

MAR 10 1925

March 7, 1925

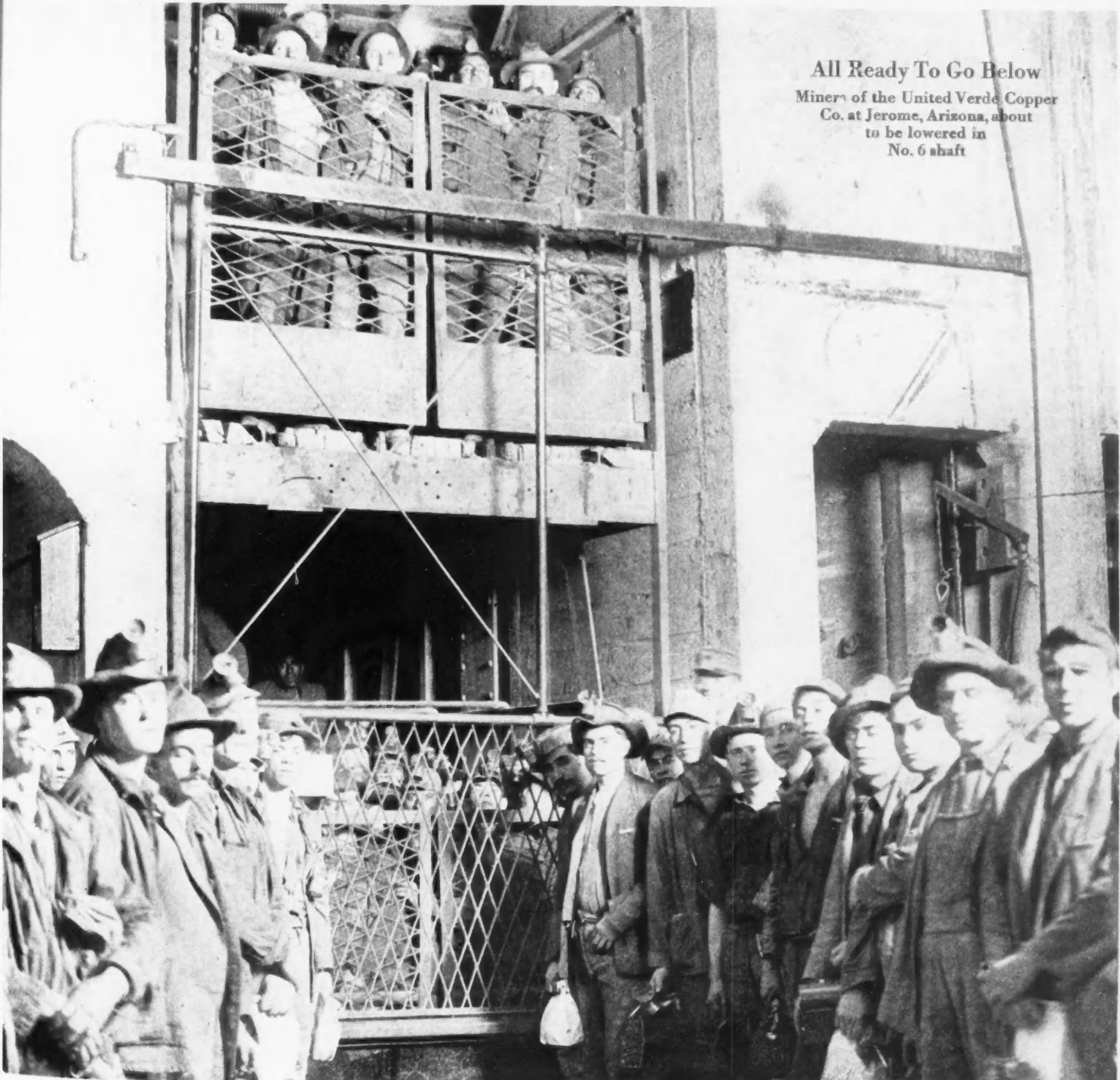
Twenty-five Cents Per Copy

No. 9

ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

st Div.
0.05
0.25
0.01
1.79
0.02
0.05
0.05
0.05
0.10
0.10
0.05
0.50
0.05
0.02
0.15
0.50
0.10
0.10
0.05
0.15
1.75
1.75
0.01
0.50
0.02
0.02
0.15
0.15
0.20
0.02
0.25
0.50
0.25
1.25
0.75
2.00
0.625
0.50
1.75
0.50
0.75
0.75
0.50
1.50
0.00
0.00
0.50
0.00
0.75
0.95
0.75
0.75
0.50
0.87
M,
n is
nd.
ons
E.
in-
ado



All Ready To Go Below
Miners of the United Verde Copper
Co. at Jerome, Arizona, about
to be lowered in
No. 6 shaft

IN THIS ISSUE

Mining Methods at United Verde-II, by George J. Young
Marketing Lump and Ground Silica, by Felix Edgar Wormser
Recovering Zircon from Zirconiferous Pegmatite, by R. C. Gosreau
Mineralization at Randsburg, Calif., by Carlton D. Hulin

S-A UNIT CARRIERS WITH HIGH PRESSURE LUBRICATION



THE new S-A Unit Carrier, equipped for pressure lubrication, can be quickly and positively lubricated by slipping the end of a pressure gun over the fitting on each roller and giving a few strokes to the handle.

New grease forced into the bearings forces old grease out. There is no shutting down, no lost time and the bearings are perfectly lubricated.

Both Units are now standard, the ball bearing Unit with plain lubrication and the same Unit fitted for pressure lubrication.

*Write for Descriptive Booklet—The
S-A Unit with Pressure Lubrication*



Stephens-Adamson Mfg. Co.

Aurora, Illinois

Designers and Builders of Labor Saving, Material Handling Machinery

ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 119

New York, March 7, 1925

Number 10

Money

THE ECONOMIC STUDY OF MONEY is an interesting and complex one. Money comprises gold and silver, government and bank promises to pay, and many other things. Its economic rôle is a never-ending and abstruse puzzle.

Money is also important in a psychologic sense and in as complex a manner. It is a moral and religious element. "The love of money," quoth St. Paul, "is the root of all evil"—which is only a misleading fragment of the truth—especially as usually garbled that "Money is the root of all evil."

Money is the tangible symbol of wealth, exchangeable for all material things. Therefore its possession enables the possessor to trade it for anything and everything tangible which is by nature transferable—provided only the owner will sell. Money will buy food, warmth, shelter, clothes—all of which are good things. Therefore money is a good thing to have, and hence the pursuit of it is advisable and commendable. Industry and thrift are virtues which are conducive to happiness. Money will also buy mansions, vast land holdings, and so on. In reality it does not buy them, but only secures to the purchaser the life occupancy. Land is not transferable—the occupant succeeds a million others unknown, and will be succeeded by a million more. He really buys only what he can consume, such as food, raiment, and cigars.

"Life, liberty, and the pursuit of happiness" says the wise preamble of the Constitution—that is what men want and will fight for. If money will buy any of these things—life, liberty, and happiness—and all of these are summed up in the last word, happiness—it is then certainly to be striven for up to the point that it continues to secure happiness. But we find that the purchasing power of money in such commodities as life, liberty, and happiness is fluctuating and uncertain. There is a perverse tendency in this class of goods to have undergone a change when we unwrap them. We strive for money to spend for life, and when we unwrap the package we find death; we pursue money where-with to buy liberty, and when the package is sent home we find servitude instead; we make long sacrifice for money to buy happiness, and when we open the box we find ashes in it. To become aware of this cheat is the privilege of the wise; and they will consider money with the knowledge of its tendency to treachery. Even those who use it to buy power may, if not alert, find themselves in loneliness or in jail.

Then there is the group of things that are not, even ostensibly, for sale. Those things are well known—such as true friendship, love and honor, real worth—brains, courage, unselfishness, kindness. Money cannot buy an honest man, for its perverse nature manifests itself here—and when the purchaser buys a man who has been honest, and opens the package after he

gets home, he finds a dishonest man, who is of no use to him.

Altogether, money is in some degree comparable to fire and water. A little fire on the hearth or in the kitchen range is necessary for happiness; but when the flame spreads throughout the house, the case is different.

Therefore, my boy, consider how much fire, how much water, how much money you want to strive for and get; consider where the critical point is reached in your own case, where happiness will change to unhappiness. There was once a son who grew up hearing about the mortgage on the old farm; and he dreamed of lifting the mortgage; so that when he became a man and fared forth and returned with a wad of dough, he secretly and joyfully paid off the mortgage, and also the note in the bank, and presented them to his father and mother. Astonishment and consternation were the principal reactions he sensed; and afterward his father confessed to him sadly that he missed the mortgage and the note. They had given him something to work for and think about; had made it necessary to have conferences with bankers and others; he was important and busy—a man of affairs. Now he had nothing but the drudgery of the farm.

Relation of Mineral Reserves to Price

ONE OF THE PAPERS presented at the Petroleum Section of the recent meeting of the A.I.M.E., held in New York was an interesting one by Mr. Joseph E. Pogue, in which he reminds us that we cannot estimate our oil reserves except on a basis of price; and that with increasing prices we shall have increasing oil reserves. This conclusion was variously regarded by his hearers, some claiming that price was not a major factor in determining the available oil supply, others agreeing in different degree with the speaker. Dr. D. F. Hewett, of the U. S. Geological Survey, pointed out that he had applied the same principle in estimating manganese reserves and had made prediction of future production on the basis of certain prices, which prediction had been fulfilled.

The relation of supply to price is of course simply our old friend the law of supply and demand. Nevertheless, this law in certain cases is modified greatly by outside factors. One should beware of assuming that it can be applied light-heartedly. It can be trusted only when there are available free and unlimited sources of supply. Such would be approximately the case (for purposes of illustration) for agricultural products, like wheat, sugar, and wool. In the case of forests, the long look ahead shows that it is not true. The time is arriving—indeed, it is here—when a rise in prices of lumber fails to reveal a corresponding increase in the reserves of lumber in the United States. The reason is that lumber can only be replaced—can only develop to supply the demand—in twenty to one hundred years.

This leads us to the statement that one should be careful in the applications of these assumptions to our mineral reserves. If timber reserves will not increase magically as the price rises, because they reproduce slowly, how much more difficult will it be for mineral reserves to respond, since there is no way whatever to reproduce them? Herein lies a common fallacy. We have heard it said with the prices sufficiently high, all the mercury that the world might need for any purpose would be produced. This is probably not so, unless the world became prudently very modest. There is of course a diffuse marginal belt of mineral supplies that can be reached by higher prices; but this is a temporary supply, and with its exhaustion higher prices will be responded to, paradoxically (from the standpoint of the theory), by decreased production—decreasing in spite of the higher price.

In the case of petroleum, this limitation is not so operative as in the case of manganese, where it is less operative than in the case of chrome ore. Nevertheless, it is probably a larger factor than the law of increased supply under the spur of higher prices. We can buy many things, but many other things are not purchasable at any price. We cannot, for example, bring out a sufficiently large tin production in the United States for the country's need, at any price. And the situation which is exposed in all its clarity, as regards tin, applies with appropriate modifications to other mineral products of the United States. A rough classification of these, showing how each stands as between the opposing pulls of the law of supply and demand and the law of non-reproductivity of minerals, might be arrived at without great difficulty and should serve to clarify our thoughts as to the right commercial and national mineral policies.

Patent Office a Busy Place

EFFICIENCY in the Patent Office has not always been all that it should be; the delays in granting patents have been too great in recent years, and in many instances too much opportunity for subsequent litigation has been left. Conditions are improving, however, and, as the recent report of the Commissioner of Patents states, "the past year has been one of unprecedented progress and gains in the Patent Office." At the beginning of 1924, twenty of the fifty-three divisions of the Patent Office were more than eight months behind in taking up patent applications, whereas at the end of the year all but five divisions were less than seven months behind, and the examining corps was gaining at the rate of 2,000 applications a month.

Some of the statistics given by the commissioner, Thomas E. Robertson, in his report, are interesting. Last year there were 76,855 applications for patents, and 42,554 patents were granted. We wonder how many of these are ever applied commercially; the percentage is probably small, though among the dozen or more granted every week in the mining field, the majority appear to have merit, and many no doubt mark a step forward in practice, though they may not, in themselves, attain practical use. A large number are obtained by manufacturers for slight improvements in their machines, or by companies or individuals who desire to protect a design or process so that they may have the free right to use it at any time.

More patents have been granted in the United States than in any other country of the world, the total to the

end of 1922 being 1,450,318, compared with 663,782 by France, 611,512 by Great Britain, 386,599 by Germany, 317,298 by Belgium, and 224,236 by Canada. Among citizens of the United States, those of Connecticut seem to have been the most inventive, one patent or design having been granted in 1924 to every 1,082 of the population, followed by the District of Columbia, 1,229, California, 1,302, New Jersey, 1,356, and New York, 1,503.

Iron-ore Taxation in Minnesota

AS WE RECENTLY POINTED OUT editorially, the tendency is for state and municipal taxation to increase, although economy and retrenchment are reducing federal taxes in the United States. And no industry is so much badgered by state and municipal taxation as is the mining industry. With state legislatures composed mostly of farmers, who have the dual idea that mineral wealth is enormously profitable, and that it really belongs to the commonwealth, the tendency is to tax to the limit—to stop only when they fear the goose may give up the struggle for existence. The mining industry is one of the great basic industries of the country, but it has few political friends—no presidents and congresses and conclaves of Cabinet members proclaim the rights of the miners and propose all sorts of panaceas for their troubles, as they do in the case of the farmers. The reason is plain—it is the same reason why the farmers control the legislatures—they are far more numerous individually—they cast far, far more votes. Therefore all politicians and statesmen of all classes and standards love them. But love the miners? The ruling powers are strangely absent-minded, strangely oblivious to this great basic industry; and when they do for some reason approach the subject, the atmosphere is rather antagonistic than otherwise. One of the special reasons why state legislatures approach the subject of miners is to squeeze their pocket-books firmly and persistently. Down in Washington the Bureau of Internal Revenue is also very persistent in this exercise. There is a general complaint among the patient mining companies that allowances for depletion, once settled, are reopened next year and argued all over again, so that they never know how much they will be compelled to pay for back taxes.

