for new properties and the money for new development are not in evidence as they should be. Unquestionably the menace of an excessive surtax is the deterrent factor. The "We dare you to succeed" air of some of our law makers who hold the tax club over the head of industry does not encourage investment.

Ore shipments from the Lordsburg district for October amounted to sixteen cars or 714 tons, consisting of copper, silver, and fluorspar ores.

UTAH

Objections Raised Against Bill For Revising Mining Law—Bingham & Garfield Ry. Wants To Stop Service—Utah Apex Fire Breaks Out Afresh

Salt Lake City—A subcommittee of the Mines Committee of the Salt Lake Commercial Club appointed to consider the Arentz bill on mining law now pending before Congress has expressed itself as being unfavorable to the changes proposed. The chief ground of opposition is that the present code has been judicially construed and that it is generally fairly well understood what steps are necessary to establish a valid location. It is felt by the committee that the enactment of a new code would cause confusion, and that laws of great practical use would be surrendered for those whose utility had not yet been demonstrated. Also, there is a feeling among practical mining men that, with the change of the time for the performance of the annual assessment work from the calendar to the fiscal year, and the elimination of the apex feature, the present law will give quite satisfactory results. The report of the committee carried a recommendation that the present extralateral right law be repealed; a more satisfactory mode of marking boundaries be adopted, and recording of mining locations in the local land office be provided. The committee took exception to the proposal that locations should conform to the four cardinal points rather than to the strike of the lode, and to Article B of Section 6, which gives the locator the choice of performing $5 worth of labor annually for each acre or of paying $5 an acre annually to the United States; also to Article B of Section 5 providing that discovery of mineral shall not be necessary to hold claims; that a claim may be held five years without discovery and that upon failure to make a discovery the locator shall have the right to hold his location for five years more by the annual payment in advance of $50 an acre, which fee shall be held in lieu of further requirement for assessment work. The objection covering the three above-mentioned points was that they would be prejudicial to the prospector of small means.

Bingham Canyon—The Bingham & Garfield railroad, which is controlled by the Utah Copper Co., has filed a petition with the Public Utilities Commission of Utah, asking that it be permitted to discontinue entirely passenger service to Bingham Canyon, for the reason that operations will not be resumed by copper companies of the camp, particularly the Utah Copper, for several months. The petition states that the railroad is at present running with an operating loss of $1,000 a month from operation of one coach daily over the line back and forth for passengers.

At the Utah Apex, the fire which started in 1917 on the abandoned 1,300 level, and which was at that time cut off from the remaining levels of the mine, has broken out between 1,400 and 1,500 levels. New bulkheads are being built. and the fire will be held in check, it is hoped.

Alta—The Alta Tunnel & Transportation in Big Cottonwood Canyon has marketed 200 tons of ore from its new find.

MONTANA

Silver Butte Acquires Coal Property Near Bozeman—B. & M. Mill Said To Have Been Started.

Butte—The Silver Butte Mining Corporation is reported to have acquired coal-producing properties to the extent of 2,000 acres, situated in what is regarded as a proven field near Bozeman, Mont.

Elkhorn—The new mill of the Boston & Montana Development Co. is reported to have been placed in operation to "tune it up."

NEVADA

Tonopah Divide Makes Good Report for September—Boom at San Antone; Named Changed to Royston

Leadville—Three cars of silver-lead concentrates, averaging about $200 per ton, were shipped by the Leadville Mines Co. during October. This makes the gross output $20,000 per month. The concentrates are hauled forty miles to Gerlach, the nearest railroad station, for shipment to Salt Lake smelters.

Tonopah—Recent bullion shipments from the mills of this district, representing clean-up of operations for the first fifteen days of October, were as follows: Tonopah Belmont, $124,500; Tonopah Mining, $46,000; West End, $61,000, and Tonopah Extension, $44,000. The MacNamara company shipped $61,000 worth of bullion during September. The greater portion of the ore treated at the MacNamara mill was custom ore, although leasers in company territory are doing some profitable work on both the West End MacNamara vein and the Lower Contact vein.

The Tonopah Mining Co. has increased development footage, and considerable prospecting for faulted segments of rich veins, in addition to regular drift and raise development on low-grade and narrow veins, is being done. Leasers in the Montana Tonopah mine are shipping some high-grade ore, and lease conditions in general in this mine are said to be good.

Divide — Official announcement has been made that the September production of the Tonopah Divide mine was 1,515 tons of ore, with an average value of $29.05 per ton, or a gross value of $51,200. This is a creditable record. The main shaft of the Tonopah Divide mine is being sunk below the 1,100 level, with the water level as the present objective. No lateral development work below the 800 level is planned until the water level has been reached. On the upper levels ore is being blocked out by raises from drifts, and on the 365 and 800 levels footwall crosscuts are being driven to prospect for the gold veins which outcrop several hundred feet south of the main shaft. The south crosscut on the 900 level from the Kernick shaft is now out 1,400 ft. A flow of warm water was recently encountered. with heavy ground to the south. No important developments are reported, although narrow stringers carrying values in sulphides have been cut. The Divide Extension has picked up the faulted segment of the vein on the 200 level, and is now drifting to the north. Values are said to be low.

