

ENGINEERING AND MINING JOURNAL

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June 4, 1921



Our Future Oil Supply

By David White

**Recent Supreme Court Interpretations
of the Mining Law**

By Horace V. Winchell

Mining Progress in the Philippines

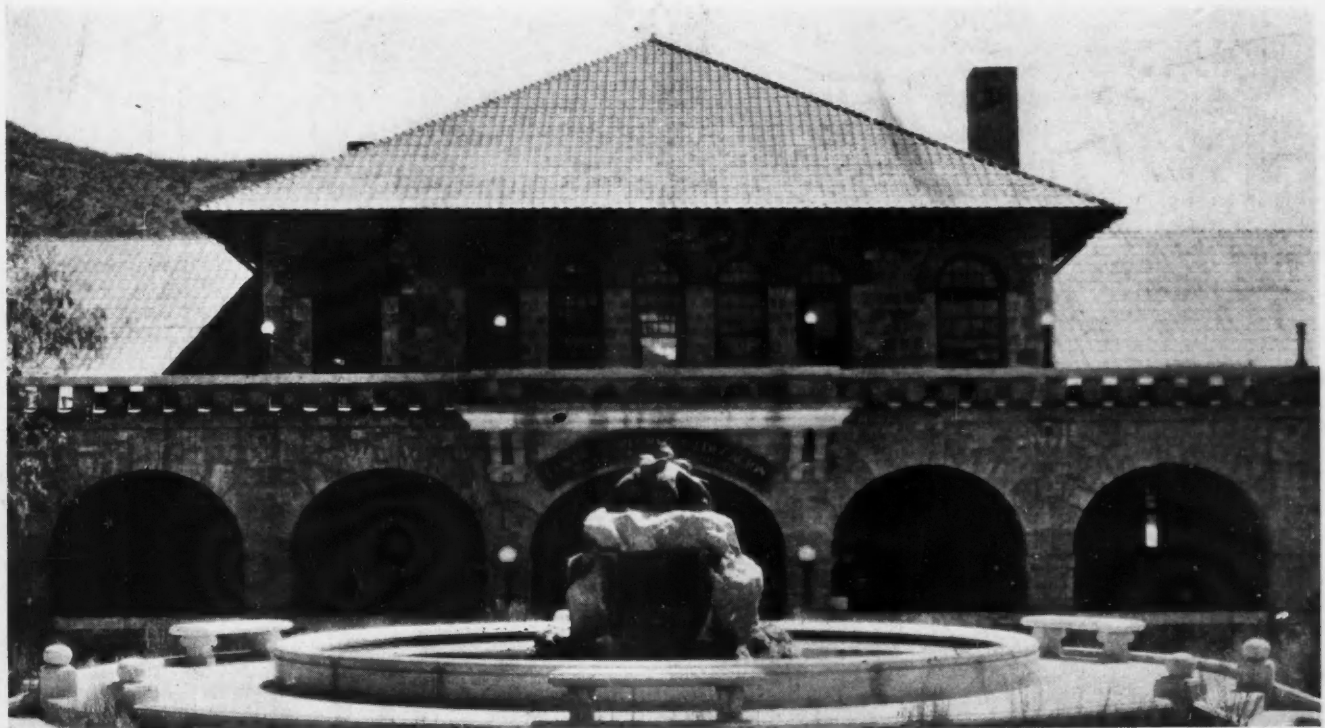
By C. M. Eye

The Reward of Bluffing

By Edward Norcott

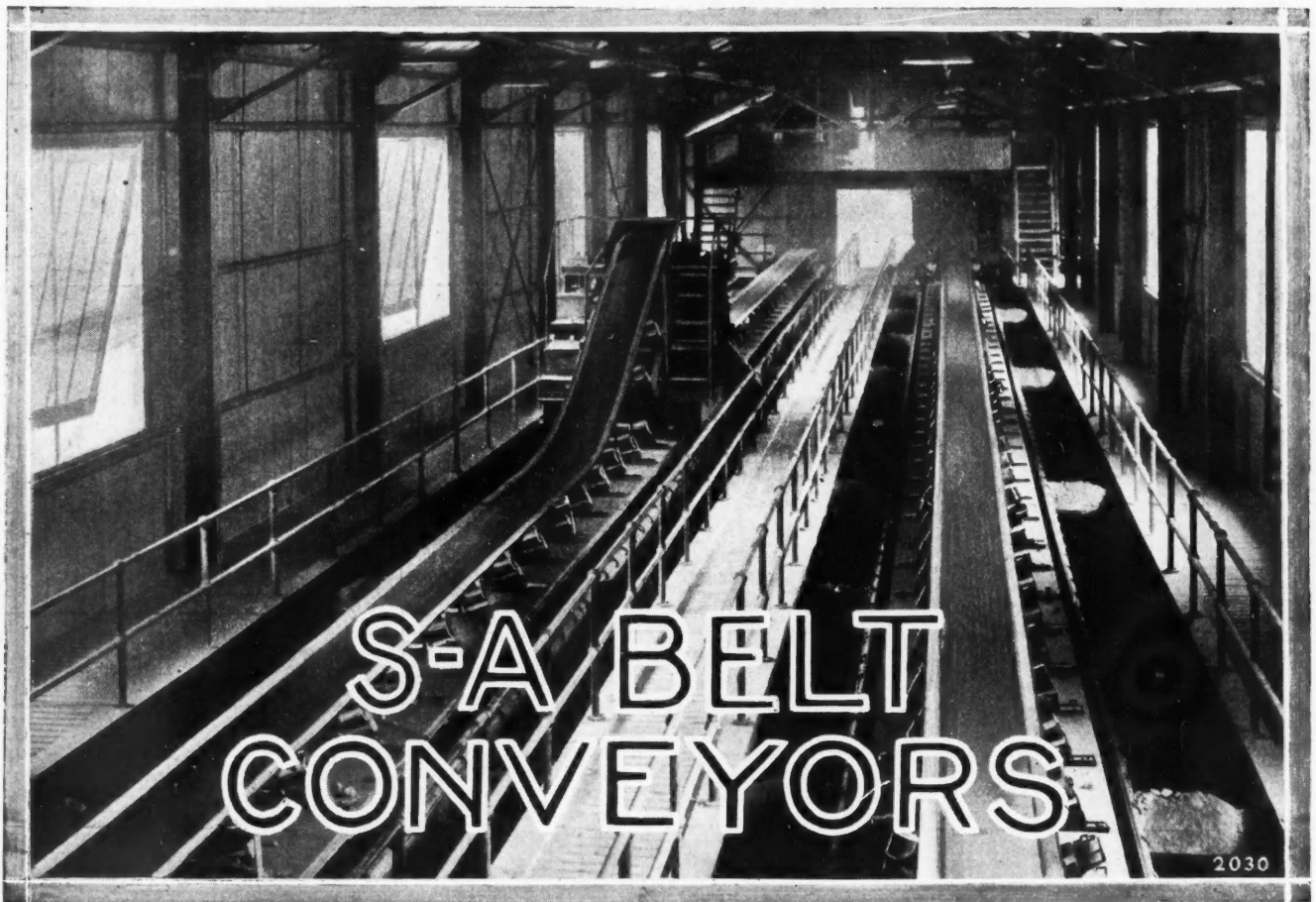
Trade Notes on Bauxite

Douglas Memorial Fountain at Nacoziari



A COPPER MINING PIONEER'S MONUMENT

Fountain Memorial to James Douglas at Nacoziari, Mexico—Public Library Erected by Moctezuma Copper Co. in Background



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Reorganization and Public Works

THE QUESTION OF REORGANIZATION of Government departments and bureaus in Washington is being actively investigated by a committee of both houses of Congress. It is a problem that will require careful study and not too breezy a method of rearrangement. Changes must be for the better: it would be easy for too casual a study to result in some changes at least for the worse. Out of these recommendations it now appears altogether unlikely that there will come any recommendation for a Department of Public Works. It is rumored rather definitely that Secretary Hoover, once strongly impressed with this plan, now no longer favors it. Our own editorial attitude has never been in favor of this proposal, which we could not recognize as constructive, and which we viewed as against the interests of the mining industry. An apothegm recently uttered regarding this formerly proposed department, by an engineer who was one of the former main champions of the idea, illustrates the case against it more succinctly than we have been able to do with all our arguments. "There is no more sense in having all the engineers in one department," he said, "than having all the stenographers in one department."

Having disposed of this engineer will-o'-the-wisp, let us see what we can do, in the reorganization, to centralize the representation of the mining industry.

The Resignation of the Institute Secretary

THE PASSING out of office of a secretary of the American Institute of Mining and Metallurgical Engineers is an event which marks a stage in the affairs of mining. The Institute represents in a broad way, and more and more completely, the engineering or technical side of the mining and metallurgical industries. The secretary is the permanent and managing officer. Presidents come and go annually: but the tone and impression of the organization are largely built up around the personality of the secretary.

In the memory of most of us there have been only two secretaries—Dr. Raymond and Mr. Stoughton. Their personalities were not similar; in a way they were antithetical; but both gained hosts of friends. Under the secretaryship of Dr. Raymond, with his enthusiasm, broad and keen intellect and dominating character, there was little room for any one else in the management of the Institute. It was natural that there should be a reaction to an organization in which administrative and executive functions and duties should be more widely distributed, and wherein the secretary, the president, the directors and the various committees contributed their share of government, and functioned smoothly together. Mr. Stoughton fitted admirably into this new order of things, and served as a well-liked, efficient, and popular guiding officer, never majestic with position, but ready to help and to serve any member.

The Institute has become very human, very popular,

broad, pleasant and active during the years since Mr. Stoughton took charge. We shall miss him; and can only hope for a continuation of this halcyon period. Mr. Stoughton had the firm intention, when he became secretary, of serving only five years. He did not feel that he should make the financial sacrifice longer; but he has stayed nine. What he may have lost in funds we believe he has gained in affection.

Economic Bedlam

TWENTY-FIVE OR FIFTY YEARS from now, when, let us hope, the world will have been settled down to peaceful industrial pursuits, many volumes will have been written covering the economic lessons and deductions from the great period of readjustment through which we are now passing. We wonder if these books of the future will faithfully record the divergent views now expressed by bankers, economists, engineers, bricklayers, and others, in accounting for the phenomena of increasing and decreasing prices, inflation and deflation, the remedy for chaotic conditions of trade and the apparent contradiction of many theories fervently held dear to and preached by students of these subjects. One cannot help but be impressed, in reading newspaper accounts giving the speech of Prof. Blank, of some New England university, or Senator Bunkum, of a Middle Western state, by the inference that little unity of economic thought seemingly exists in the nation. This is true not only for individual but also for group opinion. Recently many eminent financiers and manufacturers gathered in Cleveland to further the interests of foreign trade and the expansion of the sphere of American commerce to a point never before realized, and simultaneously we note the Congressional efforts to enact heavy trade barriers, protective tariffs, which would tend to have the opposite effect. Then again, reverting to individual opinion, the statement has been repeatedly made that deflation has progressed to its limit, a contention in which the farmer—and ourselves—cannot heartily concur, as the prices of shoes, clothing—to say nothing of rent—are still up in the clouds.

Viewed internationally, economic confusion is even graver, and the problems presented by disorganized currencies, reparations, tariffs, taxes, and other subdivisions are stupendous. A wider diversion of solutions is offered for these problems than for any other, and undoubtedly more attention will be devoted to this phase of economic readjustment.

The present period of disorganization is indeed pregnant with material for future study and the better shaping of laws that govern trade, finance, and other matters. Despite the apparent contradiction of some economic laws, it is well to be guided by sane common sense rather than by half-baked theoretical expedients for the betterment of business. The history that has been and is being made will furnish a valuable guide for the future course of nations. From the Russian extreme of

economic debauch to the conservative tactics of countries untouched by the frenzy of war, important lessons have been taught, which, if grasped by future generations, will lead them to avoid making calamitous economic experiments that result only in distress and disorganization of everything, from government to trade.

At present we must content ourselves with the functioning of economic laws, be they favorable or unfavorable to us, with the assurance that, as in the past, they will certainly and ultimately bring cosmos out of chaos and restore some semblance of the balance existing before the war.

The Story of the Pear-Shaped Globe

ENTER—Milton Eudaly, of Grandfalls, Tex., a "practical" geologist, according to a recent issue of the *El Paso Times*. The story of his discoveries will constitute an interesting number in our series of "Bed Time Stories for Mining Engineers"; so compose yourself to listen.

There was once, it appears, an old chemist in Finland, who, after long study and experiment, produced "a combination of chemicals that was accredited with the power of definitely locating underground oil and gases." The jealousy of scientists among one another is well known in this country, but in Finland it appears to take on more active and virile manifestations, for before the ancient chemist could cash in (or, as the *El Paso Times* puts it more euphoniously, "reap any monetary benefit from his arduous scientific studies,") he met an accident. The fact is that "he was assassinated by his rivals, whom he had refused to take into his confidence."

But it is well known that the wicked never prosper. When the murderous chemists tried to analyze the marvelously sensitive compound which the a. c. (ancient chemist) had mixed, they could not. They found that "there were certain peculiar elements therein that refused to respond to the tests of the most learned chemists of the period." Absolutely refused, we infer. In fact, it seems that the a. c. had discovered several new elements, and mixed them all up to obtain the almost (or quite) intelligent fluid. And the murderers had killed the goose, if we may say it, that had laid the egg of gold—quite an apt metaphor, for the fluid apparently works best in a "pear-shaped globe" of glass. We are coming to that.

The widow of the a. c., like all the residents of Finland, finally came to the United States. Her two beautiful fatherless children grew up; and one, a son, turned out to be a great oil operator in California. One day, however, he recalled his father, and his great discovery; and had an altogether brilliant and original idea of looking over his father's papers. Sure enough, they were found; but they were written in neither Finnish nor United States: therefore "the papers were dispatched to an eastern university for deciphering." Western universities please take notice. When the translations came back (we have no doubt by return mail), it was found that the great formula "was written in four almost obsolete languages." Only in an eastern university can you find any one who knows four almost obsolete languages. Ask any student at Williams about it.

The son, enthusiastic, was all for making a large number of the instruments made possible by the discovery of the formula; but the mother held there should be only three made—one for herself, one for the son, one

for the daughter. Otherwise, she said, the world would be spoiled, for all the oil in the world would be found at once, and all burned at once—and where would you be then? This is our free translation, but what the old Finnish lady thought, to use her own words, according to the *El Paso Times*, was that these instruments "would prove inimical to the welfare of the world, as their promiscuous use would result in the location of practically all of the oil under the earth's surface, and the volume would be so immense that the supply would far exceed the demand, cease to be of appreciative value, and, because of cheapness, would not be conserved, resulting in wanton waste and rapid exhaustion of a treasure that is of inestimable value to mankind." Marvelous what a way the Finnish have of putting things.

The report leaves out one chapter of the story. Mr. Eudaly has the instrument. How did he get it? Did he assassinate the son, or the mother, or the daughter? It is important, at least it would be fascinating, to know. We cannot believe that a far-sighted and super-philanthropic family like that of the a. c. would normally let one of these three instruments pass out of their hands, for what is going to prevent Milton Eudaly now from discovering all the oil in the world?

The instrument, we learn, is "simplicity itself." The pear-shaped globe (how is a pear-shaped globe for simplicity?) inclosing the mixture of elements unknown to chemists (simple enough), is, to cut the technical language of the *El Paso Times* short, hung up where the wind will not disturb it. Then the "chemicals make movements" indicating how much oil there is below, how far below, and whence it cometh and whither it goeth. We wish we could quote the beautiful language in which this is put in the article we are summarizing, but we are so short of space. The magic globe has already revealed plenty of oil under Fort Stockton.

Our correspondent writes us that the *El Paso Times* is the most widely circulated paper in the Southwest, which we already know. He further adds, "All Texas is in feverish excitement. Wealthy Texans are offering fabulous sums for the secret pear-shaped glass oil finder, even for the use of it for a single day. They say it will show the great underground river of oil which flows up from the Tampico to the Texas fields, but whose exact location no one has discovered in the intervening territory. This stream is said to be closely connected and reacted on by the Gulf Stream through some alchemy of Nature."

Ah, the romance of mining!

Silver Prices

MOST DOMESTIC SILVER producers who have been receiving 99½ or 99¾c. for the metal, and who have thought that this price would persist for three or four years, are now forced to accept less, but fortunately the price recession is only a slight one, the new figure being 99¼c. Senator Pittman assures inquirers that there is no likelihood whatever that the silver act which he sponsored will be repealed, and, in fact, is optimistic that domestic producers will continue to obtain 99c. or more for their silver for a much longer time than the minimum term mentioned. The slight reduction just made is to cover shipping charges from Eastern refineries to the Denver mint. Formerly, all silver bought under the Pittman Act has been used by the Philadelphia mint, but now the coinage of silver dollars is to be resumed in Denver.

WHAT OTHERS THINK

Mining Schools and the Mining Business

It seems that the reference made by the editor, several months ago, to a "Correspondence School Engineer" has been successful in bringing comments, which, more recently, have taken the form of a discussion of educational institutions and their methods of instruction.

It appears to me that Professor Peele, in his paper, "The Education of the Mining Engineer," mentioned in *Engineering and Mining Journal* of April 30, has "hit the nail on the head." Why should forty-three mining schools, with more or less complete equipment, and no common standard of teaching, be necessary to educate the members of this more or less limited profession? Two or three schools completely equipped and run by the Government, if you please, would be able to cover the ground and eliminate the waste of our present system.

We are agreed that education is, of course, desirable, but let us not forget that education without the ability to apply the same is next to worthless. The ability to apply is acquired after leaving school and getting into the field of active life. Few graduates are much sought after as soon as they have received their diploma, regardless of the school that issues it; but let them get out and prove their ability to apply the principles taught them, do things, and succeed. Then they are in demand, and it is not of paramount importance from which institution of learning they received their instruction.

There is one point on which, it seems to me, our schools (mining) and school system are all wrong. They take the raw material (applicants for scholarship), spend four or six years teaching them the principles of the various subjects embraced in the course chosen, and never teach them how to convert this knowledge into dollars and cents. We may not like to admit that an education, in ninety-nine cases out of one hundred, is sought after with the view of making money; nevertheless, it is a fact.

This subject is left untouched at school and left to the latent ability which the scholar may or may not possess. The ones who possess this "latent ability" climb to the top and are numbered with the stars of the profession. Some others continue to be life students in the rut of acquiring knowledge, only for someone else above them to get the credit and reap the monetary reward. I have known several graduates who have spent their lives doing really good work holding ordinary positions while their work has made their superiors noted—just because they lacked this one most essential ability of converting knowledge into cash.

Life is a campaign of salesmanship, no matter what our vocation happens to be. If we have a mine for sale, the marketing of it calls for salesmanship; if we apply for a position, we have knowledge and ability to sell, and so on down the line. So let us be taught something of the principles of this important subject while acquiring the knowledge of the various branches of learning.

It may be that Columbia is attempting to include this in the university's courses, by making its graduates "leaders of men."

Baker, Idaho.

J. F. INGLIS.

The Possibilities of Licensing

Your two recent editorials and the communication from Mr. Barbour relative to the licensing of engineers lead me to a little arithmetic. If a mining engineer were to take out a \$25 license in each of the forty-eight states it would cost him \$1,200. Assuming that there are 10,000 mining engineers, this would show a cost of \$12,000,000 which the mining profession would pay for the privilege of being licensed, but there is not that much money left in the profession at the present time to be expended for this luxury (Luxury! Shall we add 10 per cent war tax to this?).

I am not yet clear regarding the advantages of licensing engineers. Take your distinguished self, Mr. Editor. I do not think it would have added one bit to our respect for your geology if you had had the pseudo advantage of being licensed before you gave us your opinions. Take Pope Yeatman, or J. Parke Channing, or John Hays Hammond: is their efficiency going to be raised or their earning power increased by the possession of a license? But the bill is to protect the public. Just how licensing you illustrious men is going to protect the public from you I confess is not clear to me. At the other end of the scale, the mine or smelter rule-of-thumb-draftsman and the young college graduate, assuming that they both succeed in getting licenses, are not, in my opinion, thereby going to be enabled to drive the Spurr and the Ingalls and the Channings and the Yeatmans and the others out of the business in case the latter should decline to apply for licenses, nor do I think the world is going to be made safer for these embryo engineers from the democracy of this country who want engineering results irrespective of a blue-ribbon license and seal.

Another consideration, Mr. Editor. You have the privilege, once you are licensed, of using a seal on your documents and reports. Imagine adding to the plunder which the mining engineer now takes with him eight or ten or a dozen or more notarial seals, so that on his trip he may complete and authenticate the various reports which he makes within different state boundaries! The more I look at this scheme of licensing engineers, the more interesting possibilities I find. We might even have the state licenses, instead of on parchment framed in our offices where few people see them, made in the form of a jewel or dog collar and suspended around our necks like a decoration.

The engineer is doubtless the best qualified man in the world to settle the big problems now confronting us. We all concede this, but the engineer himself should turn his own affairs over to some trust company or guardian *ad infinitum* to take care of for him, because he is patently unable to watch his own interests. Witness the fact that now, five years after the Founder Societies and subsequently Engineering Council started to draw up a model bill, and after about twenty states have passed such laws, the engineer "comes to" sufficiently to begin to discuss whether he wants to be licensed or not. In these twenty states, if he decides he does not, the alternative is a jail sentence. However, we are in good company. The lawyers and doctors are licensed, and so are the veterinary surgeons, dentists, and the apothecaries, and the nurses and the plumbers—and in the super-state, if you know what I mean, we shall probably all like it.

M. R. PERCY.

New York.



HEADFRAME, MILL AND PART OF CAMP OF THE BENGUET CONSOLIDATED MINING CO.

Mining Progress in the Philippines

Lode Mining for Gold—Placer and Dredging Operations—Gold Output Exceeds \$1,000,000 per Year—Production of Other Metals Negligible—Coal Mining of Local Importance Only

BY C. M. EYE

Written for *Engineering and Mining Journal*

DURING THE PERIOD of Spanish domination, beginning with the discovery of the islands by Magellan in 1521 and ending with the American occupation in 1898, little attempt appears to have been made to develop the mineral resources of the Philippines, though a small annual production of iron resulted from the smelting of limonite ores at Augat, Bulacan Province, and, at one time, copper in commercial quantity was produced from the richer ores of the Mancayan deposit of northern Luzon, and considerable amounts of gold, from many and various localities, annually found their way into channels of commerce through barter. About 1883, a ten-stamp mill was erected by English capital on the San Mauricio lode, at Mambulao. Other modest attempts may have been made to work the gold deposits with small mills or with arrastres, but no success is recorded.

The growth of systematic development may therefore be said to date from about 1900, when, with the cessation of the hostilities incident to the Spanish-American unpleasantness, an active campaign of prospecting was initiated by men from the western United States, members for the most part of the expeditionary forces, who took their discharges in the islands. During this

campaign much valuable territory was located under the new laws of Congress, passed in 1892. In fact, most of the ground now held under patent from the Philippine government by the operating companies and others was located in this early period, which was followed by a few years of small developments and attempts to work ores of low or medium grade with small mills. These operations, fostered by local capital, were generally unsuccessful, owing to low recoveries and small output. Two mills in the Benguet district¹ (the Benguet Consolidated and the Bua), using cyanidation after amalgamation, managed to maintain a small but steady output, and made a profit for several years, until both were lost by a flood late in 1909.

The first real success in lode mining was achieved by the Colorado Mining Co., in the Aroroy district, with a twenty-stamp, fine-grinding and cyaniding mill, put in operation late in 1911. This was followed several years later by the Syndicate, in the same district, with an all-sliming cyaniding plant of about ninety tons'

¹Those who have learned the advantage of preserving in convenient form the yearly files of *Engineering and Mining Journal* will find on p. 989 of Vol. 101, No. 23, of June 3, 1916, a series of illustrations of mining in the Philippines which are of complementary interest to the present article.

daily capacity, and in 1915 by the Benguet Consolidated with an entirely new plant having a capacity of sixty tons per day and employing fine-grinding and cyanidation. This installation, including a 100-kw. hydro-electric unit, began operations in September, 1915, and has maintained steady and profitable production since that time, with material additions to power plant and mill resulting in increased capacity and saving. The data covering cost and production for the initial operations in 1915 are not available, but those covering 1916 to 1920 inclusive are given in Table I.

TABLE I. SUMMARY OF OPERATIONS OF BENGUET CONSOLIDATED MINING CO.

	Tons Treated	Yield	Recovery per Ton
1916.....	17,360	\$291,271.64	\$16.88
1917.....	20,427	326,695.69	17.80
1918.....	23,529	447,519.00	19.00
1919.....	23,719	426,942.00	18.00
1920.....	35,565	534,446.15	15.02

Total, 120,600 tons treated, yielding \$2,026,874.48. Average recovery, \$16.80 per ton. Extractions have been around 90 per cent for the entire period. Costs are given in Table II.

TABLE II. COSTS PER TON TREATED, BENGUET CONSOLIDATED MINING CO.

	Operation (Including Development)	Taxes	General and Marketing	Total
1916.....	\$6.18	\$0.17	\$0.12	\$6.47
1917.....	6.17	.32	.68	7.17
1918.....	6.20	.49	.99	7.68
1919.....	7.30	.45	.83	8.58
1920.....	6.34	.35	1.33	8.02

Profits, after allowing liberally for depreciation, have been as follows: For 1916, \$163,581.15; for 1917, \$155,082; for 1918, \$265,617.81; for 1919, \$210,689.81, and for 1920, \$216,917.57, making a total of \$1,011,888.34. A considerable portion of these profits has been reinvested in betterments, but over half a million dollars, or more than the entire capitalization of the company, has been paid in dividends; \$25,000 per quarter has been paid regularly since September, 1916, with a number of extra dividends.

Shaft sinking and development of the main lead below water level have proceeded sufficiently to indicate such a continuance for several hundred feet at least. The completion of a new drainage tunnel, now under way, will assist materially in handling the heavy flow of water encountered.

During the first half of 1912, the Colorado mine, at Aroroy, produced approximately \$150,000 gold from 18,600 tons of ore treated, at a cost of about \$5 per ton. Later figures are not available, but, with the exception of a six-months' shutdown in 1917, for repairs and enlargements, this property has operated steadily, with an increased output and lower costs per ton. The Syndicate has also been a steady producer, and both have been profitable ventures and have paid substantial dividends.

Dredging operations at Paracale, beginning in a small way about 1905, reached considerable proportions by 1915, with a number of dredges, mostly of New Zealand type, in operation; but the output has materially fallen off, owing to exhaustion of pay ground, and many of the dredges have been dismantled. Prospects for future production from this source are not promising. There are known areas of gold-bearing ground in various parts of the islands as yet unworked, mostly at the points where streams debouch from mountain gorges onto coastal plains. These may in time furnish opportunity for production. Similarly, there are known and partially proven lodes and groups of lode claims which,

under more favorable conditions than have prevailed during the last few years, may come into the producing class.

Gold production, which has been around a million dollars per year for some years, is reported by Warren D. Smith for 1919 as \$1,308,224, of which Aroroy furnished \$634,532, Camarines (mainly from Paracale) \$217,455, and Mountain Province (mainly from Benguet) \$454,672, the remainder being from other and more isolated sources. The actual amount from outside sources is probably greater than reported.

Production of other non-ferrous metals is negligible. Production of non-metallic mineral products is given by Mr. Smith for 1919 at approximately \$2,260,000, salt (from sea water) leading, with \$450,000; stone, clays, and coal, as well as asbestos and iron ore, being included. Data for 1920, though not available, are unlikely to show increases in mineral production.

COAL OF MAINLY LOCAL IMPORTANCE

Coal mining has never attained the position of an important industry in the Philippines, though deposits of lignite exist at various points and have been prospected. The most important developments thus far have been made on the Island of Batann, where, on the east end, a mine has been operated by private enterprise for many years. As early as 1910 coal was mined and sold to inter-island steamers at about \$3.25 per ton on the dock. At about this time the United States Government carried on operations extending over several years on the west end of Batann, probably with the idea of securing a coal supply for its transports, but the results were evidently unsatisfactory. During the last few years, several attempts have been made by the Philippine Development Co., a Government corporation, to open up coal mines in various localities, but apparently such efforts have resulted in failure. The nature of the coal, a highly carbonized lignite, and the irregular and limited beds, in many occurrences faulted and tilted, make difficult or impossible economical production and marketing in competition with imported Australian and Japanese coal, under normal world conditions. Yet, with proper handling, some of these deposits may be worked with profit in supplying local markets. In 1919 only 32,000 tons was produced, worth, according to Mr. Smith, \$411,000, and representing an abnormal price per ton.

POLITICAL CONSIDERATIONS HAMPER IRON MINING

Some iron ore, of a value of approximately \$40,000, was sold in 1919. It appeared probable that an important industry in export of iron ore from the Island of Calambayanca, Mambulao Bay, to Japan would result from operations there by a Japanese company, but this has failed, owing largely to Government opposition, and no doubt also to market conditions in Japan.

The prospect for increased mineral production in the Philippines is not particularly promising at this time. Practically all prospecting has ceased. No new districts are being discovered and opened up. The political future is as yet uncertain, and distance from markets and difficulties in transportation make operation expensive. Most of the development thus far has been undertaken by local capital. With a guaranteed future under American protection and supervision, and with bettered market conditions, there may come a revival of the mining industry in the islands, but it is hardly possible otherwise.