No state has distinguished itself by the agrarian pressure to tax the mining industry more than has Minnesota, where in 1923 the iron mines paid nearly \$27,000,000 total taxes—60c. a ton, or 31½ per cent of the real net value of the ore output. In 1922 the taxes amounted to 76½c. on each ton of ore mined, or 46 per cent of the true net value. This higher figure was due to lower relative output in 1922; and the 1924 figures, due also to lower output, will be in the same class—so that last year it is safe to say that the mining companies paid more than 40 per cent of the net value of their products in taxes. The heaviest tax is municipal, and it is notorious that the little mining towns like Hibbing extract huge sums. In state taxation mines are in a special unfavored class, the ad valorem levy being based on an assessment of 50 per cent of the full cash value of unmined ore, while other real estate is assessed at only 40 per cent of the value. There is also the "occupational tax," which is 6 per cent of the "net value" of the ore mined. The state has adopted the "heritage" theory of taxing the iron mines. Under

this theory, one-half of the "occupational" tax is preserved for posterity, being paid into permanent educational endowment funds, 40 per cent of the whole tax going into the permanent school fund and 10 per cent into the permanent university fund.

One effect of high taxation in the Lake Superior region is to encourage iron mining in other regions, which otherwise would not be able to compete with the natural advantages of Minnesota and the neighboring states. The Alabama iron industry appears to be flourishing; and an increasing amount of ore is coming to our Atlantic seaboard from overseas, as, for example, from South America.

Who Discovered the Witwatersrand Conglomerate?

THE RECENT DEATH of George Walker has drawn attention to the question as to who actually discovered the gold-bearing conglomerate of the Witwatersrand. Although George Walker is credited with the discovery of the Main Reef in 1886, it is a fact that F. P. T. Struben was the pioneer who first discovered gold in the conglomerate formation. In 1884, Mr. Struben, before Mr. Walker found the Main Reef, milled and was producing gold from two conglomerate beds on either side of the Main Reef at Vogelstruisfontein. According to Mr. Struben's statement which appeared in the *Rand Daily Mail*, Struben named the reef which he was working the "Water Reef." Mr. Walker was in the employ of Mr. Struben and his brother, H. W. Struben, at the time.

The Progressing World

THE RECENT RETIREMENT of Elihu Root from active life was the occasion of a notable speech from this great American. He reviewed the fifty and more years of his wise observation of life and of America, and ended with the conclusion that the world was growing better—that America is growing better. Such a conclusion is that of one who stands on a mountain peak and surveys in one long look the past and the present. It is not given to those of us who are in the midst of life's multitudinous details to be high enough out of the ruck and sufficiently detached to be able to make these comparisons. And we may take Root's judgment as having the stamp of a competent authority. There have been very few greater Americans and patriots than he is. His business as a corporation lawyer put a certain handicap on his public career, in spite of the fact that he was a Senator and Cabinet officer, and was the friend and "admonisher" of Roosevelt, of whom he stated long afterward "that he was the most hospitable to advice of any man I have ever known."

It is not given to the world to be without blemish. Strife and competition are for some inscrutable reason among the underlying laws of nature. Struggle gives tone and strength; and the strongest and best fitted survive. Good, as we understand it, struggles with evil, as we understand it: but it is only fair to say that we do not all see eye to eye as to what is good and what is bad. Our good is frequently the other man's bad. Nevertheless, many will rue the survival of hypocrisy, the greatest of all human sins; the decline of

the respect inspired by law in the United States, which is the result of prohibition and the automobile; the rise of multitudinous bootlegging millionaires and the feverish squandering of easily won millions at congested centers of jazz and moronism; the tendency toward development of social and intellectual life in the United States, and, indeed, in the whole world, on the dollar basis—that is to say, on the lines of plutocracy. Still, when we raise our eyes from these disturbing items, we are reassured by a man like Root, a snow-capped mountain peak at eighty, looking back over fifty and more years and telling us that the world is much better now—that it is getting better. And the comparison is what counts—the relativity. "Nothing has quality except by comparison."

Exploration Campaigns

IN AN ARTICLE on the "Evolution of Mining," in the issue of Jan. 3, the editor of this paper recited the experience of an unnamed mining company which had plenty of money for investment (earned from mining) and desired to continue as a permanent mining company through acquiring new mines:

"The effort to make a profitable mine from partially developed mines is also a difficult one. In this case, again, the general cry is that capital is the only thing needed. The fact is that it is most difficult to acquire a likely prospect on reasonable terms. Out of 4,000 properties that were submitted to a certain exploration company during a term of years, 90 per cent were eliminated on the basis of the reports submitted. Ten per cent were examined, and in no case did the findings correspond with the reports offered. Development work was done on about 25, and four properties were finally acquired and operated. Three of these were outside the United States in remote parts of Canada and Spanish America, where operating conditions were difficult. Other exploration companies have had exactly the same experience."

A recent circular of the Barnes-King Development Co., owning mines at Marysville, Mont., and at Kendall, Mont., tells the same story. This report is signed by Charles W. Goodale, president, a man whose excellent judgment is well known. The mines operated by the company are now exhausted, but the directors have been trying to find new properties:

"Your directors, since taking over the management of your corporation, have considered 1,029 mining properties with the idea and purpose of operating or purchasing them. Of these 473 properties were examined by engineers, and of this total amount during the last year 249 properties were considered and 64 were physically examined. Of the different properties examined, eleven were taken out under option and some work done on them, but none were found promising enough to warrant continued operation or purchase."

Therefore the directors of the Barnes-King company have unanimously voted to dissolve the corporation and to distribute the assets in cash to the stockholders.

The essential preliminary to the solution of a problem is to start with the facts. Shutting one's eyes to these and rooting for the local district is helpful, but not sufficiently so when there is no ore to be won profitably. The mining industry has a great part to play in the world's drama in the future, as it has in the past. To fit it to do this, it needs students and analysts more than claquers. The geologist, the statistician, the economist, the metallurgist, the mining engineer are men whom capital awaits to show the way to the mining of the greater amount of metal which the world will continually demand.

John Simon Guggenheim Memorial Fellowships



SIMON GUGGENHEIM

"TO IMPROVE the quality of education and the practice of the arts and professions in the United States, to foster research, and to provide for the cause of better international understanding." These are the express purposes of the John Simon Guggenheim Foundation just established in memory of their departed son by Simon Guggenheim and his wife. A gift of \$3,000,000 is the initial endowment of the foundation through which research study abroad by fifty worthy American men and women will be financed. John Simon Guggenheim died in 1922 at the age of eighteen while preparing for his university education at Harvard. Had he lived it was the plan of his parents to send him abroad for a course of graduate study. It seems to be a most appropriate memorial that the Foundation will make possible similar study for others.

Mr. Guggenheim is, of course, well known in the mining world as president of the American Smelting & Refining Co. and one of the brothers in the Guggenheim family whose mining interests spread over many states of the Union as well as to Alaska, Mexico, South America, Asia, and Africa. In 1888, when only twenty years old, he went to Pueblo, Colo., where his active

career in the mining and smelting industry began. He was United States Senator from Colorado from 1907 to 1913. His wife was Olga H. Hirsh, of New York.

The details of the operation of the plan have been worked out by an advisory board composed of a large group of leading educators in the United States. In several respects the plan differs from those of similar existing educational endowments. The absence of precise limitations is perhaps the feature. No age limit is prescribed, though the expectation is that students between the ages of twenty-five and thirty-five will predominate. Maturity and proved ability to profit by the opportunity are to be required. The fellowships are open to women as well as to men; study may be pursued in any country in the world; the yearly sum made available will be approximately \$2,500, but may be either more or less; and the appointment, though usually being for one year, may be arranged for two or three years or for only a few months. Fellows may be either married or unmarried; there are no restrictions as to race, color, or creed.

The fellowships are open not only to candidates engaged in research work along academic or artistic lines, but

also to those interested in the workings of foreign systems of government, in the study of social or business conditions, or in productive scholarship in the fields of the various learned professions, art and music being especially mentioned as among the subjects contemplated.

The principal obligation imposed on the holders of fellowships is that they shall contribute to the general store of knowledge in their special subjects and, secondly, that they shall make the results of their studies available for the use of all.

In a brief statement made at the time of the formal announcement Mr. Guggenheim said:

"We all realize that some of the finest minds, some of the most constructive thinkers in the world, have been seriously hampered in turning their natural gifts to the best advantage by the lack of adequate financial backing. I want to do my part to meet this need. It is a matter of satisfaction to me that the income of the Foundation will be spent on men and not on materials. I have noticed that it has always been an easy matter for educational enterprises to secure money for buildings; but money in the place where this Foundation proposes to use it is apparently hard to get. It has been my observation, from the outside, that just about the time a young man has finished college and is prepared to do valuable research, he is compelled to spend his whole time in teaching. Salaries are small; so he is compelled to do this in order to live, and often he loses the impulse for creative work in his subject, which should be preserved in order to make his teaching of the utmost value. . . . I have been informed that the sabbatical year is often not taken advantage of because professors cannot go abroad on half salary, and it is for this reason that we have provided that members of teaching staffs on sabbatical leave shall be eligible for these appointments.

"It has seemed to me that the educational systems of Europe are superior to ours in one respect, in that they offer greater opportunities to young men to become and remain productive scholars. It is my hope that this Foundation will do something to provide a similar opportunity for young men and women in the United States. I hope that the result of this will be to increase, at least to some degree, the vitality and effectiveness of American education."

Only the Rhodes scholarships, after which the Guggenheim fellowships in a measure are modeled, exceed the latter in point of importance. Yet in some respects the Guggenheim Foundation is more wisely conceived and more broadly devised. A more admirable ideal would be hard to conceive. It is a satisfaction to know that the fortunes which made both possible were based on the development of the mining industry.

Mining Methods at the United Verde—II

Horizontal Cut and Fill and Shrinkage Stopping—Development Entails 25,000 Feet of Drifts and Raises per Year—High Labor Efficiency Attained—Work Standards Established

By George J. Young
Associate Editor

MINING METHODS at the United Verde were first the square set and square set and fill. Eventually mining practice advanced to the point where methods were established as standards for certain conditions such as size, shape, position of

gangways are 30 ft. apart and parallel to one another and the principal axis of the orebody; loading chutes are placed at every second set on alternate sides, which gives an 11-ft. spacing between them; manways are 100 ft. apart in each gangway and are offset in the solid; solid ground is left on the bottom of each ore chute. Fig. 1 is a sketch showing the important features of the mining method.

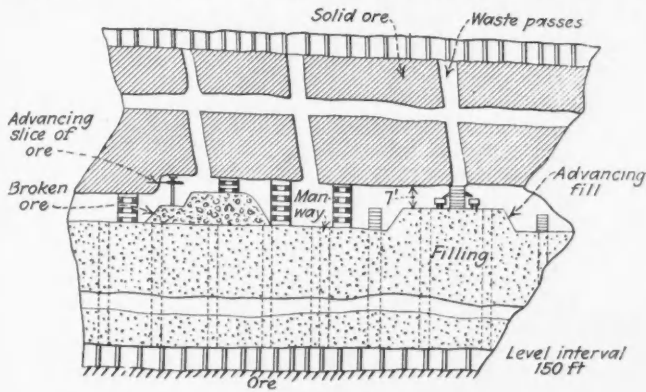


Fig. 1—Horizontal cut and fill mining method used by United Verde

The sill floor of the stope is opened out at a height of 13 ft. above the level and is floored with 4x12-in. bottom sills and two layers of 2-in. plank. Waste raises are 6x11 ft. in section and are spaced to serve approximately 3,000 sq.ft. of stope area. They are placed close to the stope walls, as raises in the center weaken the back. The ore is mined in 7-ft. horizontal slices. It is broken down upon the flooring and shoveled upon the grizzly covering the chute. Each ore chute

orebody, and physical characteristics of ore and wall rocks. The relative importance of these methods varies, but the following indicates approximately comparative percentages mined at present.

Table I—Relative Percentage of Mining Methods Used at United Verde

Method	Per Cent of Total	Method	Per Cent of Total
1 Horizontal cut and fill	45	4 Shrinkage and fill	20
2 Inclined cut and fill	0	5 Glory hole	20
3 Square set and fill	12	6 Top slice	3
100			

Horizontal cut and fill and shrinkage and fill are the two most important underground mining methods. Square set and fill is used where these methods are not applicable and also in the mining of pillars and the finishing of horizontal cut and fill stopes. Incline cut and fill is used only occasionally. The horizontal cut and fill method has proved to be elastic and especially suitable under favorable conditions for mining the wide orebodies. Shrinkage stopping has proved best for the smaller individual ore masses. By both of these methods complete extraction, very little dilution by waste, and the use of comparatively small amounts of timber are obtained. The relatively hard nature of the ore has precluded caving and top slicing methods. The comparative amounts of timber by the several methods are, in board feet per ton: horizontal cut and fill, 5.4; incline cut and fill, 3.4; square set and fill, 14.5; shrinkage and fill, 3.7. The comparative amounts of explosive in pounds per ton are: horizontal cut and fill, 0.6; incline cut and fill, 0.62; square set and fill, 0.80; shrinkage, 0.60; glory hole, 0.20; average per ton ore extracted, 0.7.

Horizontal Cut and Fill Method—The level interval is 150 ft.; ventilation raises are 200 ft. apart and so placed as to be used for waste raises subsequently;

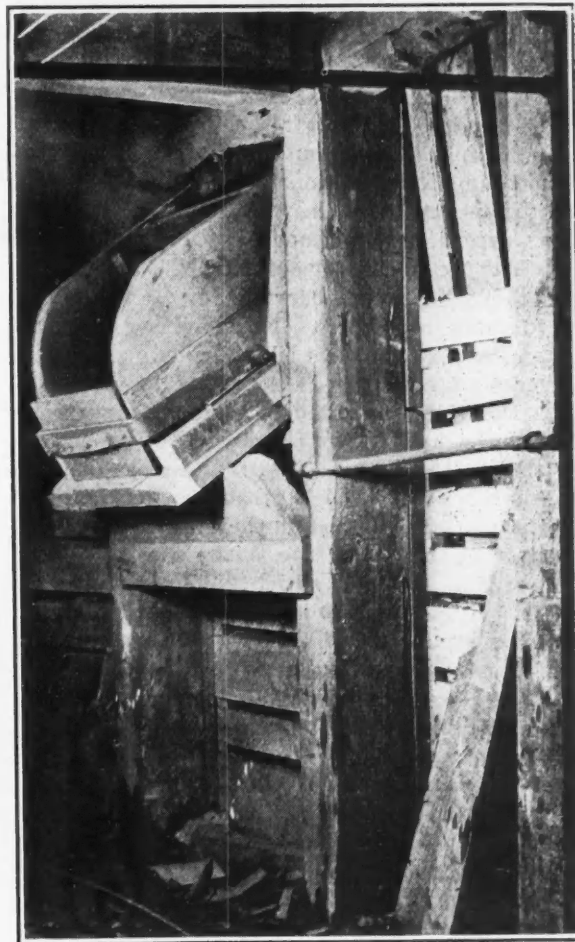


Fig. 2—How the ore chute is constructed

serves an area 22x15 ft., or 330 sq.ft. The construction of the ore chute is shown in Fig. 2. A second 7-ft. slice is broken down, using the pile of broken ore as a platform, and after the removal of the ore, waste is distributed to a height of 7 ft. and a temporary floor

is placed. The waste is distributed by 18-cu.ft. cars operated on portable track. The portable track is in 8-ft. sections of 16-lb. rail riveted to $\frac{3}{4}$ x4-in. steel plates. A slip joint held by a rail spike joins the sections. Portable curves of 9-ft. radius are used as well as portable switch sections. Loading chutes are provided on opposite sides of the waste chute.