San Antone—This district is experiencing a small boom. Several hundred people now have interests in the district, either as claim owners or lessees, and it appears that there is a fair possibility of some real work being accomplished. The ore so far discovered is high grade, but the veins are narrow. The name of the camp has been changed, by a majority vote of the claim owners and residents, to Royston. This in recognition of the faith and perseverance of one of the earlier operators in the district.

WASHINGTON

Controversy Over Star Deal Remains Chief Topic in Northwest Mining Circles

By HILLIARD W. POWER

Spokane.—Litigation undertaken by the Day-Smith interests with a view to blocking consummation of negotiations involving the Hecla Mining Co. and the Bunker Hill & Sullivan company in joint acquisition of the Star mine, adjoining the Morning property of the Federal Mining & Smelting Co., near Mullan, Idaho, continues to be the most interesting topic from the point of view of mining operators of the northwest. Notwithstanding the fact that several weeks have elapsed since the first legal papers were served, the issue appears as far from a judicial termination as in midsummer. The case, moreover, appears daily to become more complicated and there is evidence of a marked distaste on the part of the courts of both Washington and Idaho to sit in judgment. It is held by the Spokane County courts that being accustomed to trying cases involving mineral rights, the courts of Shoshone County, Idaho, should assume jurisdiction, but the Shoshone County courts have held that proceedings there should be dissolved because of similar proceedings having been started in Spokane County. Under the circumstances the issue becomes more confused each week.

Another document has been added to a rapidly growing list in the forms of a circular letter just mailed by minority Hecla stockholders in the fight, and in which the claim is made that Hecla's investment in the Star carries no clear title. "If the Hecla is compelled to buy more Sullivan stock," the letter states, "the Sullivan being the holding company for the Star, Hecla must take its earnings, your dividends, to pay for the same, or possibly mortgage the Hecla mine to the Bunker Hill to raise the necessary money. The Bunker Hill can also force upon the Hecla, through the Sullivan company, other mining undertakings which Hecla might not wish to undertake."

Chronology of Mining

October, 1921

Oct. 3—Arizona Copper Co. stockholders ratified proposal of directors to sell company's property to Phelps Dodge Corporation.

Oct. 5—Superior Court at Spokane, Wash., decided Hecla injunction suit brought by Day-Smith interests was out of its jurisdiction.

Oct. 10—Hearings on freight rates on iron ore in Lake Superior district resumed at Chicago by Interstate Commerce Commission.

Oct. 17-22—American Mining Congress held annual convention in Chicago.

Oct. 24—Receiver's petition for sale of property of Consolidated Arizona Smelting Co., at Humboldt, Ariz., heard at Tucson, Ariz.

Oct. 28—Cloudburst damaged Britannia Beach, B. C., causing loss of thirty-six lives.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
3	12.75	27.50	27.875	4.675@4.70	4.35@4.40	4.65@4.70
4	12.75	27.875	28.25	4.675@4.70	4.35@4.40	4.65@4.70
5	12.75	27.75	28.125	4.675@4.70	4.325@4.40	4.70
7	12.875	28.25	28.75	4.675@4.70	4.325@4.40	4.70
8	.....	.....	.....	.....	.....	.....
9	12.875	28.000	28.375	4.675@4.70	4.325@4.40	4.70@4.75

*These prices correspond to the following quotations for copper delivered: Nov. 3, 4 and 5, 13c.; Nov. 7 and 9, 13.125c.

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

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
3	66¾	67¼	73½	155¼	157½	23⅝	23⅜	25⅞	26½
4	66¾	67⅛	73½	156¾	158½	23⅝	23⅜	25⅞	26½
5	....	....	....	....	....	....	....	....	....
7	65⅞	66½	73½	158½	160	23¾	23⅜	25⅞	26½
8	66¼	66¾	73	158½	160½	23¾	23⅜	25¾	26⅜
9	66	66⅝	73	157¼	159¼	23⅞	23½	25½	26

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

Silver and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver			Nov.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
3	392½	99¼	70	40¼	7	393⅞	99¼	67¾	39
4	393⅞	99¼	69⅝	39⅞	8	....	....	....	39⅜
5	393½	99¼	69½	39⅞	9	393½	99¼	67⅝	38¾

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, Nov. 9, 1921

The metal markets have continued generally firm during the last week, with sales of satisfactory volume. Yesterday was Election Day, so that no business was done.

Copper

Last Thursday most producers were quoting copper at 13c. delivered for November and December, and a large quantity was sold at that price. On Friday some producers began quoting on a higher level, and by Monday most of them had advanced to 13.125c. or 13.25c. As the prices were advanced the business gravitated to those who were still willing to sell on a 13c. basis, so that they were quickly sold out. We know of no direction in which copper can be obtained for 13c. today, and the general quotation is 13.25c. However, little or no business is yet being done at that price, though some sales are reported at 13.125c. Consumers have not yet become accustomed to paying more than 13c., but are likely to revise their conception of the market before the end of the week if producers do not weaken.