Recent Supreme Court Interpretations of The Mining Law

New Decisions, Though Sometimes Settling Certain Points, Often Give Rise to Other Problems—Case of Silver King Coalition Against Conkling Company, Recently Decided, Brings Up New Questions Regarding Extralateral Rights

BY HORACE V. WINCHELL

Written for *Engineering and Mining Journal*

ALTHOUGH it is frequently asserted that there is no necessity for revision of the mining laws, because every possible question has hitherto been decided by the courts, those familiar with the subject know that many controverted points still remain undecided, and that each new decision immediately brings to the front other problems whose solution may require judicial consideration. Within the last few weeks there have been decided by the United States Supreme Court for the first time two important questions which have a vital and far-reaching bearing upon the extent and direction of extralateral rights. These decisions by the highest court settle finally some questions at issue, but at once open the gate to new ones. They reverse certain rulings of a Court of Appeals which have for some years been relied upon, and affirm the decisions of some other courts of equal authority.

In the case of the Work Mining & Milling Co. vs. the Doctor Jack Pot Mining Co. (194 Federal, 620) decided by the Circuit Court of Appeals for the Eighth Circuit some years ago, the question of extralateral rights on secondary veins was directly involved. The Court of Appeals, affirming the decision of the District Court of Denver, held that the issuance of a patent to the Lucky Corner claim established a conclusive presumption of the existence in that claim of a valid discovery, and further that there was a presumption that the discovery vein crosses an end line of the claim as located.

Although at the hearing it was shown as a matter of fact that there was no vein whatever at the point of discovery, and that the discovery shaft was in gravel in the bottom of a gulch and never penetrated to the bedrock, there was no adequate proof that no vein crossed the end line of the claim in that vicinity. The court held that a secondary vein crossing both side lines of the Lucky Corner claim was entitled to dip rights between vertical planes, passed through the respective side-line crossings at the apex and parallel to the patented end lines. A verdict was thereupon given in favor of the Doctor Jack Pot company and against the Work company for damages amounting to approximately one million dollars for ore extracted beneath the surface of the Little Clara claim, which was senior to and adjoined the Lucky Corner claim on the west. The Supreme Court declined to review this case on *certiorari*.

DECISION IN SILVER KING COALITION VS. CONKLING CASE CITED

In the recent case of the Silver King Coalition Mines Co. against the Conkling Mining Co. over an orebody in what is known as the Crescent fissure, which had been mined in the so-called Elephant stope, two questions have now been decided. The first question involves

the construction of the rights conveyed by patent where there was an error in the language of the patent. The patent to the Conkling claim conveys, in terms, 1,500 ft. in length, but the monuments upon the ground show that the claim was shorter. The District Court held that the survey monuments controlled and that the patent was void in so far as it purported to convey a stretch of ground in excess of that covered by and included within the monuments. The Circuit Court of Appeals of the Eighth Circuit reversed the District Court and held that the patent call for 1,500 ft. was valid. A writ of *certiorari* was denied by the United States Supreme Court, and the matter appeared to be closed. In view, however, of the importance of definitely deciding the law in such matters, the Department of the Interior, through the Solicitor General of the United States, joined with the Silver King Coalition company in a second petition for a writ of review, which was granted by the United States Supreme Court. Its decision reverses the Court of Appeals and holds that the survey monuments determine the position and boundaries of a claim, regardless of the language of the patent.

CASE ALSO INVOLVED QUESTION OF EXTRALATERAL RIGHTS UPON SECONDARY VEINS

The second question decided by the Supreme Court in a subsequent opinion upon April 11 had to do with the same question as that involved in the Dr. Jack Pot case; namely, extralateral rights upon secondary veins. The Crescent fissure has its apex outside of the Conkling lode claim and dips beneath it. At its apex it crosses the parallel side lines of mining claims, the property of the Silver King Coalition company. It was proved in the course of the trial that there was no vein at the discovery points of these adjacent claims, nor any veins running lengthwise thereof. On this question the language of the Supreme Court is as follows:

The general purpose is to give a right to all of the vein included in the surface lines if there is only one, provided the apex is within the location. It often must happen that the strike of the vein is not known, but must be conjectured at the time of discovery, and that the location is across instead of along the vein. This has been obvious always and therefore it would be wrong to interpret the words "end lines" narrowly as meaning the shorter ones in every instance.

Those are the end lines that cut across the strike of the vein if it crosses the location. We see no reason for thinking that because the discoverer has not claimed as long a portion of the strike as he might have he should be deprived of even his diminished lateral rights. It has been the accepted opinion of this court for many years that where, as here, the strike of the vein crosses the location at right angles its dip may be followed extralaterally, whatever the direction in which the length of the location may run. If

across the strike, as here, the side lines, as it is commonly expressed, become the end lines. Subsequent locators know as well as the original ones that the determining fact is in the direction of the strike—not the first discoverer's guess.

But it is said that where the end lines are determined they are end lines for all purposes, even if there are different veins running in different directions, having their apexes within the claim; and it is argued that there is a presumption that has not been overcome that there was a discovery vein running parallel with the side lines—that this determined the end lines and that therefore the petitioner got no extralateral rights in the Crescent fissure. The Circuit Court of Appeals, approaching the petitioner's claim as a claim of exceptional privilege, seems to have attached a weightier burden of proof to it than we are disposed to do. They were not satisfied that the discovery vein which determined what the end lines should be was not some other vein than the Crescent fissure. But we see no substantial evidence that there was another vein. We have the distinct testimony of experts that there was no such and we agree with the view of the district judge sustaining the petitioner's extralateral rights. Whether there are other answers to the contention we need not decide.

Thus we have a decision by the Supreme Court reversing what has been the interpretation of the mining law for more than ten years, based upon an erroneous decision of the Circuit Court of Appeals of the Eighth Circuit. It will at once occur to any thoughtful person that new possibilities and uncertainties arise: Suppose, for instance, that there are two secondary veins, as often happens and was indeed the situation in the Dr. Jack Pot case. Suppose, further, that one of these secondary veins crosses both side lines and one of them crosses both end lines, or one end line and one side line. In which direction, then, are the extralateral rights? Or upon which vein would extralateral rights be given?

It is a principle long supposed to be established that no mining claim can have two sets of end lines. Is it now to be inferred that the owner of a claim possessing two secondary veins may elect the direction of his extralateral rights, choosing the vein which contains the best ore or gives him the greatest sweep downward beneath the surface? Or, suppose one of these veins was discovered subsequently to the other; would the miner, after working one vein on its dip extralaterally, have the right to come in at a subsequent period and claim the right to work on another vein containing perhaps more and better ore, in a different direction, and setting up for that purpose the rights granted under the recent decision? Or if such a secondary vein should happen to cross one end line and one side line, how can anyone determine which line is the legal end line, where there is no vein at the point of discovery?

These questions are important and may arise at any time, and may involve, as in the present case, the title to ore valued at more than half a million dollars. Is it therefore strange that those of us who have much to do with such controverted questions favor discarding our present complicated mining law and the adoption of a simple law in which there shall be no such thing as extralateral "rights"?

Federal Vocational Training

Vocational education in mining work has made good progress during the present year, according to the *Vocational Summary* of the Federal Board for Vocational Education. Classes in mining subjects, with an enrollment of more than 2,000 pupils, have been organized in twenty-four training centers in thirteen states.

Madagascar Graphite Industry Quiet

The record year for the production of graphite in Madagascar was 1917, when 35,000 metric tons was produced, according to Consul James G. Carter, of Tananarive, in *Commerce Reports*. The industry has not shown any substantial signs of improvement since the middle and latter part of 1918, when the British and the French markets ceased partaking of the monopoly of the Madagascar graphite enjoyed by them throughout the war, and when the United States market ceased buying the Ceylon graphite and showed no desire to take over the Madagascar product, then anxiously offered.

Below are given the official figures of the production and exportation of graphite in Madagascar from the beginning of the industry, in 1907, to 1920, inclusive, in 1915-1920 exports representing chiefly old stocks:

Production, Tons		Exportation, Tons		Production, Tons		Exportation, Tons	
1907	8	8	1914	11,232	7,940		
1908	82	109	1915	15,940	12,189		
1909	197	200	1916	26,254	26,209		
1910	545	554	1917	35,000	27,838		
1911	1,247	1,281	1918	16,000	15,015		
1912	5,318	2,638	1919	5,000	4,050		
1913	7,227	6,573	1920	(a)	14,919		

(a) 4,000 to 5,000 tons.

The exports are given as having been slightly in excess of the production during the years 1908 to 1911. These differences are due to the fact of the production being given in net weight and the exports in gross weight. The figures for exports given in the table are taken from customs returns.

According to a published statement of the Chief of Madagascar Service of Mines, based upon an investigation made by the local government, the quantity of graphite in stock in Madagascar on April 1, 1920, amounted to 32,000 tons. Stock of 24,000 to 25,000 tons is estimated at the end of 1920. No precise data are available as to the quantity of the different grades of graphite on hand, but approximately nine-tenths of the stock is flake graphite, the remaining being amorphous. Three-fourths of the flake graphite averages 80 to 90 per cent carbon, particularly of the old stock, the tendency now being to turn out an average quality of 90 per cent and above, because of the restricted demand.

Of the graphite shipments in 1920 a total of 4,449 tons went to England, 2,127 tons to the United States, and the remainder to France, with the exception of 51 tons shipped to Belgium. Shipments have again been reduced, and the only information to be had concerning the present demand is regarding a contract held by one of the large mining concerns for 2,000 tons, to be delivered in the present year to France.

The prices obtained for the graphite shipped in 1920 averaged 600 to 700 fr. per ton, f.o.b. Tamatave and Vatamandry, for material averaging 85 to 90 per cent carbon, prices at which quantities of Madagascar flake may now be had. The freight on this material from Madagascar to New York, London, Hamburg, and other European, excluding French, ports is now quoted by one French line at 300 fr., and by another at £7 sterling, and the rate to Marseilles is 200 fr. by both lines. The Madagascar flake, however, can be produced at a cost low enough to support an f.o.b. price of 500 fr. per ton.

It is estimated that about 20 per cent of the total production of Madagascar graphite is treated mechanically. There are perhaps not more than half a dozen plants equipped with machinery, which consists chiefly of drying, separating, classifying, ventilating, and screening devices, kept more or less secret.

The Reward of Bluffing

How a Blustering "Gringo" in Mexico Won His Point,
And Thereby Lost a Small Fortune

(FROM THE FIELD NOTES OF EDWARD NORCOTT, ENGINEER)

Written for *Engineering and Mining Journal*

MARVIN K. KETCHUM made a fortune out of a "corner" in the sponge market several years ago and repeated the procedure with certain other commodities. In consequence, he was rated and recognized as a millionaire, a fact of which he was extremely conscious. In one of his business manipulations he had found it expedient, to accomplish his financial aims, to succor a friend to the extent of a loan of \$25,000, secured by the controlling stock of a silver mine in Sonora, Mexico. The money was to be used to provide equipment for the mine and make it productive on a small scale, in anticipation of enlarged operations and greater profits later.

The borrower died suddenly and the money he had received became involved in his estate. Ketchum promptly foreclosed his note, and thus made his debut into the mining business, or "game," as he called it. He engaged an engineer recommended by one of his banker friends, and, upon his advice, advanced the moderate sum needed to complete the equipment of the mine, as his friend had planned. The property was soon producing rich silver ore, and Ketchum, owning the controlling interest, was able to negotiate a sale of the property which made him a profit of nearly half a million dollars.

Having tasted the rich blood of success in mining, Ketchum naturally wanted more. He was influenced in this decision because mining seemed to him to be a somewhat more glorified business than merchandising sponges, or cork, a collateral line, which had also engaged his effective energies. He entered into negotiations for other Mexican mines, engaging an engineer to advise him, as he had been told to do by one of his fellow millionaires.

Ketchum was enthusiastic by nature and did nothing by halves. Once launched upon his new endeavors, he gave them his personal attention and put back of them his abundant, if not always well co-ordinated, energies. He went personally to Mexico and visited the principal mining camps and conferred with the prominent mining men. His crude self-assertion and his obtrusive ignorance of the mining business made him a subject of amusement with those longer associated with the interesting revival of the Mexican mining industry, then in full swing. Soon he quarreled with the engineer he had engaged to advise him, who could not tolerate his domineering ignorance. He then publicly declared he was going to "run the whole show himself."

Among the mining properties brought to Ketchum's attention was "La Predilecta," a silver mine in the State of Durango, owned by one Manuel Sanchez, a Mexican educated as a lawyer, quiet of manner and somewhat timid, to outward appearances, in his intercourse with the foreigners. Licenciado Sanchez, as he was called, according to Mexican custom, had large property interests and also a large, growing, and expensive family. He did not practice his profession, for he was generally busily engaged in the interesting and sometimes absorbing occupation of making his irregular income keep pace with his increasing yearly outgo, and to this end he had found it necessary, upon occasions, to sacrifice

some of the valuable mining properties he owned to the eager and wealthy Americans, who, in the year 1910, were overrunning Mexico like a visitation of two-legged locusts.

I had been engaged in an advisory way in some negotiations for Licenciado Sanchez, and had become friendly with him and with his family, so I was not surprised to receive a telegram from him asking me to meet him in Mexico City on a matter of business. It soon developed that Licenciado Sanchez had offered his "La Predilecta" mine to Ketchum, and that, by reason of an acute hiatus in his income, he was desirous of making the sale even at a sacrifice price. He had heard of Ketchum's manner and methods, and he frankly admitted to me that he was afraid to meet him, and, besides, he had doubts of his ability to cope with the business maneuvering necessary to close the deal with such a man.

Sanchez asked me to advise and assist him, and insisted that I should be present at the interview which was arranged for that day in Ketchum's elaborate suite at the Hotel Sanz. I had not met Ketchum, but I was nothing loath to do so, for the reason that, though I disliked his methods, I respected his shrewdness and business effectiveness.

Ketchum was alone when we called at the appointed hour. He greeted Licenciado Sanchez warmly, and quite ignored me. In fact, he frankly stated that this was an affair between principals, and he did not think any assistance was necessary from outsiders. But Licenciado Sanchez, acting upon our prearranged plan, explained that he did not understand American business methods, and politely asked permission to have me remain to explain matters to him. His politeness and his meek and timid manner probably led Ketchum to feel that it would not be difficult to get his own way anyhow, and so he acquiesced to my presence during the negotiations.

At the outset, Ketchum explained that he could "hablo Español," having learned the "lingo," to use his colloquialisms, in Spain, during his sponge and cork operations. However, the preliminaries were conducted in English, and Licenciado Sanchez, notwithstanding his limited command of the English language, replied freely to the general questions asked him. Ketchum informed us that he had full reports on "La Predilecta" mine and "knew all about it." He said he would buy it, "lock, stock and barrel," if no "greaser's" trick to rob him was tried.

THE OLD, FAMILIAR "KNOCK"

Then he began to depreciate the property, calling it a "rat hole," and other non-technical epithets, to the dismay and disconcerting of Licenciado Sanchez. Finally, he asked Licenciado Sanchez to name his price, having preceded this natural step in the negotiations by more picturesque abuse of everybody in Mexico, and everything Mexican, especially the mine. By this time, Licenciado Sanchez had forgotten all his English and launched a torrent of defence and remonstrance in fluid and fast-flowing Spanish, ending with the statement that he would sell the mine for "seis cien mil pesos" (600,000 pesos).

Ketchum had not understood a word of the reply, and, as I saw at once, did not even understand the price named, which was quite reasonable, and the one we had previously agreed upon for a first offer. Not wanting to acknowledge his complete flunk at real Spanish, as spoken by the natives, he said something about

"business being business," and taking up a pad of paper which lay upon the desk between them, he shoved it toward Licenciado Sanchez and asked him to make his proposition in "plain English."

Quite discouraged by this time and not understanding just what Ketchum wanted, Licenciado Sanchez took the pencil and wrote on the pad, "\$600,000," using the dollar sign for the Mexican peso, or money unit, as is customary in Mexico.

Ketchum roared back that it was a robber price, and that he would not pay more than "five hundred thousand dollars." Licenciado Sanchez was dismayed at this low offer, but suddenly I saw him sit up straight and I caught a quick appeal for help in his eyes. The same idea that had startled him had also come to me. Ketchum was talking about American "dollars" instead of Mexican "pesos." As the ratio was about one for two, his actual offer was far in excess of what Licenciado Sanchez had asked. It seemed too good to be true. Licenciado Sanchez and myself both seemed to come to a full realization of the critical situation at once, and to agreement on an unspoken plan to unite in playing it out. Licenciado Sanchez demurred at the price, speaking at some length of the merits and value of the mine, at the same time recounting his great personal need of making the sale. I then decided to try a bold stroke. I told Ketchum that the mine was an exceedingly valuable property, and that I would not permit my client to sell it for less than "six hundred thousand dollars." This had the desired effect, for Ketchum exploded and said some things about meddling by incompetent engineers in matters that should be left for business men to settle.

TRIUMPH OF THE MEEK

Licenciado Sanchez appeared to be really alarmed and made hasty efforts to smooth matters over. But Ketchum said that he would have no more interference by outsiders and directed another volley of rough talk and abuse at poor Licenciado Sanchez, who by this time was in a cold sweat of expectancy and fearful hope. After some more talk Ketchum blusteringly repeated his offer of "five hundred thousand dollars," and Licenciado Sanchez, waving me aside, dramatically accepted the offer.

Ketchum called in his secretary and directed him to draw the usual preliminary contract. Obviously pleased at his success in the negotiation, he condescended to ask me to help his secretary in this routine work.

Needless to say, the contract, signed in duplicate, specified the price as "\$500,000," with the important symbols "U. S. Cy." after the figures. In a few days the deeds were prepared and Licenciado Sanchez was the gainer, above his asking price, by \$200,000 "U. S. Cy."

The whole story was too good to keep, and soon I was told that it had reached the ears of Ketchum. What he thought of the affair he never said, as far as I know.

But this is not the end. A few weeks after the transaction had been closed I received a telegram from Ketchum, then in New York, accompanied by a substantial amount, also by telegraph. The message asked me to come to New York to meet Ketchum. I did not know what Ketchum wanted, but as there was no reason why I should not accede to the request, I accepted his invitation.

When I met Ketchum in his capacious New York

offices, he did not mention Licenciado Sanchez, nor the part which I had played in the business transaction by which my client had gained a small fortune. He asked me if I would take charge of "La Predilecta" mine at a most attractive salary, and added that if I would accept the position, he would make a contract to give me a half interest after the property had paid him back "five hundred thousand dollars, United States currency," dwelling upon the last three words.

That is how I came to have an interest in "Mina La Predilecta."

Hazards From Arsenous Oxide in Copper Smelting

An article on "Perforations of the Nasal Septum Due to Inhalation of Arsenous Oxide," by Dr. Lawrence G. Dunlap, in the *Journal of the American Medical Association* of Feb. 26, 1921 (pp. 568, 569), and reviewed in the *Monthly Labor Review*, gives an account of the hazard from arsenous oxide to which many workers in copper-smelting plants are exposed. Volatile gases, principally arsenous oxide and sulphur dioxide, are given off in the process of copper smelting. When Cottrell treaters are used for recovering the arsenic, about 75 to 90 per cent of the recovered precipitate is arsenous oxide. If a higher-proof arsenic is required, this 75 to 90 per cent arsenic is treated in a refining furnace and the fumes are deposited in arsenic kitchens, where at about 420 deg. C. the arsenic is deposited in a fine white powder which is 99 to 100 per cent pure, although there may be lumps which require grinding. The men at the treaters, the loaders, railway crews, dumpers, furnace men, refiners, kitchen wheelers, and men barreling all come in contact with tons of the arsenous oxide daily. We quote from the article noted:

"This arsenic dust is breathed into the nose and, coming in contact with moisture, forms arsenous acid, which causes necrosis of the septal mucosa at Kiesselbach's area. The traumatism of the air currents alone often keeps this portion of the septal mucosa irritated, especially if there is a deflection or ridge of any sort. A white, slightly elevated area about 5 mm. in diameter develops. If proper care is taken to protect this area with a camphor-menthol-liquid petrolatum mixture on cotton, the condition will resolve to normal. However, most workmen neglect the condition till there is a perforation of from 7 to 10 mm. through the mucosa and perichondrium down to the cartilage on one side. Even at this stage the process can be controlled by persistent local medication. If this is not done, the other side of the septum undergoes a similar process of necrosis and the cartilage disappears from distrophy. The 7 to 10 mm. area of cartilage rarely comes out en masse."

Some cases, it is stated, present a spontaneous physiologic cure. Failing this spontaneous cure, the case becomes one for surgical attention. In regard to preventive measures the writer states that prophylaxis by wearing a gas mask is not feasible for workers on an eight-hour shift, and nose guards and respirators result in a severe dermatitis by causing an accumulation of moisture where they come in contact with the skin, and cotton plugs in both nostrils cause pharyngitis and laryngitis. Camphor-menthol ointment and "baghouse" salve (ferri hydroxidum cum magnesi oxidum) are said to be efficient prophylactics if used constantly by those exposed to the conditions noted.



"JEUNESSE," BY MAX BLONDAT, DIJON, FRANCE, THE ORIGINAL OF THE GROUP ON THE DOUGLAS MEMORIAL FOUNTAIN AT NACOZARI

The Douglas Memorial Fountain at Nacozari

BY LESLIE CAULDWELL

Written for *Engineering and Mining Journal*

IN 1918, at a picture show held by a group of American artists in Paris, I exhibited some pastel studies of French soldier types. My pictures attracted the attention of James S. Douglas, and later, when we met as Red Cross workers, I asked him up to my studio. On my staircase walls were a number of water-color drawings made in connection with my profession as architect-decorator, and these drawings led to the following conversation:

Mr. Douglas told me that he had but lately lost his father, Dr. Douglas, and that his brother and sisters wished to erect a memorial to their father's memory in the little mining town of Nacozari, in Mexico, which Dr. Douglas especially liked. Then Mr. Douglas fixed me with a twinkle in his eye and asked me whether I would consider the idea of going out to Douglas, Ariz., and from there into Mexico to put up this memorial, which was to be a copy of a fountain he had seen at Dijon, France.

At first the thought of leaving my delightful studio in Paris and going out to what I imagined to be "the wild and wooly West" nearly took my breath away. Yet, at the same time, the idea appealed to me as interesting, and as fulfilling a long-cherished desire to visit that great southwestern country of my native land.

The difficulty was that Mr. Douglas did not know by whom the bronze group was made. He had seen it at Dijon—that was all. But, as luck would have it, a young French lieutenant, for whom I was godfather during the war, was going to transfer to an African regiment at Casablanca, and asked me to dine with him

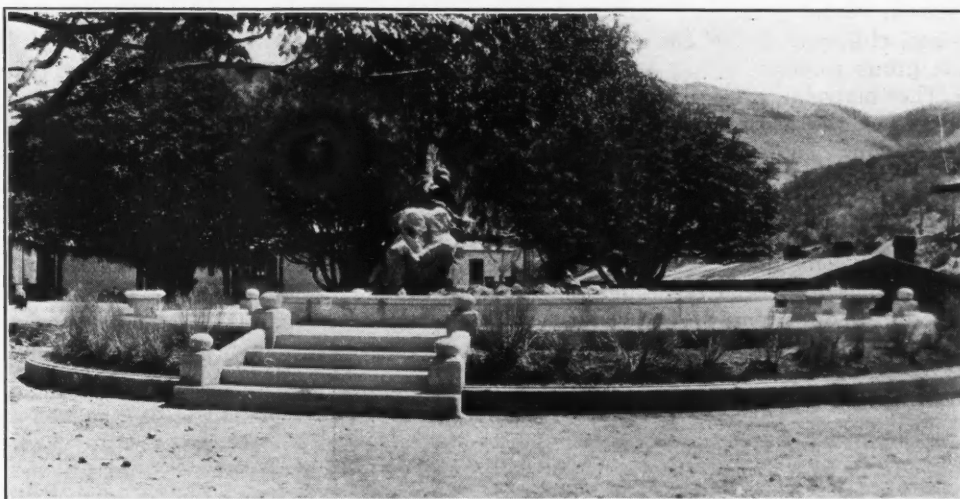
on the evening of his departure and meet his aunt and his very pretty fiancée. I accepted! One would do so for less.

The fiancée was indeed pretty, and—she came from Dijon. It did not take me long to find out that the author of the bronze group in Dijon was Max Blondat, the great French sculptor. It was an easy matter then to get in touch with Max Blondat, and after an exchange of letters I was commissioned by Mr. Douglas to order the group to be cast in bronze by the *cire-perdue* process, the most artistic and the most costly.

The *cire-perdue*, or "lost wax," process was that so much employed by the great Renaissance sculptor Benvenuto Cellini in the sixteenth century. In it, the original wax model made by the sculptor is covered by successive layers of clay, and when sufficient thickness is obtained, this mold, into which copper pipes have been cleverly introduced, is put in the kiln, at such and such a temperature, and all the wax runs out, leaving a perfect mold. Other tubes previously placed are then used to fill with molten bronze the mould thus emptied. Thus you have the direct touch of the sculptor in the bronze—which quality is often lost by other and more commercial processes.

It was part of my business to go to the foundry of M. Valsuani in the far-away Mont Rouge quarter of Paris and make arrangements for this casting. But in the meantime I had received a blueprint showing the Plaza of Nacozari. "Here was the Garcia monument; here the bandstand, and this other square was where the fountain would be placed."

The ground was apparently absolutely level. To my Paris ideas of the West there was nothing unusual in this, but I realized that the little stone basin which formed the fountain of Dijon would be lost in this public square like a postage stamp on a table cloth. So I wrote to Mr. Douglas and suggested a new plan for the basin, and in Mr. Blondat's studio had made a *maquette*, or plaster model, to scale after the sketch I had modeled in clay, and shipped the *maquette* off to Arizona. In my plan the group of children, as at Dijon, are seated on a high rock from which the fountain gushes out. The frogs at which the children are looking, instead of being placed on the curbing of the basin, are on a small rock emerging from a



THE FOUNTAIN IN THE PLAZA AT NACOZARI

reached by three flights of stone steps, the number three being at the request of Mr. Blondat. The stone steps are connected by a circular stone curbing which incloses a band of rich soil slanting to the upper level of the steps. In this band will be placed hardy plants to form a circle of green about the fountain and reduce the seeming importance of the stone work. It is this model that I have been putting up in Nacoziari.

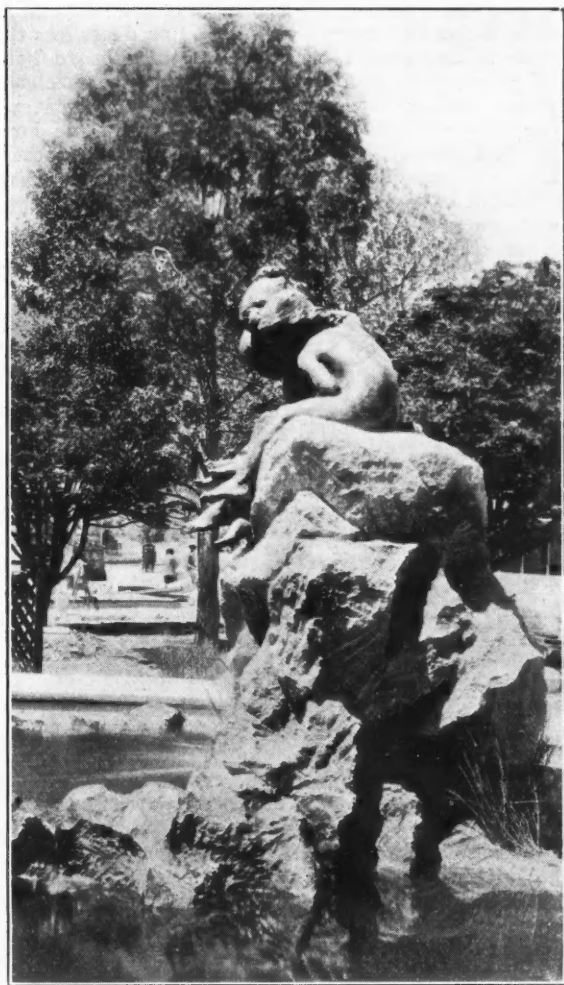
On my arrival at Nacoziari the night of Nov. 24, 1920, there being no one to meet me at the station, I wandered off in what seemed the right direction, and almost immediately came upon a high circular fortress which looked for all the world like the large Bosch pill-boxes I had seen in the Argonne. My Parisian stone carver, Monsieur Ratti, was with me; and, I said in French, "My God, that is the fountain!" "Never!" he replied; "It is at least five feet high."

But it was the cement foundation for the fountain, only the ground, instead of being perfectly level, as shown in the blueprint I had in Paris, slanted about two feet from back to front.

That night at the hotel I tossed and tossed, always coming up against the fortress fountain, until I found the solution of the problem and slept. The next morning I met Mr. Hamilton and Mr. Irwin, and they confessed that the aspect of that cement wall had demoralized them and that they had stopped all work until I arrived. I showed them a sketch I had made to obviate the difficulty by raising the level of the park and having steps leading to the street, and with their approval I wrote at once to Mr. Douglas on the subject. This change of level made it necessary to alter the entire layout of the park, and so I made a new plan, which Mr. Douglas accepted, thus making a setting for the fountain worthy of the bronze by Max Blondat.

This bronze, as I mentioned, represents three little girls sitting on a ledge of rock overhanging a cascade and pool of water. They are looking down at three frogs which have snuggled together on a stone and are gazing up at the children. The oldest child, about ten years old, is frankly amused; the second, about six, is smiling also; but the little tot, not yet three, is not quite sure about the situation.

Max Blondat calls his group "*Jeunesse*"—"Youth." I call it the "Fountain of Smiles," for no one can stop and look at this *chef d'oeuvre* without a sunny smile creeping from eyes to mouth. Old Mexican men and



THE BRONZE GROUP AT NACOZARI WAS CAST IN PARIS

little pool out of which the water falls into a large circular basin about 21 ft. in diameter. This basin is surrounded by an 8-ft. stone walk which is elevated above the level of the park about 3 ft. This walk is

women, young girls and youths, mothers, fathers and school children, all feel the spirit of guileless happiness the group imparts.