The third slice is ready to be broken after filling. Successive slices are broken down, an equivalent thickness of filling being distributed for each slice. Temporary support is afforded by 7-ft. cribs or timber bulkheads which are placed on the broken ore as the slice advances. These are removed as shoveling advances and replaced by 14-ft. bulkheads resting on the shoveling floor, and these are in turn removed and replaced by 7-ft. bulkheads as the fill advances. In heavy ground long bulkheads are left standing and waste is filled in about them. In the massive sulphide orebody, the back will support itself over comparatively wide areas, but close study of structural planes is necessary and a considerable number of bulkheads are used to prevent any failure of the back.

Transverse ribs or pillars are left at intervals and these are continuous from level to level. They are mined out in finishing a level by square set and fill. Likewise the bringing up of a horizontal cut and fill stope to the level above is accomplished by square set and fill. To facilitate the mining of the pillars later, a vertical wall of lagging separates the fill from the pillar.

The foregoing, which gives the established practice, is now modified by opening out the sill floor at a level corresponding with the fourth floor of the stope. The main drifts are thus in the solid, and require no timbers except at chute mouths. Maintenance of timbers below the filled stope is thus avoided.

Miners do their own barring down and are responsible for safe conditions. No shoveling is permitted under the edge of the slice being drilled. A 20-ft. space in advance of the brow is roped off to establish safe areas. Drills are mounted on columns, and two rows of 8-ft. holes are drilled fan shaped from one set-up. Only sufficient powder is used to break the ground. The objective is to keep the back as firm as possible. Large boulders are drilled on the muck pile and blasted at noon or at the end of the shift. Smaller pieces are broken on the grizzlies, which have clear openings of 11x44 in. Bulldozing requires 30 per cent of the labor charge for breaking. The powder required is 27 per cent of the total required in stopes.

Drill footage in massive sulphide averages 50 ft., and approximately fifty-seven tons are broken per drill shift. In schist, the drill footage averages 70 ft., and seventy-five tons are broken per shift. No. 2 square-point shovels are used in mucking from the floors, and shovellers average ten to sixteen tons per shift. Cement buggies have been tried and discarded. Mechanical scraping to the chutes would appear to offer possibilities, as well as the distribution of the waste by the same method. The blocky, heavy nature of the ore and the short planks used for flooring are the principal obstacles to the use of this method.

The stopes are accessible through raises from above or by manways from below. Stopes greater in area than 10,000 sq.ft. are served by a hoist and cage which are installed in a manway. The sheaves are supported

by a four-post frame set on the cribbing of the manway. A compressed air hoist is used for this service. Mounted drill-column and Anaconda hoists are used in raises and for bringing supplies to the stopes.

Shrinkage stoping is restricted to smaller orebodies. As originally applied the stope was opened out above the drift timbers, loading chutes being constructed at intervals along the drift and the top of the drift being protected by a heavy flooring supported upon stringers. This construction requires the use of considerable timber for the starting of a stope. Eventually the drift was left untimbered except where necessary, and inclined chute raises are driven up from them, leaving a pillar of moderate thickness to protect the drift. An auxiliary drift in line with but 20 ft. above the main drift (Fig. 3) connects by a short crosscut to the top of the chute raise. On either side of the raise and parallel with the drift, short horizontal passages (10 ft.

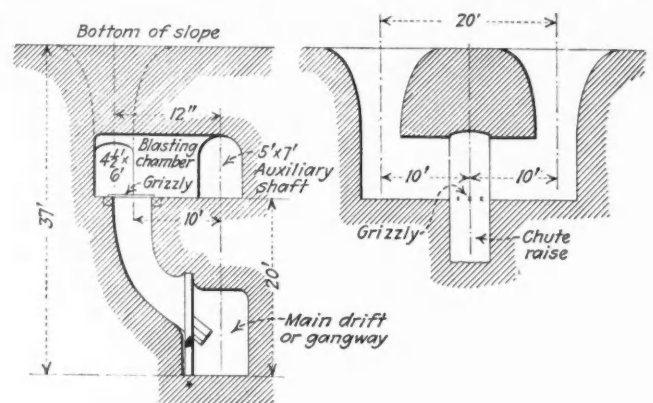


Fig. 3—Arrangement of gangway, chute raise, and blasting chamber in a shrinkage stope

center of crosscut to center of raise) are cut, and from them short raises connect with the stope which is opened out at this level. A grizzly is placed at the top of the chute raise and at the end of the crosscut. The end of the crosscut serves as a blasting chamber. The grizzly receives the broken ore from both sides through the short horizontal passages connecting with the raises to the stope. Chute raises are at 40-ft. intervals and the short raises into the stope at 20-ft. intervals. The floor of the stope is 37 ft. above the main drift. Manways are extended in pillars between the stopes and connect with the stope at 20-ft. intervals, and raises provide ventilation. After finishing and drawing a stope, it is floored and filled with waste.

Shrinkage stoping is used only in hard ground in massive sulphide areas, after carefully delimiting orebodies by diamond drilling. The method is lower in cost for timbering and waste filling and provides a large reserve of broken ore. As the sulphide ores break in large pieces the cost of drawing the ore from shrinkage stopes is greater than where grizzlies are used in the stopes. It is difficult to sort out waste. Most of the objections to shrinkage stoping are overcome by the horizontal cut and fill method. The saving in handling in the incline cut and fill method is offset by the higher cost of handling timber and steel and the difficulty of erecting bulkheads on an inclined surface. This method is used in small narrow stopes where the walls do not permit of shrinkage stoping.

Weak and heavy ground is stoped by the square set

method. It is used in the black schist stopes and in slabby ground in sulphide orebodies. At one time all ore was mined by this method, which involved an extreme fire risk, difficult supervision and ventilation, and high costs for labor and timber. R. E. Tally, the present manager, introduced the horizontal cut and fill method, and this method has proved to be peculiarly adapted to the conditions existing in the large orebodies, as well as economical in labor and supplies. The approximate labor ratios for the different methods are given in the Table II.

Table II—Approximate Labor Output in Stopes, Drifts and Raises

Method	Tons per Man-hour		Man-hours per Ton	
	Miners	All Men	Miners	All Men
Horizontal cut and fill.....	9.05	0.72	0.11	1.39
Incline cut and fill.....	5.90	0.51	0.17	1.96
Square set and fill.....	1.84	0.46	0.54	2.18
Shrinkage and fill.....	3.74	2.07	0.27	0.48
Glory hole.....	26.10	25.50	0.04	0.04
Drifts	Ore.....			
	Massive Sulphide.....	0.93	1.07	
	Schist.....	1.38	0.72	
	Waste.....	1.10	0.91	
Raises 6 by 10 ft.	Quartz porphyry	1.30	0.77	
	Ore.....			
	Massive Sulphide.....	0.56	1.79	
	Schist.....	0.81	1.23	
Fresh.....	0.66	1.51		
Altered.....	0.80	1.25		

Development is planned on the basis of 3,000 tons per day output. This requires 100 ft. in depth and 25,000 ft. of drifts and raises for exploration and development per year. The ratio for several years has been thirty-four tons of ore developed per foot of development work, or approximately 0.8 cu.ft. of development per ton of ore. (The volume-weight relations are: massive sulphide ore, 8.3; schist, 9.9, and porphyry, 11.5 cu.ft. per ton.) The stope areas of sill floors on four representative lower levels, not including material of less than 2.5 per cent copper content, are given in Table III.

Table III—Stope Areas on Certain Lower Levels

Stope Area, Sq.Ft.	Average Grade, per Cent Copper	Tons of Ore per Foot of Depth	Tons of Copper per Foot of Depth
38,400	5.22	4,266	222.7
46,700	8.01	5,495	440.1
102,760	8.01	12,089	968.3
58,280	6.77	6,856	464.2
Av... 61,535	7.28	7,176	523.8

The center of an orebody is intersected as far as practicable by the main drift. All new orebodies are developed by drifts and crosscuts or by diamond drilling followed by drifts and crosscuts. Diamond drilling is

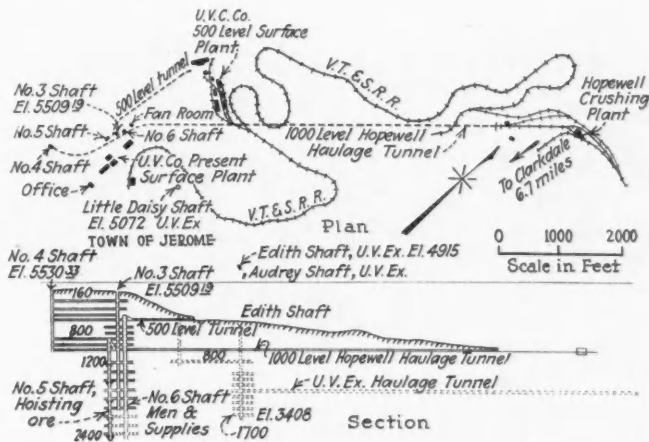
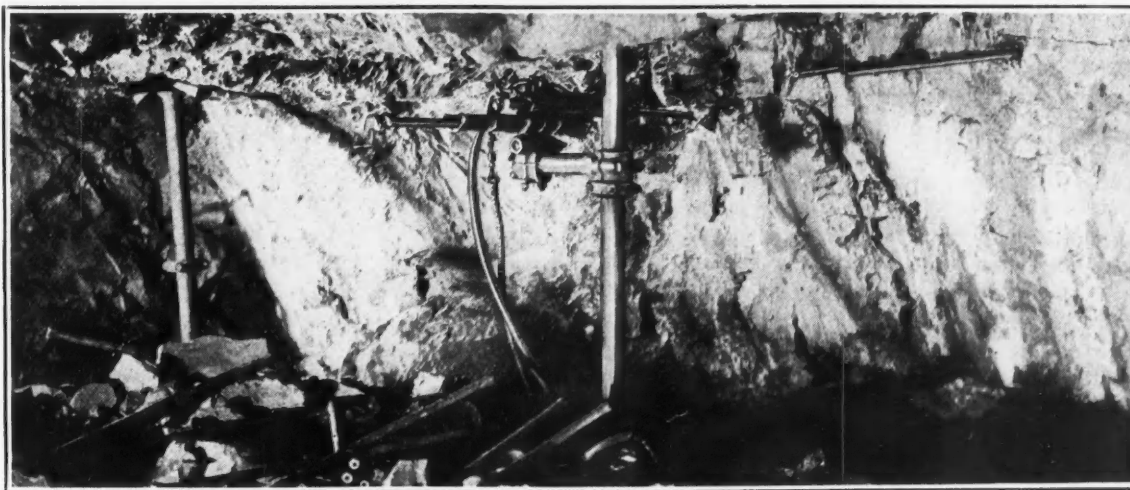


Fig. 4—Sketch showing location of United Verde's shafts and tunnels

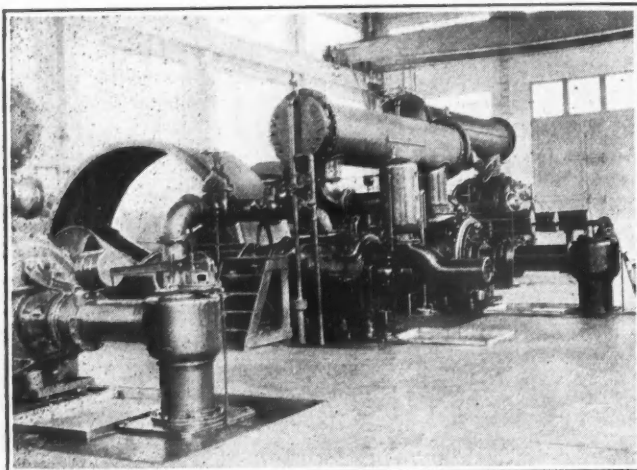
used also to obtain geological data. Subsequently massive sulphide orebodies are blocked out by numerous short holes. Experience has shown that diamond-drill cores give adequate information in massive sulphide orebodies but cannot be relied upon in schist areas. The diamond drill is therefore used to locate and determine the size of schist areas, but subsequent development is necessary to determine values. The hard ground results in high drifting costs, and as a consequence diamond drilling is in general use.

For short holes the ES bit (3/8-in. core) is generally used, but for holes over 1,000 ft. in depth, the E bit (1/2-in. core) is used on the first 700 ft. of hole and the ES bit completes the hole. The cost of drilling 3,533 ft. (monthly average, 589 ft.; wages of drill runner and bit setter, \$5.25 per shift and helper, \$4.25; first quality diamonds, \$77 per carat) was \$3.17 per foot (labor, \$1.32; supplies, 0.01; carbons, \$1.09; power, 0.43; repairs, 0.32).

Rock drilling is an important feature of the mining work, as the rocks and ore are hard. Drilling is under the supervision of one engineer, and the equipment and practice have been standardized as much as possible. For drifting, crosscutting, and stoping, the Leyner Ingersoll, 248, is used on a 3.5-in. vertical bar; the CC3-11 stoper, hand-rotated, is used in raises; Sullivan DP-33 and the Jackhammer for block holing, and the DP-33 and DCRW-430 in shaft sinking. Hollow round



Stope scene, showing drill mounting and position of holes



Compressors at 500 level adit

drill steel, 1.25 in. diameter, is used for the drifters and $\frac{3}{4}$ -in. quarter octagon, hollow, for the stopers and hand-held drills. At the time of my visit, more than 2,600 drill steels were required per day. The sharpening of the steel has been given special attention and a high standard has been set and attained. Bit-gage changes have been reduced from $\frac{1}{8}$ to $\frac{1}{16}$ in. The double taper cross bit is standard; the smallest bit is 1.5 in. diameter, and steel changes are restricted to 12 in.

Comparative drilling rates are given in the accompanying Table IV. As exemplifying the tightness of the ground the powder ratios are given in Table V.