Inquiry continues good. Orders from brass companies are particularly satisfactory when compared with expectations several months ago. During the summer months the brass companies were operating only at about 30 per cent capacity, but September business was better than August, and October was better than September. Operations are now being carried on at about 50 to 60 per cent of capacity. This improvement in business is reflected to an even greater extent in their requirements for copper, inasmuch as their stocks of scrap are being exhausted and little or no more of a desirable quality is to be had. Last week we mentioned the English stocks, and the American stocks of cartridge brass in the hands of the Government were only about 5,000,000 lb. on Oct. 1.

The price of copper for European delivery is reported to have been advanced to 13.375c. c.i.f., by the Copper Export Association, and with a freight rate of $3.50@$4 this is equivalent to close to 13.20c. f.o.b. New York. There is a fairly good demand from Germany, France, and Italy, but the Far Eastern business seems to have fallen away for the time being.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c. The New York market has strengthened slightly, and we are no longer advised of any sales as low as 4.65c. A fair amount of orders have been placed both at the 4.675c. and at the 4.70c. figure, but much of the business has been in small lots. The larger consumers seem well supplied for current requirements, but have no large stocks on hand, and the statistical position of lead, from every angle, continues good. In St. Louis, however, the market has weakened somewhat, and demand seems very slight. Some business continues to be booked at the 4.40c. price which obtained two or three weeks ago, and this level probably still holds for desilverized lead. Chemical lead of an excellent brand was freely offered all week, beginning Thursday, at 4.35c. and several lots were sold at that price. There was evidently more available than the market could absorb, for the best price which one seller could obtain for a lot of several hundred tons on Saturday was 4.325c., and the sale was made at that figure.

On Dec. 10, the freight rate on lead from St. Louis to New York will be reduced to 35c. a hundred. This will permit Missouri producers to compete in the New York market, something which they have not been able to do for some time. It will be noted that the difference in price is now almost exactly 35 points, so that little or no change in either market is likely as a result of the decreased cost of transportation. Missouri producers will not be able to sell lead in New York for less than 4.70c. unless the St. Louis price should be reduced.

Forward demand is still very quiet, with most producers refraining from making quotations.

Zinc

The market advanced during the week, bringing quotations higher than they have been since the latter part of May, but even at the present level of the market at 4.70@4.75c., there is little disposition to press the metal for sale.

It is not yet known whether the reduction of the freight rate from St. Louis to New York, from 49c. per hundred to 35c., will apply to zinc as well as to lead, but producers expect that it will. This reduction should directly affect the price of zinc in New York, which should be at a premium of 35 points, instead of 49 points above the St. Louis figure, if the new rate applies.

High-grade zinc is going forward in fair volume at prices similar to those quoted for some weeks—namely, 6c. per lb. with freight allowed.

Tin

In the past week the price of Straits has risen to close to 29c., with increased inquiries and buying from consumers. The 99 per cent grade continues about one-half cent under the price of Straits, though the differential may be nearer three-eighths of a cent for desirable grades of Chinese tin. Some undesirable tin, but still of 99 per cent grade, has been on the market.

Quotations on Straits tin for February delivery have been about as follows: Nov. 3d, 28.375c.; 4th, 28.375c.; 5th, 28.375c.; 7th, 28.875c.; and 9th, 28.875c.

Arrivals of tin, in long tons: Nov. 1, Straits, 5; 7th, Straits, 500.

Gold

Gold in London: Nov. 3d, 104s. 7d.; 4th, 104s. 4d.; 7th, 104s. 4d.; 8th, 104s. 3d.; 9th, 104s. 2d.

Foreign Exchange

Sterling has been somewhat stronger during the last week. Marks have continued their downward course, and a plotted curve of the value of the mark indicates that the zero hour is approaching. The next step is still in doubt. On Monday, Nov. 7, francs were 7.265c.; lire, 4.165c.; and marks, 0.345c. New York funds in Montreal, 8¼ per cent premium. Sterling cables continue to be quoted at one-half cent premium over the figures given on page 796 for demand.

Silver

Eastern exchanges have continued to fall, but with the price of silver lower in London and New York, China has continued a moderate buyer in both markets. There is also the possibility of the Indian bazaars becoming buyers again and of bears covering sales made at the recent higher levels. Under present-day conditions accurate predictions are impossible; however, the market appears somewhat steadier at the lower figures.

Mexican Dollars—Nov. 3d, 53⅞; 4th, 53½; 5th, 53½; 7th, 52½; 9th, 52.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c. with practically no sales.

Antimony—Chinese and Japanese brands, 4.80@5.25c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

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@$2.10 per lb. in bbls.

Iridium—Nominal, $150@$170 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 tonnages, spot, 35@38c. Market dead.

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

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

Palladium—Nominal, $55@$60 per oz.

Platinum—$85 per oz. The market has become slightly easier. Greater supplies of metal are available, but no change is noticeable in quotations.

Quicksilver—$39@$41 per flask. San Francisco wires $41. Market dull.

The prices of the following metals remain unchanged from the figures published in these columns on Nov. 5: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Nov. 5 issue: Chrome, Iron, Magnetite, Manganese, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 5—Zinc blende per ton, high, $26.70; basis 60 per cent zinc, premium, $26; Prime Western $24@$25; fines and slimes $23@$22; average settling price, all grades of blende, $23.84.

Lead, high, $64.50; basis 80 per cent lead, $55; average settling price, all grades of lead, $62.71 per ton.