The material difficulties in building the fountain were removed as far as possible by Mr. Hamilton and Mr. Irwin. The limestone had been cut to my plan by the John A. Rowe Cut Stone Co. of Bedford, Ind., and shipped to Nacozari. But there were of course stones to be prepared on the spot, and it was, as we say in Arizona, "some job" to educate a miner into being a good stonemason who respected the edges of moldings and finish of surface; but even that has been accomplished.



BRONZE TABLET ON FOUNTAIN

The last wonder of all is that we are going to be able to cast in Nacozari, after the details made from my sketch, the copper lamp posts to light up the fountain and park. Near the top of each are four jolly little dolphins which wriggle downward with their tails in the air. They carry in their mouths bronze rings, which are mobile, and strung from these, from post to post, will be hung garlands of tiny lamps on the nights of *fiestas*, so that through the branches of the pepper trees they will look as if a multitude of fairy fireflies had come to dance a *saraband* about Max Blondat's group and invite the three bronze children to step down and join the fun.

Home-Made vs. Standard Milling Supplies

In a contribution to the *Bulletin* of the Institution of Mining and Metallurgy, T. B. Stevens agrees with statements recently made by E. A. Wraight that the best and standardized mining and metallurgical supplies are not always the most economical. Mr. Stevens mentions the large amount of locally made steel-mill spares, especially stamp-mill and ball-mill parts, which have come into use in Australia during and since the war. Taking into account the work done and the cost, the material of local manufacture has usually proved cheaper than that formerly imported.

In contrast to this Mr. Stevens mentions the use of manganese-steel camshafts. At one plant containing a battery of fifty 1,200-lb. stamps, the 5½-in. fagoted iron shafts of local manufacture were replaced with a similar

size made of manganese steel. The life of the iron shafts seldom exceeded six months, but no breakage of the steel ones has yet taken place, although some of them have been in use for four years. The cost of the manganese steel is at least three times that of the iron, but it is the most economical to use.

At Kalgoorlie, balls for use in ball mills have been locally forged out of discarded battery shoes and dies, and have given equally as good service as imported balls. The scrap metal used was largely imported forged steel. Cast iron is the most economical material to use for battery dies at several plants with which Mr. Stevens was acquainted, although those plants had foundries attached.

No Wage Reductions Tolerated by Mount Lyell Miners

American copper producers feel that their lot is a hard one, but they may be thankful that they do not have to operate in Australia, where Labor reigns with a capital L. It is hard to imagine a fairer or more earnest appeal than the following, which was circulated among the employees of the Mount Lyell company in South Australia at Easter:

The price of copper is beyond the control of any influence in Australia, as the commonwealth only produces less than 3 per cent of the world's consumption. The board has approved of further expenditure to increase the efficiency of the plant, and the staff is considering every point where further improvements can be made. There is no hope of meeting the present financial loss without a reduction of wages and salaries and a rearrangement of hours of working. Such a course cannot be undertaken without the full co-operation of the employees, and the directors desire to secure such co-operation.

The directors invite the consideration of two main points: (1) The introduction of the forty-four hours' week underground at the mines has been a most wasteful arrangement, and it is satisfactory neither to the company nor its employees. The directors suggest for consideration a trial of eighty-eight hours a fortnight, forty hours one week and forty-eight hours the other. This will increase the output of ore without increasing the costs, and will give the underground employees the benefit of a full day off on alternate Saturdays. At present Saturday is a hotch-potch. (2) A reduction in wages and salaries ranging from 10 to 15 per cent of the equivalent. This proposal is made with the greatest regret, and only after endeavoring in every way to avoid it. The directors fully recognize what it means, but there is no other method of meeting the situation. In the United States mines have only been enabled to continue operations by reducing wages generally by about 20 per cent.

Even if these two suggestions are adopted the shareholders will still be left without any return on their capital, and the company will still have to carry a loss. The company is willing to bear this loss so long as the financial conditions permit for the sake of holding the industry together and preserving the interests of the employees and all that this means to the people of Queenstown, Gormanston, Linda, and the surrounding districts. As a preliminary step a conference with representatives of the unions in the district has been held this afternoon, and further conferences will be necessary to consider all the conditions of working that are necessary to the continuation of the industry at Mount Lyell. It is only with the greatest reluctance that the board can contemplate the closing of the company's mines, but unless some arrangements along the lines suggested are agreed to at an early date, they will have no other option.

Chemical Engineering and Mining Review, from which we clip the above, follows this appeal with the laconic statement, "The men have decided not to accept the suggestions."

Trade Notes on Bauxite*

American and European Specifications for the Mineral as Utilized in the Chemical Industries—Field Tests and Manifold Uses of the Material—Organization of the Markets

BY J. COGGIN BROWN

BAUXITE is a clay-like hydroxide of aluminum regarded by some writers as a definite mineral species, having the empirical formula $Al_2O_3 \cdot 2H_2O$, corresponding with $Al_2O_3 = 73.9$ and $H_2O = 26.1$ per cent. Chemical analysis shows that it rarely has this composition. It is usually found to be intermediate between $Al_2O_3 \cdot H_2O$, a mineral known as diaspor, and $Al_2O_3 \cdot 3H_2O$, or gibbsite. It seems, in fact, to be a mixture of these two hydrates of aluminum in an amorphous condition. Between bauxite and laterite there is no sharp dividing line. Laterite is essentially a mixture of ferric hydroxides, aluminum hydroxides, and free silica in varying proportions. Detrital laterites are often contaminated with mixtures of clay and sand. The laterites have been divided chemically into the following three groups:

1. Laterites (including bauxite laterites) with 90 per cent or more of the hydrates of aluminum and iron.
2. Argillaceous laterites, in which these hydrates total from 50 to 90 per cent.
3. Laterite clays, with less than 50 per cent of the two hydrates.

These groups are again subdivided on the basis of mineral composition, but this need not be considered here.

The hardness, color, density, and composition of the commercial bauxites varies. In general it may be said that the material never shows any indication of crystalline structure, being compact or earthy, or often with a concretionary (oolitic or pisolitic) structure. Rarely it exhibits a granitic appearance. It may be solid and clay-like or hard and massive. The softer kinds may become harder on exposure. Its color ranges through shades of red, brown, gray, and yellow to white. The creamy and buff to yellowish tints are common in India.

FIELD TESTS

It is not easy to distinguish bauxite from clay. The former is said to granulate when rubbed between the fingers, instead of becoming plastic, and a soft bauxite to vary in its degree of granulation or plasticity according to the proportion of bauxite to clay, or, in other words, of hydrated alumina to hydrated silicate of alumina, contained in it. An American writer states that some measure of the relative quality of dried bauxite can be had by grinding a sample in an agate mortar for half a minute. A bauxite of good grade will be found hard to grind, and will stick to the mortar with such tenacity that it will have to be scoured out; a poor bauxite, or a bauxite clay, will grind much more easily and will stick little if at all. Clay or kaolin grinds with ease and does not stick to the mortar. Similar results are obtained if the sample is rubbed on glass; the glass will not be scratched even by high-grade bauxite.

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Although such rough tests, coupled with the general pisolitic or round shot-like appearance, set in a fine-grained matrix, may serve to distinguish some kinds of bauxite in the field, it cannot be too strongly insisted that the only way to determine the quality of the mineral is by careful analysis. This must show not only the total quantity of alumina present, but also the silica, iron and titanium oxides, and water.

METALLIC AND CHEMICAL APPLICATIONS

The chief uses of bauxite are as follows:

1. In the manufacture of aluminum.
2. The purer varieties of bauxite are used in the preparation of salts of aluminum, notably of alum and aluminous sulphates. These are employed in water purification, dyeing, tanning, and for various other minor purposes.
3. In the manufacture of artificial abrasives. These are made in the electric furnace—notably at Niagara Falls—by fusing calcined bauxite. The product obtained is really a form of crystalline corundum, which is marketed under various trade names, such as "alundum," "aloxite," and others. The quality of the product is said to be under complete control, a factor of considerable importance in any abrasive industry. In 1918 approximately 112,908 long tons of bauxite were used for this purpose in the United States.
4. In the manufacture of bauxite bricks for furnace linings. The purer the bauxite used the more refractory is the resulting product. These bricks are said to be replacing the more costly magnesite and other refractory materials, and are made by mixing calcined bauxite or high-alumina clay with a bonding material such as fireclay, sodium silicate, and lime. Another class of high-alumina refractories is made by the electric fusing of bauxite. There is an increasing demand for them in the United States for the construction of various furnaces and cement kilns, and on account of the recent progress in the chemical industries.
5. As a filtrating medium for the decolorization and refining of mineral oils and various organic substances.

The only statistical data obtainable as to the amounts of bauxite used in the different industries are those of the United States. For 1918 they were as follows:

	Per Cent of Total Bauxite Output
Aluminum manufacture.....	69
Chemical manufacture.....	10
Abrasives manufacture.....	19
High-alumina refractories.....	2

ANALYSES OF GREAT IMPORTANCE

Bauxite is graded according to its chemical composition and is sold to consuming industries on the basis of its analysis.

The French bauxites are roughly classified into red, white, and siliceous groups. The red bauxite owes its color to ferruginous impurities, and is used in the

manufacture of metallic aluminum. The white bauxites are employed in the preparation of aluminum salts and refractory materials.

According to Pitaval and Ganet, who wrote in 1913, bauxites for aluminum manufacture are often obtained by mixing pure and impure materials. Their composition, carefully fixed by analysis in each particular application, may vary between certain limits, which are usually as follows: The average percentage of alumina is from 57 to 60 per cent, but it may reach 75 or even 80 per cent. The number of units of alumina above 60 gives rise to a bonus paid by the buyer. The percentage of silica must not be over 3 per cent. When it is below 2 per cent the buyer pays a bonus in proportion to the decrease. The percentage of iron oxide may be between 10 and 15 per cent or even up to 25 per cent. Above 15 per cent the seller generally accepts a reduction in the price for each supplementary unit of Fe_2O_3 . Finally, bauxites contain 10 to 20 per cent of water, 1 to 2 per cent of tannic acid, with a little lime, magnesia, and organic matter.

General conditions of the sale of French bauxite for aluminum manufacture are as follows:

Al_2O_3 equal to or greater than 57 per cent. Above 60 per cent, a bonus of 0.20 to 0.40 fr. per unit.

SiO_2 equal to or less than 3 per cent. Below 2 per cent, a bonus of 0.20 fr. per $\frac{1}{16}$ unit, maximum 3 per cent.

Fe_2O_3 equal to or greater than 14 per cent. Below 14 per cent, a penalty of 0.20 fr. per unit; maximum 17 per cent.

American practice limits bauxites of commercial grade to at least 52 per cent of alumina. It is stated that low contents of silica and titanium are essential to the makers of metallic aluminum, but the iron content may be fairly high. Bauxites low in iron and titanium are preferred by the chemical manufacturers who produce alum and aluminum sulphate. Makers of artificial abrasives appear to be able to use lower grades containing larger amount of silica and iron oxides than are permissible in bauxite for other purposes, though abrasives are also made from bauxites low in silica and iron. The bauxite required for refractory purposes must be low in iron. Current American specifications follow:

For bauxite containing about 52 per cent alumina, less than 2 of iron and up to 20 per cent silica, and artificially dried to contain not more than 4 per cent free moisture, \$10 per gross ton at mine; 54 per cent Al_2O_3 and about 15 per cent SiO_2 , \$11; averaging 57 per cent Al_2O_3 , 8 to 12 per cent SiO_2 , less than 3 per cent Fe_2O_3 , \$13 on basis of 8 per cent free moisture. Ores of low silica content suitable for manufacture of aluminum oxide and hydrate of alumina command a fancy price.

One of the large English aluminum-producing concerns states that the grade of bauxite most suitable for aluminum manufacture should contain:

	Per Cent
Alumina.....	60 minimum
Titanic oxide.....	2 maximum
Silica.....	2 maximum

Another company, also engaged in aluminum manufacture, writes that bauxite used for the production of aluminum should contain a minimum quantity of silica. It is generally stipulated that it shall not exceed 3 per

cent. The alumina content should be from 55 to 60 per cent.

A large firm of English alum makers states that for the production of aluminum sulphates a quality of bauxite containing a minimum of iron and a maximum percentage of alumina is desired. The following may be taken as a representative analysis of a satisfactory quality:

	Per Cent
Alumina.....	60
Ferric oxide.....	3
Insoluble acid.....	12 or less
Combined water.....	25

Another firm of manufacturing chemists regards the most suitable grade of bauxite as one of the following typical composition:

	Per Cent
Alumina.....	60-65
Ferric oxide.....	5 maximum
Silica.....	10 maximum

It is, however, willing to consider lower grades, containing, say, 50-55 per cent of alumina.

A third chemical firm writes that as there is at present a plentiful supply of bauxite to be found in Europe, any material from overseas would be of interest only if it was of a high quality; that is, containing 60 to 65 per cent of Al_2O_3 or more, and less than 1 per cent of SiO_2 . The price of course would have to compare favorably with the present price of European bauxite.

The large aluminum-producing companies of the United Kingdom control their own bauxite mines. As far as can be gathered, when such concerns purchase ores from external sources no general form of contract is used. A price is fixed, for a given analysis, and a unit price fixed for each per cent of alumina and silica above or below both figures. Test samples are taken by both seller and buyer, and in the event of dispute the analysis figures given by a chemist of standing are accepted by both parties. Payment is usually made on presentation of the documents in London.

Bauxite for other purposes, as, for example, for use in the manufacture of aluminum salts, is bought under contract, and the period covered is arranged between seller and buyer. Such contracts generally guarantee a percentage of Al_2O_3 and SiO_2 , with possible allowances of a stated per cent above or below the figures agreed upon. Delivery dates are given and shipping weights taken as a basis. The usual "Force Majeure Clause," as recognized by merchants in the United Kingdom, is added. It is customary to weigh and sample the mineral during discharge of the steamer at the port of destination, and an English chemist of repute is appointed to settle the analysis.

Payment is made at the price per unit of Al_2O_3 in the mineral, "as delivered," per ton of 2,240 lb.

The French bauxites are sold to French and other manufacturers of aluminum. These manufacturers, including the foreign ones, own nearly all the bauxite deposits of France. Direct sales are mainly to the United States and Canada.

Besides the large producers, there are many small operators, for the mineral is easily won and anyone may open a quarry, after making a simple declaration to the authorities.

French business methods, both for deliveries at home or abroad by rail, demand full settlement of bills without discount within thirty days of the end of the month of delivery, and in the case of deliveries by

¹This condition for iron oxides is not general; some works treat bauxite with 25 per cent Fe_2O_3 .

sea, either in France or abroad, payment of 80 per cent of the total cost, free of discount against the bills of lading, and the remainder immediately after receipt of the merchandise at the unloading port.

The weights taken are those in the trucks at the point of departure in the case of rail-borne bauxite, and those inscribed on the bills of lading for sea-borne mineral.

Sampling by both parties is done at the point of departure, and analysis on the mineral dried at 100 deg. C., with no deductions for moisture. In cases of dispute a second analysis is made, for which both parties pay.

The market for bauxite in the United States of America is east of the Mississippi River, and the largest consumers are situated in or near the cities of East St. Louis and Aurora, Ill.; Detroit, Mich.; Cincinnati, Ohio; Knoxville, Tenn.; Philadelphia and Erie, Pa.; Niagara Falls and New York City, N. Y.; and Boston, Mass. Of recent years a number of small plants for the manufacture of aluminum sulphate for local use in water purification have been installed by municipal water works in the various states.

The only publication with which I am acquainted regularly quoting the market prices of bauxite is the *Engineering and Mining Journal*, of New York.

The price received for bauxite in 1919, as reported by the producers, and as given in an official publication of the U. S. Geological Survey, ranged from \$5.45 to \$12 per ton, the average being \$5.85 per long ton at the shipping point. This price is much below the open market rates which ruled during the period. It is explained by the fact that in the United States, as elsewhere, the larger consumers work their own mines, and the value assigned to the output is merely an arbitrary one, presumably being based on operating costs.

CHIEF SOURCES OF SUPPLY

The bauxite deposits of commercial importance in the United States of America are situated in Arkansas, Georgia, Alabama, and Tennessee. The Arkansas deposits were discovered about 1887 in Pulaski and Saline counties. They have an average thickness of 10 to 15 ft., are closely associated with syenite intrusive rocks, and are overlain by Tertiary materials. The ores are high grade, and have supplied 80 per cent of the bauxite mined in the United States.

The Georgia deposits are found near the margin of the Coastal Plain, about thirty miles east of Macon. They form beds up to 10 ft. in thickness and are overlain by sands and clays. Georgia bauxite is more suitable for the manufacture of chemicals than for other purposes.

Magnesite Production Almost Double in 1920

The production of magnesite in the United States in 1920 increased 94 per cent in quantity over that of 1919. The entire output was made by two states, California and Washington. California mined more than eight times as much as it mined seven years ago. Washington increased its production 109 per cent over that of the preceding year, making by far the largest output it has yet made. The accompanying table, compiled by the U. S. Geological Survey, shows the production by states.

Most of the output of California was calcined and used as plastic material, only a small part being natural

ferromagnesite used as a refractory lining of steel furnaces on the Pacific Coast. On the other hand, practically all the magnesite mined in Washington was dead-burned into synthetic ferromagnesite and used as a refractory lining for furnaces and settlers.

The largest producers in California were the Tulare Mining Co. and the Sierra Magnesite Co., at Porterville; the White Rock mine, operated by Frank R. Sweasy, in Napa County, and the property of the Western Materials Development Co., on Red Mountain, operated by C. S. Maltby.

CRUDE MAGNESITE PRODUCED AND SOLD OR TREATED IN THE UNITED STATES, 1913-1920

Year	California		Washington	
	Quantity (Short Tons)	Value	Quantity (Short Tons)	Value
1913	9,362	\$77,056	.....	.....
1914	11,293	124,223	.....	.....
1915	30,499	274,491	.....	.....
1916	154,259	1,388,331	715	\$5,362
1917	211,663	2,116,630	105,175	783,188
1918	84,077	761,811	147,528	1,050,790
1919	50,020	504,973	106,206	743,442
1920	81,782	1,083,262	221,985	1,664,888

The Northwest Magnesite Co., of Chewelah, Wash., was the largest producer in the United States. It shipped in 1920 more than 90,000 tons of dead-burned ferromagnesite, most of which was sent to steel companies and manufacturers of refractory products east of the Mississippi. The American Mineral Production Co., of Valley, Wash., sold its output crude to the Northwest Magnesite Co., whose quarries are near by. The Western Materials Co. operated the Double Eagle magnesite mine, near Valley, and shipped the calcined product to the American Refractories Co.

At the end of December, 1920, all the operations in Washington were stopped, principally, it is believed, on account of a lack of orders from the steel companies, many of which were idle or were not working full time. Some of the California producers were discouraged at the end of the year on account of the high cost of labor and supplies, the high freight rates, and by the belief that there will develop formidable competition of foreign material.

The imports of magnesite in 1920, reported by the Bureau of Foreign and Domestic Commerce as calcined, not purified, amounted to 43,154 long tons, valued at \$780,078. These imports came from the following countries:

MAGNESITE IMPORTED INTO THE UNITED STATES, 1920

From	Quantity (Long Tons)	Value	From	Quantity (Long Tons)	Value
Austria.....	.....	\$4	England.....	28	3,511
Germany.....	713	28,566	Scotland.....	190	13,720
Italy.....	21,185	241,220	Canada.....	6,028	184,060
Czecho-Slovakia.....	3,829	126,827	Mexico.....	500	6,300
Greece.....	4,000	38,418	Venezuela.....	2,300	11,500
Turkey in Europe.....	3,528	70,540	Australia.....	34	417
Netherlands.....	819	54,891	str'ts Settlements.....	.....	4
Total.....				43,154	780,078

The magnesite imported from Italy was mined in Austria, and that from Czecho-Slovakia was obtained from the former Hungarian deposits. That imported from Mexico came from Santa Margarita Island, and was calcined near San Diego, Cal. A shipment from Greece received in November was the first sent from that country since 1916. The arrival of 2,300 tons from Venezuela in September, 1920, was a notable event, as the recorded imports of magnesite from that country are meager.

Although the quantity of magnesite imported in 1920 was nearly three times as great as in 1919, it was only about one-seventh of the quantity commonly imported before the war.

BY THE WAY

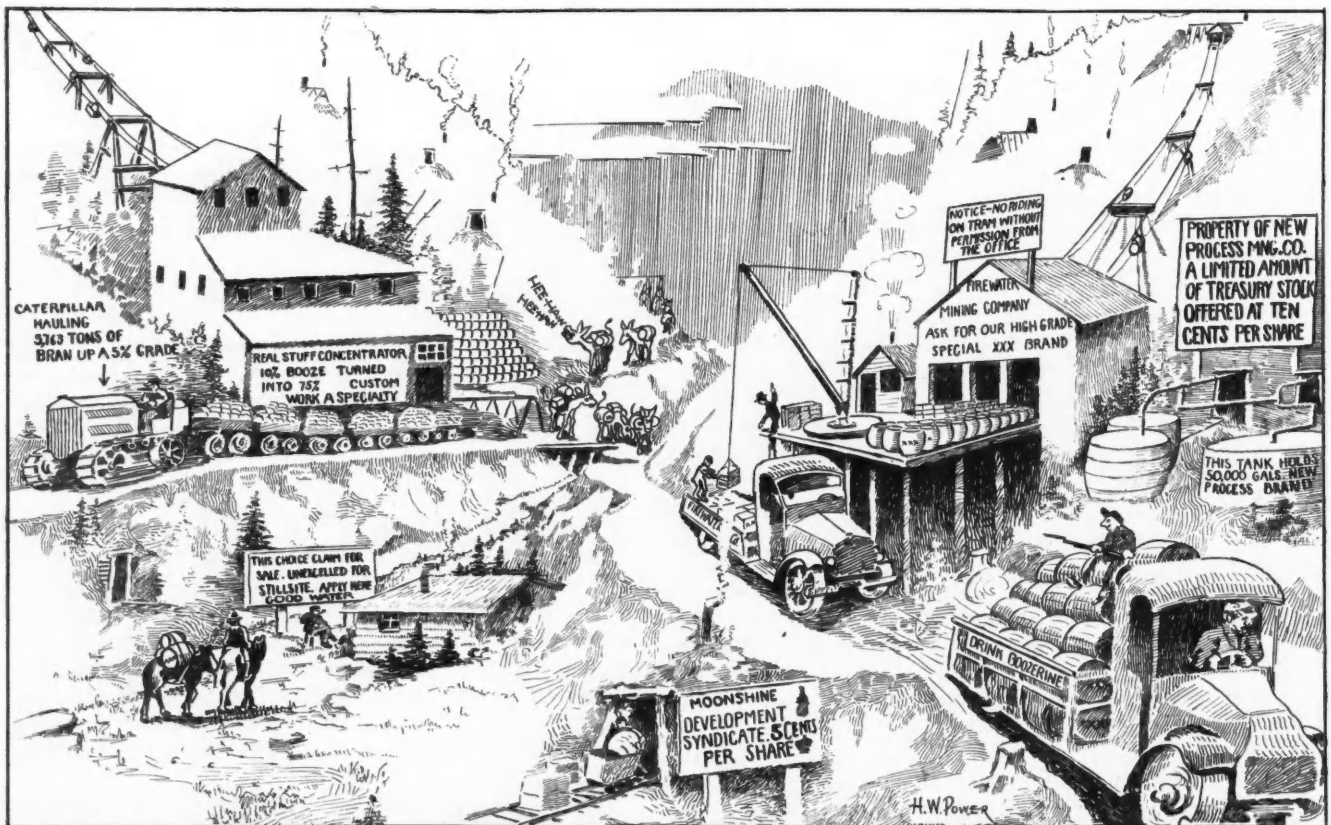
An Optimistic Phenocryst

"Things are down in mining," said old Birdseye Porphyry, as he shifted his chair and glanced out of the window down the almost deserted street. "Copper's down, the Germans are selling their zinc here and have knocked the tar out of the zinc business, and if it weren't for the cousinly action of silver in parading out of the mine with lead, there wouldn't be any work in some bang-up lead mines. Our friend George Otis Smith is praying for people to buy coal. The coal miners are going to movies and listening to phonographs and just working enough to remember where the mine is. What's it all coming to, Phenocryst?" "Well, it strikes me you're a misanthrope and a trifle petrified this morning," said Phenocryst Jones as he stared coldly at his questioner. "Haven't you got the Pittman Act and dollar silver? How about the \$20.67 for an ounce of gold. That's not down, is it? I heard you raving about the low metal prices the last time you read the market report in the *Journal*. Do you expect that metal prices are always going to be high enough to pay handsome profits every minute of the year? How about the farmers and the horticulturists? The lemon growers of California aren't having a cheerful time looking out of their back windows at the kind of lemon handed to them. There are a lot of people in the same stew as the miners. Now, you old horn-rimmed, joy-killing piece of pyrite, come out of your vug and chase a smile over your face. Life wouldn't be worth living if there

weren't some ups and downs. Copper, lead and zinc have had a fine big up; now they're down. The gold miners were so far down that they were yelling to McFadden to bring on the oxygen. Now they're perking up, and some folks are wondering why they ever quit gold mining. Prices are beginning to get weary, roosting on the top rungs of the economic ladder, and are going to join their metallic confrères on the ground floor soon. Harding and Hoover are just getting their sleeves rolled up and have started the fires in the national kitchen range. Soon they'll have the chimney red hot, and then some of you frozen-up pessimists will be taking your coats off and going to work. Anyway, don't you think it's time we were mucking out that shaft? Rock won't walk out of the mine, and a little elbow grease is going to cheer you up and stir up your liver. Let's go! Come, sweat out your liver and bacon in twisting that windlass."

Where Ignorance Is Bliss

"'Ere's a bit I over'ear'd tha h'other day, m'son,' said' Cap'n Dick. "Jan Trevarthan and Tommy Penglaze were walkin' 'ome from shif', w'en Tommy sez to Jan, 'Look ee 'ere, Jan; I got sumthin' to tell 'ee, an' I do pray thee won't be put h'out baout un. But let me warn thee to keep tha bloody shades daown w'ile thee art raoun' tha 'ouse at night.' Jan, ee flares right h'up, an' sez, 'Wot's thee got to say baout un?' 'W'y I'll tell ee,' sez Tommy. 'Tha h'other h'evenin' I wuz a'passin' o' tha 'ouse, an' I see thee in a h'upstairs winda a'kissin' o' tha wife an' 'uggin' 'er too. Naow coorse that's h'all right for thee, but it h'aint nothin' for tha neighbors to be gapiin' at.' 'Then so much tha fool be thee,' sez Jan, 'Gos on baout thy business. Tha shoe's on tha h'other foot, an' tha joke's on thee—I wuzn't 'ome tha h'other night.'"



The finding of a still in active operation in old workings of the Sierra Nevada mine at Kellogg, Idaho, recently, suggests immense new possibilities for the mining industry and good prospects for a real old-time mining boom.

HANDY KNOWLEDGE

The Wuensch Bore-Hole Graviscope

BY C. ERB WUENSCH

Written for *Engineering and Mining Journal*

The bore-hole graviscopes is a device proposed for automatically surveying and recording on a small paper ribbon the course of bore holes. At present bore holes, or diamond-drill holes, are seldom surveyed, because of the tediousness and expense of the work, as well as on account of the questionable accuracy of the survey. All methods thus far used for obtaining the course of bore holes depend upon the magnetic needle, which cannot be relied upon, because of the possibility of local attraction and difficulties due to oscillation. It is therefore evident that any device which would record the strike and dip of a bore hole accurately along every part of its length would have decided advantages over either the Oehman photographic, the George gelatin tube, or the Maas bore-hole compass method.

dip, whereas the other will give the strike by virtue of the fact that the plumb bob will always seek the maximum dip and orient the graviscopes so that the axis through pivot, Part 8, will always be vertical. Therefore in passing the graviscopes down a bore hole, the graviscopes will seek the maximum dip, and hence there will be a relative movement between the two gimbals and the mounting. This relative deviation in strike and dip is recorded graphically on a paper ribbon by the use of two small stylographs.

As indicated in the accompanying sketch, the graviscopes is inserted in a thin protecting tube, which incases it and supports the mechanism, Part 1.