Table IV—Comparative Drilling Rates, Inches per Minute

Rock	Single Taper $\frac{1}{4}$ -in. Change	Double Taper $\frac{1}{4}$ -in. Change	Double Taper $\frac{1}{8}$ -in. Change	Per Cent Increase in Drilling 3 Over 1
Massive sulphides.....	1.53	3.30	4.20	174
Jasper.....	2.65	3.75	5.20	96
Porphyry.....	5.10	5.48	7.88	54
Gage of starter, inches.	2 $\frac{1}{2}$	2 $\frac{1}{2}$	1 $\frac{1}{2}$	..

Table V—Pounds of Powder per Ton Broken

	Massive Sulphides	Schist	Quartz Porphyry
Drifting.....	8.80	8.90	13.1
Raising.....	8.00	5.90	9.7
Stoping.....	0.6	0.8	.....

The pyramid cut is used in drifting in massive sulphide and tough quartz porphyry. The bottom cut is used in schist and average ground. In raising, twelve to sixteen holes are required, and a draw cut (at the end of the section) is generally used. In ordinary ground one machine is used, and a shoveler assists in setting up. In ground requiring two shifts to drill a round, two machines are mounted on the same bar and one chuck tender is provided to carry steel and powder.

Two kinds of explosives are in use, 35 per cent and 50 per cent gelatin, the respective proportions being 37.5 and 62.5 per cent. For drifting, stoping, and raising, 8X blasting caps are used and for block holing 6X. A black-finished cotton-countered safety fuse is standard. A mechanical cutter and cap crimper is used in preparing the fuse, which work is done in a special room on the 500 level near the portal of the adit. A minimum of 800 fuses is cut and prepared by one man per hour. The prepared fuses are distributed in waterproof cans.

Each miner does his own blasting. No stemming is used. The last stick in the hole is usually the primer, the blasting cap being placed so as to point toward the

bottom of the hole. Tamping sticks 1 in. in diameter by 10 ft. in length are in general use. At one time a separate blasting crew was maintained and stemming was used. I am told that the use of stemming will be re-established eventually. Powder is stored in a concrete magazine contiguous to the Hopewell tunnel and 2,500 ft. from the portal. A two months' powder supply is maintained. On each level of the mine temporary storage is provided for by a small magazine.

The important parts of the mine surface plant are near the portal of the 500 level adit. Change house, compressor house, tool-sharpening and blacksmith shops, machine shop, timber-framing sheds, and store-houses are arranged in close co-ordination with the mine trackage system and the connecting spurs of the V. T. & S. R.R. The buildings are of brick and steel construction, well lighted, and with equipment systematically arranged. Excepting the timber-framing shop, all structures are fireproof.

The compressor equipment supplying 100-lb. air consists of three Ingersoll-Rand two-stage compressors of 1,500, 3,000, and 6,800 cu.ft. per minute capacity. The first two are belt-driven by 300- and 500-hp. motors respectively, and the third is direct-connected to a 1,163-hp. synchronous motor. The power requirement for air compressors is given in Table VI.

Table VI—Power Requirement of Air Compressors

Load per cent.....	Horsepower per 100 Cu.Ft. of Air per Minute Compressed to 100 lb.			
100.....	100	75	50	25
6,800 cu.ft. compressor.....	17.65	18.18	22.85	31.90
3,000 cu.ft. compressor.....	21.20	.....	27.90	.....
1,500 cu.ft. compressor.....	19.2	19.35	25.60	39.50

The power requirement for the mine in kilowatt-hours per ton is given in Table VII.

Table VII—Power Requirement per Ton of Ore

Service	Kw.-Hr. per Ton
Compressed air.....	3.18
Haulage.....	1.11
Hoisting.....	1.14
Pumping.....	0.24
Ventilation.....	2.83
Lighting.....	0.22
service Plant and Miscellaneous.....	0.49
	9.21

The machine-shop unit is equipped with heavy machine tools for railroad and mine work. The change house has locker equipment, showers, and lavatories for 1,400 men. In a part of the building are accommodations for time and check offices and separate quarters for foremen and shift bosses. The drill-sharpening



Mine plant at 500 level adit

shop is provided with six machine sharpeners and accessory equipment. Several repair shops are maintained at the bench represented by the 300 level, and light repairs to the open-pit equipment are made at this point.

The high-voltage power lines of the Arizona Power Co. serve two substations, one at the Hopewell tunnel and the other at the 500 level, with 44,000-volt current, stepped down to 2,300 volts. Direct current for underground haulage is supplied by two 500-kw., 250-volt motor generator sets installed at the No. 6 shaft station. Outside power circuits to substations are double and are supported on steel towers provided with lightning arresters and selective relays. Within the mine in dry places, ordinary 5,000-volt, varnished-cambric double-braid cable in iron conduit is used for 2,300-volt circuits on horizontal runs. For damp or wet places, three-conductor, varnished-cambric, lead-covered, band-steel armored, jute-covered cables are used on horizontal runs and are sectionalized by pot-heads placed at intervals in waterproof concrete or steel boxes. On vertical shaft runs steel-wire armored cables are used. These are provided with tight tiebands spaced 15 ft. apart to prevent the copper conductor, with its insulation, from slipping inside the armor. Shaft cables are suspended in fiber conduit set in the concrete walls of the shaft. Recessed concrete pull boxes are provided at main landings facing away from the shaft. From the bottom of these boxes the cables are suspended from the armor wires. The armor wires are cut, banded, and bent back 180 deg. and leaded into a socket. Under the socket a heavy split clamp is fastened on the cable over the armor. The socket rests on the clamp, which is supported by a steel sill in the bottom of the concrete pull box. The 2,300-volt cables are sectionalized by pot-heads placed in the pull boxes. A waterproof cover is fitted over the boxes.

HANDLING LABOR

A stable and efficient operating force has been developed by a carefully planned bonus system. The basis of this is thorough supervision and a participation of the men and the company on a 50-50 basis for all improvement over an established standard based on the ruling day's pay. The system applies to most of the work, such as raising, drifting, crosscutting, and stoping. It is being extended, after five years' growth, to all of the departments. For miners the bonus is figured on the advance made in footage per machine shift over the established standard; for shovelers in stopes, the increase in the number of cars loaded per shift, and in development the increase in daily advance per machine shift. Base rates are established by careful study of conditions and performance. One engineer is in charge of the system, and he is permitted to increase a bonus rate only where the ground has proved to be harder than anticipated. As an example, during one month the bonus payments amounted to \$17,307.62, or \$0.649 per shift worked on bonus and \$0.469 per shift for all employees, of whom 72.4 per cent worked under the bonus system.

Table VIII gives a comparison of stoping costs in typical massive sulphide stopes. The improvement in costs is not to be wholly ascribed to the bonus system, but is largely due to better planning of the work.

The general effect of the bonus system has been the retention of higher-grade men and less discontent,

Table VIII—Comparison of Bonus Performance in Stopes

	Wage	Bonus	Total Labor	Stand-ard Tons	Tons per Shift	Miner's Cost per Ton
1918.....	\$5.46	.....	\$5.46	.....	21.0	\$0.26
In Sept., 1923, Stope						
1650-10-0 No. 4.....	\$5.45	\$1.81	\$7.26	34.12	53.3	\$0.136
1800-10-0 No. 5.....	5.45	2.75	8.20	41.75	80.1	0.097
1500-10-K.....	5.45	4.55	10.00	36.50	95.2	0.095

resulting in smaller labor turnover. Supervision has cost less and average efficiency has been increased. The increased output per man per shift has reduced overhead unit costs. The analyzing of operating conditions, costs, and methods has resulted in general improvement.

The operating organization under Robert E. Tally, general manager, is divided into three divisions—mine, open pit, and mechanical and electrical departments. W. V. De Camp is general superintendent; W. W. Lynch, assistant superintendent; J. C. Perkins, steam-shovel superintendent; C. E. Mills, chief engineer; E. W. Fredell, electrical engineer; J. E. Ryan, master mechanic; L. E. Reber, Jr., geologist; and A. S. Bilderback, safety engineer. A corps of younger engineers is in charge of details. A plan for training and advancing the younger members of the staff, including foremen and shift bosses, is being experimentally tried out.

A close study of the United Verde is stimulating to any engineer. Granted that the mine has a dependable supply of good-grade ore, nevertheless the enterprise as a whole has been well proportioned and exhibits the vitality that must needs be founded upon intelligent and conscientious direction. Soundness is exemplified by the attainment of low costs and at the same time by the material encouragement of the miner and worker.

In the preparation of the foregoing articles, I have selected certain information from a summary by H. De Witt Smith, recently general superintendent, which appeared in the *Transactions* of the American Institute of Mining and Metallurgical Engineers, and also from a paper by J. B. Johnson and C. L. Gerhardt, published in the *Electrical World*. I visited the mine and surface plant and gladly acknowledge the courtesy of Robert E. Tally, general manager, and his assistants.

French Metallurgical Production in 1924

French iron-ore production in 1924 exceeded 26,000,000 metric tons, which was 3,000,000 tons in excess of the 1923 output. Production in 1913 did not reach 10,000,000 tons, but at that time part of the Lorraine deposits were in German hands.

The French metallurgical industry has undergone a considerable extension, though handicapped throughout the year by a scarcity of coke by reason of slack delivery by Germany on one hand and insufficient imports by reason of the world situation and foreign exchange value. Production, in detail, was as follows: Pig iron, 7,500,000 tons, an increase over 1923 production of 1,500,000 tons; steel, 6,500,000 tons, an increase over the 1923 output of 200,000 tons. Blast furnaces in operation (average) numbered 130, an increase over 1923 of 10. Exports of pig iron and steel for the first nine months of 1924 were valued at 1,371,000,000 francs, an increase over the 1923 figures of 207,000,000 francs.

French iron and steel plants are estimated to have a production of 18,000,000 tons, of which the home consumption is about one-quarter. The chief problem which concerns the industry is the sale and distribution of the remainder abroad.

Marketing Lump and Ground Silica

*A Common Mineral Which Is Exceedingly Useful
in Many Industries*

By Felix Edgar Wormser

Assistant Editor

SILICA (SiO_2) occurs in a great number of different forms. This article will attempt to cover only those varieties that have not received extended treatment in other papers¹ of this series—i.e., vein quartz, quartzose rocks, crushed to lump or powdered form, and flint. Although silica is of common occurrence in nature, it has certain qualities immensely valuable to commerce. Hard, tough, resistant to acids, refractory and often transparent, it possesses physical properties of great usefulness. Its chemical affinity for alkalis and other compounds is utilized in the manufacture of glass and the fluxing of ores.

In massive form silica may be quarried and used as a packing in acid towers of chemical works; it may be fashioned into grindstones, or it may be shipped to smelters to be used as a flux. Acid towers are generally packed with quartz broken to uniform sizes—fist size is preferable. When used as a flux in smelting the silica is customarily quarried by the smelting company itself. I do not know of an instance of barren silica being purchased from producers directly by smelters. Often sufficient siliceous matter is contained in the ores to be smelted to obviate the necessity of quarrying barren quartz for the purpose. It is desirable to procure a quartzose rock as high in silica as possible—upward of 80 per cent SiO_2 .

Lump silica obtained from a pure quartzite may also be used in the manufacture of ferrosilicon in the electric furnace or a siliceous iron ore substituted. Ferrosilicon is one of the commonest ferro-alloys used in steel manufacture. The silica used should be free from objectionable impurities such as lime, phosphorus, and arsenic, which make the production of ferrosilicon difficult, yielding an inferior product, and should run over 97 per cent SiO_2 . Dense quartzite seems to be better suited as a raw material than sandstone for ferrosilicon production despite a possible higher SiO_2 content in the sandstone.

QUARTZ IN SILICA BRICK MANUFACTURE

The highly refractory nature of silica is taken advantage of in the manufacture of the silica brick widely used in metallurgical work. The rock from which the brick is produced may be known as ganister. It contains a natural bonding material in the form of refractory clay, which the ordinary quartzite does not possess—sometimes as much as 10 per cent. The rock is generally ground coarsely—to an 8 or 10 mesh—before being used, and is shipped in bulk.

Ganister is defined by the U. S. Geological Survey as a highly refractory siliceous sedimentary rock used for furnace linings; by Raymond, as a mixture of ground quartz and fireclay used in lining Bessemer converters. The term has a loose application and can refer to either the raw product as it is quarried or mined, or to the finished refractory brick made from the raw material

ready for the furnace. It is more generally used to designate the raw material. The Survey states that the requisite qualities for ganister are a content of 98 per cent silica and not more than $1\frac{1}{2}$ per cent of alumina, and that the material should be of such a nature as to be crushed into fine angular fragments. The U. S. Bureau of Standards recommends a content of approximately 97 per cent silica and not much over 0.4 per cent alkalis. Loose sand and sandstone reduced to the original rounded grains on crushing yield a weaker brick.

The ganister sold in the United States in 1922, the last year for which figures are available, was 724,860 tons, compared with 404,650 tons for 1921.

Pennsylvania is the leading ganister-producing state and accounts for about three-quarters of the domestic output. Wisconsin, Colorado, and Ohio are other producing states of lesser importance, and Illinois, South Dakota, Tennessee, Alabama, Minnesota, North Carolina, Maryland, and New York produce the material in small amounts.

One-half the ganister used in the United States is derived from the Tuscarora or Medina formation from Blair and Huntington counties, Pa. This formation consists of two distinct divisions underlain by the Juniata or Oneida formation. The ganister floes, as they are called, or fragments of ganister lying on steep hillsides, are formed by the unequal weathering of the components of the white and red formations of the Medina and Oneida sandstones. These floes, talus slopes, furnish the material used in the manufacture of silica brick, although the ganister may also be quarried from the solid formation. The white formation contains more than 99 per cent silica and the red about 97.8 per cent. Ganister resources are large, and the supply is not limited by artificial combination.

According to Cole² a quartzite suitable for silica-brick manufacture when ground should have grains that are splintery, sharp, heterogeneous as to form and size, and slightly translucent. It should analyze approximately 97.5 per cent SiO_2 , 1 to $1\frac{1}{2}$ per cent Al_2O_3 , and 0.75 per cent other impurities, and when molded into brick and fired should expand and swell without perceptible cracking.