Shipments for the week: Blende, 7,167; lead, 972 tons. Value, all ores the week, $231,810.

The American Metal Company, having secured a new supply of gas for the Blackwell smelter, came into the market this week offering $25 basis price, and secured 6,600 tons. Two smelter agents paid $26 basis for premium grades. A little ore was purchased early on $24 basis.

Buyers were offering $55 basis for lead concentrates, but as sellers found a ready market for blende, few would accept the lower lead price level, and settlements and shipments were from previous purchases on the higher basis rate of $60. Buyers of lead expect the market to lower next week unless pig lead marks improvement.

Platteville, Wis., Nov. 5—Blende, basis, 60 per cent zinc, $30; lead ore, basis, 80 per cent lead, $60 per ton. Shipments for the week: Blende, 362 tons. Shipments for the year: Blende, 9,672; lead ore, 1,605 tons. Shipped during week to separating plants, 612 tons of blende.

Non-Metallic Minerals

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Nov. 5 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

Mineral Products

The prices of Arsenic, Sodium Nitrate, Sodium Sulphate, and Potassium Sulphate are unchanged from the quotations published in these columns Nov. 5.

Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Nov. 5 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Copper Sheets and Wire, Lead Sheets, Nickel Silver, Yellow Metal and Zinc Sheets are unchanged from the quotations given in the Nov. 5 issue.

Refractories

Prices on the following are unchanged from the figures published in the Nov. 5 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Nov. 8, 1921

The dullness that began developing in the steel market about the middle of October continues. A moderate volume of business is coming in, and the mills have some tonnage ahead. Steel ingot production is at the rate of about 40 per cent of capacity.

On Nov. 3 the Steel Corporation reduced its tin plate price from $5.25 to $4.75. Independents had been shading to $4.75, though endeavoring to maintain $5.

Pig Iron—There has been so little buying in recent weeks that prices have become more or less nominal, there being no quotable change: Bessemer, $20; basic, $19; foundry, $21, f.o.b. Valley furnaces, with $1.98 freight to Pittsburgh.

Coke

Connellsville—Furnace, $3.35@$3.50; foundry, $4.25@$4.75 per ton.

World's Zinc Industry Becoming More Active

British Smelters Resuming Production on a Moderate Scale—Future of Silesian Zinc Industry Clouded by Politics—Australia Likely To Produce Cheap Metal

THE secretary of the American Zinc Institute has received the following discussion of world zinc conditions from its honorary foreign correspondent dated London, Oct. 21:

The zinc quotations of the London Metal Exchange do not show much variation, and for some time the price has ranged between £25 15s. and £26 12s. 6d. For the last six weeks Germany has refrained from offering at all for export, and Belgium has been a seller of small quantities at the London parity. Scandinavia appears to have now disposed of the bulk of her zinc in the hands of weak holders, and which mainly consisted of metal of German origin.

United Kingdom—The Board of Trade recently announced its willingness to make available to British smelters supplies of its Australian concentrates at a specially favorable price, conditionally upon the smelting companies and labor unions agreeing upon a scale of wages which would make zinc smelting economically possible. Negotiations between the smelters and the men have resulted in wages being fixed at approximately 50 per cent above the 1914 rates. I have reason to believe that the price will be fixed on the basis of a 47 per cent zinc concentrate and upon a sliding scale governed by the fluctuations in the official market quotations for zinc.

Wheat is available for all the cargo space offering from Australia and is paying 57s. 6d. per ton from commonwealth ports to Great Britain. Zinc concentrates from Port Pirie therefore cannot come forward in cargo lots at under 50s. per ton freight, and it follows that the government's c.i.f. selling rate to the English smelters must be drastically trimmed to enable the smelters to plan the production of zinc at £26 or better. As regards costs, supplies are certainly becoming cheaper, and industrial coal, which was costing upward of 40s. a ton at the time the smelters were last operating, is now available at 26s. delivered. Industrial coal should be obtainable soon at under 20s. per ton.

Swansea Vale and Villiers have already started up furnaces, and several other works are prepared to resume soon after the Board of Trade's price terms are known. As the total capacity of the British smelters under present conditions is under 60,000 tons of virgin zinc a year, if it be assumed that they work for the next few months at 30 per cent capacity, the British output will not amount to more than 1,500 tons monthly.

France—At present France is producing zinc at the rate of 18,000 tons a year, and this is the result of the repairing work which has been slowly proceeding since the Armistice. It must be remembered that three-quarters of the French zinc industry is situated in the extreme north and within the recent war zone. Consequently, all the plants suffered severely during hostilities, and it has proved a tedious and costly undertaking to make good the damage. The Auby smelter is producing at the rate of nearly 1,000 tons a month, or 50 per cent of its pre-war capacity of 22,000 tons annually. The plant at Mortagne-du-Nord—previously German-owned—is now turning out about 450 tons monthly, and early in 1922 will be in a position to run fifteen furnaces for an output of 20,000 tons per year if conditions warrant. The small St. Amand smelter is producing 150 tons to 200 tons of zinc monthly. There is also a smelter in the Artois district near Noyelles-Godault, which had a pre-war capacity of 7,500 tons yearly, but it is extremely unlikely that these works will be put in operation inside the next two years. For statistical purposes there is warrant for assuming the present French cost of producing zinc at £27 10s. per ton expressed in sterling.