Parts 2 and 2' are rings with a small groove cut in them to act as a ball-bearing raceway, No. 9. These rings are made of various widths, so that the same graviscopes may be inserted in bore holes of various diameters. Part 3 is a light metal frame with a groove cut in it so as to accommodate the ball bearings in the

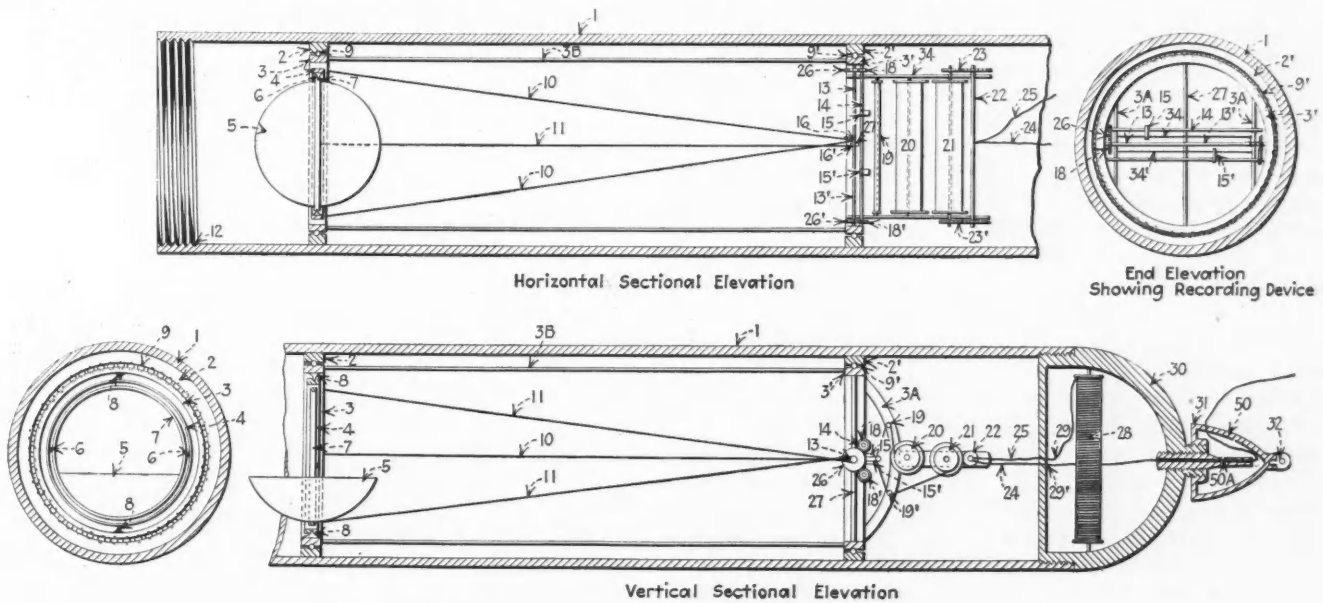


FIG. 1. DETAIL OF WUENSCH BORE-HOLE GRAVISCOPES

The graviscopes is nothing more than a new application of the principle of the plumb bob as used in clinometers. These instruments are used for determining the dip. The clinometer will always seek the maximum dip. The graviscopes, however, differs from the ordinary clinometer in that it is mounted in a ring having two inner rings (gimbals) carefully pivoted at right angles to each other, which enables the plumb bob to seek the maximum dip regardless of the orientation of the instrument itself. In the ordinary clinometer the rotary movement is only in one plane, and to get the true dip it is necessary to orient the instrument in that direction.

The strike and dip are always at right angles to each other. By referring to the sketches of the graviscopes, it can be seen that because of its construction (the plumb bob within two gimbals, with their mountings at right angles to each other) one ring will give the

raceway of Part 2. This is made as frictionless as possible, so that the rings Nos. 3 and 3' are free to rotate in any direction in the plane of the raceway. These two rings, 3 and 3', are joined together by four light metal rods, 3-B, spaced at 90 deg. to each other. The purpose of these is to cause the two rings, 3 and 3', to rotate in unison.

There are two jeweled bearing pivots, Part 8, mounted on Ring 3, which in turn are used to support the small gimbal, 4. Ring 4 contains the jeweled bearings, pivots No. 6, which serve as a mounting for the inner gimbal, Part 7. The lower portion of this gimbal contains the plumb bob, Part 5. This should be made of a metal of heavy specific gravity, such as tungsten or gold, so as to make the plumb bob as heavy as possible for a small volume of material. The form of the plumb bob is that of a segment of a sphere.

These taken together constitute the graviscope proper. Referring to the portion of the device at the other end of the tube which is used to record the movement of the graviscope graphically on a small paper ribbon, Ring 3' contains the supports 3-A and 27. These are used to support the bearings of the various minute shafts such as 13, 14, and 34.

The paper ribbon on which the graph is recorded is wound on Roll 20. The paper ribbon is then drawn over the small Roll 19 down past the two stylographs 15 and 15', then around Roll 19' and back to Roll 21. Roll 21 is connected with a small shaft, 22, by virtue of the gears 23 and 23'. No 22 has a few turns of fine fish-line cord wrapped around it. This cord is mounted

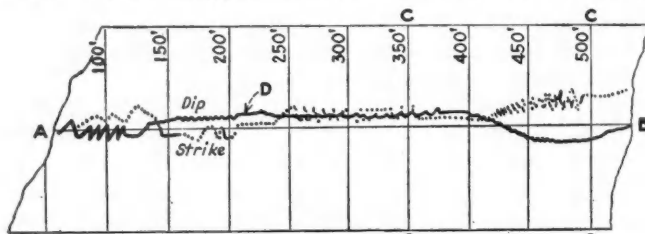


FIG. 2. SECTION OF PAPER RIBBON SHOWING HYPOTHETICAL GRAPHS

in a spindle, 28, which serves as a storage spool. For deep holes there may be several reserve spools, similar to 28, placed in series in the cap, 30. In this event, the cap, 30, would be more elongated. The thread is taken from Roll 28, passed through the small eye, 29, in the cap, 30, and then passed over the spindle, 22, back through small eyelet, 29', and thence out of the cap, 30, through the duct, 50A, in Part 50.

The purpose of the hydraulic diving bell is to prevent the water in the bore hole from entering the instrument and injuring the delicate mechanism.

By virtue of the fact that the tension (which causes the small Roll 22 to rotate) is applied through the center of gravity (through the eyes, 29 and 29') the graviscope is able to operate without interference. The plumb bob 5 is of sufficient weight to cause the whole graviscope and recording device to be subject to its governing influence under the action of gravity. The loose end of the twine is fastened at the top of the bore hole; therefore as the device is inserted in the hole the thread is gradually unwound from the reserve spool, 28, and the shaft, 22, is rotated. This causes the paper ribbon to be fed from Roll 20 on to Roll 21. The gears, 23 and 23', are of such sizes that there is a definite ratio between the amount of paper ribbon that is fed past the stylographs so that each inch of paper will correspond to a definite number of feet of hole traversed.

The movement of the graviscope is transmitted to the recording device thus: There are two sets of threads, 10 and 11. Set 10 is attached to Ring 4, which gives the course of the hole. Set 11 is attached to Ring 7, at a point at right angles to the pivots 6 and 6'. This set of strings records the dip of the hole. Therefore, by virtue of these strings, any movement of rings 4 and 7 will cause shafts 13 and 13' to rotate. These in turn will actuate the small countershafts, 18 and 18', which in turn cause the stylographs 15 and 15', respectively, to move back and forth on the shaft. Shafts 18 and 18' contain small threads of a steep pitch. The stylographs 15 and 15', besides engaging the shafts 14 and 14', engage simultaneously the shafts 34 and 34'. These prevent the stylus from rotating and hence cause a movement of translation rather than of rotation.

In Fig. 2 there is a paper ribbon showing the graphs. Line AB is the center line and corresponds to the course and dip of the hole at its mouth. The stylographs 15 and 15' are both set so they will coincide with the center line as shown at A, regardless of the dip or direction of the hole. The transverse lines, CC, are those corresponding to a certain unit of length traversed. Therefore, it is possible to tell what the deviation is from the original course and dip of the hole as shown by the center line, at any point in the hole.

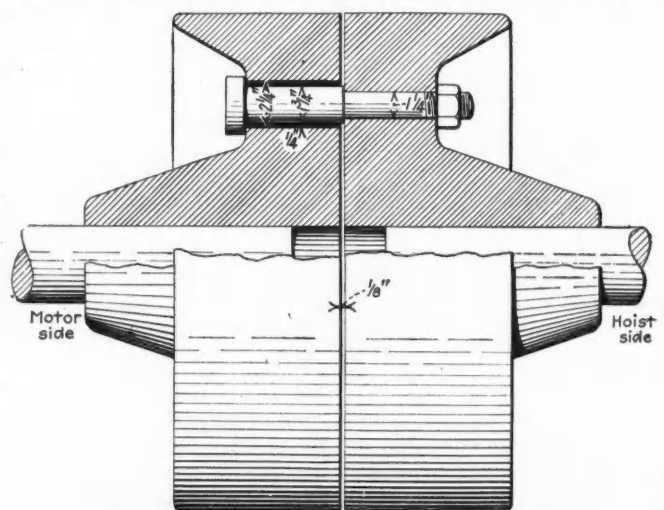
By having a set of calipers, properly graduated, one can tell the angular variation by measuring the distance the graphs are at any point from the center line. In this connection it might be well to call attention to the fact that, even though the plumb bob may oscillate, it will be easy to determine the true strike and dip from the graph. For instance, at the point D will be noted the oscillations on the graph of the dip. By allowing the apparatus to remain at a point in the hole for a few moments until the oscillation ceases, the point D is well defined when the instrument is again lowered into the hole. In the case of flat holes or holes inclined above the horizontal, the small stud, 32, at the end of Part 50, may be replaced by the rods.

For flat or vertical holes the plumb bob, 5, will not act as a positive governor, to orient Ring 4. In either of these cases Ring 4 can assume any position. In these instances, however, the graph of the strike will be disregarded, but only that which indicates the dip will be considered. This will always be correct. Therefore, if the hole should deviate from either of these courses (0 deg. or 90 deg.) the dip will change simultaneously and the plumb-bob action assert itself.

Flexible Hoist Motor Coupling

Written for *Engineering and Mining Journal*

At the Fremont Mines, Amador City, Cal., a simple flexible coupling was constructed and placed between the motor and the pinion shaft of the double-drum hoist. The motor is 200 hp. The bolt holes of one side of the coupling were enlarged from $1\frac{1}{4}$ in. diameter to



FLEXIBLE COUPLING FOR HOIST MOTOR

$2\frac{1}{4}$ in. Special bolts were made, the upper part of the bolt next to its head being made of $\frac{1}{2}$ in. greater diameter than the lower portion. A sleeve made of rubber hose was placed in the annular space between the bolt and the inner wall of the bolt hole, as shown. The coupling, designed by Edwin Higgins, cost \$75.

THE PETROLEUM INDUSTRY

Our Future Oil Supply

BY DAVID WHITE

Written for *Engineering and Mining Journal*

THE RECENT DISCUSSIONS of the oil resources of the world, of their political control, and, in particular, of the situation of the United States as to oil, have developed the existence of misapprehensions on both sides of the Atlantic. The confusion is due largely to the mental reaction caused by the close conjunction of the claims of British economists and statisticians, that Great Britain has acquired control of by far the greater part of the world's oil resources, with the statements of the political representatives of Great Britain that a small part only of the world's petroleum production is British, and that America holds a near-monopoly of the world's supply of oil. On casual consideration these contentions appear to be in radical conflict, but in reality they bear only the appearance of contradiction. Broadly speaking, both assertions are not far from the truth. One refers to oil for the future; the other to the oil now taken from the ground each year.

BRITAIN CONTENTS UNITED STATES CONTROLS 80 PER CENT OF WORLD'S PETROLEUM

To the charge that Great Britain, through direct diplomatic action, through governmental co-operation, and even through partnership with her interlocking oil companies, has systematically and in some cases secretly been carrying out plans for the establishment of British dominance over the world's future oil supplies, the replies of the British spokesmen run along essentially identical lines. His Excellency the British Ambassador; Sir John Cadman, government Petroleum Administrator of Great Britain; Lord Curzon, and many British journalists and editors all dilate on the preponderant position of the United States in the world's petroleum production. They concentrate attention on the fact that the United States controls nearly 80 per cent of all the oil now taken from the ground, and on the surprisingly small amount, said not to be more than 4½ per cent, taken from British sources. They cite the vital need for assuring a supply for the British navy, for all time, under British control; and all this is said with the polite implication that the Americans are seeking to perpetuate a monopoly, and are unconsciously, of course, un-sportsmanlike. These seductive statements have soothed the apprehensions of many American hearers, and have served as the foundation for many misleading American editorials. The real issue—the question of oil for America when our oil fields are exhausted—is so far as possible, skilfully dodged.

The direct statements kept prominently in view by the representatives of the British are essentially true. The United States in 1919 produced from her oil fields, or handled as commerce, about 82 per cent of the world's entire petroleum output, and owing to industrial and

political conditions restricting the oil production of the European fields, our oil companies handled nearly 80 per cent of all the oil mined in 1920. It is most obvious that *at the present moment* the United States vastly predominates in the world's oil production.

EARLY EXHAUSTION OF DOMESTIC FIELDS INEVITABLE

Beyond this present picture of opulence in oil may already be seen, casting their shadows across the path of our prosperity, the rapidly approaching exhaustion of our own oil fields before most of the great oil reserves of the world are touched; our inevitable loss of world dominance in oil at a relatively early date; a waning exportation of oil products and its unfavorable effect on our trade balance; and the prospect that, even for a restricted consumption, we shall be compelled to shift to other countries for ever-increasing importations to meet our necessities, except in so far as help, possibly at high or commercially disadvantage cost, may come from oil shales. We must expect these things, face them manfully, and plan wisely, thoroughly, and promptly to meet them.

The losing of our dominance in oil has begun. The greatest menace, however, lies in the fact that American oil companies are excluded from over half of the prospective oil territory of the world outside of our own country; in the fact that much the greater part, probably three-quarters, of the foreign oil resources of the world, including concessions held mainly by companies under control of the British, the French, the Japanese, and the Dutch, are already inaccessible to us, the greatest portion by far having been gathered into the control of the British; and in the most important fact that to secure the oil for our great consumption requirements, for our industries, our commerce, our merchant marine, our navy, our air service, and our daily living, we may after a time be obliged to purchase largely from foreign companies under the control of a commercially competitive and conceivably unfriendly nation. In short, unless oil shale saves us at whatever economic handicap, the day is coming when our future in oil in no small part is likely to be at the mercy of a nation or combination of nations which at this moment are conniving not only to bring the oil fields of the Old World under their national control, but also, so far as practicable, to shut out our nationals from other regions, including the mandatory countries.

BRITISH OIL COMPANIES UNDER CONTROL OF GOVERNMENT

The San Remo agreement is one document, once secret, but now in evidence of this fact. If there is known to be one such convention, may there not be other

secret agreements inimical to our interests, not yet brought to light? Provision is made that stock holdings in the newer British oil companies, including those in which the British government is a partner, shall not pass from British hands. This bodes an evil day for the United States. If it is important to Britain that she assure herself of British control of adequate supplies of oil for her motors, her navy, and her merchant marine, as is absolutely logical and wise, is it not equally important that the oil on which the United States must depend be in the control of our nationals?

WASTEFULNESS AND OPEN DOOR POLICY IN PETROLEUM PROGRAM

The British spokesmen chide us for our waste of oil in the past, which some of them offer as an excuse for present British policies. That the United States has been wasteful is true. It has taken our people a long time to learn the lesson of the value of oil and of its importance in the advance of civilization—a lesson learned long ago by our mother country and put to profitable application even in the midst of hostilities. Our American fields were the first great oil fields of the world to be extensively developed. Widespread, accessible, and cheaply exploited, they have been drilled by an ever-increasing army of drillers, until for some years we have furnished the world with two-thirds of its annual supplies.

Meanwhile, in common with our copper, our iron, our coal, our silver, and other mineral deposits, oil territory in private ownership has from the first day been as open to development by the nationals of foreign countries as to our own citizens. Foreign owners of American companies and companies with American charters, but in the control of any other country, have until 1920¹ been as free as our own domestic corporations or nationals to buy, lease, and drill, even on the public lands of the United States, and to refine, transport, and market oil in this country or any other part of the world.

AMERICA'S RESOURCES DRAINED BY FOREIGN COMPANIES

The open-door policy is traditional in America. British, French, Dutch, German, Japanese, and Belgian capital has had a free hand in the development of our oil fields, and no inconsiderable part of our 1920 production, reported by G. B. Richardson, of the Geological Survey, to be approximately 443 million barrels of oil, was mined, transported, and sold over the world by British and British-Dutch companies. In fact, the amount of oil taken by foreign companies from our oil fields is nearly one-half as great as the total world's foreign production outside of Mexico.

British companies have organized and begun drilling operations in the Mid-Continent and Gulf oil regions since the San Remo agreement was secretly passed between the representatives of Great Britain and France, and American geologists in British employ were outlining oil territory in Palestine and other parts of Asia Minor probably while the Peace Conference was sitting in Paris.

One cannot exhaust his oil fields and expect them to fill up again any more than he can eat his cake and

keep it too. So, after sixty years, during which the United States has contributed generously to the supply of the rest of the world, while developing an extravagant consumption capacity herself, we find that her oil fields can no longer be made to meet her requirements. A taking account of stock by the U. S. Geological Survey shows that although in 1920 we produced oil at the rate of nearly 450 million barrels, the requirements of the petroleum industry called for about 531 million barrels—i.e., for over half a billion barrels per annum. Unless curbed by industrial depression, the total requirements will be larger in 1921.

The oil remaining in the American ground and recoverable by present methods of mining was in 1919 estimated by the Geological Survey at about seven billion barrels—enough to meet the 1920 rate of requirements of the United States for thirteen years, if it could be mined and made available so rapidly for use, which of course is impossible. At the consumption rate of 1919, this would suffice for over eighteen years, but requirements increased more than 100 million barrels during the year. The estimates made by the Geological Survey, though formulated with great care and representing the combined views of a considerable number of oil geologists experienced in the study of the different regions of the country, are necessarily subject to revision by reason of the nature of the problem and the character of the available data. They are bound to differ from the final production, but it is unlikely that they will vary so much as two billions of barrels (enough to supply requirements for less than four years) from the truth; any difference is likely to be additional.

PROBABILITY OF QUANTITY OIL PRODUCTION IN CERTAIN AREAS INDEFINITE

Should Alaska far exceed our rough forecast, should the Permo-Carboniferous of Wyoming prove more widely productive than has been calculated, or should Utah and Colorado and western Washington disclose some surprises not compensated by corresponding disappointments in some of the other states, such an increase may be realized. Nine billions of barrels would satisfy our 1920 rate of consumption for less than seventeen years. However, the chance of discovering so much available oil in the ground must not be relied on. So large a recovery by present methods is possible, but to gamble on it is dangerously hazardous and unwarranted.

INCREASED PRODUCTION POSSIBLE BY BENEFICIATION

It will be noted that the Survey's estimates are based on present methods of recovery. If better methods of extraction of oil from the ground can be devised, and generally employed so as to increase recovery by so much, possibly, as 50 per cent, as is hoped by the U. S. Bureau of Mines, the supplies may approximate 10½ billion barrels, enough for twenty years, perhaps, according to the conservative estimates, or, on the basis of the possible 9 billion discussed above, 13½ billion barrels—enough, if available at once, to satisfy the wants of the United States for nearly twenty-five years, provided our use of oil is not increased after this year. Not to insure such an increase—and an enormous increase if oil is not too costly—would be sheer insanity. On the other hand, as I have pointed out, unless the evil day is held back by more complete extraction of oil from the ground, our domestic production will probably pass its peak in less than four years, and perhaps within

¹The leasing law of 1920 provides that companies in the control of nationals of a country excluding our companies from operating in territory in the control of that country may be excluded from operation on the "public lands" of the United States. This is retaliatory only.

two; after which our oil fields will fall off, slowly at first, then rapidly, and we will depend upon imported oil, use oil-shale oil, or resort to the other alternative and go without oil.

IMPORTATIONS VS. EXPORTATION

For several years the United States has had to depend upon oil from other countries, principally from Mexico, to make up the deficit in our domestic production. In 1920, our importations doubled those of 1919, reaching 100 million barrels in excess of our exportations (estimated at 7½ million barrels) of crude petroleum, notwithstanding that, under the influence of oil shortage and consequent advancing prices, greater efforts than ever before were put forth during the first three-quarters of the year to increase production in this country.

Restriction of production near the close of 1920 resulted from over-supply, due to favorable production conditions, including open weather, abundant supplies, and ample railway and other transportation; to the usual winter curtailment of consumption; to special curtailment on account of industrial depression and high costs, and to over-importation. It is, however, to be borne in mind that up to the present (May, 1921) the results of curtailment of domestic production are at most less than the increase of the present importation over that of a year ago. Even during the winter period of slackened consumption our domestic production capacity has been found to be far short of that actually required for our need.

UNITED STATES INCREASINGLY DEPENDENT ON FOREIGN OIL

Larger production will soon be necessary if imports or prices are not further increased. In short, the United States is dependent upon foreign oil for nearly 20 per cent of its requirements, and this dependence must enormously increase in the near future. Barring, again, a marked improvement in the way of more complete extraction from the ground, it cannot be many years before our wells are able to supply less than half our normal requirements, even with more effective efforts to restrict the latter. Evidently our standards of living, our industries and our prosperity must depend upon our ability to get adequate supplies either from foreign sources or from our shales. The latter we have not yet been able to treat with commercial success, and it remains to be determined at what cost satisfactorily usable oil-shale products can be made at a profit, and when they will become available even in relatively small quantities.

NATIONAL OIL CONTROL ESSENTIAL

One thing is certain: If we are to have oil for our cars and our machinery, without paying more for it than some other nation has to pay; and if our ships, which with Diesel engines will have nearly three times the radius of ships burning oil under boilers, are to sail the Seven Seas and are to be sure of securing bunker oil at foreign ports as cheaply as ships of our trade competitors, that oil must from first to last be under the control of our own nationals. There is no room for possible doubt on that point. Only through American control of supplies sufficient to meet our needs can we expect to secure oil for our automobiles, tractors, or ships as cheaply as the country from whose nationals we will otherwise be obliged to buy it. In this way only

can we be sure that oil will not be withheld from us in some time of greatest necessity. At whose mercy shall we be in time of war?

The American public does not yet fully realize the grave danger of our petroleum situation. The U. S. Geological Survey, which has taken the census of our oil reserves, and the U. S. Bureau of Mines, have for two years been warning the country to prepare for the day when our oil fields will begin to fail. In fact, the main task of arousing the public has been carried by these bureaus of the Government, and by Mark L. Requa, in charge of petroleum in the late Fuel Administration. The *Engineering and Mining Journal* also has carried on a consistent campaign of enlightenment as to the situation for the last year and a half. The leaders of the great oil companies cannot, in general, be expected to enter a publicity campaign to the effect that the oil resources behind the capital stock of many of their companies are likely at an early date to enter permanent decline. A relatively small number, including some of the largest of our companies, have secured promising if not actually productive concessions in foreign countries, mainly in Mexico; but even the largest companies seem careful to locate near the coast or inland transportation and timid of undertaking too much development. Few, if any, have ventured across the ocean.

As yet, American oil companies have made only a beginning in the acquisition of rights for the development of oil in foreign countries commensurate with our prospective needs, and, therefore, necessary for the safety of our country. Their managers seem incapable of visualizing the nearness of our peril or the extent of the concessions necessary to guarantee our future. It is time that our oil men abandoned the fatuously complacent belief that the United States contains all she needs and ever will want, a national conceit now threatening harm to several other American mining industries.

In a juncture like the present it is deplorable that the people of the United States are constitutionally jealous of investing the Government with power such as is needed to meet our rivals even-handed, and effectively to assist our nationals in the protection of our country.

PETROLEUM REQUIREMENTS OF UNITED STATES DOUBLE THOSE OF OTHER COUNTRIES

The total petroleum resources of the world recoverable by present mining methods are estimated by Eugene Stebinger, of the U. S. Geological Survey, and by myself at 60 billion barrels, about 8½ times those of the United States. On the other hand, the annual requirements of the United States are at present twice those of the rest of the world. The proportions of this disparity in consumption will probably decrease from 1921 on, by reason of rapid increase in the use of petroleum by other nations and the development of oil fields nearer to their hands. However, though our rate of increase must fall off, no permanent reduction in our total consumption is to be looked for in the near future, if oil, either imported or made from oil shale, is to be made obtainable within the purchasing power of the consumer.

The available contents of the discovered oil fields of the world, according to the estimates given in my paper on "The Oil Resources of the World" in the May, 1920, issue of the *Annals of the American Academy of Politi-*

cal and Social Science, are grouped as follows, the estimates being based on present methods of recovery:

OIL RESOURCES OF DISCOVERED OIL REGIONS OF THE WORLD

Country or Region	Millions of Barrels
United States and Alaska.....	7,000
Canada.....	995
Mexico.....	4,525
Northern South America, including Peru.....	5,730
Southern South America, including Bolivia.....	3,550
Algeria and Egypt.....	925
Persia and Mesopotamia.....	5,820
S. E. Russia, S. W. Siberia, and the region of the Caucasus.....	5,830
Rumania, Galicia and Western Europe.....	1,135
Northern Russia and Saghalien.....	925
Japan and Formosa.....	1,235
China.....	1,375
India.....	995
East Indies.....	3,015
Total.....	43,055
Total eastern hemisphere.....	21,255
Total western hemisphere.....	21,800
Total north of equator.....	36,400
Total south of equator.....	6,655

To the estimated oil resources (43 billion barrels) in the discovered oil regions are to be added 17 billion barrels, which, on geologic evidence, I have estimated to be present in areas where oil has not yet actually been discovered. The total, 60 billion barrels, is conservative and almost certain to be exceeded eventually—possibly by 15 billions of barrels. The most accurate calculation is that for the United States, for which the data are by far most nearly adequate. The estimate for our own country includes oil from undiscovered regions as well as that from known fields.

In my paper, mentioned above, also are briefly summarized the conditions of political control adversely affecting the privilege of American participation in the development of the oil resources of other countries, which give rise to the following conclusions:

As the case now stands, our nationals are either distinctly or in effect shut out of the regions containing nearly one-half of the oil in sight in the rest of the world if the open-door policy is not assured in the mandatory countries. Further, if to the petroleum resources in the countries now held by Great Britain, France, and The Netherlands, there be added the concessions held by their nationals in producing or prospective oil regions of other countries, the total oil resources in the control of these nations will probably exceed three-fourths of the world's oil reserves outside of the United States. An open-door policy, in the mandatory countries, at least, is an economic necessity to the United States.

The legislative restrictive regulations and policies of these countries are more fully presented in a report by the Secretary of State, May 14, 1920, to the President, and published as Senate Document No. 272.

To the above quotation I may be excused for adding another paragraph:

Behind the curtain of secret diplomacy, the rich oil reserves of the unappropriated mandatories of the Near East and of the Caucasus-Transcaspian regions are stakes of a great game during which more than one political boundary is likely to be adjusted to meet the oil ambitions of a prospective protector, while in portions of Latin America the stresses of commercial and political diplomacy are fully exerted to the disadvantage of our nationals. Even during the long war, oil geologists in the employ of the French, the British, and the organically allied Dutch Shell interests have been examining the most remote lands, including some of the unstable countries, and in certain regions have carried on their search at the very heels of the armies. According to recent British oil news, the division of the Mesopotamian oil regions between the French and British has been agreed upon, and an understanding formulated in accordance with which Great Britain and her European allies will control the oil resources of the Mediterranean region.

The statement quoted above was written in February,

1920, before the San Remo agreement dividing the rich petroleum resources of Mesopotamia and Syria—75 per cent British and 25 per cent French—with the joint arrangement for the aggressive acquisition, with government aid, of oil territory in Russia, Rumania, and other parts of Europe, was known in America, though probably long after it had actually been signed. There is no sign of an open-door policy in this; no reciprocity or equality of opportunity for the United States. As a Washington editor writes: "Moral obligations are soluble in oil." British fair play seems to have been lost sight of and British sportsmanship to have broken down.

PETROLEUM SITUATION IN THE FAR EAST

In this connection it is pertinent to recall the remarkable situation in the Far East. The German domains in Africa, and, for the most part, in the East Indies and Polynesia, having been scheduled by secret treaty for allocation to the British and French spheres of influence, there was little German territory outside the German islands of the Pacific north of the Equator left to give to the Japanese. Accordingly, the surrender by China to Japan of certain of her sovereign diplomatic, financial, and military rights under the terms of the "twenty-two (?) articles" forced on China by Japan in 1915, and Japan's aggressions on the territory of China, one of our allies, appear to have been tacitly sanctioned—league-alized, as it were—and Japan left to proceed according to her ambitions and her conscience in acquiring territory and resources belonging to the Chinese and the Russians. Digressing a moment, it may be remarked that the interests of two of the Allies, China, in an important way, and the United States, in a very subordinate way, seem to have been sacrificed to a third ally. No account is taken of Russia. Japan, whose oil reserves are quite limited, has since "occupied" Russian Saghalien (Sakhalin), with its stores of high-grade coal and its 200-mile belt of tempting oil, gas, and asphalt seeps, until a permanent government is established and the prospective interests of Japan, including other oil territory in eastern Siberia, are recognized and assured. Oil territory under Japanese control is not likely to be open to development by the oil companies of the United States.

Within the last year, representatives of British inter-related oil interests, some of which are in part directly underwritten by the British government, have been making examinations in Siberia, in Mexico, in Colombia, in Peru, in Bolivia, and in other countries in South America, and in the United States; have been gathering in German and other concessions in the Rumanian, Galician, and Russian fields; spreading their holdings of prospective oil territory in the East Indies, and, in general, proceeding with feverish energy with the British plans for a world domination in oil more complete and arbitrary than that which is now slipping away from the United States. In these plans the open door of opportunity seems to play no part such as it has played during the world domination by our country. It is rumored, also, that arrangements are now nearly if not quite completed whereby the British will secure an oil concession covering the entire Province of Kan-Su, which from the oil standpoint now appears to be second best, if not the best, prospective great oil region in China. The oil resources of Shensi are said to be in Japanese control, and the grasp of the

British is stronger in Szechuen, the remaining of the great prospective oil regions of China. If we are to have oil bunker stations for our merchant marine and our navy, along the avenues of world trade, from which oil may be obtained as cheaply for our ships as for the ships of any other nation, where is this oil to come from?