Flint is a cryptocrystalline variety of quartz of vitreous luster and no visible structure. In the form of pebbles it is used as a grinding medium in pebble mills. Nearly all the pebbles so used are imported from Denmark or France. They are graded to size as follows:³

Sizes of Danish Flint Pebbles

Size No.	Range in Inches	Size No.	Range in Inches
1	1 to $1\frac{1}{2}$	5	$4\frac{1}{2}$ to 5 $\frac{1}{2}$
2	$1\frac{1}{2}$ to 2 $\frac{1}{2}$	6	5 $\frac{1}{2}$ to 6 $\frac{1}{2}$
3	2 $\frac{1}{2}$ to 3 $\frac{1}{2}$	7	6 $\frac{1}{2}$ to 7 $\frac{1}{2}$
4	3 $\frac{1}{2}$ to 4 $\frac{1}{2}$		

Flint pebbles make an excellent grinding material where it is desired to use a medium that will not discolor

¹"Marketing of Diatomaceous Earth." By Norris Goodwin. *Engineering and Mining Journal-Press*, June 30, 1923.
²"Marketing of Tripoli." By G. V. B. Levings. *Engineering and Mining Journal-Press*, Oct. 13, 1923.

³"Silica in Canada." By L. Heber Cole. Department of Mines (Canada).

⁴Data from Frank L. Wilson, New York City.

the material ground. They are worth about \$16 per ton, c.i.f., New York, and are shipped as ballast at a low rate of freight to the United States.

Natural silica sand is used mainly in glass manufacture, as a molding or foundry sand, in building materials, and in sand blasting. Sand for glassware should be as pure as it is possible to find and clean it. Coloring substances such as iron, magnesia, various alkalis, and alumina are harmful and objectionable in the manufacture of high-grade glass. Iron oxide is especially undesirable; even a small amount may make the sand unfit for use. The limits allowable in common practice and specifications are given as follows by Cole:

	Per Cent Fe ₂ O ₃
Flint glass and soda lime glass.....	0.02 to 0.05
Plate glass.....	0.10 to 0.20
Bottles and window glass.....	0.20 to 0.35
Dark bottles.....	0.50 to 0.65

When the iron oxide content is not above 0.20 per cent, the green color it imparts can be neutralized by a decolorizer such as manganese, cobalt, selenium, and nickel. Alumina decreases the transparency of the glass and makes the batch difficult to melt. For the best grades of flint glass the Al₂O₃ content should not run over 0.1 per cent; for plate or window glass not over 0.6 per cent. The presence of lime is not harmful, but glass makers prefer to add it as required and to use a lime-free sand. Magnesia raises the melting point of the batch, and hence is undesirable. Organic matter can generally be removed by washing. Glass sands will average over 99 per cent silica.

CHARACTER OF SILICA GRAINS AN IMPORTANT FACTOR

Uniformity in grain size is desirable for greater ease in melting. A tentative specification states that all material should pass a 14-mesh screen and 90 per cent be retained on 100 mesh with 65 per cent between 20 and 65 mesh. Either rounded or angular shaped grains may be used.

Silica sand is also used in the manufacture of carborundum. It must be an exceptionally pure material—99.5 per cent is preferable and not less than 99.25. It should be fairly uniform in texture and be graded between 20 and 100 mesh.

Foundry sand is a silica sand to which some bonding material has been added. It must be highly refractory, have excellent bonding power, and still porous enough to permit the escape of the gases generated in casting metals. The bond used may be a fireclay or some organic substance. The best foundry sand has grains that are neither too angular to make an excessively coherent mold nor too round to make a mold that will not resist deformation when the metal is poured. Co-ordination of the proper bond and sand is necessary to furnish the best foundry sand. Grain size used depends upon the size of the casting to be made. Tentative specifications for a satisfactory steel foundry sand, according to Cole, would have a silica content of 97 per cent or more and would consist of well-rounded grains graded between 20 and 100 mesh having an average fineness of 35 to 48 mesh.

Crushed silica may be used for lining furnaces, converters, and other smelting apparatus.

Water-clear quartz crystals are now used to manufacture clear fused quartz. The material demanded must be the very highest quality. According to Berry⁴,

who has been making experiments on the commercial production of fused quartz for the General Electric Co., the rock crystal used is water clear and contains less than 0.2 per cent impurities. The surfaces are often incrustated with iron oxides and other foreign matter, and the crystal itself can be seen to contain clusters of small bubbles. The crystals are washed in acids, broken up, and the unsuitable pieces discarded. Hess states⁵ that for those uses in which it is not necessary to have a transparent glass, pure quartz sand furnishes a good raw material. Berry emphasizes the fact that it is difficult to make a high quality clear fused quartz from the best sand. For transparent glass only the purest quartz in large pieces can be used, so that the difference in price of quartz free from bubbles and that containing comparatively few of them may appear disproportionately large. The quartz used is the best Brazilian pebble. Although commercial production has not yet begun, the field for the use of clear fused quartz seems to be a large one.

Dr. Berry points out that fused quartz can be used up to 1,000 deg. C. without injury, that its coefficient of expansion is so low, 58×10^{-6} , or about one-seventeenth that of platinum, as to make it almost negligible, and that it will transmit light rays even into the extreme ultra-violet with very little absorption. The small probability of fracture under sudden changes of temperature makes it especially desirable for many uses. It is possible to heat a tube of clear fused quartz $\frac{1}{2}$ in. in diameter to melting point and plunge it into ice-cold water without fracturing. Where it is used as a mirror in reflecting telescopes this small expansion and contraction with change in temperature causes almost no distortion of the image. Clear fused quartz is also valuable in medical work, as it is the only material that can be obtained in quantity that is transparent to those rays in the ultra-violet end of the spectrum important in the treatment of various afflictions.

PULVERIZED SILICA HAS NUMEROUS USES

Powdered silica has a moderate industrial application. It may be prepared from flint, quartzite, or what is known as amorphous or residual silica. The principal source of production is the Middle West, in Illinois. It is used mainly in the manufacture of paints, pottery, soaps, polishes, wood fillers, tooth powders, phonograph records, rubber goods, and in dusting foundry molds and roofing papers. Silica used as a paint filler has the advantage of being impervious to the action of the elements; the sharp particles of silica help the paint adhere to the surface coated. It may be used in proportions up to 50 per cent in paint. The finer the silica is crushed the better paint filler it makes. Some producers furnish a water-floated or bolted silica, running as fine as 45 mesh. It should be pure white in color.

One producer of ground silica in Illinois states that his output will analyze 99½ per cent SiO₂ with slight traces of alumina and iron oxide—an exceptionally pure material. His standard meshes of production are 250, 350, and 450 mesh, which sell for \$20, \$25, and \$31 per ton, respectively, f.o.b. mines. Shipments are made to consumers in burlap bags of various sizes, and also in barrels, or they may be made in bulk to those companies desiring coarse grades of silica. It is claimed for this particular brand that it can be ground finer than ordinary silica sand or crystal quartz.

⁴"Clear Fused Quartz." By E. R. Berry. *Chemical and Metallurgical Engineering*, May 5, 1924.

⁵"Silica in 1922." By Frank J. Katz, U. S. Geological Survey.

Silica for use in pottery manufacture need not be ground so fine as for paints. The content of SiO_2 is also more important, since its chemical reaction is brought into play. There should be no discoloring agent, such as iron oxide, present in any amount that would injure the pottery—not over 0.50 per cent. Silica diminishes the shrinkage in drying and furnishes rigidity in firing. It should be ground to pass a 140-mesh screen. Powdered silica may also be used as a glaze on white and other ware.

The prices of all silica products sold in raw form fluctuate slowly. Owing to the abundance of the mineral and the ease with which it may be produced prices are also usually low. Each user has his own ideas as to the material best suited for his especial requirement, so that no general specifications are to be found in the trades. Purchases are customarily made on sample. The purchaser likes to be assured that he can count not only upon one order equal in quality to sample but

upon a steady supply of the identical grade. As in most non-metallic mineral production, uniformity of product is highly desirable but not always attained.

Silica Sold for Pottery, Paints, Fillers, Polishers, Abrasives, and Other Uses in the United States, 1920-1922 (a)

Material	1920		1921		1922	
	Short Tons	Value	Short Tons	Value	Short Tons	Value
Quartz (vein quartz, pegmatite, and quartzite).....	68,190	\$320,350	11,252	\$84,957	10,653	\$101,347
Sand and sandstone (a).....	158,395	1,183,014	105,887	802,450	163,295	1,061,057

(a) Includes only finely ground material. Figures probably incomplete.

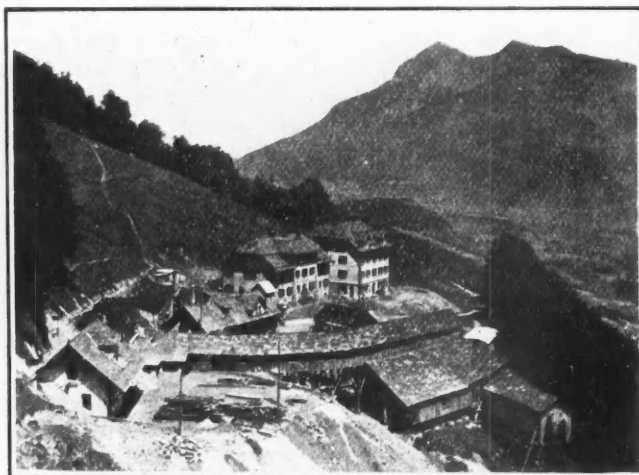
Quartz Sold in the United States, 1918-1922 (b)

Year	Crude		Ground		Total	
	Short Tons	Value	Short Tons	Value	Short Tons	Value
1918.....	61,008	\$121,888	10,732	\$137,442	71,740	\$259,330
1919.....	51,774	135,187	11,558	238,384	63,332	373,571
1920.....	59,423	142,397	8,767	177,953	68,190	320,350
1921.....	8,570	39,660	2,682	45,297	11,252	84,957
1922.....	5,085	23,093	5,568	78,254	10,653	101,347

(b) U. S. Geological Survey.

The Gonzen Iron Mines

THE Gonzen is the most conspicuous mountain formation in the district of Sargans, in Switzerland. With its tremendous rocky peak it stands like a guardian at the barrier of the two valleys, those of the Rhine and Seez. On its slopes, iron ore has been mined as far back



General view of the plant at the Gonzen mines

as in Roman times, a fact substantiated by diggings made in 1891 which brought to daylight some crude and primitive melting furnaces, parts of crucibles and tools mixed with all kinds of bronze objects, as well as the further fact that on the southeastern part of the Gonzen mountain, between Sargans and Trübbach, the largest Roman settlement in the Canton of St. Gall has since been discovered. The ore varies in the different pits, but consists of hematite, magnetite, and manganese.

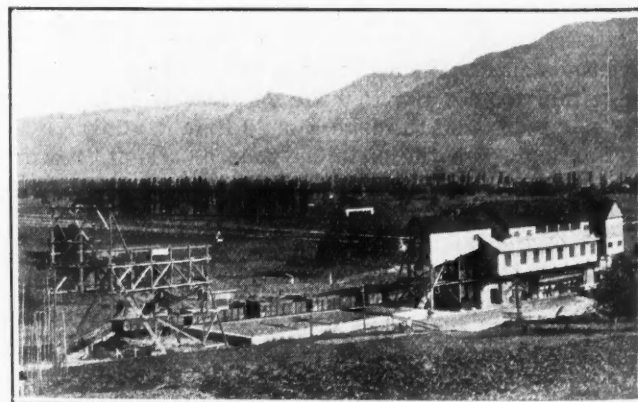
The first authentic reports on the mine appeared in the year 1050, at which time the iron-ore deposits of the Gonzen were owned by the princely chapters of Chur and Pfaefers. In 1550 there existed two melting furnaces, and the owners of the mine were allowed, by special feudal letters, "to cut wood at discretion whenever needed for the operation of the furnaces." In 1824 a new melting furnace was erected, and operations were carried on uninterruptedly from 1825 to 1868.

In 1868, the furnace was blown out. High coal and low iron prices compelled the proprietors to shut down.

The Gonzen iron could no longer compete with the English, Swedish, Belgian, and German iron, chiefly also on account of the steadily increasing railway facilities. It must be added that iron could be imported duty free at those times in Switzerland. Work was later resumed, but in 1876 the mines had to shut down again.

The mines are now worked by the Gonzen Iron Mines, Ltd., capitalized at 3,500,000 Swiss francs. About forty rock drills are in use. The ore is hauled from the mine in trains of ten one-ton cars by locomotives. These trains deliver the ore to a wire-rope tramway 6,075 ft. long with a drop of 1,620 ft., which carries it to the terminus in the valley near the station of Sargans, where, after passing over a picking belt to remove pyrite and chalk, it goes to railroad cars. Shipment is made chiefly to Lorraine, the Rhine and the Ruhr districts, and lately to Upper Silesia.

In the annual report of the Gonzen mines for 1923, it is stated that the exports of iron ore increased from 46,870 tons in 1922 to 57,610 tons in 1924. At present the company is making extensive geophysical examinations to determine the extent of the Gonzen ore deposits, which, according to all appearances, will lead to very



Unloading station of aerial tramway, near Sargans

interesting results. The problem of treating the ore is being studied. The report adds that during 1924 the company suffered largely from the unsettled political conditions in Germany, but that the final result would probably not fall short of that of 1923.

Recovering Zircon from a Zirconiferous Pegmatite

Tests Indicate a Valuable Product May Be Obtained from Wisconsin Deposits

By R. C. Gosreau
Metallurgical Engineer



R. C. Gosreau

ZIRCON is found in a number of widely separated places throughout the earth's crust. It is a silicate of zirconium, $ZrSiO_4$. Zircon deposits of a high purity are known to occur in India, Ceylon, Canada, United States, and in South America. In the United States, deposits of varying extent and value have been reported from North Carolina, Virginia, Colorado, Florida, Washington, Connecticut, and

Wisconsin. Of these, apparently the least known is the Wisconsin occurrence. Of the deposits in the United States, only one has been commercially developed, that at San Pablo Beach, in Florida.

The Florida deposit consists of a beach sand, in which the zircon is associated with ilmenite. The zircon sand is recovered by milling, and the ilmenite and the zircon are both sought-after products from this treatment. The zircon sand is a white, high-grade product running 99 per cent zirconium silicate. The Wisconsin deposit is of less known value and extent. The mineral from this deposit was the subject of the treatment described in this paper.