Belgium—All smelters are running at part capacity and limiting production to 5,000 tons a month. Stocks of ore on hand are sufficient to maintain this rate of output for over six months, and as the costs of only a few favored works are within the present selling price of zinc, it is deemed desirable to limit the next six months' production to 30,000 tons unless an improvement in both price and consumption ensues. Continental demand is now absorbing the Belgian production, and in addition is now happily making a hole in the accumulated stocks of zinc sheets, which at mid-October were not nearly so formidable as three or four months back. Coal and labor are still very high if measured by pre-war standards.

Generally speaking, the cost of producing zinc in Belgium may be broadly assumed at £26 10s. on the average, but, as indicated in the foregoing, the best-placed smelters are slightly below that figure, and some look to a profit from the conversion of their metal into sheets. Of course, the big Vieille Montagne Co. does well from its large production of zinc oxide, in addition to its rolling mills.

Germany—With the revival of German trade the production of zinc in the country, including Silesia, has increased to upward of 6,000 tons a month. There has been a good domestic demand, and this has prevented stocks from becoming excessive. The London Metal Exchange feared the dumping of German zinc into England when the mark collapsed, but it is significant that practically no offers whatever have been received from Germany, and it may well be that the report generally accepted on the Continent is correct in that zinc and zinc sheets are included in the list of articles Germany has undertaken to supply to France under the agreement entered into at Wiesbaden last month providing for payment of reparations in kind.

The decision of the League of Nations as to the disputed territory in Upper Silesia has again clouded the future of the German-Silesian zinc industry. Many smelters are within the Kattowitz and Beuthen districts, which now fall definitely inside the new Polish border. These smelters are German-owned and the Polish workmen are so temperamentally constituted that they may conceivably refuse to work satisfactorily for German masters under the new conditions. I know that certain prominent zinc interests in France have long coveted the control of the Silesian industry and have looked forward to the day when the works in the disputed areas would fall within Poland's domain. Presumably these Paris interests will attempt to turn the present-day situation to their advantage, and altogether the position is too hopelessly mixed to enable one to formulate any idea as to the future of the Silesian zinc industry. But it is only reasonable to believe that until the situation is clearer the present owners of smelting works there will certainly not attempt to force production.

Expressed in terms of sterling, it would seem that the producing cost of zinc in Germany and Silesia is on an average £23 per ton.

Scandinavia—Owing to inability to sell their high-grade zinc at much, if anything, above the London quotations for "G. O. B.," and then to Britain only, and also to the fact that the production cost exceeds the present market price, Scandinavian smelters are merely marking time by keeping a few furnaces at work. Meanwhile the accumulations of German zinc in Norway and Sweden appear to have been sold.

Australia—The 5,000-ton distillation works at Port Pirie are unlikely to be again put in operation except perhaps with zinc over £30. Even then it is doubtful whether it would prove economically advisable to start up as long as high-grade zinc can be produced by more or less the same interests at Risdon at certainly £10 a ton cheaper.

It will be near the end of 1922 before the electrolytic plant at Risdon is completely finished and producing 34,000 tons of 99.95 per cent purity zinc a year. The first half of the plant is to start in the next week or two, however, so the industry can expect Australia to re-enter the ranks of zinc producers with an initial output of 1,400 tons or 1,500 tons monthly.

Cheap water power and other natural advantages, as well as the fact that the works represent the most improved technical development in zinc-plant practice, warrant the belief that the Australian Electrolytic Co. will be able to produce zinc cheaper than any other smelter in the world. Unless the management is in error in the figures published, I imagine the plant can achieve an over-all producing cost of zinc at £21 per ton when the Risdon plant is running at full capacity. Such an achievement will reflect the highest credit on the technical administration of Messrs. H. W. Gepp and Gilbert Rigg, and will denote the realization of the vision of the Baillieu-Robinson group who so early foresaw the potentialities of the Tasmanian hydroelectric program.

The United States—Notwithstanding that zinc exports from the United States are impracticable, inasmuch as the metal stands at a substantially higher price in New York than in Europe, both Britain and Belgium carefully follow the monthly statistics of United States production and stocks. The reduction of the American stocks to the extent of 11,000 tons during the last two months is doubtless regarded with the same measure of satisfaction in the United States as in Europe.

French Indo-China—Though Tonkin has produced between 25,000 and 50,000 tons of ore annually for some years, no attempt has been made at local reduction. However, a Paris company has now decided to erect a small plant with a first capacity of 1,500 tons of zinc yearly, and if this is successful the works will be extended to a total capacity of 6,000 tons per annum. Engineers have been engaged, and the erection of the first furnace will be started soon, and metal should be actually turned out in 1922.

Zinc Ores—The ore-supply position is in a troubled state, owing first to Belgium being little interested, because of her existing large stocks, and, second, to Germany's inability to purchase on account of the adverse mark exchange. All the North African producers are shut down and indeed have still some thousands of tons of calcined calamine to dispose of from stocks at shipping ports. For this material they are asking 5½ to 5¾ French francs per unit of zinc f.o.b., which is roughly equivalent to 2s. 4d. to 2s. 6d. c.i.f., Antwerp or Swansea. This is rather more than the United Kingdom smelters can afford to pay unless some of them find it necessary—as is quite possible—to mix a certain percentage of Mediterranean ore with the Australian concentrate.