Referring to the Stebinger map, published in my above-cited paper to show the open and closed countries and the geographical distribution of the estimated oil reserves, it now would seem that to the countries closed to American oil companies, according to present policies of Great Britain, France, Japan, and The Netherlands, may be added the Dutch East Indies, Saghaliën, and possibly Mesopotamia (British claim based on a concession never granted by the Turkish government), Syria, the northern strip of Persia, and Arabia; and it remains to be seen whether American companies will hold oil concessions of value in mandatory German territories in Africa or other regions of the world. The exclusive monopoly of oil development in mandatory New Guinea was promptly granted by Australia, which holds the mandate, to the Anglo-Persian Oil Co., in which the British government owns a controlling interest.

A concession, or perhaps several selections, from cull territory in Mesopotamia or some other country, eventually offered American oil companies, after the prospective oil regions have been examined and all the promising areas covered by the nationals of more favored nations, might technically figure as an open door, but such belated opening, at best without evenly competitive conditions of operation, will assure little oil for America.

It is common knowledge that our principal allies, now our commercial rivals and trade competitors, have, by secret agreements, by diplomatic camouflage, and by direct action, shown a purpose to close to us the open door of equal opportunity in the mandatory as well as in other countries under their influence, and to hasten the day when we may be dependent on them for oil. Neither in recent history, nor in the present outlook, is there any foundation warranting the United States in leaving her future as to oil not only to foreign supplies, as she surely must, except as she may perhaps be saved by oil shale, but also to oil mined, prepared, transported, and marketed by companies in the control of a nation not only competitive but commercially antagonistic.

Oil is essential to our work, to our daily living, and to our protection. In the day of our disadvantage and dependence can we expect fairer treatment than we are receiving now?

Petroleum in Bolivia*

BY ARTHUR H. REDFIELD

Two districts of interest as possible producers of petroleum are recognizable in Bolivia: The Chaco or Yacuiba district, in the southeast of the country, comprises a strip 300 miles long and 50 miles wide along the eastern foothills of the Andes, between latitudes 22 deg. S. and 17 deg. 45 min. S. or between the towns of Yacuiba, on the Argentine frontier, and Santa Cruz de la Sierra. It includes portions of the

departments of Tarija, Chuquisaca, and Santa Cruz. This is the district of greater promise. The other, of less interest, known as the Pacajes district, lies in the northwestern part of Bolivia, in the Department of La Paz, comprising chiefly a limited area (so far as reported) around Chulluncayani, in the southwest of that department, sixteen miles from the Arica-La Paz railroad.

The occurrence of oil both in the Chaco and the Pacajes districts of Bolivia is connected with the same petroliferous formation which supplies the oil indications of the Salta-Jujuy district of Argentina. This formation has been in recent years assigned to the Cretaceous, with its latest member extending perhaps into the Early Tertiary. The lack of fossils makes its correlation uncertain; earlier geologists have ascribed it to a variety of periods, from the Silurian to the Tertiary.

The petroliferous formation is folded along a north-south line, parallel with the Cordillera, into anticlines and synclines. Recognized anticlines are observed at the Quebrada de Peima, at the Quebrada de Cuarazuti, and at the Quebrada de Machareti.

Seeps of oil, often of high grade, are the outstanding evidence of the petroliferous character of southeastern Bolivia. Such seepages are found at the Loma de Ipaguazu, the Quebrada de Peima, Quebrada de Cuarazuti, Quebrada de Machareti, Quebrada de Itacua, and at numerous other points between Yacuiba and Santa Cruz. Oil seeps occur also at Chulluncayani, in the Pacajes district.

The Chaco oil fields have been known since 1868, and several observers visited the region prior to the World War. In 1913 a British engineer surveyed the region from Machareti to Buenavista for an English company. A well drilled by the company near Cuevo found oil at a shallow depth. The work stopped suddenly in 1914. In 1915 an American engineer prospected the Yacuiba district, and reported unfavorably on it in view of the difficulties of development and transportation.

The Sindicato Petrolifero del Oriente Boliviano was formed in 1916 by a group of German and Chilean nitrate producers who desired to solve the fuel problem for the nitrate refineries. The field was prospected; a railroad to Potosé was planned; and even a pipe line over the Cordillera to Antofagasta and Iquique was considered. No active development took place, however. In the Pacajes district, the company Montes y Zupan was reported in 1915 to be drilling on the Copacabana claim. No reports of the outcome of its venture have been made public.

There are no exclusive or monopolistic concessions in Bolivia covering large tracts of land. Prospecting on public land is free, the prospector being required merely to notify the authorities. Claims (called "concessions"), to the extent of thirty areas of 100 hectares each, may be taken out by any individual, citizen or alien, by complying with the necessary formalities. A large number of such claims have been taken out by individuals who are holding them for speculative purposes.

The mining laws make no distinction between the rights of citizens and of aliens to prospect or to acquire land for mining and development. A measure passed early in 1920 taxes the net earnings of mining companies. The purpose of this bill appears to be purely fiscal, to make up for the shortage of revenue.

*U. S. Geological Survey, Section of Foreign Mineral Resources.

Book Reviews

Le Platine et les Gites Platiniferes de l'Oural et du Monde. By Louis Dupare, professor at the University of Geneva, and Marguerite N. Tikonowitch. Quarto, pp. 600, 99 plans, 90 stereotype plates, 11 plates in black and colors, atlas containing 5 geological colored maps, and 8 plates. Price, 150 fr. Geneva; S. A. des Editions Sonor, 46 Rue du Stand.

This is a monumental work on a subject but little studied heretofore, and is, therefore, classic. The subject of platinum is treated for the world in general, but the actual research has been done mainly in the world's greatest platinum field—that of the Urals, in Russia. The monograph treats of the geology, mining and treatment methods, refining, industrial uses, and production statistics of this metal. After a preliminary geologic sketch of the Oural Mountains, five chapters are devoted to the description and petrography of the basic igneous intrusions which form the "mother rock" of platinum. The principal "mother rock" is dunite, an olivine rock containing chromite. This rock occurs generally in rudely elliptical outcrops, outside of which is a ring of pyroxenite, and still outside a ring of gabbro, all rough and interrupted. Platinum occurs to a less extent in the pyroxenites; only rarely in the gabbros.

The origin of the dunites and the concentration of platinum by magnetic differentiation is demonstrated. Dike rocks of many varieties, belonging to the same general type of magma, cut the major phases. A chapter is next given to the metamorphic schists into which the basic eruptions are intrusive; another treats in detail of the occurrence of platinum in the "mother rock." Chapter IX treats of the analyses of platinum and the other rare metals with which, in the Urals, it is alloyed.

Chapter X treats of "placer" platinum, and Chapter XI of the different methods of working platinum from gravels, from the cradle to the dredge. Chapter XII describes in detail the different platinum-mining districts of the Urals in the dunites, and Chapter XIII the corresponding districts in the pyroxenites. In Chapter XIV thirty pages are given to sketching the occurrence of the platinum of the world outside of the Urals. In a number of places, in various parts of the world, the "mother rock" is shown to be dunite, and in some cases, as in the Urals, the dunite outcrop is surrounded by rims of less basic intrusions. Chapter XV treats of the metallurgy and refining of platinum, Chapter XVI of its uses, and Chapter XVII of the world statistics of its production.

Essentially, of course, this monograph is on Russian platinum. The inclusiveness of treatment is unusual, involving everything from drill tools and close-

connected dredge buckets to general geology, so that the editorial blue-pencil would doubtless have given a more compact and as valuable a treatment containing whatever the writers have to offer that is new. Nevertheless, this is a most important contribution to the knowledge of platinum and its allied metals, particularly concerning their origin. J. E. S.

Preliminary Report on the Sand and Gravel Deposits of Georgia. By L. P. Teas. Geological Survey of Georgia, Bulletin No. 37. Cloth; 7 x 10; pp. 392; 20 plates, 13 figures, 1 map. Atlanta, 1921.

Sand and gravel are commodities of such common occurrence, and are so familiar, that few authors have thought it worth while to devote any attention to their properties or problems. Consequently, the literature on the subject is neither voluminous nor comprehensive. The Georgia bulletin is welcome, therefore, in that it supplies a real need, both in general and special information on a subject of wide interest. The first forty-four pages describe the origin, classification, physical properties, and methods of determination of physical properties of sand and gravel. Pages forty-four to ninety-five outline the various uses, such as for building, glass manufacture, foundry, sand-lime brick, roads, ballast, filter, engine, abrasive and other. The two following sections are devoted to methods of excavation, transportation, and preparation for market, and methods of prospecting and testing sand and gravel applicable to the three main types of deposits, stream, bank, and sandstone. Production figures, prices, and a list of producers of Georgia sand and gravel are supplied. A large part of the volume, comprising 221 pages, is devoted to a discussion of the three principal areas, the Coastal Plain, the Crystalline area, and the Paleozoic area, giving their extent, physiography, geology, and a detailed description of deposits by counties. The addition of an excellent bibliography on sand and gravel literature is noteworthy. The bulletin concludes with four appendices on special types of Georgia sands. O. B.

Zinc (1913-1919). Part of "The Mineral Industry of the British Empire and Foreign Countries." Paper; pp. 112. Published by His Majesty's Stationery Office, London. Price, 3s. 6d., net.

A paper similar to the ones published by the U. S. Geological Survey on domestic mineral resources, with particular reference to the position of the British Empire in the world's zinc industry. A mass of statistical information is presented, covering the production and trade in zinc, supplemented by descriptive accounts of developments in important zinc-producing and zinc-consuming countries. An excellent bibliography is appended. The paper should prove interesting to persons wishing a compact exposition of the British Empire's zinc trade.

Recent Patents

Allen Cone—No. 1,374,625. Charles Allen, El Paso, Tex. A baffle for deflecting the feed into an Allen cone so that conditions therein will be quieter and more favorable for proper settlement and efficient classification.

Automatic Sand Trap—No. 1,374,626. Charles Allen, El Paso, Tex. A tank supported over a cone classifier, so arranged that when a sufficient amount of sand collects, a spring will be released, thereby opening a valve through which the sand discharges into the cone beneath.

Ball Mill—No. 1,370,700. B. A. Mitchell and F. G. Janney, Garfield, Utah. A ball mill with a new design of liners and grate discharge.

Chloridizing Roasting—No. 1,375,002. Julius H. Hirt, El Paso, Tex., assignor to Alvarado Mining & Milling Co., New York. A method of heating ore for chloridizing, and introducing the chloridizing agent in gaseous or vapor form.

Combined Flotation Machine and Classifier—No. 1,375,211. David Cole, Morenci, Ariz., assignor to Minerals Separation North American Corporation, New York. A frothing classifier used in combination with a ball mill, by means of which minerals capable of being floated are removed and the oversize is returned to the mill for re-grinding.

Concentrator—No. 1,370,601. R. Luckenbach, Philadelphia, Pa., assignor to Luckenbach Processes, Inc., San Francisco, Cal. A method of gravity separation of the heavy particles in an ore, followed by recovery of the valuable minerals in the resultant tailings by forcing them through a porous medium to which the minerals will adhere.

Electrode—No. 1,373,273. Urlyn C. Tainton, Martinez, Cal. A permeable electrode for electrolytic precipitation of metals, which comprises a paper sheet in which is incorporated a powdered conducting material.

Differential Flotation—No. 1,375,087. Charles Faul, St. Kilda, and Henry Lavers, Surrey Hills, Victoria, Australia, assignors to Minerals Separation North American Corporation, New York. The use of a copper compound and a bichromate of an alkali metal to effect differential flotation of mixed sulphides.

Riffled Trommel—No. 1,374,472. William W. Richardson, London, England. An apparatus consisting of at least one trommel with riffle plates arranged longitudinally on the interior surface, designed for classifying and concentrating ores and also applicable to dredging operations.

Tube-Mill Liner—No. 1,371,929. M. R. O'Shaughnessy, Cobalt, Ont. A method of designing and securing sectional liners within a tube mill.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Vegetation May Indicate Geology Soils Not Always Safe Guides to Parent Rocks—Much Research Needed

Speaking before a recent meeting of the Geological Society of Washington Edgar T. Wherry discussed the variations in soils derived from similar rocks and the fundamental soil characters important to plant growth. He summarized present knowledge and showed that many soil factors control surficial vegetation, and that much work is yet to be done before vegetation may be accepted as a sure guide to the mineralogical character of the underlying rocks. The title of the paper was "Our Present Knowledge of the Relation Between Vegetation and Geology." Mr. Wherry's remarks are summarized in the following:

The observation that there is some relation between the vegetation and the underlying soil or rock formation was made at least as early as 300 B.C., by Theophrastus. During the Middle Ages and the early part of modern times the subject was looked at in the same light as the divining rod, namely as an easy means of penetrating the mysteries of the earth's interior, and of finding hidden ore deposits. Hence there arose beliefs concerning the existence of silver plants, lead plants, zinc plants, and so on, the data on which were summarized in 1875 by the late Rossiter W. Raymond in the Transactions of the American Institute of Mining Engineers.

For many years ecologists have been collecting data concerning the kinds of rock preferred by individual species of plants, and have named certain species calcicolous and others silicolous on the basis of the results obtained. As the study of such relations progressed, however, numerous exceptions to the rules came to light, plants which were limited to limestone in one region being found to be indifferent or even limited to siliceous rocks elsewhere. Because of these exceptions, as well as from various theoretical conclusions (not always based on sound knowledge of chemistry and other sciences) there has come into vogue an opinion that the physical properties, specially the moisture content, of soils or rocks are the chief factors in determining where given plants will grow. Such physical factors unquestionably have considerable importance, but chemical factors have far too great significance to be overlooked. It is difficult to determine in any given case how much of the various chemical constituents of a rock or a soil are available to plants. Fortunately, however, we now have ready means for determining soil acidity and alkalinity, and as these have a marked

influence on the availability of plant foods, such as calcium, nitrogen, and phosphorus, their study is of great importance in this connection.

The simplest method of determining the acidity or alkalinity of a soil is by some indicator, as litmus, but synthetic dyes developed in recent years indicate by their color changes different degrees of acidity and alkalinity. Many hundred soils and rocks have been tested in this way, with reference to the vegetation growing upon them. It has been found that many native plants are decidedly sensitive to the reaction of the soil. In particular most of the members of the Heath family prefer highly acid soils, while a number of rock ferns and some members of the Saxifrage family, especially the "grass of Parnassus," are quite intolerant of such soils and grow only where the reaction is neutral or alkaline.

As to rocks, the following observations have been made: limestone and other rocks containing calcium carbonate tend to yield alkaline or neutral soils. They are attacked by any acids which may form in the soil through the decomposition of organic matter, and neutralize these acids wherever the circulation of soil water permits. Only where a thick layer of humus matter or rain-leached clay accumulates over limestone ledges can acid soils develop. The more basic igneous rocks are also attacked by organic acids when these become strong enough, and may neutralize them at least in some degree, so that the resulting soils are low in acidity. The more siliceous rocks seem to be attacked so slowly by soil acids that little neutralization occurs and acid soils most frequently develop over them. It has also been noted that in some soils no acids are produced by decomposition of the organic matter. Instead the latter goes off as carbon dioxide and water, leaving the lime and potash of the original plant tissue behind, and thereby rendering the soil reaction neutral or even slightly alkaline without the underlying rock having any effect one way or another.

Because plants, on the whole, are affected more by the soil than by the underlying rock, and as the soil is not necessarily related to the rock on which it rests, it seems impracticable to use vegetation as a certain indication of the calcareous or non-calcareous nature of a rock in general. In regions where soil and rock are more definitely connected, as in mountainous country, high latitudes, or in special situations, as near a glacial moraine, a study of the vegetation may aid the geologist in preparing his maps. Much more work is needed, however, both on individual plant species and on associations of

plants; and not only the acidity and alkalinity, but also other chemical features preferred by each, must be considered. In conclusion, it seems that either the geologist must have a fairly detailed knowledge of botany, or botanist and geologist must work in conjunction, to render the botanical method of practical value in geology.

Institution of Mining and Metallurgy Awards Two Gold Medals

The gold medal of the Institution of Mining and Metallurgy (London) has been awarded this year to Sir Thomas Kirke Rose "in recognition of his eminent services in the advancement of metallurgical science, with special reference to the metallurgy of gold."

At the same annual meeting of the Institution, on April 21, the "New Consolidated Goldfields of South Africa, Ltd., Gold Medal and Premium of Forty Guineas" was awarded to H. Livingstone Sulman for his paper of 1920, "A Contribution to the Study of Flotation." This paper won for Mr. Sulman the Institution's gold medal in 1920, and President Merricks expressed his desire to indorse the words used on the previous occasion by his predecessor.

Sir Thomas and Mr. Sulman are the first two members of the Institution of Mining and Metallurgy to receive both the gold medals mentioned.

British Committee on Rock Names Makes Report

The Geological Society and the Mineralogical Society appointed a joint committee in February of last year, which was to consider standardization of British petrographic nomenclature, and make such recommendations as seemed adapted to secure that end. Prof. W. W. Watts was appointed chairman, and the other members of the committee were J. V. Elsdon, J. S. Flett, J. Teall, H. H. Thomas, G. W. Tyrrell from the Geological Society; and J. W. Evans, F. H. Hatch, Arthur Holmes, G. T. Prior, R. H. Rastall, and W. Campbell Smith, from the Mineralogical Society. This committee has now reported its recommendations. No names of general undisputed definition are discussed and only British ones appear. Forty-seven terms naming rock species or textures are given preferred definitions; twenty-seven terms are classed as obsolete or unnecessary, being used in more than one sense, and their further use is condemned. In this list one notes "diabase," "binary granite," and "melaphyre." A list of synonyms indicates the committee's preference for nineteen terms which have simplicity or priority in their favor. No new terms are recommended.

MEN YOU SHOULD KNOW ABOUT

H. F. Bain, director of the U. S. Bureau of Mines, was in New York City on May 26 and 27, on professional business.

Charles Hayden and **D. C. Jackling**, of the Mesabi Iron Co., inspected the company's new plant at Babbitt, Minn., last week.

E. F. Burchard, geologist, is visiting centers of pig iron, iron ore, and cement production in research for the U. S. Geological Survey.

D. B. Dowling, of the Department of Mines, Canadian Geological Survey, Ottawa, has received the degree of D. Sc. from McGill University.

L. W. Stephenson, who went to Mexico early in February on a private geologic commission, has resumed his work with the U. S. Geological Survey.

Daniel M. Drumheller, Jr., superintendent for the Tidewater Copper Co., Sidney Inlet, B. C., has gone to Spokane, Wash., for an indefinite stay.

W. F. Ferrier, mining geologist, of Toronto, Ont., has gone to Vancouver, B. C., on professional work, and will spend some time in British Columbia.

M. M. Duncan, vice-president and general manager of the Cleveland-Cliffs Iron Co., Ishpeming, Mich., is spending a few weeks at Asheville, N. C.

A. P. Low, geologist, is on his way to the Fort Norman oil fields, in charge of a party employed by the Mackenzie River Oil, Ltd., Co. to locate sites for three wells.

Edward R. Knowles, consulting engineer, is now associated with Murrie & Co., Inc., 74 Broadway, New York City, in charge of that company's fuel engineering work.

J. P. McFadden, general manager for the Rosebery-Surprise Mining Co., has returned to the Slocan district properties, from a visit to New York and other Eastern points.

Charles W. Potts, of the Northern Minnesota Ore Co., has returned from Washington, where he has spent several months in the interests of his company and of manganese mining legislation.

Carl J. Trauerman, formerly manager of Liverpool Silver Mines Co., Clancy, Mont., has resigned to accept a post with the oil stock department of the Lauzier-Wolcott Co., Butte, Mont.

J. S. Diller, of the U. S. Geological Survey, is en route to continue his study of the volcanic activity at Lassen Peak, Cal. He also will make geologic observations in the vicinity of Fallon Reservoir, Nev.

Charles P. Perin, consulting engineer, of the firm of Perin & Marshall, New York City, has returned from his recent trip to England. **S. M. Marshall**, of the same firm, sailed from India for the United States about June 1.

Pierre Pruvost, of Lille, France, a geologist who has made important contributions to our knowledge of the coal fields of northern France, has been awarded the Gosselet prize by the Geological Society of France.

W. L. Loveland has resigned as general manager of The Mine and Smelter Supply Co., Denver, Col. His successor will be **H. J. Gundlach**, who has been manager of the company's store in Denver for the last year.

Roy M. Wolvin, president of the British Empire Steel Corporation, has sailed for England in connection with the business of the corporation, involving the arrangement of some details with the English interests concerned.

Charles Butts, of the U. S. Geological Survey has been detailed to make an additional study of the geology of northwestern Alabama. **E. O. Ulrich** will make a similar study in middle Tennessee and in Kentucky, and **R. D. Mesler** in southern Illinois.

Robert J. Grant, mining engineer, of Denver, Col., has been selected as superintendent of the Denver Mint to succeed **Thomas Annear**. Mr. Grant began his mining career in Colorado in 1888 and has had mining interests in Mexico, California, Arizona, British Columbia, and Australia.

H. G. McClain, general superintendent for Liberty Bell Gold Mining Co., Telluride, Col., and **Webster P. Cary**, recently general manager for New Henrietta Mining Co., Globe, Ariz., announce the organization of McClain & Cary, mining and metallurgical engineers, 708 Harrison Ave., Leadville, Col.

O. C. Ralston, superintendent of the U. S. Bureau of Mines Experiment Station at Seattle, Wash., has been named assistant chief metallurgist of the Bureau, the appointment to become effective July 1. Mr. Ralston will have headquarters at Berkeley, Cal., where he also will have charge of the Berkeley station. He will direct all the work of the Bureau on non-ferrous metals.

J. Cavalier, rector of the University of Toulouse, and an authority on metallurgical chemistry, has been selected by the French faculties as their first representative in the international exchange of professors in engineering and applied science, arranged between seven United States institutions and that country. **Prof. A. E. Kennelly**, of Harvard University and Massachusetts Institute of Technology, is the American representative.

SOCIETY MEETINGS ANNOUNCED

American Society for Testing Materials holds its annual meeting at Asbury Park, N. J., on June 20 to 24, inclusive. Headquarters will be in the New Monterey Hotel. The secretary, **C. L. Warwick**, may be addressed at 1315 Spruce St., Philadelphia.

The **Army Ordnance Association** purposes forming a local branch in the metropolitan district of Greater New York to include all ordnance officers of the Officers' Reserve Corps. There will be a meeting for this purpose at Engineering Societies' Building on June 15, at 8 p.m. **Guy E. Tripp** will preside. All who served as officers in the Ordnance Department and all others interested in ordnance as a factor in preparedness are invited to attend.

OBITUARY

Louis Tausin, vice-president of the Council Général des Mines, a former professor and director of the Saint-Etienne School of Mines, died at Chantegrillet, France, from overexertions attendant on the celebration of the Saint-Etienne centenary.

Frank D. Baker, mechanical engineer, for the last twenty years head of the mechanical staff of the Colorado department of the American Smelting & Refining Co., at Denver, Col., died there the last week in April. Mr. Baker, who was a graduate in mechanical engineering from the University of Illinois, had spent over thirty years in Denver, and had become closely associated with a number of mining enterprises. He was a member of the American Society of Mechanical Engineers.

John D. Gilchrist, mining engineer of Denver, Col., died at Kansas City, on May 8, of plural pneumonia. Mr. Gilchrist was born at Hancock, Mich., in 1864, but had lived in Denver for many years. He first engaged in mining for his own interests, but in 1901 he became general superintendent for all the iron mines belonging to the Colorado Fuel & Iron Co., and so continued to 1914 when he resigned to re-engage in private mining operations. The A. I. M. E. elected him to membership in 1896.

William Fernie, pioneer prospector, mine operator, and railway promoter, died in Victoria, B. C., on May 15 at the age of eighty-four years. The city of Fernie, B. C., was named after him, and he was the original discoverer of coal in that district. His first work as a mining man was done in the Bendigo and Perdue mines, in Australia. Coming to British Columbia in 1860, he was attracted to the Cariboo district, where he engaged in mining for many years. In 1873 he was appointed Gold Commissioner for Canada, a position he held for four years. On resigning, he joined Colonel C. Baker and other western Canadians in their effort to obtain a charter for the British Columbian Southern Ry. In this he and his confrères were successful, and in 1887 Mr. Fernie located the coal fields of Crow's Nest Pass. With the opening of these fields there grew up in that locality the now flourishing community of Fernie, so named in honor of the man primarily responsible for its existence.

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

Wisconsin Zinc-Lead District Quiet but Not Despondent

Mineral Point Zinc Co. Not To Leave District, as Reported—National Zinc Separating Co. Will Increase Acid Plant's Capacity

Platteville, Wis., May 28—No despondent gloom pervades the Wisconsin zinc district but, rather, as much optimism perhaps as in any sister mining field which is feeling the pinch of reaction, all reports to the contrary notwithstanding. It is not a fact, for instance, that the Mineral Point Zinc Co. has discharged all its engineering staff and is dismantling its mining plants and shipping its mining machinery to New Mexico. Though no official information is available as to the company's future plans, the only visible grounds for the current rumor that it contemplates leaving this district is the pulling of some of its mine pumps and the fact that a single air compressor was shipped from the Coker mine to New Mexico. Pulling of pumps is the common practice in this district when a mine is shut down, as the water problem is not difficult, and the mines are quickly unwatered when operations are resumed. This company is still operating the Penna Benton mine, at Benton, and is running the oxide plant at Mineral Point. Its other mines and also the roaster and acid plant are down, owing to the large excess amount of ore in storage and the general industrial depression.

Other mines still operating in the district are the Nightingale, Connecting Link, and two Vinegar Hill company's properties, the Yewdall and the North Unity. The National Zinc Separating Co. has continued to operate its separating and acid plants at Cuba City; these will be shut down in June for a month, but only for general repairs and to increase the acid plant capacity by 25 per cent.

The Federal Bureau of Mines staff has been conducting experimental work in zinc-slime separating for the last six months at the Platteville substation, and results obtained indicate table installations at the individual concentrating mills, and central plants to treat this enriched table product by flotation.

A new ray of hope for zinc is the fact that some cities are now adopting ordinances forbidding the further use of wooden shingles on all city buildings, to reduce fire hazard. Sheet zinc roofing and the kind of sheet zinc

WEEKLY RÉSUMÉ

In the Lake Superior iron-ore district, operations have been curtailed by the Cleveland-Cliffs Iron Co. The Oliver Iron Mining Co. has abolished the twelve-hour shift and has made other readjustments along this line. On the Gagebic Range, the Colby and Ironton mines shut down on May 28, 500 men being laid off. C. A. Remington has been granted a new trial of his suit against John A. Savage & Co. In the zinc-lead district of Wisconsin conditions are quiet, but no more so than might be expected at present. The National Zinc Separating Co. is to increase its acid-manufacturing capacity by 25 per cent. In Utah, the Utah Consolidated Mining Co. has decided that it will appeal in the case involving apex rights at Bingham Canyon won by the Utah Apex company. At Tonopah, Nev., strike conditions are but little changed. In the Coeur d'Alenes, the Mudd-Wiseman interests have added the Great Eastern to the holdings under their control. The Hecla and the Bunker Hill & Sullivan companies are reported to have decided upon the joint purchase of the Star mine. Alaska Gastineau has shut down. Verne M. Bovie has resigned as superintendent of the New York Assay Office.

At Washington, the House Committee on Mines and Mining has reported favorably on the proposal to change the assessment work year to a fiscal basis. The report of the Ingalls committee on changes needed in the mining law has been received by the Director of the U. S. Bureau of Mines. Will H. Coghill will undertake a study of the zinc problems in the Joplin-Miami district.

shingles just recently put on the market by the Illinois Zinc Co. are going to win favor and preference for economy, strength, weight, adaptability, and durability. The Methodist church in Platteville is now being roofed with zinc.

Utah Consolidated To Appeal From Recent Apex Decision

The Utah Consolidated Mining Co., of Bingham Canyon, Utah, has announced that it will appeal to the Circuit Court of Appeals against the verdict of the United States District Court at Salt Lake City awarding damages to the Utah Apex Mining Co. for ore taken from beneath the surface of the latter by the Utah Consolidated, claiming the ores by apex rights.

Cleveland-Cliffs Iron Co. Reduces Operations

5,000,000 Tons of Ore in Stock at Mines and 1921 Orders Scarce—Aid for Those Out of Work

The Cleveland-Cliffs Iron Co. made a considerable reduction in its operations on June 1. The Angeline and Lake mines, at Ishpeming, Mich., and the Meadow, on the Mesabi Range, were abandoned, and mining operations will not be again conducted at these properties. The ore reserves are practically exhausted at these three mines, and it will not pay to operate them again. The Cliffs Shaft mine, at Ishpeming; the Spies, at Iron River, and the Wade-Helmar and Crosby, on the Mesabi Range, were closed down. The Holmes and the Morris-Lloyd, at Ishpeming; the Maas, at Negaunee; the Francis, Gwinn, Stephenson and Princeton, in the Gwinn district, are now being operated three days a week, as compared with the former practice of five days each week. The curtailment means a cut in production of 130,000 tons per month for this company.

In addition to the reduction in the mining department, the Pioneer furnace, at Marquette, was closed. All timber operations by the company were discontinued several weeks ago. The company has over 5,000,000 tons of ore in stock at its mines, and is experiencing difficulty in booking orders for 1921 delivery. Only three of the company's fleet of boats are engaged in the ore trade.

W. G. Mather, president of the company, stated in an interview at Ishpeming that everything possible would be done to aid the men out of employment. Those living in company houses and out of work would not be asked to pay rent, and those working but half-time would be charged but one-half the regular price. Medical attention will be given free to those out of work, and the same applies to members of their families. There are but two operating mines in Ishpeming today; the Holmes and Section 16, the latter being owned by the Oliver Iron Mining Co.