THE WISCONSIN ZIRCON PEGMATITE

The Wisconsin occurrence of zircon pegmatite is situated in north-central Wisconsin, just outside of the drift area, and in igneous rocks. It is in Marathon County, about 11 miles from the city of Wausau. The zircon mineral, and its associated minerals and rock structures, crystalline shape, and habits, are described by Weidman, from whose report the following descriptive data are taken. The general geology of the district consists of igneous rocks of diorite, with syenite and pegmatite veins, more or less vertical, intruding the diorite rock masses. These veins are of varying thickness, not definitely known. The pegmatite is coarsely crystalline, a characteristic of these pegmatites. Several varieties of the syenite occur, as well as several mineral phases of the pegmatite. The quartz-pegmatite is composed of quartz and feldspar, and it is the quartz-pegmatite phase that carries the zircon. Other associated minerals are the oxides of cerium, thorium, tantalum, columbium, and yttrium. The syenite carries some small crystals of zircon, of purely mineralogical interest. The diorite does not carry any zircon, according to surface examinations.

The system of pegmatite dikes or veins apparently has a width on the outcrop of about 1,300 ft., and the

strike was followed for about 2,000 ft. The strike of the outcropping pegmatite veins is north-west south-east, but no data as to the probable dip are at this time available.

On the surface the pegmatite is much weathered, forming a residual soil from six inches to three feet thick, in which zircon crystals are found plentifully. Considerable float, in boulders as large as ten and fifteen inches across, covers the area, these having been thrown in huge piles, so that the land could be farmed. These rock piles are from 75 to 100 ft. long, 30 to 40 ft. wide, and about 15 ft. high. The boulders furnished the supply of zircon for the milling and chemical treatment of the pegmatite to be described.

An analysis of the aluminous-zircon mineral, given by Weidman, follows:

Table I—Typical Analyses

	1	2	3
SiO ₂	28.87	30.89	31.01
ZrO ₂	57.79	60.89	62.12
Al ₂ O ₃	7.80	5.11	4.28
Fe ₂ O ₃	4.47	1.54	1.21
H ₂ O (red heat).....	1.61	1.41	1.76
H ₂ O (105 deg. C.).....	0.43	0.56	0.24
Sp. Gr.....	4.28	4.30	4.65
Color.....	Reddish Brown	Reddish Brown	Pale Yellow
Occurrence.....	Coarse Pegmatite	Fine Pegmatite	.....

This zircon is high in alumina, accounting for the lower content of ZrO₂, and giving an average oxide content of only 60.3 per cent, against 67.1 per cent for pure mineral.

The apparent quantity of rock available and the fairly high purity of the mineral suggested that mining and concentrating into a product of sufficient richness for commercial uses might under favorable conditions be profitable.

A lot of 3,100 lb. of raw rock was crushed through a jaw crusher to ½-in. and sampled carefully. The analysis showed 15.9 per cent of ZrO₂ and 26.4 per cent of ZrSiO₄. The ½-in. rock was then ground sufficiently fine to release the zircon from the quartz-feldspar matrix, a minus-35 and plus-65-mesh product being desired, though the crushing and grinding equipment was not controllable to this degree of accuracy.

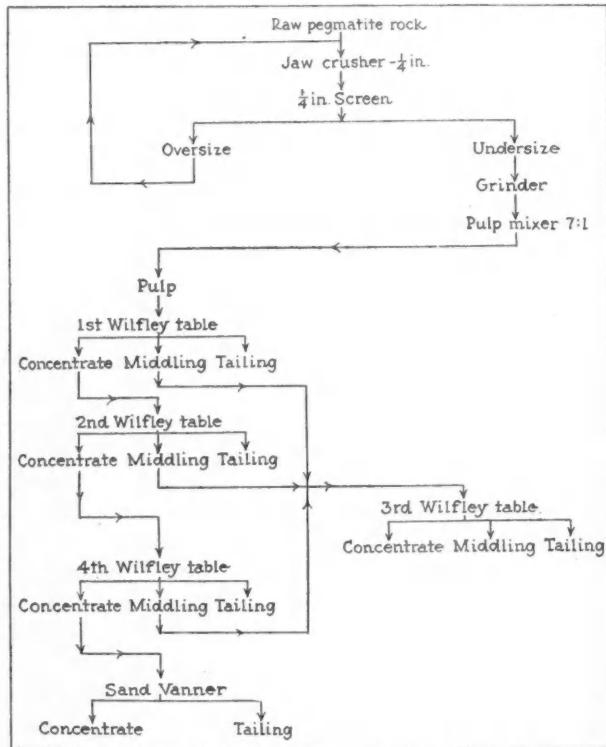
Table II—Screen Analysis of the Ground Rock

Mesh	Tyler Standard Screens			
	Per Cent	Lb.	Per Cent ZrO ₂	Per Cent ZrSiO ₄
+ 28	25.0	775	15.30	25.40
+ 35	25.0	775	14.43	24.00
+ 48	12.5	387	17.17	28.50
+ 65	12.5	387	16.81	27.90
+ 100	12.5	388	18.51	30.70
+ 200	9.4		291 93	14.25
-200	3.0			

Water was added to make a 7 to 1 pulp, which was fed slowly to a Wilfley table, using a slight inclination and a long stroke, with plenty of wash water.

Table III gives the results of the test runs. The silicate was calculated on a basis of 60.3 per cent oxide in the mineral, and no deduction was made for the alumina content, which was constant. Although the mineral is not pure zircon, the alumina content is not

¹Weidman: Bulletin 16, "Geology of North Central Wisconsin."



Flow sheet of test run

thought prejudicial to its ultimate use. I have attempted to use an aluminate bond and a zirconate bond for zircon, and the natural alumina content may have considerable value.

Concentration ratios: vanner concentrate, 12.5 to 1; vanner tailing, 12.2 to 1.

A pure concentrate rather than high recovery was here sought. Results should be better in a commercial mill. The products containing more than 30 per cent ZrO_2 seem to be suitable for a refractory material, especially the vanner products.

The specific gravities of the minerals involved are: Zircon, 4.0 to 4.7; quartz, 2.3 to 2.7; feldspar, 2.5 to 2.6.

The two vanner products were combined for the chemical treatment. This product averaged 51.1 per cent ZrO_2 , thus being 84.8 per cent pure mineral. Considerable iron was also present, which was removed by chemical treatment, to make the following product:

	Per Cent		Per Cent	
ZrO_2	57.34	Al_2O_3 (free).....	0.65	
$ZrSiO_4$	95.00	SiO_2 (free).....	4.80	
Fe_2O_3	0.30			

Table III—Products of Test Runs

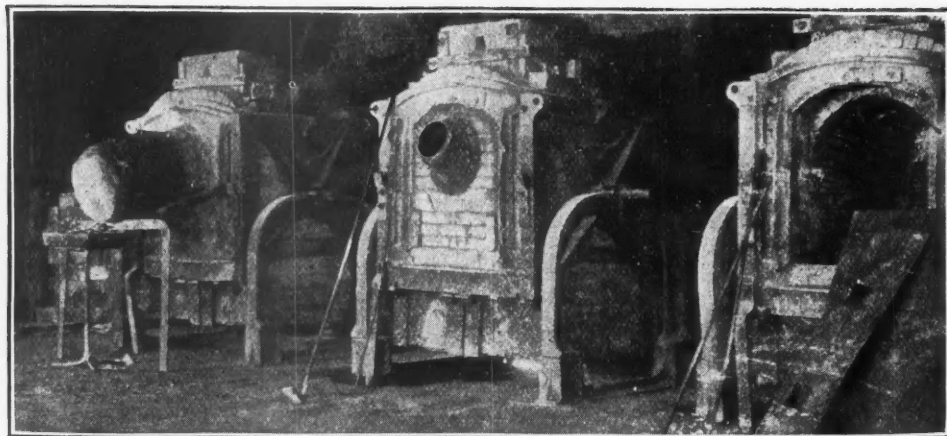
Product	Screen Analysis							Per Cent		
	+28	+35	+48	+65	+100	+200	-200	ZrO_2	$ZrSiO_4$	Recovery
Vanner Concentrate	1.5	4.7	6.25	12.5	31.2	37.5	6.25	52.89	87.85	26.6
Vanner Tailing	12.5	25.0	25.0	18.7	12.5	4.7	1.5	49.36	81.90	25.4
Table Tailing	26.8	26.0	11.8	12.2	11.5	8.2	3.0	12.40	20.60	
1st. Table Concentrate								29.30	48.60	
1st. Table Tailing								13.67	22.65	
2nd. Table Concentrate								37.85	62.80	
2nd. Table Middling								13.15	21.80	
2nd. Table Tailing								11.05	18.30	
3rd. Table Concentrate								30.95	51.35	
3rd. Table Tailing								8.30	13.75	
4th. Table Concentrate								43.55	72.25	
4th. Table Tailing								29.65	49.20	
Light streak on table above concentrate streak								48.00	79.50	

Concentration ratios: Vanner concentrate, 12.5 to 1; vanner tailing, 12.2 to 1.

This final chemically treated product was dried and ground to 120 mesh. When ground, it had a dull white color. Both the final product and the concentration products from this treatment of the raw pegmatite were studied, tested, and found suitable for the following uses:

1. Brick for iron, steel and glass furnace linings.
2. Crucibles, muffles, combustion tubes, insulating tubes.
3. Surface cement for covering other refractory brick, linings, and roofs.
4. Enamel pigment, for iron and steel covering enamels.
5. Added to enamelware, silica and stoneware, to increase the elasticity and the strength.
6. To prevent devitrification in enameling.
7. Monolithic lining material for walls and hearths, and patch material for electric furnaces making steel, iron, ferro-alloys, and brass.
8. Fused in the electric arc and reground, a refractory of high quality would result.
9. A base for making pure white zirconium oxide.
10. An ingredient in magnesia and alumina refractories.

It is not affected by acid or basic slags provided sodium and potassium oxides are absent.



Furnaces for retorting zinc crusts from lead refining

Mineralization in the Vicinity of Randsburg, California*

A Study of the Tungsten, Gold, and Silver Deposits of This Interesting Area

By Carlton D. Hulin

Consulting Geologist, Alameda, California

PERHAPS no mining region of the West has had a more varied or fortunate career than that surrounding Randsburg, in San Bernardino and Kern counties, Calif. First known as a gold camp, gold was the chief metallic product of Randsburg from its discovery in 1895 until high production costs resulting from the World War forced most of the gold properties to shut down. At the same time the war created a demand for tungsten, which resulted in feverish exploitation of the scheelite deposits known to exist near Atolia. After the war, when costs still prohibited the operation of most of the gold mines, and when the market for tungsten had practically ceased to exist, the Pittman Act was passed, guaranteeing the price of domestic silver at \$1 an ounce. It was at this time that the bonanza silver deposits were discovered.

Accurate statistics concerning the metal production of the region are practically impossible to obtain. It seems certain, however, that the gross value of the metal produced between 1895 and 1924 has exceeded \$35,000,000. Of this amount nearly \$30,000,000 has been taken from three properties—namely, the Yellow Aster mine (gold), the California Rand Silver mine, and the properties of the Atolia Mining Co. (tungsten).

Of the total value of metals produced, a little more than \$10,000,000 may be credited to the silver deposits, from \$10,000,000 to \$12,000,000 to tungsten, and the balance of from \$12,000,000 to \$15,000,000 to the gold properties.

Despite the value of metals produced, but little geological work had been done in the Randsburg quadrangle before 1923, the report of F. L. Hess, of the U. S. Geological Survey, published in 1910, comprising practically the only data available to the public. Other articles of a more popular nature which have appeared in current publications from time to time have added comparatively little to existing knowledge of the geology of the region.

TWO GROUPS OF ROCKS

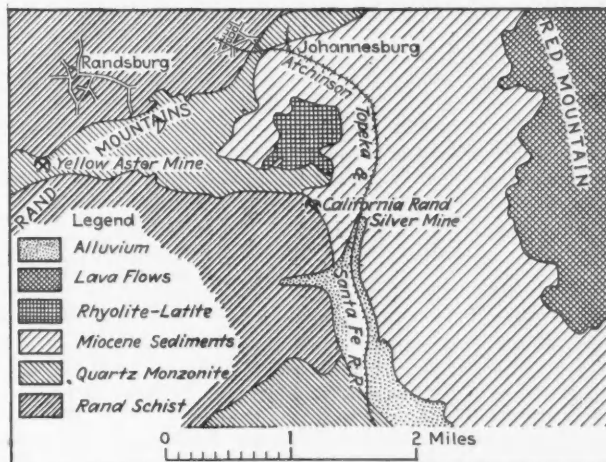
The rocks exposed in the vicinity of Randsburg may be broadly divided into two groups, a "basement complex" composed of Archæan schists intruded by Mesozoic quartz monzonite, and a "superjacent series" consisting of continental Miocene sediments which are intruded by acidic and igneous rocks and overlain by andesitic lava flows.

The schists, to which the name of Rand schist has been given, consist predominantly of mica-albite schists, with lesser quantities of amphibole schists, quartzites, and limestones. The mica-albite schists, quartzites, and limestones are of sedimentary origin. The amphibole schists appear to have been derived from basic tuffs which were interbedded with the original sediments.

The recrystallization of these rocks occurred through

processes of stato-thermal metamorphism,¹ whereby the original rocks were deeply buried and subjected to great vertical pressures (due to load), increased temperatures (due to depth of burial), and to action of solutions trapped in the rocks. Igneous activity and lateral compression appear to have been absent during the metamorphism. As a result, the schistosity and bedding are concordant, both being roughly horizontal except where effected by subsequent folding.

The metamorphism of the Rand schist was completed long before the intrusion of the Mesozoic (late Juras-



Randsburg and the Yellow Aster mine

The town is built on Rand schist; the crest of the hill is quartz monzonite

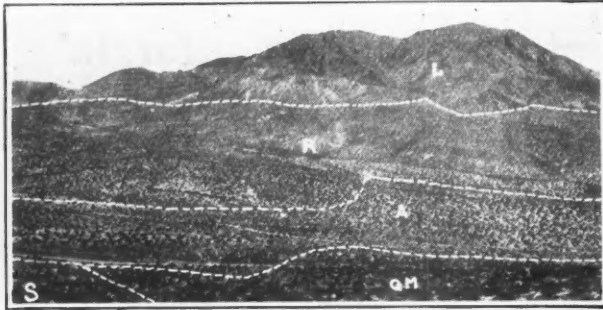
sic?) batholith of quartz monzonite. Three areas of quartz monzonite are exposed in the Randsburg quadrangle, one in the northern part of the quadrangle, a second just south of Randsburg and Johannesburg, and a third in the vicinity of Atolia and on the south slope of the Rand Mountains. These three areas are probably connected in depth and are probably also connected beneath the cover of later sediments and lavas composing Red Mountain and the Lava Mountains.

Following the batholithic intrusion of quartz monzonite, the region was subjected to erosion, which continued until the late Tertiary. Though no exact measure of the erosion is available, the surface during this interval must have been lowered at least several thousand feet to permit of the large exposures of quartz monzonite.