Spanish zinc mines are not working, and the blende on offer at the moment is mainly Chinese from the Sui-Kui-Shan mines. The price asked for this ore of a grade of 40 to 45 per cent Zn, 8 to 12 per cent Pb, and 8 oz. Ag is 1s. 11d. per unit of zinc, c.i.f., which is not unreasonable, and Germany has purchased some parcels at this rate. It will be remembered that these particular Chinese mines, situated in Hunan, were under the control of Messrs. Carlowitz & Co. before the war, but their contracts were cancelled at the time China joined the Allies. This mine has a plant capable of producing 50,000 tons of concentrates yearly, and, now that Japan is no longer an active zinc producer, the material must seek a selling outlet in Europe.

World Stock of Zinc—My estimate of virgin slab zinc stocks on Sept. 30, 1921, is 139,000 metric tons, made up as follows:

	Metric Tons
United States	74,000
United Kingdom	16,500
Belgium	9,000
Germany	25,500
France	7,000
Scandinavia	3,000
Other countries	4,000
Total	139,000

Galvanized Sheets—During September British galvanizers booked overseas orders for galvanized sheets to the extent of nearly 60,000 tons, and further substantial business transpired in October. Coal, steel, and labor all have a tendency to fall, and reductions therein will be followed by lower quotations for galvanized iron. Most of the September and October business has been booked on the basis of £18 to £19 f.o.b. for 24 and 26 gages. British galvanizers are booked up for several weeks ahead at the present scale of operations, and if export business continues to be satisfactory the manufacturers will augment their production.

There is now no Continental competition with British galvanized steel sheets, and the prospects are that Britain's position as the chief producer of this line will be as unassailable as before the war.

September Movements of Ores and Metals

Imports and exports of the more important metals and ores as reported by the Department of Commerce for September, 1921, and the figures for September, 1920, as finally revised, are as follows:

IMPORTS, SEPTEMBER, 1920 AND 1921
In Pounds, Unless Otherwise Stated

	September, 1920	September, 1921
Antimony ore, contents	685,581	.....
Antimony matte, regulus or metal	1,020,012	1,288,072
Brass, fit only for remanufacture	5,957,392	3,488,787
Copper		
Ore, contents	5,368,657	3,915,128
Concentrates, contents	3,151,503	1,481,743
Matte and regulus, contents	1,612,617	871,764
Imported from		
Spain	.....	946,452
Canada	2,374,342	26,763
Mexico	4,037,912	24,219
Chile	2,619,099	3,583,379
Peru	30,165	233,033
Cuba	127,680	.....
Unrefined, black and blister	17,728,139	8,614,851
Refined, in bars and plates	1,117,817	9,213,018
Old, for remanufacture	1,509,444	1,330,490
Composition metal, copper chief value	73,466	10,284
Lead		
Ore, contents	6,396,981	916,246
Bullion, contents	14,998,560	435
Imported from		
Canada	576,477	401,069
Mexico	15,595,399	375,495
Chile	1,057,048	29,682
Pigs, bars and old	17,125,245	2,005,049
Manganese ore, long tons	88,422	10,402
Imported from		
Cuba, long tons	75	.....
Brazil, long tons	61,800	10,400
British India, long tons	7,300	.....
Tungsten ore, long tons	360	145
Pyrites, long tons	14,433	14,627
Imported from		
Spain, long tons	883	14,627
Canada, long tons	10,700	.....
Tin ore, long tons	2,489	664
Tin bars, blocks and pigs	9,154,070	5,796,186
Imported from		
United Kingdom	1,064,504	1,375,549
Straits Settlements	6,034,850	3,714,741
Hongkong	1,432,739	672,296
Australia	190,400	33,600
Zinc		
Ore, contents	3,753,221	.....
Imported from		
Canada	283,886	.....
Mexico	3,469,335	.....
Blocks, or pigs, and old	500	.....

EXPORTS OF COPPER, LEAD AND ZINC
In Pounds

	September, 1920	September, 1921
Copper		
Ore, contents	36,000	.....
Concentrates, contents	167,194	.....
Unrefined, black and blister	2,700	12,885
Refined, in ingots and bars	19,128,143	60,169,763
Exported to		
Belgium	2,803,913	2,879,685
France	4,659,360	7,100,177
Germany	1,536,105	24,999,433
Netherlands	840,505	2,691,234
United Kingdom	3,326,631	2,688,620
Japan	.....	12,096,095
Composition metal, copper chief value	6,269	.....
Old and scrap	2,463	130,890
Pipes and tubes	360,729	84,125
Plates and sheets	2,812,249	494,254
Wire, except insulated	2,142,898	399,576
Lead		
Pigs and bars		
Produced from domestic ore	758,579	87,248
Produced from foreign ore	1,493,600	6,394,017
Exported to		
United Kingdom	672,000	2,240,950
Canada	37,683	370
Brazil	380,800	227,149
Japan	672,000	1,176,000
Argentina	336,000	.....
Other countries	146,868	2,836,832
Zinc		
Dross	740,279	85,725
Spelter		
Produced from domestic ore	2,232,550	341,574
Produced from foreign ore	955,055	.....
Exported to		
France	1,008,000	.....
United Kingdom	786,979	.....
Mexico	58,300	302
Japan	.....	336,268
In sheets and strips	1,104,515	285,483