V. M. Bovie Quits Assay Office In New York

Isaac H. Smith has been nominated by President Harding to be superintendent of the U. S. Assay Office in New York, to succeed Verne M. Bovie. Mr. Bovie has accepted the presidency of a company operating a group of stores.

Northern Light Co. Organizes To Build Ontario Railroad

Proposes To Construct 100 Miles of Narrow-Gage To Outlying Camps

The proposed construction of a narrow-gage railway to the outlying mining districts of northern Ontario appears in a fair way of being realized soon. The Northern Light Railway Co., Ltd., has been organized, with Frank L. Culver, president of the Beaver and Kirkland Lake mines, as president, and several experienced business men as directors. It is proposed to build approximately 100 miles of railway, using 36-in. gage 56-lb. rails and 8-ton oil-burning locomotives. The company has been authorized to make a bond issue of \$15,000 per mile, and the Ontario government is asked to supplement this amount by the purchase of bonds not yet authorized to the amount of \$3,500 per mile. The provisional program is to build about 75 miles this year, connecting the West Shining Tree, Matachewan and Gowganda camps on the west with Swastika on the Timiskaming & Northern Ontario Ry., and then looping round to the east to Kirkland Lake, Larder Lake and Skead, returning to the T. & N. O. at Boston Creek.

Remington Granted New Trial in John A. Savage & Co. Suit

C. A. Remington's appeal to the Minnesota Supreme Court for a new trial in his suit against John A. Savage & Co. for \$47,083 has been granted. The litigation, which is of two years' standing, grew out of the sale of a stockpile of iron ore by the plaintiff to the defendant. The plaintiff alleges that he entered into a contract with the defendant for the sale of 50,000 tons of 48-per cent iron ore at a price of \$2.825 per ton and has received only half of the sale price. In the counter claim of the defendant it is stated that the iron content of the ore was considerably lower than represented and that the silica content was higher, so that the value of the ore was materially lowered.

In June, 1919, the defendant in a counter suit for \$18,000 was awarded \$2,374 for damages, but the appeal that has been granted will reopen the case for another trial.

Hecla and Bunker Hill Reported To Have Bought Star Mine

It has been announced from Milwaukee that the directors of the Hecla Mining Co., of Wallace, Idaho, have decided to join with the Bunker Hill & Sullivan Mining & Concentration Co. in the purchase of the Star mine. The price paid for the property has not been divulged. The action of the directors in acquiring this interest marks a departure from the course they have hitherto pursued in confining their attention to the Hecla mine.

Parry H. Stewart has been named by the President to be assayer in charge of the U. S. Assay Office at Deadwood, S. D.

Oliver Iron Mining Co. Abolishes Twelve-Hour Shift

The U. S. Steel Corporation has issued orders abolishing the twelve-hour shift which affect the employees of the Oliver Iron Mining Co. in the Lake Superior district. All working shifts of twelve hours a day have been discontinued. Wherever it is feasible in certain departments, relative to office work, the working day constitutes eight hours. Locomotive firemen and stationary engineers and firemen have been placed on a basis of eight hours per day. The steam-shovel engineers and all pit men are still on the ten-hour basis. This order is in line and follows the suggestion made at the last annual meeting by Elbert H. Gary, chairman of the board of the U. S. Steel Corporation.

Compensation Awarded for Death Caused by Insane Employee

A recent decision of the Utah State Industrial Commission, awarding compensation for injury by a fellow employee, later adjudged insane, is of interest. The case in point is that of Frank Como, who on June 11, 1917, was killed in one of the shafts of the Spring Cañon Coal Co. at Storrs, in Carbon County, by a blow on the head delivered by John Avostino, who was later committed to the state mental hospital as insane. A dissenting opinion on the part of one of the commission holds that only if Como had been killed by Avostino because of his employment could compensation be allowed under the law, and that there was no evidence that the decedent had been killed because of his employment. The Spring Cañon Coal Co. is ordered by the commission to pay the widow compensation in the sum of \$9.52 per week for a period not to exceed 312 weeks, and \$150 for funeral expenses.

More Iron Mines Close Down

The Colby and Ironton iron mines, both of which are on the Gogebic Range, Michigan, closed down completely May 28. Five hundred men were laid off.

Madagascar Embargoes Unfabricated Gold

The French Minister for the Colonies has taken a step long awaited by Madagascar. Because of speculation in the precious metals, notably gold, produced in great quantity by "la Grande Ile" (as the French call Madagascar), and by reason of the large-scale frauds practiced, particularly by the Hindus, who are at liberty to send the metal abroad as "fabricated gold," M. Saurraut has signed a decree prohibiting the export of jewelry that has not been increased in value, through expended labor, by at least one-quarter of that of the metal. "This very opportune measure will certainly end the intolerable abuses which are pouring abroad considerable quantities of the metal France has such pressing present need of," says a recent issue of *Le Bulletin du Commerce de la Nouvelle Calédonie*.

Mudd-Wiseman Interests Secure Option on Great Eastern Control

Will Aid in Developing Flynn Group Property in Coeur d'Alenes

The Senator Mining Co., in the Coeur d'Alene district, Idaho, has secured an option on the control of the Great Eastern Mining Co. on a basis of 10c. per share, and an easement for the use of the Great Eastern tunnel for developing the Senator. The privilege of using Great Eastern ground for practically all mining purposes is also included.

The Coeur d'Alene Syndicate, of which Colonel Seeley W. Mudd and Phillip Wiseman, of Los Angeles, are the trustees, and Rush J. White, of Wallace, is local manager, has an option on the control of the Senator company, and these deals with Great Eastern will enable the Syndicate to proceed with the development of the former. The Coeur d'Alene Syndicate also has an option on the control of the Flynn Group Mining Co., which with the Senator owns the large block of ground between the Frisco and Black Bear on the west and the Morning and Star on the east.

Old Tombstone Camp More Active Than in Recent Years

Tombstone, Ariz.—The new Co-operative mill, on the Fisher mill-site, is in successful operation. Led by V. G. Mellgren, eight mine owners erected the plant, and each will operate it while it is handling his own ores. Water is secured from a well on the ground. Another milling project is that of George Kitt and others, of Tucson, who will erect a concentration and cyaniding plant for handling ores and dump material from the State of Maine and other mines on which they have leases. H. O. Hammond will be in charge. The mill of the National Metals Recovery Co. is handling sixty tons a day in two shifts, turning out concentrates. The plant is in charge of J. W. Stockham, who erected the Shattuck mill, in Bisbee. A small mill is being operated by Bert Holland and associates at the foot of Emerald gulch, with high percentage of recovery and with ore available for two years working. In addition, a contract has been entered into for the shipment by the Bunker Hill company of 1,000 tons of manganese-silver ore to the El Paso smelter. It is remarkable that in a time of general mining depression the old bonanza silver camp of Tombstone is showing greater prosperity than for years.

E. J. Longyear Co. Secures Contract for Sinking Shaft

The E. J. Longyear Company has secured a contract from the American Lime & Stone Co., of Tyrone, Pa., to sink a 9 by 24-ft. 52-deg. inclined shaft, and drive four 8 by 24-ft. crosscuts at the latter's No. 3 Belfonte limestone quarry. At the completion of this work, underground mining will replace the present quarry work.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Proposed Change of Assessment Work Year to Fiscal Basis Reported Favorably

Opponents Claim This Will Interfere With Agricultural Pursuits

The House of Representatives is urged by its Committee of Mines and Mining, in a report submitted May 27, to change the period for doing assessment work on unpatented mineral claims from a calendar to a fiscal year basis. This action was taken after a full discussion of the matter by the committee. A tentative decision had been reached to allow the matter to go over until the whole subject of the revision of the mining law could be taken up. At the committee meeting, however, it was pointed out that the general revision would give rise to many controverted points, which necessarily would require considerable time for their discussion. The fact that the 1920 assessment work period had been extended to July 1 made the time particularly opportune for putting into effect promptly the new arrangement.

The Secretary of the Interior advised the committee that he had no objection to the measure, but pointed out that the tendency would be to put off the assessment work until the spring and early summer, when it would conflict with agricultural pursuits. In reporting the bill, Representative Rhodes, the chairman of the Committee on Mines and Mining, said that it is the usual and natural tendency of all persons to postpone until near the close of the period anything that must be done in a limited time. This has resulted in most of the assessment work's being done in November and December, when climatic conditions frequently interfere with the work. The measure has the support of practically every member of Congress who is personally familiar with the activities surrounding assessment work. The Legislature of Nevada, a body particularly familiar with mining matters, by a unanimous vote memorialized Congress urging that the change to a fiscal year basis be made. The Secretary of the Interior, however, doubts if the demand for this change is sufficiently widespread to justify the alteration in such a well-known and long-established provision of the mining law.

Mr. Rhodes meets the objection as to the conflict with farming by stating that the harvest season in the greater part of the West does not begin until after July 1, so that there is ample time for the labor engaged in assessment work to go down into the irrigated valleys and assist in gathering the crops.

The delegate from Alaska, who is

also a member of the committee, objected to the legislation on the ground that assessment work in Alaska can be done best when the snow is on the ground and travel is relatively easier. Other members of the committee pointed out, however, that it still would be possible to perform the assessment work during the winter period. It also developed that there is division of opinion on the matter even in Alaska. Delegate Sutherland, from that territory, is communicating with the industry in Alaska. In case it should be found universally desirable for Alaska to continue on the calendar year basis, he probably will be able to secure an amendment to that effect when the bill is considered in the House.

Bureau Gets Report on Changes Needed in Mining Law

The final report of the Ingalls committee on changes needed in the mining law has been received by the Director of the Bureau of Mines. Before submitting the report to the Congressional committees, it may be necessary to return it to New York, but it is regarded as certain that the final report will be in the hands of the committees within a short time.

Patent Amendment Proposed

In the interest of the national defense and to prevent unwarranted advantages to foreign inventors, Senator Stanley, of Kentucky, has proposed an amendment to the revised statutes providing that any patents issued to foreigners must be put in operation and production in reasonable quantities begun within the continental limits of the United States within two years. Failure to comply with that provision entitles the United States to issue a license which will permit use of the patent by the recipient.

Ferromanganese Case Dismissed

The Federal Trade Commission has dismissed its complaint against Rogers, Brown & Co., of New York, in which unfair competition against a number of importers of ferromanganese was alleged.

Coghill To Study Joplin-Miami District's Zinc Problems

After having rendered notable assistance to the operators in the Wisconsin zinc field, W. H. Coghill of the metallurgical staff of the Bureau of Mines, will take up the metallurgical problems of the zinc industry in the tri-state district.

Longworth Resolution on Tariff Bill Causes Discussion

Few pieces of legislation have given rise to as much discussion as has followed the reporting out of Representative Longworth's resolution to give immediate effect to the permanent tariff bill directly after its being completed by the Committee on Ways and Means. The object of the resolution is to prevent large losses of revenue to the Government during the time the revenue bill is under discussion. When the proposed higher rates of duty become known, importers bring in large quantities of goods in anticipation of the higher rates. The large loss of revenue always has been regretted, but Congress never has been willing heretofore to give immediate effect to legislation previous to its having gone through the usual course. There is evidence that there will be no departure from this precedent, but, nevertheless, there is certain to be a determined effort to secure such legislation.

Great Britain, France, Italy, Canada, Australia, and other governments follow such a procedure. It requires from five to nine months for tariff legislation to take its regular course through Congress. Representative Longworth, in reporting his resolution, declared that between the dates of reporting a revenue bill to the House and of its final enactment into law, the loss of revenue resulting from the artificially stimulated imports will run into hundreds of millions of dollars "at a time when the Government is in need of revenue as never before, and when the resulting damage to American industries would be incalculable."

The suggestion for this legislation came originally from Secretary Hoover. In a letter to the Committee on Ways and Means, he said in part:

"It seems to me desirable that the new tariff should be made legally effective upon the introduction of the bill. This is the custom in many countries. It prevents a large amount of speculation. Of even more importance, however, is the fact that during the period of discussion there is always a flood of goods in anticipation of the tariff. This decreases the revenue and renders the position of our commercial community extremely difficult. The presence of these goods and their subsequent realization handicaps the effect of the tariff for many months, or even years, after its passage. The objection to the tariff being made effective upon its introduction is that the subsequent changes may necessitate refunds to importers in case of a reduction from the initial rate."

NEWS BY MINING DISTRICTS

Special London Letter

**Nigerian Tin Companies To Merge—
Gold Discovery Rumored at Nara-
guta Tin Mines—Gold Shares
Quiet as Sterling Ex-
change Improves**

By W. A. DOMAN

London, May 17—Because the price of tin shows an upward tendency, some of the Nigerian tin mining companies are beginning to give evidences of life again. Not so much from the point of view of production as from that of finance. Few of the undertakings can be said to be in sound condition, so the present dull period is being utilized to devise schemes of amalgamation. Even if it were possible to produce tin profitably, which it is not, and will not be until another £80 or £90 a ton is added to the market price, there are still large accumulations to be marketed. No country apparently seems able to stimulate consumption.

A big scheme is being carried through, and it remains to be seen whether the best is being made of the opportunity. In August, 1919, the New Lafon Tin Fields, Ltd., disposed of its Nigerian properties to the Associated Nigerian Tin Mines, Ltd., for shares. The latter company is now to be absorbed by the Keffi Consolidated Tin Co., Ltd., the Associated company to receive one fully paid 5/- Keffi share for each of its own 5/- shares. Both are quoted in the market at 1/9 $\frac{3}{4}$. The capital of the purchasing company will be increased by £275,000. Taking all circumstances into consideration, it might have been better to write down the capital and raise additional funds, as it will prove none too easy to distribute substantial dividends on the enlarged capital of £775,000. It may perhaps be asserted that the mining companies in general are in a bad way financially, and it is frequently a mistake not to be drastic at the outset when amalgamation is decided upon.

For some time rumors have circulated of the discovery of an auriferous deposit in Nigeria on one of the properties of the Naraguta Tin Mines. I have made inquiries, and all that I can gather is that "to be skeptical would be wrong"! A trial crushing of five tons giving 4 oz. to 5 oz. to the ton has taken place; but trial crushings are somewhat delusive.

With the improvement in the sterling, dollar exchange investors in gold-mining shares are beginning to look rather glum. Last year they benefited enormously by the so-called premium, and now they not only see profits and dividends declining, but in some cases absolute disaster seems ahead unless the expense of winning the metal can be lessened. The Transvaal, Rhodesia, and Australasia are all in the same predicament, and there is no life in the

share market. Australian mining companies are hit doubly hard. Recently I quoted the Ivanhoe. Now the Golden Horseshoe comes along with a similar tale of misfortune. On Dec. 31 last the ore reserves were estimated at 637,330 tons of an average value of 8.75 dwt. The cost of treating a ton of ore at the mine was 36/1. The total net value of bullion for the year from 125,340 tons was £324,461; yet the profit was only about £95,000, and £87,223 of it was on account of sales of gold over the standard price. Over the whole year the excess averaged 32/3 per fine ounce, which will not be the case during the current period. Wage increases and reduced hours have created a serious condition of affairs, and the directors are throwing out hints.

In West Africa the Fanti Consolidated Mines owns an extensive manganese property. For a considerable time the company was prevented from dealing with it on account of the demands that would have been made for excess profits duty. To obviate the difficulty, the company issued reserve shares at a premium. It is intended to equip the property to produce and ship 200,000 tons of ore per annum at an estimated cost of £250,000. One contract has been entered into for the sale of 500,000 tons of ore at a guaranteed minimum profit of 7/6 per ton. Another and similar contract could have been made, but the directors are of opinion that they can make better terms later.

CANADA

Ontario

Gold Draws Prospectors Into Brice Township

Porcupine—McIntyre plans to carry operations down to 3,000 ft., but it will probably be two years before this objective is reached.

Last year diamond drilling was undertaken by English interests on the sand plains near the Hollinger, where the overburden is 200 to 300 ft. deep. Work was discontinued during the winter and has not since been resumed. Some of these claims have been taken under option by Americans, who are preparing to explore them.

A small force of men is at work on the Big Dyke property four miles south of the Dome Mines.

Cobalt—The Mining Corporation of Canada has resumed operations at full capacity on its Cobalt properties, taking on a working force of upward of 250 men. The enlargement of the mill is expected to lower the operating costs to a point which will enable the company to realize a profit on silver at 60c. per oz.

An option held by the National Mining Co. on that part of the Silver Cliff mine lying below a depth of 500 ft. was dropped some time ago. The Northern

Customs which held an option on the upper section of the mine has also allowed it to lapse.

Matachewan—Fifteen men under the direction of William Judge are engaged in mining asbestos in Bannockburn Township. Thirty tons will be mined and shipped as a preliminary test.

Brice Township—A rush of prospectors has set in to this locality on the Elk Lake branch of the T. & N. O. Ry., stated to be fifteen miles south of any previously known gold occurrence in northern Ontario. Some claims were staked last fall, and good gold showings are reported to have been found this spring. About 200 claims have been staked.

British Columbia

Operations Resumed at Providence Mine

Greenwood—After some delay due to high water operations at the Providence mine are again well under way, with a crew of about twenty-five men. Stopping is progressing on the 400 and 500 levels, and it is planned to open up the 600 level. The property has been profitably operated for some years by lessees.

Penticton—D. C. Coleman, vice-president of the Canadian Pacific Ry., while on an official visit here the latter part of May, stated that he did not anticipate that the Canada Copper Co.'s property at Copper Mountain would be reopened for a long period. Mr. Coleman stated the Canadian Pacific had no further interest in the Canada Copper Corporation beyond contracts for ore transportation and was not entertaining any proposition with a view to acquiring the property or its control.

Trail—Application is being made to the provincial government for incorporation of the municipality of Tadanac, the area immediately surrounding the Trail smelter of Consolidated Mining & Smelting Co. of Canada, Ltd.

Ore received at the Consolidated smelter during the week ended May 22 totaled 9,587 tons, of which 9,586 tons come from company mines and 1 ton from the Krao at Ainsworth.

Hedley—If some further reduction in operating costs and mining supplies is manifested by July 1, of this year, Hedley Gold Mining Co., operating the Nickel Plate mine, is prepared to proceed with the expenditure of \$35,000 on additional development, with a likelihood of resumption of productive operations in 1922.

Alice Arm—There is more activity in the Illiance River valley than in any other section of this district at present. Some development work is being done on the Bellevue group and the Silver Star. A number of claims also are being opened up by A. J. Bowen, former

smelter superintendent at Anyox. In the Kitsault Valley there is no work in progress at present, the Dolly Varden being idle, with no information as to what the plans are for the forthcoming season. A. J. T. Taylor, who has returned from abroad, has not yet made a statement on this point.

Quebec

Report of Discovery of Gold at Kazubazua Doubted

Kazubazua—An investigation into the reported gold discoveries in the Gatineau district has been made by Theo. O. Denis, superintendent of mines for Quebec, who reports that eleven prospect pits and strippings were examined and sampled. None of the samples showed any trace of gold or silver. The geological conditions noted at all points appeared unfavorable to mineralization on a large scale.

BURMA

Bawdwin Mines Continue To Produce Steadily

Namtu—The lead production of the Bawdwin Mines for April was 3,526 tons gross; refined lead production was 2,369 tons; refined silver production was approximately 231,934 oz.

NEW CALEDONIA

Chrome Exports Expected To Drop in 1921

The Kopéto mine, operated for many years by the Béchade company, has been closed down and all the personnel have been released. A few laborers have been retained to dismantle the twenty kilometers of railway tracks.

The Edison mine, yielding auriferous copper, is under active development. A power pump was received in March and will facilitate prospecting at depth.

Thio—La Société le Nickel is offering contractors, in its cobalt mines only, as high as 230 fr. per tonne of ore running 4 per cent. Most of the cobalt miners (lessees) claim that this price does not pay them, because of the high costs of mining supplies, such as sacking, tools, and the like. Moreover, the contracts are aleatory and without guaranty for the future. However these things may be, there certainly is a demand for cobalt, which seems to presage important developments for the future.

Tiébaghi—Chrome ore exports in 1921 will not reach the high figures of 1920. American freighters "Nishmaha" and "Chepadoha" have loaded about 18,000 tonnes, cleaning all ore that had been brought down to the docks. Future loadings must wait the mining of new ore, and everything indicates that there will be but two or three more cargoes this year.

ALASKA

Alaska Gastineau and Perseverance Close Down

Juneau—The Alaska Gastineau and the Perseverance mine at Thane are reported to have closed on May 31, in accordance with an announcement previously made.

MEXICO

Coahuila

Government May Return Rolling Stock to Peñoles Company

Sierra Mojada—Walter B. Gates, representing the Cia. Minera Asarco, has filed on an extensive area of mining territory embracing in all a group of sixty-seven claims to be titled under the name of El Panama. This property is on the north side of the Sierra Mojada Mountain in the vicinity of the American, El Capitan, and Orientales mines, in the Sierra Mojada district. Development work will soon be started on these claims, which are to be explored for silver, lead, and copper. Max F. Quinn, engineer, has been appointed to make the official survey and plans.

A large number of the miners of the Sierra Mojada camp have left for the oil fields in search of employment, having been thrown out of work by the closing of the principal mines of the district.

The train over the branch line from Escalon to Sierra Mojada now makes only one trip each week, as very little ore is being shipped out and only a small amount of supplies is coming in.

The few miners that remain are finding employment in development work at the big mines or prospecting on some of the new claims recently taken up.

Torreón—During the recent railroad strike on the National Lines of Mexico the mines of the Peñoles Mining Co. at Mapimi were closed down and their rolling stock and railroad employees were turned over to the government to relieve the situation. The government is now receiving a large number of new engines and cars, the striking employees are returning to work, and it is proposed to return to the Peñoles company the borrowed equipment, to enable it to resume operations. The smelter at Mapimi will not be blown in for the present, but it is said that employment will be given to about two thousand miners in the mines. The ores will be shipped to the company's plant at Torreón and Monterrey.

Durango

Durango—Alexander O. Stevenson, possessor of a large number of mines in the San Dimas camp, is doing considerable development work at his properties and is also acquiring new claims. He has made two recent filings before the mining agent at Durango, one for a group of eleven pertenencias embracing the bid Tecolotes and Santa Rita mines and the other a relocation of abandoned mines in the Tecolotes mountains.

Federal District

Import Duties Removed on Mining Supplies and Equipment

Mexico City—A recent mining decree exempting mining supplies and equipment from import duties is intended to encourage idle mines to resume operations. An improvement in railroad traffic also is hoped for by the end of May.

ARIZONA

State To Appeal From Recent Decision That Industrial Commission Law Is Unconstitutional

Clifton—Smelter and mines of the Arizona Copper Co., Ltd., closed May 31, affecting about 125 men at Clifton and about 800 in the mines at Morenci and other points. Most of the employees were Mexican, many of them long employed. The power plant at the smelter will be kept in operation, to supply electricity to the town of Clifton, and the company stores will be kept open. Passenger service on the Arizona company's seventy-two mile railroad to Lordsburg will be maintained by motor car, with occasional freight trains. A large proportion of the Mexican workmen had already been sent back to Mexico through El Paso.

Globe—James J. Jeffries, former heavyweight champion, is said to be one of a company of five associates that has acquired possession of eight asbestos claims in the Sierra Ancha Mountains, north of Globe. Jeffries recently visited the mines.

Miami—Inspiration is to lay a 7,000-ft. stretch of railway over a part of the newly acquired porphyry ground to connect the main shaft with the Live Oak, to facilitate carriage of Live Oak ores to the big mill.

Jerome—The orebody in the Verde Central has not yet been fully cross-cut. It has been found that the supposed footwall, giving a width of 30 ft., was merely a streak of hard quartz-porphory and all that is known is that the footwall lies somewhere further to the west. The lower drift is being pushed ahead and is expected to be under the original ore showing within another week.

The Verde Central showing has renewed interest in the old Venture Hill property nearby. The mine was sold by the sheriff six months ago and was bid in by John Robinson and Edward Shumate, of Prescott, and Boaz Duncan, of Los Angeles. The stockholders are trying to organize a new corporation to redeem the property.

Phoenix—Amethyst is being mined near Roosevelt by W. S. McDaniels, who is shipping to Loss Angeles. Pink cnyx, capable of high polish, has been found on the west slope of the Whetstone Mountains, near the Mexican border, the deposit having been located by Dr. L. W. Klene of Nogales.

Notice of appeal has been given by the Attorney General from Superior Judge Stanford's decision that the Arizona Industrial Commission law is unconstitutional. Arguments are to be heard June 15, and a decision is not expected before fall.

Kingman—At a recent meeting of the Nancy Lee Mining Co., operating a gold-silver property in Secret Pass, Mohave County, it was decided to change headquarters of the company from Bisbee to Kingman, to facilitate the dispatch of business. Kingman is

the railroad point for the mine, being twenty-three miles distant. The new officers elected are John Olson, president and general manager; Fred T. Bragonier, vice-president, and Robert B. Manson, secretary and treasurer, who with Senator Henry Lovin, Dr. Robert Ferguson and H. J. Hierl compose the directorate.

Bisbee—A meeting of the directors of the Apache Powder Co., held at the company's office in Bisbee, Ariz., was attended by the following: T. H. O'Brien, general manager of the Inspiration Consolidated Copper Co.; Thomas H. Collins, director of the Calumet & Arizona Mining Co.; F. W. MacLennan, general manager of the Miami Copper Co.; Norman Carmichael, general manager of the Arizona Copper Co., Ltd.; and J. E. Curry, secretary of the Arizona Chapter of the American Mining Congress.

The plant of the Apache company is on the San Pedro River, a short distance from the town of Benson, in Cochise County, and is in the final stages of construction. The moving spirit of the enterprise is Charles E. Mills, president of the company and formerly general manager of the Inspiration company. The plant has been under construction for the last ten months. W. W. Edwards, assisted by D. E. Fogg, has been in direct charge of construction.

Douglas—The office of the general manager of the Phelps Dodge Corporation at Douglas has been closed since May 15 and will remain so during the period of depression in the copper market.

NEW MEXICO

Work To Be Resumed on American Mine at Old Hachita

Lordsburg—Exploration work by the new owners on the Last Chance property is showing up well. A parallel vein on the 275 level has been opened, showing 12 in. of high grade. Two samples gave an assay of 172 oz. and 278 oz. silver, respectively, with 7 per cent copper. John H. White is in charge.

The Co-operative Mining Co. held a special stockholder's meeting on May 14. The capital stock was increased from 250,000 shares to 500,000 shares, 215,663 shares voting. The board of directors was given greater authority. The enlarged mill was started May 9. A recovery of 91.50 per cent is claimed. Concentrates are reported to run \$169.50 per ton. Shipments will be made to the El Paso smelter. It is planned to do 200 ft. of sinking. C. H. Walters is manager.

A rich strike of specimen gold ore has been made at Gold Hill by Frank C. Cline. Mr. Cline has operated a two-stamp mill successfully for a number of years in this district, doing all the work of mining and milling himself.

Steins Pass—C. W. Mitchell and associates have taken an option upon the old Volcano mine and sixteen adjoining claims. A small force is working. A

16-ft. vein carrying considerable argentite and chlorides has been opened on the 100 level. A car of sorted ore is being hauled for shipment.

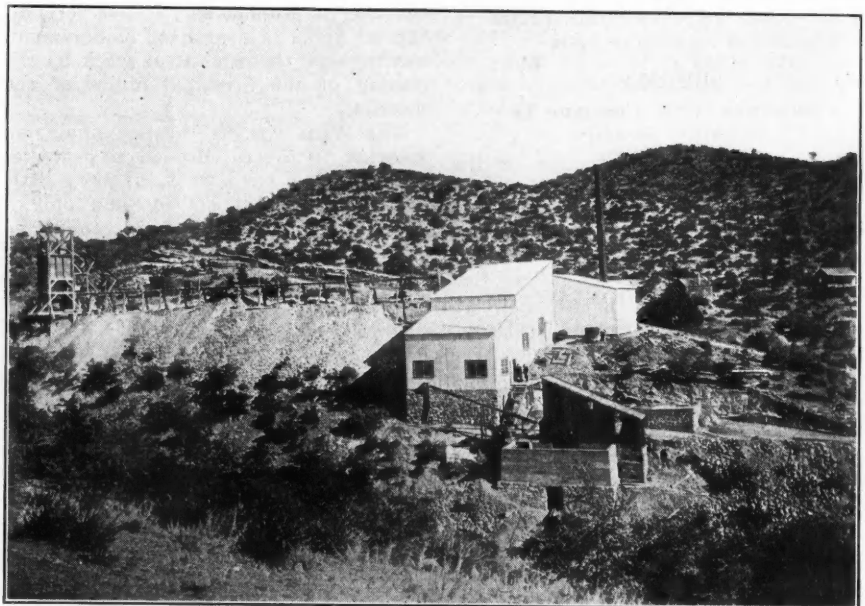
Hachita—The American Metals Mining Co. report that work will be resumed soon upon the old American mine at Old Hachita, in the Eureka district. A 100-ton concentrator is to be installed; also a new compressor and a complete equipment of air drills. A 15-ft. orebody is reported upon the 200 level that assays about 60 oz. silver and 60 per cent lead. The property consists of eight claims. Charles Fowles, is manager.

Albuquerque—The Mont de Lion Mining Co. has filed application for 10 second-feet of water from Peralta

The Gold Crown mill at Ouray is being overhauled by Frank E. Henn, owner, and was put into operation on June 1, to treat custom ores and ore from the Two Kids mine, the property for which the mill was built. Prospectors and small mine operators are beginning to prospect the old mines and small properties on East and West Gold Hill in the vicinity of this mill, as considerable milling ore can be won and easily transported to the mill.

The Chipeta Mining, Milling & Reduction Co. has completed the electric-power line and the compressed-air line for its new plant, and is now erecting mine buildings and a compressor plant.