Beginning in the Upper Miocene, faulting and warping of the surface resulted in the formation of inclosed basins in which the accumulation of continental sediments occurred. These sediments vary from sandy conglomerates to clays, but are predominantly poorly cemented arkosic sandstones. All are commonly highly colored in shades of red, green, buff, and white. Probably in excess of 1,000 ft. of strata occur east of the "Silver Camp" and under Red Mountain.

*Published by permission of the State Mineralogist of California. A detailed report on "The Geology and Ore Deposits of the Randsburg Quadrangle, California," is now being published by the California State Mining Bureau.

¹R. A. Daly: "Metamorphism and Its Phases." Bull. G. S. A. 28, 1917, p. 375.



Red Mountain from the west

L = andesitic lava flows; E = Miocene sediments; A = alluvium; S = Rand schist; QM = quartz monzonite.

After only a part of these sediments had accumulated (200 to 500 ft.) igneous activity began, the first action being the intrusion of a series of acidic dikes and other bodies. This was soon followed by the intrusion of a series of basic dikes. The acid dikes are characterized by a porphyritic texture with an aphanitic groundmass, by their light color, and by their general poverty in ferromagnesian minerals. They vary in composition from andesites to rhyolites, a latite with subordinate quartz being probably the most common type.

The basic series is in general slightly more crystalline than the acid, its members being characterized by their dark color and their high content of ferromagnesian minerals. They vary in composition from andesites to diabases, the diabasic texture being quite common. The degree of crystallinity of the dikes of both groups is a direct function of the size of the dike.

Overlying the Miocene sediments are a series of lava flows having a general composition of basic andesites. These attain a maximum thickness of 1,400 ft. in Red Mountain.

THREE PERIODS OF MINERALIZATION

All of the mineral deposits in the vicinity of Randsburg which have proved to be of economic importance were formed under similar conditions during a single epoch of mineralization. This epoch of mineralization may be subdivided into three periods, during each of which deposits characterized by the predominance of a different metal were formed. These are, in order of time, (1) tungsten, (2) gold, (3) silver.

TUNGSTEN VEINS IN QUARTZ MONZONITE

The tungsten deposits reach their major development near Atolia in a vein system cutting quartz monzonite. The mineralization does not appear to follow single continuous veins but rather a series of veins which occur in a zone of shearing or fracturing. This zone, which trends N. 80 deg. E., is roughly 500 ft. wide and has a known extension along its strike of over 12,000 ft. The individual veins dip to the north at angles of 70 to 76 deg. They vary in thickness from a fraction of an inch to as much as 17 ft.

The ore occurs in definite shoots, which are ordinarily lenticular in habit and of triangular outline, the apex of the triangle being downward. With a single exception, all of the oreshoots which have been worked have been bottomed at depths of 50 to 400 ft. The exception noted—namely the South vein of the Union mine—has been worked to a depth of 598 ft. This shoot is growing noticeably shorter with depth.

The tungsten occurs entirely as scheelite, the calcium

tungstate. The chief gangue mineral is a dense fine-grained crystalline quartz aggregate, grayish white in color, the component grains of which are too small to be resolved except by use of a microscope. Locally coarser quartzes occur lining drusy cavities and fractures. Other associated minerals which have been identified include calcite, dolomite, ankerite, pyrite, stibnite, cinnabar, and chalcopyrite, the last three being comparatively rare. A gold pocket which produced \$600 was taken from one vein.

The tenor of the ore produced has varied greatly in different parts of the mines. Between 1909 and 1919 the average run-of-mine product, taken by years, varied from 3½ per cent to nearly 8½ per cent of contained WO₃. Exceptionally much higher-grade ores occur, as much as 100 tons of ore having been mined and sacked direct which averaged 63 per cent of WO₃. Pure scheelite contains 80.5 per cent WO₃.

Besides the deposits near Atolia, scheelite is contained in the ores of many of the gold properties to the north, in a number of occurrences being present in sufficient quantity to have been profitably extracted during the war period.

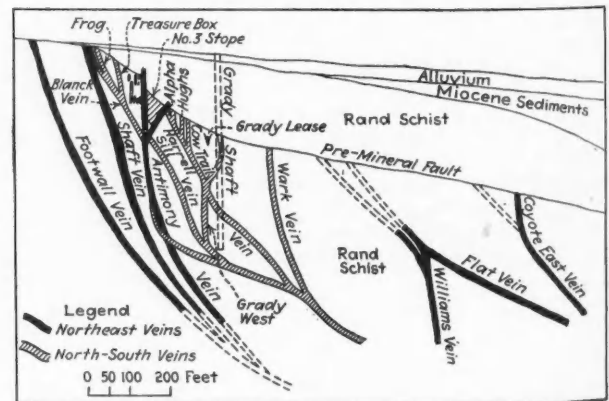
GOLD DEPOSITS OCCUR IN SCHIST OR QUARTZ MONZONITE

The gold deposits occur chiefly in the vicinity of Randsburg, Johannesburg, and in the Stringer district, 2 miles southeast of Randsburg. The country rock containing the deposits may be schist or quartz monzonite, or locally in a deposit the wall rocks may be diabase or quartz latite.

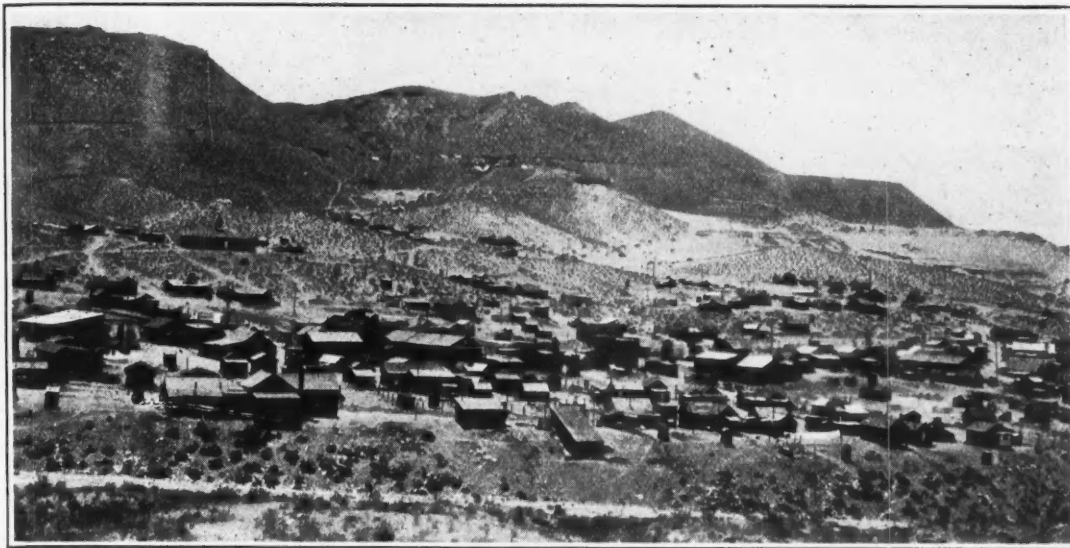
The deposits consist of veins formed along definite faults or fractures, and of stockworks composed of numerous intersecting mineralized fractures occurring in a zone of fracturing. In the former case the vein walls, usually one but sometimes both, are well defined and commonly polished and striated and show a thick development of gouge. This is especially true of the hanging wall of those veins possessing a low dip. The stockworks seldom show well-defined walls.

Veins striking east and west (roughly parallel to the Atolia scheelite belt) and northwest and southeast appear to be the most common. There are many exceptions, however, which would not fit well into either of these systems. Dips vary from vertical down to 10 or 15 deg. to the horizontal.

Although in a number of mines definite quartz veins occur, these may be considered as exceptional, for, in general, gangue minerals other than those of the orig-



Map of surface geology of Randsburg district



Idealized section through silver deposits
Strike of section N. 47 deg. W.

inal wall rocks are present in comparatively small amount. Many of the veins consist entirely of iron-stained schist impregnated with gold without other gangue materials being present. The iron stains in such veins are probably derived from pyrite and arsenopyrite which were deposited with the gold and later oxidized.

GOLD MINES SHALLOW

The deepest development of gold ores in the district has been in the Sunshine mine, where a depth of about 600 ft. was reached. The majority of mines reach depths of only 100 to 200 ft. Within these depths all of the known orebodies have become too lean to work. Since all of the ores mined have been rather thoroughly oxidized, knowledge of the primary mineralization is somewhat imperfect.

Where quartz is present it is usually white and finely crystalline. Open drusy cavities are common as well as comb structures. Other primary minerals present in the ores besides the native gold include scheelite, calcite, arsenopyrite (abundant), pyrite (not abundant), and galena, chalcopyrite, and sphalerite, the last three being rather uncommon.

Although most of the ores worked have been oxidized, the deposits, except those parts very close to the surface, appear to owe their value to the primary mineralization. The grade of ores as mined has varied through wide limits.

SILVER DEPOSITS PRODUCTIVE IN ONLY ONE MINE

The silver deposits, of which only a single mine, the California Rand Silver mine, has proved productive, occupy a comparatively small area approximately 2½ miles southeast of Randsburg. The deposits consist of veins cutting schist, though locally traces of mineralization are known to occur in quartz monzonite, diabase, rhyolite, and the Miocene sediments.

The vein system is complex. The veins may be divided into two systems, an older system, striking N. 40 deg. E., and a younger system the average strike of which is roughly north and south, and which forms transverse vein segments within the older system. The veins of both systems have a general eastward dip,

steep near the surface and flattening slightly with depth. Two exceptions exist which dip to the west. The veins appear to merge with depth.

Upward, practically the entire vein system is capped by a pre-mineral fault which dips at a low angle to the east. This fault has been a surface of major movement, possessing a very strong development of gouge, the adjacent schists locally being crushed through a thickness of 50 ft. Except where erosion has stripped away the cover, all the veins terminate at or in this fault zone. In addition a variable thickness of Miocene sediments covers parts of the deposits.

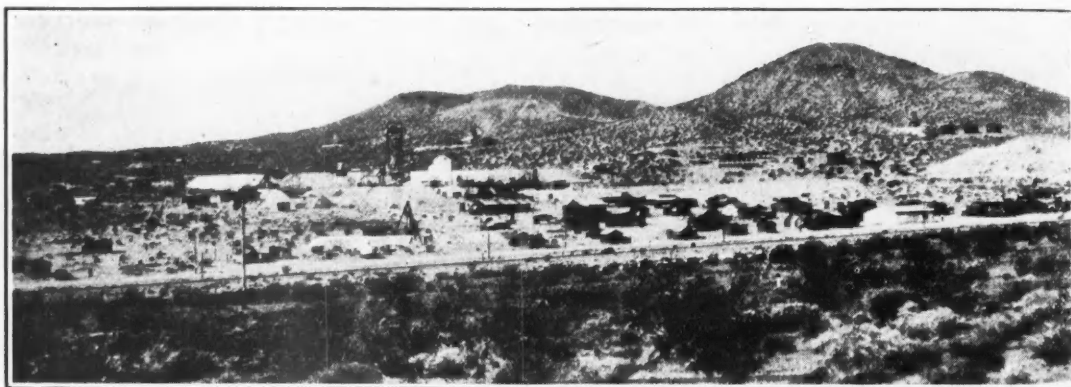
The veins are formed along lines of fracture and faulting. The vein walls in many places are polished and striated and show a development of gouge. Elsewhere the veins gradually merge into the wall rocks. Locally the veins are highly brecciated, both by inter-mineral and by post-mineral movements.

The veins of the northeast system are the most persistent. The largest of this system, the Footwall vein, outcrops on the surface for over 3,500 ft. Those of the north-south system are in general comparatively short. The different veins vary in thickness from a few inches to as much as 80 ft.

The principal gangue material is a bluish-gray silica, occurring either as a finely crystalline quartz or in a chalcedonic state. Locally opal and calcite are present. Drusy cavities, crustification banding, unfilled vein centers, and angular inclusions of the schist wall rocks are characteristic of the ore.

The chief primary silver mineral is miargyrite. A second mineral, tentatively identified as polybasite, is only slightly subordinate to the miargyrite. Pyrargyrite and proustite occur in small quantities. Fine-grained arsenopyrite and pyrite are abundant in the ores, and stibnite is fairly common. Other minerals present in small amounts are mariposite, chalcopyrite and argentiferous bornite(?).

As the veins are capped in many occurrences by a low-dipping pre-mineral fault which shows only slight cross breaks, the movements along the veins must have been largely horizontal. The northeast fissures (faults) were formed first, and in these fissures vein matter was



The "Silver Camp" from the east

California Rand Silver mine at left center. The two prominent hills are composed of Miocene sediments, the one at the right being intruded by a rhyolite plug.

deposited which consisted of a dense siliceous gangue containing some silver throughout, but in general being of too low grade to constitute ore. Further movements then occurred, the southeast side of the veins tending to move to the northeast. Finding the earlier formed fissures tightly cemented, these later movements were in large degree relieved by the formation of cross fractures striking roughly north and south. And it was in these cross fractures and in those parts of the northeast veins which had been brecciated by the intermineralization movements that the chief silver mineralization occurred.

The silver ores owe their principal value to the primary mineralization. In the California Rand Silver mine the effects of oxidation and enrichment were found to extend to only about the third level (145 ft.) Above this level the ore and wall rocks were badly iron stained, due to the oxidation of pyrite and arsenopyrite, and the silver sulphides were largely replaced by cerargyrite. Near the third level some secondary sulphides, probably chiefly stephanite, occurred.

The silver workings are predominantly in fresh unoxidized schist which is hard and commonly bluish-gray in color. Most of the gold workings, on the contrary, are in oxidized schist which is soft and more or less decomposed and iron stained. This difference in appearance has given rise to the belief that the silver deposits occur in a separate formation which is locally termed the "Silver Formation." The schists containing both the gold and silver deposits, however, are of the same formation, the Rand schist, though all the deposits are not necessarily at the same horizon.

AGE AND GENESIS OF THE DEPOSITS

A most noteworthy feature as observed in the field is the similar areal distribution possessed by the Miocene acidic and basic intrusives and the ore deposits, whether of gold, silver, or tungsten. This is true not only broadly but also in detail, the ores being intimately associated with dikes in most of the mines of the region. There can be no question that the ores are genetically related to the dikes. The mass of the dikes precludes the possibility of direct derivation of the ores from the dikes themselves, leaving as the only alternative the hypothesis that the ores were derived from the same deep-seated magmatic reservoir from which the dikes were derived.