MINING STOCKS

Week Ended November 5, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	53½	51	52	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*50	*36	*46		
Allouez	Boston	22	20	22	Mar. '19	1.00
Anaconda	New York	43	41	42½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅜	2⅛	2⅛		
Ariz. Com'l	Boston	8⅝	8⅛	9	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*34	*30	*32		
Bingham Mines	Boston	13⅜	13⅛	13⅜	Sept. '19, Q	.25
Calumet & Arizona	Boston	52½	50⅜	52½	Sept. '21 Q	.50
Calumet & Hecla	Boston	245	235	244	June '20, Q	5.00
Canada Copper	N. Y. Curb	*30	*28	*30		
Centennial	Boston	9	8½	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	31½	29⅝	30⅛	Mar. '21, Q	.50
Chile Copper	New York	12⅜	11⅛	12⅛		
Chino	New York	26⅛	25⅛	26⅛	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*15	*15	*15		
Con. Arizona	N. Y. Curb	*3	*2	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1½	*90	*90		
Copper Range	Boston	35	34½	35	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*41	*37	*39		
Davis-Daly	Boston	7¼	6⅛	7	Mar. '20, Q	.25
East Butte	Boston	10	9	9	Dec. '19, A	.50
First National	Boston Curb	*75	*75	*75	Feb. '19, SA	.15
Franklin	Boston	2⅛	†2⅛	2⅛		
Gadsden Copper	Boston Curb	*40	*40	*40		
Granby Consol.	New York	21	19⅜	21	May '19, Q	1.25
Greene-Cananea	New York	24	22⅞	23	Nov. '20, Q	.50
Hancock	Boston	†3	†2	2⅞		
Howe Sound	N. Y. Curb	2⅜	2⅛	2⅜	Jan. '21, Q	.05
Inspiration Consol.	New York	36⅜	35⅛	35½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6½	5⅜	6¼	Sept. '20, K	.25
Isle Royale	Boston	†22	†20⅜	21	Sept. '19, SA	.50
Kennecott	New York	23⅜	22⅛	23⅜	Dec. '20, Q	.50
Keweenaw	Boston	†1⅛	†1 1/16	1⅛		
Lake Copper	Boston	3	3	3		
La Salle	Boston	†1¼	1⅛	1¼		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	22	21	21½	Jan. '19, Q	.50
Majestic	Boston Curb	*12	*12	*12		
Mason Valley	Boston	1⅜	1⅜	1⅜		
Mass Consolidated	Boston	2	2	2	Nov. '17, Q	1.00
Miami Copper	New York	23⅛	22⅜	22⅜	Aug. '21, Q	.50
Michigan	Boston	†2⅛	†2	2⅛		
Mohawk	Boston	52⅞	51	52	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅜	5⅛	5⅜		
Nevada Consol.	New York	13⅛	12⅜	12⅜	Sept. '20, Q	.25
New Cornelia	Boston	15⅜	14⅜	14⅜	Aug. '20, K	.25
North Butte	Boston	11	10	10⅜	Oct. '18, Q	.25
North Lake	Boston	†*50	†*15	*20		
Ohio Copper	N. Y. Curb	*7	*7	*7		
Old Dominion	Boston	24	23	23	Dec. '18, Q	1.00
Osceola	Boston	30	29⅜	30	June '20, Q	.50
Phelps Dodge	Open Mar.	†180	†165	....	Oct. '21, Q	1.00
Quincy	Boston	40	40	40	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅞	13⅛	13⅜	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*26	*21	*23		
St. Mary's Min. Ld.	Boston	39	38	38	June '20, K	2.00
Seneca Copper	Boston	20¼	19⅜	20⅛		
Shannon	Boston	1	1⅛	1⅛	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6	6¼	Jan. '20, Q	.25
South Lake	Boston	†*51⅛	†*50	*75		
Superior & Boston	Boston	1⅜	1⅛	1⅛		
Tenn. C. & C. cfs.	New York	8⅜	8	8	May '18, I	1.00
Tuolumne	Boston	*41	*38	*40	May '13	.10
United Verde Ex.	Boston Curb	27⅛	25⅞	26⅛	Nov. 21, Q	.25
Utah Consol.	Boston	3	3	3	Sept. '18,	.25
Utah Copper	New York	56⅛	54⅜	55⅛	June '21 Q	.50
Utah Metal & T.	Boston	1⅜	1 1/16	1 1/16	Dec. '17,	.30
Victoria	Boston	1⅜	1⅜	1⅜		
Winona	Boston	*60	*40	*50		
Wolverine	Boston	†12	†11	11		
NICKEL-COPPER						
Internat. Nickel	New York	14⅛	13¼	13	Mar. '19,	.50
Internat. Nickel, pf.	New York	....	....	74	Nov. '21, Q	1.50
LEAD						
National Lead	New York	77⅞	76⅛	76⅞	Sept. '21, Q	1.50
National Lead, pfd.	New York	104⅜	104	104	Sept. '21, Q	1.75
St. Joseph Lead	New York	13⅜	13¼	13¼	Sept. '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50	....	*50		
ZINC						
Am. Z. L. & S.	New York	9	8⅛	8⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	33	33	33	Nov. '20, Q	1.50
Butte C. & Z.	New York	5	4⅜	5	June '18,	.50
Butte & Superior	New York	14⅛	13⅛	13⅛	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4⅛	4	4	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	124⅜	124	124	Aug. '21, Q	2.00
Success	N. Y. Curb	....	....	2	July '16	.03
Yellow Pine	Los Angeles	*35	*35	*35	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.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	⅛	⅛	⅛		
Carson Hill	Boston	13⅛	12⅛	12⅛		
Cresson Consol. G.	N. Y. Curb	1⅛	1 1/16	1⅛	June '20, Q	$0.10
Dome Extension	Toronto	*68	*68	*68		
Dome Mines	New York	18⅛	18⅛	18⅛	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*39	*35	*35		