This company has opened a good showing of milling ore in a wide vein on the H. A. C. property in the Amphi-



CO-OPERATIVE MINE, LORDSBURG, N. M., SHOWING ORE DUMP AND FLOTATION PLANT

Cañon Creek in the Bland district. The water to be used for a hydro-electric power plant to operate a 30-hp. stamp mill. It is expected to impound 500 acre-feet in the reservoir.

Santa Fe—The Mineral Mining & Milling Co., a New York corporation has filed a foreign corporation statement. The authorized capital stock is \$50,000, with \$10,000 subscribed. The principal office is in New Mexico at Santa Fé. J. O. Seth is the statutory agent.

COLORADO

Ouray Union Co. Begins Work at Wanakah Mine—Chipeta Company Completes Air and Power Line

Ouray—The Ouray Union M. & M. Co. has begun work at the old Wanakah mine, close to Ouray. The mine is being re-furnished with a mining plant and the mill is being overhauled and equipped with oil flotation apparatus as well as closed-circuit ball-mill machinery. The mine has produced a large quantity of pyritic ore carrying high gold values, with copper. Development of the unexplored parts of the property is planned.

theatre, and plans to push development when the new plant is complete.

The Mountain Top Mining Co. has completed the sinking of an additional 150 ft. of its shaft disclosing excellent ore at the new level, and is now drifting on the vein at this level. The mill is operating steadily. Shipments of high-grade silver ore are also made regularly.

Carey Bros. & Summerville have begun operations under lease and option on the old Plutus & Sampler property just north of Ouray, and have opened some good high-grade gold ore accompanied with a good grade of milling ore.

John Sylstra has resumed work at the Little Maudie under lease. A shipment of good silver ore was made from this property last year, but work was suspended for the winter.

The Eurades Mining Co., with a small crew, continues development of the shoot of silver-copper ore encountered last winter.

The weather has been continuously bad, and the roads and mines at high altitudes are still heavily snowed under.

UTAH

M. J. Dailey Elected Director of Silver King Coalition—Zuma Shaft, at Eureka, To Be Deepened

Park City—M. J. Dailey, mine manager of the Silver King Coalition, has been elected director to succeed William S. McCornick, recently deceased. F. D. Wescott, for some time secretary, will succeed Mr. McCornick as treasurer. Remaining members of the directorate are: David Keith, president; Thomas Kearns, vice-president; W. Mont Ferry, managing director.

Eureka—The Zuma has contracted to have its shaft, now down 500 ft., continued to 1,200 ft. It is reported that part of the payment for the work will be made with treasury stock. The Eureka Bullion has shipped thirty-five tons of silver-lead ore carrying gold from the 900 level, where ore cut higher up appears to have been picked up again. The ore has come in bunches, thus far.

Moab—The Buena Vista Copper Co. is reported to have given up its lease on the property and mill of the Big Indian Copper Co. The Buena Vista company has been working the mill and property for about two years and a half, and making experiments on the low-grade copper ores of the mine. A sample of uranium ore weighing about 15 lb. from the claims of H. W. Baisley in the Brown's Hole country has been on exhibition in Moab. About forty sacks of ore similar to the sample has been taken from a petrified tree which was largely replaced by the high-grade carnotite ore.

IDAHO

Coeur d'Alene District**Highland-Surprise Resumes Work—Polaris Leased to Ferguson and Associates—Sunset Drift 100 ft. in West Sunset Ground and Still in Ore**

Kellogg—After a prolonged suspension the Highland-Surprise company is again active. According to official announcement, the first work to receive attention will be to extend the raise, which is now up about 50 ft., from the No. 3 to the No. 2 level. The completion of this raise, the statement says, "will make available enough ore to run the mill for a long time and with a favorable market condition, should be a source of much profit." The company has a mill of 125 tons' capacity. The property is on Pine Creek.

Wallace—John F. Ferguson and associates have secured a lease on the Polaris, situated in the Big Creek silver belt. The property was located many years ago by the late Senator Heyburn, who shipped gray copper ore having a high silver value and did considerable development work. Following his death, the Polaris was sold by his widow for \$20,000 to a group of Wallace and Spokane men. These owners were unable to carry out their development plans, and the lessees have now stepped in and are in line to make a good profit, as indicated by the pres-

ent showing of ore and the high price of silver.

The Kennan Mining Co., operating in Pony Gulch, is developing a remarkably fine tungsten vein, which where exposed by stripping and sinking a few feet in the bed of the creek appears to be about 15 ft. wide and has streaks of clean scheelite varying from 1 to 8 in. thick. A drift is now being run which is expected to develop a large body of ore.

A report from the West Sunset, which appears to be reliable, says that the drift from the 1,000 level of the Sunset has been extended over 100 ft. into the West Sunset ground; that there was from 10 in. to 3 ft. of ore for a distance of about 200 ft. in the Sunset ground, and that since passing into the West Sunset the ore showing remained practically the same for about 80 ft., and from that point the amount has steadily increased until there is now 5 ft. of shipping ore, mostly lead-silver, in the face. The West Sunset is controlled by the Days.

Bonnors Ferry—Construction of a two-bucket aerial tram, connecting mine and mill of the Cyanide Gold company, in the northeast corner of Boundary County, is about to be completed, work having been delayed because of a late spring and deep snow.

Sandpoint—A car of high-grade ore is being taken out on the Marguerite property, on Trestle Creek. Arrangements have been made to resume development of the Chilco group, just north of Hayden Lake, and it is planned to add a two-drill compressor to the equipment during the summer.

Porthill—An accumulation of about 3,000 tons of concentrates left over from last year's operations of the Idaho-Continental mine and mill will be shipped this summer to the Bunker Hill & Sullivan smelter at Kellogg.

MONTANA

Cascade Silver Stockholders to Meet in Butte June 7

Butte—An orebody with a width from 5 to 6 ft. of bornite and running 16 per cent copper is one of the latest developments of importance at the Davis-Daly's Colorado mine. This shoot is found on the 2,300 level, serving further to emphasize the enrichment found in the so-called "northwest" veins at depth.

The hanging wall fissure of the Spread Delight vein on the 1,600 level of the Main Range mine of the Tuolumne company is expected to be reached within three weeks. This fissure was well mineralized on the 1,200 level with about a foot or two of ore, a marked improvement over the showing on the 1,000 level.

Drifting operations on the recently uncovered copper-bearing vein on the 2,050 level of the Black Rock mine of the Butte & Superior company constitute the chief feature of the development work under way at this property. Ore reserves were increased at the end of the first quarter by 39,250 tons over those of the preceding quarter. The

total reserve tonnage on that date was 461,350.

Drifting on a 7-ft. orebody found on the 400 level in the Norwich vein, together with crosscutting for the foot wall of this vein where another ore shoot is looked for, constitute the development work at the Butte & Plutus. Plans are taking form for a resumption of operations at the Mapleton shaft of this company, about 1,200 ft. away.

Lessees operating through the shaft of the Butte-New England on the Hesperus vein of the Davis-Daly have a 7-ft. body of commercial ore from which shipments are being made.

Neihart—The annual meeting of the stockholders of the Cascade Silver Mines & Mining Co. will be held in Butte on June 7, at which time it is expected that the question of rebuilding the concentrator recently destroyed by fire at Neihart will be taken up.

OREGON

Several Stamp Mills Being Remodeled in Southwestern Part of State

Gold Hill—Construction work under way at present in southwestern Oregon is indicated as follows: The Gold Ridge company, of Medford; the Pittsburgh-Oregon company, of Gold Hill; the Millionaire mine, C. A. Knight, manager, Central Point; and the Boswell mining company, of Holland, are all remodeling small stamp mills, of which there is one of five stamps on each property. All these are gold mining companies. The War Eagle mining company (quicksilver), of Medford, is remodeling a 25-ton Scott furnace to save byproducts. The principal byproducts are arsenic, zinc, gold, silver, and cobalt.

Sumpter—The Mammoth gold quartz property is reported to have been sold by J. J. Heilner to W. H. W. Hamilton, of Baker, Ore. There is a 300-ft. shaft on the property.

CALIFORNIA

Calaveras Copper Co. Improving Copper Smelter—Finnegan Mining Co. Completes New Stamp Mill

Copperopolis—The Calaveras Copper Co. is sinking its south shaft, which is vertical and has two compartments and a manway and has reached a depth of 225 ft. At the copper smelter, a new dust flue and 75-ft. stack is being constructed and a converter will be added. The blast furnace is also to be altered, and many improvements are under way to increase labor efficiency in the smelter. At the flotation mill, minor changes in crusher and conveyor arrangements are being made. No production is being made, but work will be speedily resumed when the copper market improves.

Angels—At the Angels Deep, ore development on the 200 and 500 levels has been such that the continuous operation of a new twenty-stamp mill in the near future is assured. The property has been brought to its present efficiency by J. C. Benson. Alfred Hunt is superintendent.

The Toll Gate Mining Co., near Altaville, is opening up a promising prospect called the Port Arthur, and has sunk a shaft to the 100 level and constructed a small testing mill.

The Triple Lode Gold Mines has purchased the Hardenburg mill, and construction of a twenty-stamp mill is expected to be completed within ninety days.

At Vallecito, A. H. Mackenzie and Don Steffa have been prospecting for eleven months for the continuation of the Vallecito channel and have driven over 1,000 ft. of workings in an effort to find the channel. Lately the discovery of coarse gold has encouraged them in the belief that the channel has been found.

Melones—The Carson Hill Gold Mining Co. is pushing development and mining over 500 tons of gold ore per day. There is a shortage of highly skilled miners. The thirty-stamp amalgamation and concentration mill is handling over 500 tons per day. The tailings are pumped and laundered over to a sand and slime cyanide plant near the old Melones mill.

The Finnigan Mining Co. has completed the erection of a ten-stamp mill and is operating it on part time.

Jamestown—Operations at the Belmont Shawmut at Shawmut are restricted to shaft repairs and plant betterment.

The Rawhide mine has resumed operation to a limited extent, and the Patterson has started up.

Amador City—The mill of the Treasure mine has been temporarily shut down pending placing a new hoist.

Merced—The Original Mining & Milling Co. has applied to the Federal Power Commission for permission to build a conduit 3,100 ft. long from the present diversion dam in the Merced River, in Sec. 22, T. 3 S., R. 19 E., M. D. M., to a power house developing 500 hp. This plant will supersede a small existing plant.

NEVADA

Little Change in Strike Situation at Tonopah—Orebody 18 ft. Wide Discovered at Gibraltar Mine

Tonopah—There are no new developments in the strike situation in this district. The larger companies, including the Tonopah Extension, Tonopah Belmont, and Tonopah Mining, are making housing preparations to accommodate men being brought in from the outside. It is believed that sufficient men can be brought in to enable these properties to resume operations at an early date. The Tonopah Extension is operating with about sixty-five men, out of a normal crew of 250. The strikers are "sitting tight," relying on the poor quality and inefficiency of the imported labor to bring the operators to terms. Many men are reported as ready to return to work at the new scale, but are held in line by the strike leaders, most of whom are craftsmen.

The West End on May 18 shipped 47,500 oz. of bullion valued at approx-

imately \$53,000. This represents the result of operations for the two weeks ended May 15. During the week ended May 24, 200 ft. of development was done and 1,500 tons of ore hoisted.

Divide—The south crosscut on the 900 level of the Kernick shaft has recently cut several small stringers carrying high values in gold and silver. One picked sample assayed 128 oz. of gold and 146 oz. of silver. The crosscut has advanced 700 ft. from the shaft and is making excellent headway. Most of the small properties in the district are operating under the old scale of wages, but the Tonopah Divide mine is closed down, wages having been cut 75c. per shift at this mine.

Gibraltar—It is reported that a tunnel being driven on the Gibraltar property, situated in Jett Canyon 65

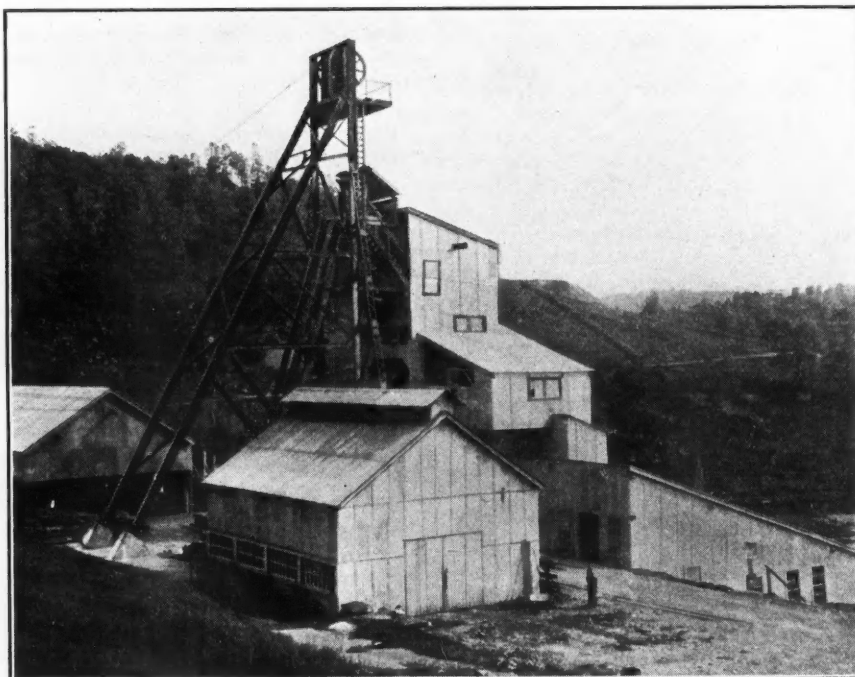
Negaunee—Engineers in the employ of the Laughlin Ore Co. are making a complete survey of the lands recently acquired by the company from the Breitung interests. The lands comprise twenty-seven forties, and include the Breitung Hematite mine. The mine is idle at present, but will be operated when the ore market improves. Every operating mine in the Negaunee field is now on a three-day-a-week basis.

MINNESOTA

Mesabi Range

Dunwoody Open Pit, Biwabik Pit and York Mine To Be Reopened

Buhl—The Oliver company has started shipments from four other properties since the first orders were issued this season. The Wanless and Shiras mines are now shipping steadily,



SURFACE PLANT AND MILL, TREASURE MINING CO., NEAR AMADOR CITY, CALIF. THIS MILL HAS JUST SHUT DOWN TEMPORARILY

miles north of Tonopah, has proved the existence of an orebody about 18 ft. wide which contains values from \$10 to as much as \$500 in picked samples in gold and silver. Some work was done on this property in 1919, but no commercial ore was discovered then. It now appears that the ore recently discovered lies at right angles to what was originally supposed to be the strike of the outcrop. A crosscut tunnel is to be run under the ore showing which will give approximately 150 ft. of backs.

MICHIGAN

Marquette Range

Laughlin Ore Co. Surveying Lands Bought From Breitung

Palmer—The M. A. Hanna Co. has resumed operations at the Richmond mine, an open-pit property. Shipments were begun on June 1. The Maitland is preparing to start shipments at an early date.

also the Pool mine, at Hibbing, and the Leonidas mine, at Eveleth.

Chisholm—The Tod-Stambaugh is making all preparations to reopen its Dunwoody open-pit mine. It is planned to ship daily.

Biwabik—Preparations have been made to reopen the Biwabik open pit. Four shovels will be used, three on ore and one on stripping.

Nashwauk—The York mine, operated by Coates & Tweed, will reopen soon. Equipment is being overhauled.

Marble—The Hill-Trumbull mine, operated by the Mesaba-Cliffs company, is running only one shift, as the new plant of the Trumbull-Cliffs Furnace Co. is not yet ready.

The Interstate Iron Co. has ceased all ore operations at its Hill-Annex open pit. The property had only been shipping for a month. This does not effect the stripping work being done by A. Guthrie Co.

THE MARKET REPORT

Daily Prices of Metals

May	Copper, N. Y., net refinery*		Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.	
26	13 @13.25	31.25	32.25	4.75@4.875	4.75	4.70@4.75	
27	13 @13.125	30.75	32.00	4.75@4.875	4.70@4.75	4.70@4.75	
28	13 @13.125	31.00	32.00	4.75@4.875	4.65@4.75	4.70@4.75	
30	.....	.....	.....	.....	.....	.....
31	13 @13.125	30.50	31.50	4.75@4.875	4.60@4.75	4.70	
June 1	13 @13.125	30.25	31.25	4.75@4.875	4.60@4.75	4.70	

*These prices correspond to the following quotations for copper, "delivered": 13.25 @ 13.50c. for May 26; 13.25 @ 13.375c. May 27 to June 1. 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.

Monthly Average Prices for May

Copper:	
New York Electrolytic	12.742
London Standard	73.196
London Electrolytic	74.298
Lead:	
New York	4.952
St. Louis	4.784
London	23.399
Silver:	
New York, foreign	59.810
New York, domestic	99.250
London	34.165
Sterling Exchange	396.580
Zinc:	
St. Louis	4.848
London	26.923
Tin:	
99 per cent	31.431
Straits	32.500
London	177.411
Antimony	5.250
Quicksilver	47.000
Platinum	73.740

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
26	74½	74½	76	180½	181½	23½	23½	28	28½
27	73½	73½	76	177½	178½	23	23	28	28½
28	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	73	73½	76	173½	174½	22½	22½	27½	27½
31	72½	72½	76	174	175	22½	22½	27½	27½
June 1	73	73½	76	173	173½	22½	22½	27	27½

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

May	Sterling Exchange	Silver			May	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
26	392	99½	58	33½	30	.....	.....	.....	34½
27	389	99½	58	33½	31	387	99½	57½	33½
28	389½	99½	58½	34	June 1	389	99½	57½	33½

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

Metal Markets

New York, June 1, 1921

Consumers continue to take no interest in the metal market, and the speculative element is also lacking. Monday was a holiday, but it is probable that no one would have suffered had the market remained closed for the entire week. In view of this inactive condition, nothing but gradually decreasing prices could be expected. Our monthly averages show that the prices for copper, tin, lead, and zinc all exhibited increases for May over the corresponding figures for April, which were in turn higher than those for March, when the turning point occurred. June starts none too well, however; particularly in

the case of zinc, which is now lower than any monthly average price since March, 1909, when 4.607c. was recorded.

Copper

Export demand, which has been the sole support of the market for the last few weeks, almost completely died out during the last week, owing to the fall of sterling exchange and the increased prices quoted by the Copper Export Association. Large producers continue optimistic because of the greatly curtailed production. As will be seen from reference to page 971, copper production dropped from ninety million pounds in April to forty-six million in May, practically 50 per cent, and a further reduction may be expected in June,

when the curtailments will be more complete. The larger producers are asking 13.50c. delivered for June copper, and threaten to raise this price as soon as business of any magnitude sets in. There seems little immediate cause for them to consider this matter, however. Large quantities of June copper can be obtained for 13.25c., delivered, today; 13.375c. being quoted for July-August by those willing to sell at these prices.

Lead

The A. S. & R. official contract price continues at 5c., New York and St. Louis.

One lot of several hundred tons of lead was sold at our average prices yesterday, but business in general has been dead dull. At least one interest has been anxious to sell New York lead for 4.75c. all week, but has found practically no demand even at this marked concession over previous figures. At present lead could be imported probably for slightly less than 4.75c., but there is some hesitation about doing this, even if the demand were sufficient to warrant it, because of the possibility of the passage of the Longworth Bill.

The St. Louis market is also weaker, particularly for soft Missouri lead. Large producers of the more popular brands are quoting 4.75@4.85c. St. Louis and Chicago, but it is reported that some lead can be obtained at 4.60c.

Zinc

The zinc market is exceptionally quiet and galvanizers are buying practically nothing. The metal is freely offered by the few willing to sell at 4.70c. The market for forward zinc is non-existent. High-grade is quoted at 6.25c. delivered in the East.

Tin

Tin continues to be neglected, and there is practically no market in this country. Futures are nominally the same price as spot.

Arrivals of tin, in long tons: May 25th, China, 10; 28th, China, 5; 31st, Liverpool, 25; Straits, 500.

Gold

Gold in London: May 26th, 104s. 8d.; 27th, 105s. 1d.; 30th, 106s. 1d.; 31st, 106s. 4d.; June 1st, 105s. 9d.

Foreign Exchange

The break in sterling which began last week has progressed further, and quotations are now back to what they were several weeks ago. German reparations payments and many buying orders for dollars in foreign markets are assigned as the reason. On Tuesday, May 31, francs were 8.37c.; lire, 5.245c.; and marks, 1.59c. New York funds in Montreal, 12 $\frac{3}{8}$ per cent premium.

Silver

The outstanding feature in the silver market the last week has been the weakness and violent fluctuations in sterling exchange, which seriously affected the export price for silver. The London price has been fairly steady between 33 $\frac{1}{2}$ and 34 $\frac{1}{2}$ d., with small demand from India buyers, and closing dull at 33 $\frac{1}{2}$ d. China demand still continues lifeless, with no indication of a decrease in stocks of silver on hand. The demand for silver in the domestic market continues quiet and below normal for this time of the year. Further shipment of about 50,000 ounces was received in New York this week from Germany. The tendency of the market is uncertain, with no marked movement, and the price for shipment is dependent on developments in the sterling-exchange situation.

Mexican Dollars — May 26th, 44 $\frac{1}{2}$; 27th, 44 $\frac{1}{2}$; 28th, 45; 31st, 44 $\frac{1}{2}$; June 1st, 44 $\frac{1}{2}$.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 28@23.5c. are nominal. Outside market, 22@23c. per lb.; 22 $\frac{1}{2}$ c. for imports, duty paid. Metal being imported in anticipation of a higher tariff.

Antimony—Chinese and Japanese brands, 5 $\frac{1}{2}$ c.; market dull. W.C.C. brand, 5 $\frac{1}{2}$ @6 $\frac{1}{2}$ c. per lb. Cookson's "C" grade, spot, 9 $\frac{1}{2}$ c. Chinese needle antimony, lump, nominal at 4 $\frac{1}{2}$ c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6 $\frac{1}{2}$ c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, wholesale lots, 6 $\frac{1}{2}$ @7c.

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

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

Cobalt—Metal, \$4 per lb.; black oxide, \$3@\$3.10 per lb. in bbls.; sulphate, \$1.35 per lb. in bbls.

Iridium—Nominal, \$250@\$300 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@40c.

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

Osmium—\$70@\$80 per troy oz.

Palladium—\$70 per oz.

Platinum—\$75 per oz.

Quicksilver—Nominally, \$46@\$48 per 75-lb. flask. San Francisco wires \$48.50.

Rhodium—\$150 per troy oz.

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

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

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

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr₂O₃, foreign ore with a maximum of 6 per cent silica, 45@55c. per long ton unit, f.o.b. Atlantic ports.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, \$7.45; Mesabi bessemer, 55 per cent iron, \$7.20; Old Range non-bessemer, 51 $\frac{1}{2}$ per cent iron, \$6.70; Mesabi non-bessemer, 51 $\frac{1}{2}$ per cent iron, \$6.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, \$5.80; old bed concentrates, 63 per cent, \$6.70; Harmony, cobbled, 63 per cent, \$6.70; new bed low phosphorus, 65 per cent, \$9.50.

Manganese Ore—25c. per unit, seaport; chemical ore (MnO₂) \$55@\$60 per gross ton, lump; \$70@\$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS₂, 55@60c. per lb. of contained sulphide, New York.

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

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

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

Uranium Ore (Carnotite)—Ore containing 1 $\frac{1}{2}$ per cent U₂O₃ and 5 per cent V₂O₅ sells for \$1.50 per lb. of U₂O₃ and 75c. per lb. of V₂O₅; ore containing 2 per cent U₂O₃ and 5 per cent V₂O₅ sells for \$2.25 and 75c. per lb., respectively; higher U₂O₃ and V₂O₅ content commands proportionately higher prices.

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

Zircon—Washed, iron free, 3c. per lb.

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

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

Zinc and Lead Ore Markets

Joplin, Mo., May 28—Zinc blende, per ton, high, \$28.55; basis 60 per cent zinc, premium, \$25; Prime Western, \$23.50@\$22.50; fines and slimes, \$20@\$27.50; average settling price, all grades of zinc, \$23.44.

Lead, high, \$65.20; basis 80 per cent lead, \$55; average settling price, all grades of lead, \$55.91 per ton.

Shipments for the week: Blende, 4,761; lead, 942 tons. Value, all ores the week, \$164,290. Shipment for five months: Blende, 116,478; calamine, 80; lead, 23,212 tons. Value, all ores five months, \$4,084,420.

Lead was unchanged from last week, but spirited demand for a limited tonnage of premium ore resulted in \$25 basis for 200 tons. Around 300 tons was bought early in the week on \$24 basis, the balance of 3,800 tons purchased sold on \$23.50@\$22.50 basis. Production is estimated to be around 4,300 to 4,500 tons per week, and decreasing.

Platteville, Wis., May 28—Blende, no sales or shipments. Lead ore, basis 80 per cent lead, \$58 per ton. Shipments for the week: Lead ore, 80 tons. Shipments for the year: Blende, 11,460; lead ore, 910 tons. Shipped during the week to separating plants, 441 tons.

Non-Metallic Minerals

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

Barytes—Crude, 88 to 94 per cent barium content, \$10@\$12 per net ton; ground (white) \$24@\$30 in bags, carload lots; (off-color) \$22@\$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, \$25 per net ton f.o.b. Atlantic seaports. Western grades are \$24.50. Crude quoted \$7 per long ton, f.o.b. Cartersville, Ga. Small lots sell for as low as \$5.

Bauxite—High-grade French bauxite, \$8@\$10 per ton, Atlantic ports. American quotations the same. Consumers generally well supplied. Prices vary according to grade. Crude, unground, \$16.50 per ton; ground, \$22; calcined, ground \$35; unground, \$45, f.o.b. plant.

Chalk—English, extra light, 5@5 $\frac{1}{2}$ c. Domestic light, 4 $\frac{1}{2}$ @5c.; heavy, 4@4 $\frac{1}{2}$ c. per lb., all f.o.b. New York.

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

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

Feldspar—Crude, \$7@\$14 per gross ton, f.o.b. Maryland and North Carolina points; \$7.50@\$10, f.o.b. Maine; ground, \$27@\$30, car lots, f.o.b. Baltimore; ground, \$17@\$21, f.o.b. North Carolina points; \$17@\$21 per ton, No. 1 ground, f.o.b. New York State; \$21@\$23 per ton, ground, f.o.b. Maine.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$20@\$25 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, \$40@\$55; ground, suitable for acid, chemical or enameling purposes, \$32@\$35; lump, \$15, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF₂, \$32, New Mexico. Canadian price generally \$18 (Canadian currency) per ton, f.o.b. mines.

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

Graphite—Ceylon lump, first quality, 7@7½c. per lb.; chip, 5½@6c.; dust, 3½@4c. No. 1 flake, 6½c.; amorphous crude, ¾c.@2¼c.

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

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, \$1.40@\$2 per net ton; 1½ in., \$1.50@\$2. Prices for other sizes practically the same. Agricultural limestone, \$2.50@\$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, \$12@\$15 per ton. High-grade caustic calcined, lump form, \$30@\$40 per ton. Plastic calcined, \$56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, \$60.

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

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, \$1.20; No. 4, \$2.50@\$3; No. 3, \$3.50@\$4; No. 2, \$4.50@\$6; No. 1, \$5.50@\$6.50. Clear block: No. 6, 50c.; No. 5, \$1.75; No. 4, \$3.25; No. 3, \$5; No. 2, \$6.50; No. 1, \$8; A1, \$6.50@\$8.50; extra large, \$25; ground, wallpaper grade, \$90@\$160 per ton (depending upon quantity); ground roofing mica, \$25@\$70, all f.o.b. New York.

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

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, \$12.50; 75 per cent, \$11.50; 75@74 per cent, \$11; 70 per cent, \$6.75; 68 per cent, \$6.25; 68@66 per cent, \$6.

¹Wootte Mineral Co., Philadelphia, Pa.

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

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

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

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

Talc—Paper making, \$11@\$20 per ton; roofing grades, \$8.50@\$13; rubber grades, \$11@\$18; all f.o.b. Vermont. California talc, \$18@\$40, talcum powder grade. Southern talc, powdered, carload lots, \$10@\$14 per ton; less than carload, \$25, f.o.b. cars. Imported, \$35@\$40; Canadian, \$20@\$40 per ton.

Mineral Products

Arsenic—White arsenic, 7½c. per lb. in carload lots.

Sodium Nitrate—\$2.85@\$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, \$18@\$20 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract; \$33@\$35 per ton, New York.

Potassium Sulphate—Powder, domestic, \$1.50@\$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

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

Ferrocerium—Per lb., \$12@\$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 15c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, \$80@\$82, f.o.b. furnace; resale, \$90, delivered; English, \$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, \$30@\$32, f.o.b. furnace.

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

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

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

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

Ferrovanadium—\$5@\$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21.50c. per lb.; wire, 15c.

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

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

Yellow Metal—Dimension sheets 17¼c.; sheathing, 16¼c.; rods, ¾ to 3 in., 14¼c.

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

Refractories

Bauxite Brick—56 per cent alumina, \$35@\$50 per ton, f.o.b. works.

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

Chrome Brick—Straights, \$75 per net ton, shipping point; arches, keys, wedges, \$80; splits, soaps, \$90.

Fire Brick—First quality, 9-in. shapes, \$40@\$50 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, \$35@\$40.

Magnesite Brick—9-in. straights, \$90 @\$95 per net ton; 9-in. arches, wedges and keys, \$100; soaps and splits, \$110.