Golden Cycle	Colo. Springs	*67	*67	*67	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*5	*5	*5	Dec. '19,	.05
Hollinger Consol.	Toronto	7.50	7.46	7.48	Nov. '21, 4 wks.	.05
Homestake Mining	New York	55	55	55	Oct. '21, M	.25
Kirkland Lake	Toronto	*39½	*26	27		
Lake Shore	Toronto	1.24	1.19	1.23	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.90	1.86	1.89	Sept. '21, K	.05
Porcupine Crown	Toronto	*15	*12	*13½	July '17,	.03
Porcupine V. N. T.	Toronto	*17⅜	*15	*17		
Portland	Colo. Springs	*35	*35	*35	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Schumacher	Toronto	*26	*22	*25		
Silver Pick	N. Y. Curb	....	....	*8		
Teck Hughes	Toronto	*15⅛	*15	*15½		
Tom Reed	Los Angeles	*44	*34	*35	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2⅛	2 1/16	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	*24	*24	*24	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*5	*5	*5		
Yukon Gold	N. Y. Curb	1⅛	1⅛	1⅛	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*20	*17	*18	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25	*21	*22	May '20, K	.03
Coniagas	Toronto	1.50	1.20	1.40	May '21, Q	.12½
Crown Reserve	Toronto	*13	*10	*12	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅜	3⅜	3⅜	Oct. '21, Q	.12½
La Rose	Toronto	*35	*33	*33½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20½	*16	*19	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.00	1.10	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	Oct. '21, Q	.03
Ontario Silver	New York	....	....	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	.10
Temiskaming	Toronto	*28	*22	*26	Jan. '20, K	.04
Trethewey	Toronto	*13	*10	*11	Jan. '19,	.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	1 1/16	*94	*96		
Cash Boy	N. Y. Curb	*4	*4	*4		
Consol. Virginia	San Francisco	....	....	*36		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛		
El Salvador	N. Y. Curb	*16	*15	*16		
Jim Butler	N. Y. Curb	....	....	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*3	*4	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*14	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	....	....	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅜	1 1/16	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*70	*66	*70		
Tonopah-Extension	N. Y. Curb	1⅛	1 1/16	1⅛	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 1/16	1 1/16	1 1/16	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*97	*95	*96	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*8	*8	*8	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.00	1.00	1.00	Dec. '20,	.15
Chief Consol.	Boston Curb	3⅛	3⅛	3⅛	Aug. '21, Q	.05
Consol. M. & S.	Montreal	18	17	17⅛	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.00	....	....	July '20, Q	.10
Daly-West	Boston	2	2	2	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2⅛	2	Apr. '21, K	.05
Electric Point	Spokane	*5	*4	*5	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*48	*40	*45		
Federal M. & S.	New York	....	....	7⅛	Jan. '09,	1.50
Federal M. & S., pfd	New York	25⅛	25	25⅛	Sept. '21, Q	1.00
Florence Silver	Spokane	*9	*4	*9	Apr. '19,	.01⅛
Grand Central	Salt Lake	†*30	†*11	....	June '20, K	.03
Hecla Mining	N. Y. Curb	4½	4⅛	4⅛	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	....	....	*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	†2.00	....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	†*7⅛	†*5	*7⅛	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*1	*1	*1	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*9	*10		
South Hecla	Salt Lake	†*40	†*20	....	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	....	....	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1.95	1.80	1.95	Jan. '21 K	.04
Tintic Standard	Salt Lake	1.95	1.87½	1.95	July '21, Q	05
Utah Apex	Boston	2 1/16	2⅛	2⅛	Nov. '20, K	25
Wilbert Mining	N. Y. Curb	....	....	*1	Nov. '17,	01
VANADIUM						
Vanadium Corp.	New York	33⅜	31¼	31⅜	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	62⅜	53¼	62	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	80¼	74	80½	Oct. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	40⅛	38⅛	39	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	80	76½	80	Sept '21, Q	1.75
Am. Sm. pf. A	New York	81⅜	78	81⅜	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	33⅜	32⅛	33⅛	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	39¾	39⅛	39⅛	Oct. '21, Q	.87½