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

The Iron Trade

Pittsburgh, May 31, 1921

The last week has easily been the dullest the iron and steel trade has experienced since the latter part of 1914, if not for a longer period. The period is regarded as the regular mid-summer dullness, coming simply about a month head of the usual time. Predictions are made more commonly, and with more confidence, that there will be a substantial improvement in demand in August. No one looks for definite improvement before that time.

Steel prices are steady at the levels reached about the middle of April, but that means little as to inherent strength, as buyers' requirements are in such small tonnages that it is hardly worth while to seek competitive prices and mills have no incentive to cut prices.

Steel production is now at under 30 per cent of capacity, and a 25 per cent rate or less seems probable before the middle of June, so that predictions that there will be some kind of improvement by August seem natural. Buyers expect steel prices to decline farther before then; producers are non-committal.

Pig Iron—Bessemer iron, being only occasionally inquired for in carload lots, remains quotable at \$24, Valley. On two 1,000-ton lots basic has declined 25c. to \$21.75, Valley, and there is a rumor of \$21.50 having been done. On light transactions foundry has declined 50c. to \$23, Valley.

Coke

Connellsville—Furnace, \$3.25@\$3.75; foundry, \$4.50@\$5.

COMPANY REPORTS

Chile Copper Co.

A report of operations of Chile Copper Co. for 1920 states that the net surplus realized was \$151,994, compared with a loss of \$2,290,658 in 1919. Copper production amounted to 55,565 short tons, compared with 38,359 tons in 1919. A combined statement of the income and surplus accounts of Chile Copper and Chile Exploration companies follows:

	1920	1919
Operating revenue:		
Copper sold and delivered— —96,498,116 lb. @ 18.354c.	\$17,711,021	\$10,350,167
Operating cost:		
Cost f.o.b. plant yards.....	\$8,490,962	\$7,643,991
Freight, insurance, and delivery expense.....	1,538,435	1,085,965
Selling expense.....	176,368	8,729,956
Operating profit.....	\$7,505,256	\$1,620,211
Other income:		
Dividends—Chile Steamship Co.....	\$250,000	\$500,000
Interest and discount received.....	824,903	343,784
Miscellaneous.....	94,964	25,094
Total income.....	\$8,675,123	\$2,489,089
Charges against income:		
Taxes and miscellaneous charges.....	\$433,211	\$395,557
Interest on bonds of Chile Copper Co.....	3,157,069	3,590,280
Balance of income carried to surplus account.....	\$5,084,843	(a) \$729,511
Charges against surplus:		
Depreciation of plant and equipment.....	\$2,754,749	.....
Plant and equipment superseded or abandoned.....	133,690	65,639
Depletion of ore reserves.....	1,904,411	1,355,508
Amortization of discount on bonds.....	140,000	4,932,851
Net surplus from operations.....	\$151,992	(a) \$2,290,658
Surplus from operations previous to 1920:		
Deficit—Dec. 31, as stated..	\$287,795	\$2,787,882
Add:		
Adjustment of plant and equipment accounts, depreciation and obsolescence.....	1,794,797	.....
Miscellaneous adjustments.....	111,270	785,019
Less—Adjustment of depletion reserve.....	\$2,193,861	.....
Net deficit—Dec. 31, as adjusted.....	1,692,149	.....
Net deficit—Dec. 31, as adjusted.....	501,711	(b) 2,002,863
Net deficit—Dec. 31, as adjusted.....	\$349,719	(c) \$287,795
(a) Loss. (b) Dec. 31, 1918. (c) Dec. 31, 1919.		

The actual cash cost of producing copper was 10.7c. per lb., exclusive of depreciation and depletion, compared with 13.01c. per lb. in 1919. The president states that operations have now passed the development stage; the metallurgical predictions of engineers have been met; the company has an extremely efficient staff of expert and loyal employees.

Capitalization: 3,800,000 shares outstanding of \$25 par; funded debt: \$15,000,000 7 per cent bonds, ten-year convertible; \$34,916,250 6 per cent bonds, ten-year convertible.

Mexican Corporation

A report of operation of the Mexican Corporation, Ltd., (British) for the period Nov. 1, 1919, to June, 30, 1920, states that the surface orebody of the Fresnillo unit produced 100,901 dry tons of ore, having a value of \$693,033, or 531 oz. of gold and 390,744 oz. of silver; and accumulated tailings yielded 428 oz. of gold and 180,141 oz. of silver, a gross value of \$507,139. The Teziutlan unit produced 2,199,692 lb. of copper, 58,451 oz. of silver, and 829 oz. of gold from 32,256 dry tons of ore, having a value of \$547,326.57.

Profit-and-loss account indicates a loss of £5,691 14s. No dividends were paid.

Judge Mining & Smelting Balance Decreases

A report of operations of the Judge Mining & Smelting Co. for 1920 states that 7,877,121 lb. of lead, 2,664,005 lb. of zinc, 359,186 lb. of copper, 650 oz. of gold, and 483,890 oz. of silver were produced and sold for \$969,122.87. Operating account follows:

Balance on hand Jan. 1, 1920.....	\$148,385.43
Receipts	
Ore sales.....	\$675,677.19
Zinc plant.....	293,445.68
Interest and sundry receipts.....	15,801.57
	\$1,133,309.87
Expenditures	
Mine account.....	\$309,587.13
Mill operation.....	66,621.80
Ore expense.....	36,583.07
Prospecting and dead work.....	70,296.50
Zinc reduction plant.....	287,619.22
General expense.....	9,402.21
Taxes, fire and liability insurance.....	40,511.78
Engineering and surveying.....	2,541.61
Drainage.....	12,000.00
Emergency hospital.....	1,590.04
Property purchase.....	55,250.00
	\$892,003.36
Dividends Nos. 36, 37, 38.....	180,000.00
	\$1,072,003.36
Balance available Jan. 1, 1921.....	61,306.51
	\$1,133,309.8

Issued capitalization, 480,000 shares of \$10 par.

Daly West Dividends \$225,000 in 1920

A report of operations of the Daly West Mining Co. for 1920 states that 3,364,606 lb. of lead, 505,506 oz. of silver, 341,465 lb. of copper, and 241 oz. of gold were produced, and sold for \$615,464.45. Operating statement follows:

Balance on hand Jan. 1, 1920.....	\$141,978.99
RECEIPTS	
Ore sales.....	\$615,464.45
Interest and sundry receipts.....	6,809.77
	\$622,274.22
EXPENDITURES	
Mine account.....	\$158,408.33
Prospecting, exploratory and dead work.....	134,894.14
Ore expense.....	22,647.49
General expense	
Office, salaries, rent, legal, etc.....	8,167.73
Engineering and surveying.....	1,083.12
Tunnel rent and drainage.....	9,000.00
Taxes, fire and liability insurance.....	9,061.78
Emergency hospital.....	482.35
Property purchase.....	55,250.00
Dividends Nos. 62, 63, 64, 65.....	225,000.00
	\$623,994.94
Balance on hand Jan. 1, 1921.....	140,258.27
	\$764,253.21

Mining Dividends for May, 1921

The following dividends were paid by American mining and metallurgical companies during May, 1921.

Companies in the United States	Situation	Per Saare	Totals
Bunker Hill & Sullivan.....	Idaho	\$0.25M	\$81,750.00
Chief Consolidated, s.l.....	Utah	.05	44,201.60
Homestake Mining, s.....	S.D.	.25	62,790.00
Internat. Nickel, pfd.....	U. S. and Can.	1.50Q	133,689.00
Miami Copper, c.....	Ariz.	.50Q	373,557.00
New Jersey Zinc, z.....	N. J.	2.00Q	840,000.00
Silver King Coalition, s.....	Nev.	.15K	187,500.00
United Verde Exten., c.....	Ariz.	.25Q	262,500.00
Companies in Canada and Mexico			
Amparo Mining, g.s.....	Mex.	\$0.02½	\$50,000.00
Coniagas Mines, Ltd., s.....	Ont.	.12½ Q	100,000.00
McIntyre Porcupine, g.....	Ont.	.05	182,014.00

Coniagas Mines, Ltd. and Homestake Mining re-enter the ranks of dividend payers, the latter not having paid since Sept. 25, 1919, when it made a monthly disbursement of 50c. per share. New Jersey Zinc Co. disburses a part of its surplus.

METAL STATISTICS

Monthly Average Prices of Metals

	New York		London		Sterling Exchange	
	1920	1921	1920	1921	1920	1921
January	132.827	65.950	79.846	39.985	367.082	372.650
February	131.295	59.233	85.005	34.745	337.466	385.932
March	125.551	56.023	74.194	32.479	370.870	381.806
April	119.779	59.337	68.848	34.250	392.438	391.784
May	102.585	59.810	60.010	34.165	383.360	396.580
June	90.957	51.096	51.096	393.663	.....	.....
July	91.971	53.736	.....	385.538	.....	.....
August	96.168	59.875	.....	360.404	.....	.....
September	93.675	59.476	.....	350.370	.....	.....
October	83.480	54.197	.....	346.460	.....	.....
November	77.734	50.952	.....	342.333	.....	.....
December	64.774	41.845	.....	348.101	.....	.....
Year	100.900	61.590	.....	364.840	.....	.....

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		Standard		London Electrolytic	
	1920	1921	1920	1921	1920	1921
January	18.918	12.597	118.095	70.964	123.238	79.119
February	18.569	12.556	120.188	70.925	126.950	75.925
March	18.331	11.976	109.533	67.565	118.348	71.190
April	18.660	12.438	103.025	69.381	111.500	71.786
May	18.484	12.742	96.750	73.196	109.200	74.298
June	18.065	87.864	.....	101.909	.....	.....
July	18.576	90.148	.....	106.455	.....	.....
August	18.346	93.935	.....	111.143	.....	.....
September	18.144	96.381	.....	111.905	.....	.....
October	15.934	93.327	.....	104.905	.....	.....
November	14.257	84.807	.....	94.614	.....	.....
December	13.188	75.702	.....	85.905	.....	.....
Year	17.456	97.480	.....	108.839	.....	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	8.561	4.821	8.300	4.747	47.095	23.387
February	8.814	4.373	8.601	4.228	50.256	20.650
March	9.145	4.084	8.894	4.000	46.054	18.911
April	8.902	4.356	8.618	4.272	39.225	20.589
May	8.576	4.952	8.352	4.784	38.488	23.399
June	8.323	.....	8.169	.....	34.960	.....
July	8.338	.....	8.283	.....	36.304	.....
August	8.687	.....	8.160	.....	35.452	.....
September	8.177	.....	7.018	.....	35.238	.....
October	7.070	.....	6.127	.....	32.489	.....
November	6.159	.....	4.717	.....	24.089	.....
December	6.727	.....	.....	.....	.....	.....
Year	7.957	.....	7.830	.....	37.832	.....

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York		Straits		London	
	1920	1921	1920	1921	1920	1921
January	61.596	36.000	.....	36.000	376.512	190.464
February	58.466	28.534	59.932	32.142	395.750	166.250
March	61.037	27.296	61.926	28.806	369.489	156.024
April	61.120	28.990	62.115	30.404	345.450	163.905
May	53.230	31.431	55.100	32.500	294.813	177.411
June	46.125	.....	48.327	.....	250.614	.....
July	45.798	.....	49.154	.....	261.886	.....
August	43.856	.....	47.620	.....	274.048	.....
September	41.940	.....	44.465	.....	270.120	.....
October	39.310	.....	40.555	.....	258.190	.....
November	35.667	.....	36.854	.....	241.080	.....
December	31.135	.....	34.058	.....	212.440	.....
Year	48.273	.....	49.101	.....	295.866	.....

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	9.133	5.413	58.643	25.262	.....	.....
February	8.708	4.928	61.338	24.850	.....	.....
March	8.531	4.737	53.467	25.077	.....	.....
April	8.184	4.747	47.388	25.530	.....	.....
May	7.588	4.848	45.088	26.923	.....	.....
June	7.465	.....	41.193	.....	.....	.....
July	7.720	.....	41.886	.....	.....	.....
August	7.835	.....	41.220	.....	.....	.....
September	7.661	.....	39.690	.....	.....	.....
October	7.150	.....	39.756	.....	.....	.....
November	6.247	.....	35.028	.....	.....	.....
December	5.824	.....	27.762	.....	.....	.....
Year	7.671	.....	44.372	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)	
	New York	1921	New York	1921	New York	1921
January	10.577	5.258	90.192	48.440	154.23	73.400
February	11.588	5.250	84.432	49.545	151.59	70.227
March	11.056	5.282	92.611	46.796	138.56	72.463
April	10.500	5.137	102.192	45.423	127.04	73.404
May	9.655	5.250	89.560	47.000	97.50	73.740
June	8.289	.....	90.154	.....	83.19	.....
July	7.500	.....	90.333	.....	83.94	.....
August	7.177	.....	83.806	.....	111.44	.....
September	7.113	.....	75.000	.....	115.20	.....
October	6.723	.....	67.200	.....	101.70	.....
November	6.109	.....	58.417	.....	84.75	.....
December	5.534	.....	49.577	.....	79.62	.....
Year	8.485	.....	81.123	.....	110.90	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1920	1921	1920	1921	1920	1921
January	\$40.47	33.96	\$39.88	31.96	\$39.86	33.88
February	42.95	28.96	42.61	26.96	43.40	30.25
March	43.40	28.16	42.90	26.46	43.40	27.85
April	43.72	26.96	44.22	24.46	43.90	26.77
May	44.00	.....	44.88	.....	45.36	.....
June	44.89	.....	45.41	.....	46.40	.....
July	47.21	.....	47.42	.....	46.56	.....
August	48.90	.....	49.88	.....	49.35	.....
September	50.46	.....	50.46	.....	51.96	.....
October	49.21	.....	44.38	.....	48.58	.....
November	41.26	.....	39.20	.....	42.61	.....
December	36.96	.....	34.90	.....	37.73	.....
Year	44.45	.....	43.85	.....	44.93	.....

In dollars per long ton.

Monthly Crude Copper Production

	1921			
	January	February	March	April
Alaska shipments	5,241,634	5,482,962	4,985,259	5,615,500
Arizona Copper	2,300,000	2,000,000	2,000,000	2,000,000
Calumet & Arizona	2,438,000	3,330,000	3,455,672	2,204,000
Cons. Ariz. Smelting	(1)	(1)	(a)	(a)
Inspiration	5,000,000	4,500,000	5,000,000	1,100,000
Magma	600,000	600,000	650,000	378,900
Miami	4,439,000	4,200,101	4,572,000	4,262,625
New Cornelia	2,170,000	1,975,918	2,220,186	1,864,772
Old Dominion	2,822,000	1,882,000	2,199,000	984,000
Phelps Dodge	6,339,000	5,712,000	6,959,000	1,461,000
Shattuck Arizona	(1)	(1)	(a)	(a)
Ray	2,983,000	2,976,000	2,940,000	(a)
United Verde	3,500,000	3,450,000	4,115,000	2,600,000
United Verde Extension	3,219,912	3,349,942	2,951,390	3,092,746
Calumet & Hecla	7,234,300	7,395,084	9,147,000	(a)
Other Lake Superior	6,000,000	5,000,000	5,000,000	5,000,000
Anaconda	9,700,000	9,000,000	11,600,000	2,935,840
East Butte	1,600,000	1,500,000	1,000,000	1,047,140
Nevada Cons.	3,000,000	3,000,000	3,100,000	(a)
Chino	2,999,751	2,978,934	3,051,838	(1)
Utah Copper	7,500,000	7,500,000	7,500,000	(a)
Eastern Smelters	1,500,000	1,500,000	1,500,000	1,500,000
Others, estimated	10,000,000	9,300,000	7,100,000	10,900,000
Total United States	90,586,597	86,632,941	91,046,345	46,946,523
Imports: Ore and concentrates, matte, etc.	8,634,206	10,580,611	9,865,917	.....
Imports of blister, unrefined, etc.	21,456,013	19,424,907	12,448,823	.....
Imports of refined, etc.	9,679,973	10,631,161	359,572	.....
Grand total	130,356,789	127,269,620	113,720,657	.....
British Columbia:				
Granby Cons.	2,530,038	2,274,530	2,617,702	2,459,250
Mexico:				
Boleo	969,920	813,650	618,222	728,000
Cananea	2,530,038	(a)	(a)	(a)
Phelps Dodge Mexican properties	2,362,000	1,870,000	2,285,000	407,000
Other foreign:				
Cerro de Pasco	4,086,000	4,174,000	4,200,000	5,344,000
Chile	6,732,000	5,278,000	6,000,000	3,993,802
Katanga	2,912,805	3,283,960	5,360,128	4,862,025
Backus & Johnston	1,760,000	1,306,000	1,642,000	1,400,000

(a) No copper produced during this month. (b) Corrected.

Comparative Annual Copper Production

	1919	1920	1921
	January	135,733,511	121,903,744	90,586,597
February	111,649,512	117,450,000	86,632,941
March	102,040,460	120,309,316	91,046,345
April	98,808,998	116,078,871	46,946,523
May	92,652,975	114,964,207	.....
June	95,856,570	116,107,856	.....
July	100,369,247	109,729,510	.....
August	107,994,040	116,460,654	

MINING STOCKS

Week Ended May 28, 1921

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.	
COPPER						GOLD						
Adventure.....	Boston			*50		Alaska Gold.....	New York					
Ahmeek.....	Boston	52	52	52	Sept. '20, Q	\$0.50	Alaska Juneau.....	New York	1 1/2	1 1/2	1 1/2	
Alaska-Br. Col.....	N. Y. Curb	2 1/2	2 1/2	2 1/2	Mar. '19	1.00	Carson Hill.....	N. Y. Curb	14 1/2	14	14	
Allouez.....	Boston	23	21	21	Nov. '20, Q	1.00	Cresson Consol. G....	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Anacanda.....	New York	42 1/2	40 1/2	40 1/2	Oct. '18,	.50	Dome Extension.....	Toronto			*75	
Arcadian Consol.....	Boston	2 1/2	2 1/2	2 1/2			Dome Mines.....	New York	19 1/2	18 1/2	18 1/2	
Ariz. Com'l.....	Boston	9 1/2	9	9	Sept. '19, Q	.25	Golden Cycle.....	Colo. Sprgs.	*74	*72	*74	
Big Ledge.....	N. Y. Curb	10	10	10	Mar. '21, Q	.50	Goldfield Consol.....	N. Y. Curb	*8	*7	*8	
Bingham Mines.....	Boston	254	252	252 1/2	June '20, Q	5.00	Hollinger Consol.....	Toronto	7.40	7.25	7.25	
Calumet & Arizona.....	Boston			*13			Homestake Mining....	New York	56 1/2	56 1/2	56 1/2	
Calumet & Hecla.....	Boston	10	7 1/2	7 1/2	Dec. '18, SA	1.00	Kirkland Lake.....	Toronto	*49	*49	*49	
Canada Copper.....	N. Y. Curb	29	28 1/2	28 1/2	Mar. '21, Q	.50	Lake Shore.....	Toronto	1.32	1.31	1.31	
Centennial.....	New York	12 1/2	11 1/2	11 1/2	Sept. '20, Q	.37 1/2	McIntyre-Porcupine	Toronto	2.00	1.97	1.97	
Cerro de Pasco.....	New York	26 1/2	24 1/2	24 1/2	Dec. '18, Q	.05	Porcupine Crown.....	Toronto	*20 1/2	*20 1/2	*20 1/2	
Chile Copper.....	New York	*27 1/2	*26 1/2	*26 1/2	Feb. '19, SA	.15	Portland.....	Colo. Sprgs.	*60	*59 1/2	*59 1/2	
Chino.....	Salt Lake				Mar. '20, Q	.25	Reorgan. Booth.....	N. Y. Curb	*4	*2 1/2	*3	
Columbus Rexal.....	N. Y. Curb				Jan. '19, Q	.50	Silver Pick.....	N. Y. Curb	*6	*3	*5	
Con. Arizona.....	N. Y. Curb	36 1/2	34 1/2	34 1/2	Sept. '20, Q	.50	Teek Hughes.....	Toronto	*16	*16	*16	
Con. Copper M.....	N. Y. Curb	*30	*26	*30	Feb. '19, SA	.15	Tom Reed.....	Los Angeles			*80	
Copper Range.....	Boston	7	6	6 1/2	Mar. '20, Q	.25	United Eastern.....	N. Y. Curb	2 1/2	2 1/2	2 1/2	
Crystal Copper (new)	Boston Curb	9 1/2	9	9 1/2	Dec. '19, A	.50	United Eastern.....	N. Y. Curb	*34 1/2	*34 1/2	*34 1/2	
Davis-Daly.....	Boston	*75	*65	*65	Feb. '19, SA	.15	West Dome Consol....	Toronto	*8	*8 1/2	*8	
East Butte.....	Boston			2 1/2			White Caps Mining..	N. Y. Curb	*7 1/2	*4	*7	
First National.....	Boston Curb						Yukon Gold.....	N. Y. Curb	1	1	1	
Franklin.....	Boston			*25			SILVER					
Gadsden Copper.....	N. Y. Curb	22 1/2	22 1/2	22 1/2	May '19, Q	1.25	Arizona Silver.....	Boston Curb	*28	*25	*28	
Granby Consol.....	New York	23 1/2	23 1/2	23 1/2	Nov. '20, Q	.50	Batopilas Mining....	New York				
Greene-Canaan.....	New York	3 1/2	3 1/2	3 1/2	Jan. '21, Q	.05	Beaver Consol.....	Toronto	*34	*33	*33	
Hancock.....	Boston	36 1/2	35	35	Oct. '20, Q	1.00	Coniagas.....	Toronto			1.70	
Howe Sound.....	N. Y. Curb	21 1/2	21	21	Sept. '19, SA	.50	Crown Reserve.....	Toronto			*13	
Inspiration Consol....	New York	21 1/2	20 1/2	20 1/2	Dec. '20, Q	.50	Kerr Lake.....	Boston	3 1/2	3 1/2	3 1/2	
Iron Cap.....	Boston Curb						La Rose.....	Toronto	*21	*18 1/2	*19	
Ile Royale.....	Boston	2 1/2	2	2	Jan. '19, Q	.50	McKinley-Dar.-Sav..	Toronto			1.08	
Kennecott.....	New York	2 1/2	2	2	Jan. '19, Q	.50	Mining Corp. Can....	Toronto			4 1/2	
Keweenaw.....	Boston	2 1/2	2	2	Nov. '17, Q	1.00	Nipissing.....	N. Y. Curb	4 1/2	4 1/2	4 1/2	
Lake Copper.....	Boston	2 1/2	2	2	May '21, Q	.50	Ontario Silver.....	New York			5	
La Salle.....	Boston						Ophir Silver.....	N. Y. Curb			2	
Magma Chief.....	N. Y. Curb	21 1/2	20 1/2	20 1/2	Jan. '19, Q	.50	Peterson Lake.....	Toronto			*6 1/2	
Magma Copper.....	N. Y. Curb	*11	*09	*09			Temiskaming.....	Toronto			*18	
Majestic.....	Boston Curb						Trethewey.....	Toronto	*16 1/2	*16	*16	
Mason Valley.....	Boston	2 1/2	2 1/2	2 1/2	Nov. '17, Q	1.00	GOLD AND SILVER					
Mass Consolidated....	Boston	4 1/2	4	4	May '21, Q	.50	Atlanta.....	N. Y. Curb	*1	*1	*1	
Mayflower-Old Col....	Boston	23 1/2	22 1/2	22 1/2	May '21, Q	.50	Butte.....	N. Y. Curb			1.10	
Miami Copper.....	New York	53 1/2	52 1/2	52 1/2	Nov. '20, Q	1.00	Boston & Montana..	N. Y. Curb	*65	*58	*65	
Michigan.....	Boston	12 1/2	11 1/2	11 1/2	Sept. '20, Q	.25	Cashboy.....	N. Y. Curb	*6 1/2	*5	*6	
Mohawk.....	Boston	15 1/2	15 1/2	15 1/2	Aug. '20, K	.25	El Salvador.....	N. Y. Curb				
Mother Lode (new)....	N. Y. Curb	10 1/2	10 1/2	10 1/2	Oct. '18, Q	.25	Jim Butler.....	N. Y. Curb	*10	*8	*9	
Nevada Consol.....	New York						Jumbo Extension....	N. Y. Curb	*7	*5	*6 1/2	
New Baltic.....	Boston Curb						Louisiana Con.....	N. Y. Curb				
New Cornelia.....	Boston						MacNamara M. & M.	N. Y. Curb	*18	*14	*15	
Nixon Nevada.....	N. Y. Curb						Open Mar.....	N. Y. Curb	*10 1/2	*9	*9	
North Butte.....	Boston						Tonopah-Belmont....	N. Y. Curb	1 1/2	1 1/2	1 1/2	
North Lake.....	Boston						Tonopah-Divide.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Ohio Copper.....	N. Y. Curb						Tonopah-Extension..	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Old Dominion.....	Boston	22 1/2	21	22	Dec. '18, Q	1.00	Tonopah Mining.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Oscoda.....	Boston	32	30	30	June '20, Q	.50	West End Consol....	N. Y. Curb	1	1	1	
Phelps Dodge.....	Open Mar.	†160	†150		Apr. '21, Q	1.00	SILVER-LEAD					
Quincy.....	Boston	40	39	39 1/2	Mar. '20, Q	1.00	Caledonia.....	N. Y. Curb	*11	*9 1/2	*10	
Ray Consolidated....	New York	14 1/2	14	14	Dec. '20, Q	.25	Cardiff M. & M.....	Salt Lake	1.10	1.10	1.10	
Ray Hercules.....	Boston Curb						Chief Consolidated..	Boston Curb	2 1/2	2 1/2	2 1/2	
St. Mary's Min. Ld....	Boston	39	38	38	June '20, K	2.00	Consol. M. & S.....	Montreal	16 1/2	16	16	
Seneca Copper.....	Boston	0.80	0.80	0.80	Nov. '17, Q	.25	Daly Mining.....	Salt Lake	1.50	1.50	1.50	
Shannon.....	Boston						Daly-West.....	Boston			3	
Shattuck Arizona....	New York	7	7	7	Jan. '20, Q	.25	Eagle & Blue Bell...	Boston Curb			2	
South Lake.....	Boston						Electric Point.....	Spokane	*7 1/2	*7 1/2	*7 1/2	
Superior Copper.....	Boston						Federal M. & S.....	New York	7	6 1/2	6 1/2	
Superior & Boston....	Boston	1 1/2	1 1/2	1 1/2	Apr. '17,	1.00	Federal M. & S., pfd.	New York	27 1/2	26 1/2	26 1/2	
Tenn. C. & C. cfs....	New York	9 1/2	8 1/2	8 1/2	May '18, I	1.00	Florence Silver.....	Spokane			*12 1/2	
Toulumne.....	Boston	*65	*60	*62	May '13,	.10	Grand Central.....	Salt Lake			*07 1/2	
United Verde Ex....	Boston Curb	28	25 1/2	25 1/2	May '21, Q	.25	Hecla Mining.....	N. Y. Curb	4 1/2	3 1/2	4	
Utah Consol.....	Boston	4	3 1/2	3 1/2	Sept. '18,	.25	Iron Blossom.....	N. Y. Curb			*20	
Utah Copper.....	New York	56 1/2	54 1/2	55	Mar. '21, Q	1.00	Judge M. & S.....	Salt Lake			3.00	
Utah Metal & T.....	Boston	1 1/2	1 1/2	1 1/2	Dec. '17,	.30	Marsh Mines.....	N. Y. Curb	*7 1/2	*6 1/2	*7	
Victoria.....	Boston						Prince Consol.....	N. Y. Curb				
Winona.....	Boston	*45	*40	*40			Rambler-Cariboo....	Spokane	*5 1/2	*5	*5 1/2	
Wolverine.....	Boston	11	11	11			Rex Consol.....	N. Y. Curb	*11	*9	*10	
NICKEL-COPPER						QUICKSILVER						
Internat. Nickel.....	New York	15 1/2	15 1/2	15 1/2	Mar. '19,	.50	New Idria.....	Boston	†*50	†...	*50	
Internat. Nickel, pf..	New York	82 1/2	82 1/2	82 1/2	May '21, Q	1.50	VANADIUM					
LEAD						ASBESTOS						
National Lead.....	New York	77	77	77	Mar. '21, Q	1.50	Asbestos Corp.....	Montreal			58	
National Lead, pfd..	New York	104	102	102	Mar. '21, Q	1.75	Asbestos Corp., pfd..	Montreal			80	
St. Joseph Lead.....	New York	12	12	12	Mar. '21, Q	.25	MINING, SMELTING AND REFINING					
Stewart Mining.....	Boston Curb			*6	Dec. '15,	.05	Amer. Sm. & Ref....	New York	43 1/2	42 1/2	42 1/2	
ZINC						ASBESTOS						
Am. Z. L. & S.....	New York	9 1/2	9 1/2	9 1/2	May '20,	1.00	Amer. Sm. & Ref. pf.	New York	78	77	77 1/2	
Am. Z. L. & S., pfd..	New York			29	Nov. '20, Q	1.50	Am. Sm. pf. A.....	New York	72	71	72	
Butte C. & Z.....	New York	5 1/2	4 1/2	4 1/2	June '18,	.50	U. S. Sm. R. & M...	New York	34 1/2	33 1/2	33 1/2	
Butte & Superior....	New York	14 1/2	13 1/2	13 1/2	Sept. '20,	1.25	U. S. Sm. R. & M. pf..	Boston	41 1/2	41	41	
Callahan Zn-Ld.....	New York	5 1/2	4 1/2	4 1/2	Dec. '20, Q	.50						
New Jersey Zn.....	N. Y. Curb	126	126	126	May '21, Q	2.00						
Success.....	N. Y. Curb	*3	*2	*3	July '16,	.03						
Yellow Pine.....	Los Angeles			*60	Sept. '20, Q	.03						

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