The textures of the various ores, the time order of

deposition of the components of the ores, and the absence of gangue materials syngenetic with the values in certain deposits—features which have been but lightly touched upon in this article—indicate as the only possibility that the deposition occurred from ascending heated solutions. These solutions appear to have commonly followed the openings into which the dikes were intruded.

SURFACE ERODED LITTLE SINCE MIOCENE TIME

A consideration of the geologic history and the physiography of the region indicates that the surface over which the schist and quartz monzonite now outcrop, though modified by faulting, has been reduced by erosion comparatively little since Miocene time. As the various deposits are in general later than and intimately associated with the Upper Miocene intrusives, and hence must themselves be of Upper Miocene age, it would follow that the deposits must have formed at comparatively shallow depths and hence at relatively low temperatures. They must therefore be classed as epithermal³ deposits.

The relative time of formation of the three types of deposits is based on field evidence. At Atolia a diabase dike cuts one of the scheelite veins. Two miles to the north scheelite veinlets follow a basic dike⁴. The tungsten veins may therefore be considered contemporaneous with the basic intrusives. The gold deposits, even those carrying scheelite, were in all observed occurrences later than the diabase intrusives. Hence the gold is younger than the tungsten mineralization, though, as indicated by the scheelite content of many of the gold veins, the two periods of mineralization slightly overlap.

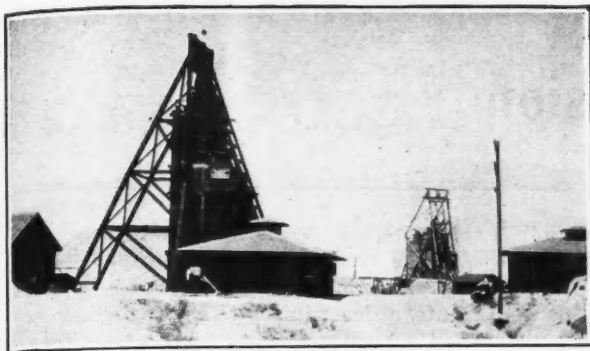
A direct relation of the gold and silver mineralization is found on the eleventh level of the California Rand Silver mine, where a silver vein, the Williams vein, cuts directly through a typical gold vein. The silver mineralization is therefore the youngest of the three, and the order tungsten-gold-silver is obtained.

Epithermal solutions are notably erratic and subject to radical changes in composition, so that the abrupt changes in metallization observed near Randsburg are not entirely surprising.

Epithermal deposits of other regions have invariably been bottomed at comparatively shallow depths—depths

³W. Lindgren: "A Suggestion for the Terminology of Certain Mineral Deposits." *Econ. Geol.*, Vol. 17, 1921, p. 292.

⁴These occurrences were inaccessible, and I did not study them.



Old and new shafts, the latter on the left, of the Union mine of the Atolia Mining Co.

well within the reach of mining operations. In all cases such deposits appear to be underlain by a barren zone. Mine operators have repeatedly attempted to explore this zone—and failure has invariably resulted. Probably the deepest of the deposits of this type which has so far been worked has been the Valenciana mine of Guanajuato, Mexico, which reached a depth of about 3,000 ft. The majority of the shallow-type deposits

of the district have been bottomed at lesser depths.

There is no reason to believe that the Randsburg deposits will behave differently from deposits of similar origin in other parts of the world. The majority of the known gold and tungsten oreshoots have already been bottomed at depths of a comparatively few hundred feet. The silver veins have so far proved persistent to a depth of over a thousand feet. How much deeper they will prove profitable is entirely problematical. The California Rand Silver mine will be interesting to watch, as almost the whole deposit exists as formed, comparatively little having been lost by erosion.

It must be recognized that the future of the Randsburg region lies in further surface or shallow discoveries rather than in great continuation in depth of the known deposits. In this regard it must be pointed out that much of the *deep* silver prospecting which has been carried on in the last four years has been entirely unwarranted *except* where a promising vein was actually being followed or where special geological conditions existed. Such special conditions exist in that part of the region overlain by a thick cover of Miocene sediments. Elsewhere, prospecting at 500 to 800 ft. depth offers no better chances than does prospecting at 100 to 300 ft. depth.

Leaching Ore in Place at Kimberly, Nevada

The proposed leaching in place of the orebodies in the property of the Consolidated Coppermines Corporation at Kimberly, Nev., has begun and part of one orebody is now under treatment. Previously, mine development and mining by the usual methods of undercutting and caving had been tried. In considering the leaching method, estimates of a cost of 7c. per pound of copper were considered to be reasonable, and preparations were made to begin work many months ago. J. L. Fozard, general manager, worked out the details of the initial installation. A dependable supply of water was available at the Alpha shaft. Old records showed that 750 gal. per minute had been removed from this shaft when bailing and pumping below 1,000 ft. in depth. A double-drum electric hoist driven by a 400-hp. motor was installed, and the old bailers were cut down to 1,100-gal. capacity. With this equipment 400 gal. per minute of water has been obtained. The water as delivered from the bailers is picked up by a pair of 250 gal. per minute pumps, forced over the ridge, and distributed by a pipe system upon the broken and fissured capping on top of the orebody. The water was turned on early in August. Three days elapsed before water appeared in the lower workings. The first water came through clear, but after the fourth day, 25 gal. per minute came through carrying 2.5 lb. of copper per 1,000 gal. By the ninth day the flow had increased to 100 gal. per minute, and the copper content had increased to 10 lb. per 1,000 gal.

The solutions are gathered in wooden launders and after decanting are precipitated on detinned scrap. The solutions are pumped to the surface, 360 ft. above, by two pumps, both of 250-gal. capacity. One is an Aldrich vertical triplex pump equipped with cement-lined cylinders and porcelain plungers and the other is a four-stage bronze centrifugal. Two pump columns are available, each consisting of a steel pipe, dipped in pitch and lined with redwood staves. One-third of the precipitating boxes are underground and the remainder

on the surface. It is proposed to precipitate most of the copper in the solutions underground and to pump the reduced solutions to the surface for further precipitation. About one-half of the returned solution will be run back over the surface and the remainder wasted.

The system has been in operation for several months, and late in 1924 the quantity of copper recovered was around 2,100 lb. per day. The cold weather of winter has undoubtedly interfered with the solution of the copper, and nothing better than the existing rate of recovery is expected until an additional area is brought under the action of the water. It is also proposed to tear up the surface by a stream of water under pressure and thus start percolation over a larger area. It is anticipated that the solvent action will be more energetic when bodies of sulphides begin to oxidize on an extensive scale. It is not expected to pass from the experimental stage until after an interval of six months or one year. More than 8,000,000 tons of copper ore, carrying well over 1 per cent copper, is available.

French Miners Seek Wage Increase

With the new year, French miners, through their "federation," have begun to exert pressure in government circles to secure a wage increase. They especially ask a readjustment of wages in various categories and that all mine workers above eighteen years shall be considered as adults and paid according to the adult scale. Above all the federation wants a unified wage scale for all mining districts in France.

The government is accused of being too passive in this most important of basic industries. All possible consistent measures will be taken to prevent a possible strike at this time, but the federation looks to the government to arrange with mine owners to this end.

This is said to be something more than a veiled threat, but the issue is one of some moment in view of the influx of so large a foreign element which is now working in French mines. The same scale is demanded for French and foreigner.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

The Student Theory of Education

THE EDITOR:

Sir—I read with interest your editorial on "The Faculty Theory Versus the Student Theory" in the issue of Jan. 3. I agree with what you say, but I think you have in places stated the case somewhat too strongly. For instance, I do not hold that the faculty and president "not infrequently secretly share somewhat of the same belief." My experience has been only with British Indian and English universities, and we may therefore be discussing the question from different points of view. I take it you had in mind the American university.

As you say, there is a group of men, but it represents the large minority, who go to a university primarily with the idea of forming judicious friendships. This group rarely amounts to much in after life, because it commences life by looking at it from a wrong angle. In India men as a rule attend a university at a more mature age than in England. Their heads consequently are more firmly screwed on the shoulders and they realize more clearly (many, as elsewhere, are forced to the realization by scanty financial resources) that the years are few and precious. Yet they are just as good an average bunch of men at games as the men in England. The faculty realized the importance of and encouraged physical exercise, but on the other hand the waster did not last long.

In England the undergraduate has an average age of perhaps nineteen. He has less all-round experience than the American freshman of the same age. He finds a freedom from restraint to which he has not been accustomed, and it goes to his head for a term or two. During this period it matters little whether "the general cultural education . . . is well chosen." The whole matter is one of maturity, and you put the case in a nutshell when you say "In effect the college proper is an advanced high school." The *university* is not the place for men of nineteen to twenty-three years of age. Its proper purpose, in my opinion, is to serve as a center for advanced work. I mean to say that men of nineteen to twenty-three should go to an institution called a college and later on, when things for them have assumed something of their true relative values, to a university.

The "grind" in England is by a few "looked down upon," but those few are in practically every instance well-to-do students suffering from youth. A professor would hardly look down upon a man for studying hard, if for no other reason than from purely selfish motives. Let us say, "A. Sprinter" wins a championship in some branch of athletics. At best people ask from what college he comes, and nobody is interested in his departmental professor. Now take the case of "A. Scientific

Shark." I think you will agree that the tendency is to ask under whom he studied. To an appreciable extent a professor is brought into prominence by the successes of his ex-students, at least in the realm of science.

I have noticed a greater and greater tendency for the present-day young man to specialize entirely too early in life; he forgets that there is some relationship (however long the chain that binds two of them together) between the various branches of science. I include literature because literature is but the science or knowledge of thought expression in writing. I have been told that a man can "get on" (I suppose make much money) only if he can do even one thing a shade better than anyone else. There is truth in that, of course, but somehow the price he pays seems a pretty stiff one.

I think as we grow older we become a little too critical of the lightheartedness of youth.

Four years in college are too few to hope to build a complete edifice; they are hardly sufficient for the pouring of the foundations of a wide culture. The problem is a complex one. We say the young graduate has not had an all-round training, and yet we have not allowed him the necessary time to get such a training. Besides, there is the question of dollars and cents. We claim he is not serious-minded, and yet we would be honestly surprised to find an old head on young shoulders. Do you not think that "general cultural education" can best be acquired during the many years *after* one has left the campus? One cannot expect to impart much of it during the three or four years when a young man is by nature most impatient of knowledge!

Rosario, Honduras.

PAUL T. BRUHL

Homesteader vs. Mining Claim Owner

THE EDITOR:

Sir—In *Mining Journal-Press* of Dec. 20, 1924, J. H. Favorite, chief of the Field Division of the General Land Office, says that an entryman cannot make an entry without complying with the restrictions in the application unless he wishes to commit perjury. The law is quite plain in regards to perjury; but what steps, if any, has the chief of the Field Division ever taken to prosecute any perjurer making false application?

Valid mining locations in the Melville and the Los Burros mining districts have been jumped by "enlarged grazing" homesteaders, and the acts of the entrymen seem to be sanctioned by J. H. Favorite. The mining claims in the Melville district have been condemned and appropriated, while a test case was pending a decision, to secure the Palisades townsite and Mary B. Melville millsite for an addition to the Pinnacles National Monument. The mines of the Copper Mountain Mining Co. have been proved to contain minerals of value, as shown by one of the best assayers in California, who personally visited the claims in question and took his own samples for assaying. In the face of all this the government says, "No discovery."

In view of the facts it does not seem that the Land Office is trying to settle the dispute between the homestead entrymen and mining claimants. I can refer to the official records of the chief of the Field Division in the case of Herman A. Hermansen, enlarged grazing homesteader, U. S. Intervenor, in the Melville mining district, San Benito County, Calif., and Ernest Bauman, homesteader, vs. Ralston-Gold Mining Co., Gold Ridge, Los Burros mining district, Monterey County, Calif.

The Lone Prospector and his burro, Old Longears, take no stock in Mr. Favorite as a guardian of the mining industry.

HENRY F. MELVILLE,
President and General Manager
Copper Mountain Mining Co.
California.

A Misstatement Corrected

THE EDITOR:

Sir—In looking over my copy of your issue of Jan. 24 I came across the attached clipping which refers to the joint meeting of the Vancouver Board of Trade, the British Columbia Chamber of Mines and several other interested associations which met to consider the possibilities of the recent discovery of placer gold in the Dease Lake district of British Columbia.

No such petition as you speak of was authorized by the meeting, and as proof of this I inclose herewith the Vancouver Board of Trade *News* with the resolution passed marked on page 27.

As a member of the council of the Vancouver Board of Trade and past president of the British Columbia Chamber of Mines I regret that a false impression of this kind should have found its way into your widely read journal, and in fairness to the Vancouver Board and the British Columbia Chamber of Mines, I hope you will correct the misstatement.

N. THOMPSON.

Vancouver, B. C.

[The clipping inclosed with the above letter follows, and confirms Mr. Thompson's correction. The news item in our issue of Jan. 24, to which Mr. Thompson refers, read in part: "With the possibility of the discovery of a rich gold field at Dease Lake, the British Columbia Chamber of Mines, the Vancouver Board of Trade, and other public bodies are petitioning the Dominion Government to enact legislation providing that mineral lands in Canada shall be staked in the future only by British subjects."—Editor.]

Embargo on Gold—The following report was submitted by the Mining Bureau, and endorsed:

"At a joint meeting of the Mining Bureau of the Vancouver Board of Trade, the Wholesale Merchants Bureau, the British Columbia Chamber of Mines and the Native Sons of B. C., Post No. 2, held in the Board of Trade rooms on Monday the 5th of January, 1925, to consider the best means of providing for and securing the business likely to accrue from the anticipated rush into the recently discovered placer gold fields in the Dease Lake and Cassiar Districts of British Columbia.

"It was unanimously resolved that a petition be presented to the Prime Minister, the Minister of Mines, and the Minister of Finance of the Dominion Government at Ottawa, asking under powers of Section 14, of Chap. 48, 13-14, George V., an Act to supplement the Finance Act, 1914, assented to 30th June, 1923, to further extend the embargo on gold produced from placer mines, for at least another year from the 31st of July, 1925, the time at which the present embargo expires, and that the payments for such placer gold continue to be made in New York funds, and that no licenses or permits be granted for the export of placer gold."

Mining Journals for French Schools

THE EDITOR:

Sir—It has been my good fortune during my year's leave of absence from the University of Chicago to be able to visit many of the technical schools in France, including practically all of them at Paris. These schools have found the economic situation resulting from the war a heavy burden for them, for their resources have not increased in anything like the same ratio as their essential expenditures. One result has been to cut them off from the possibility of subscribing to American technical and scientific magazines, for, in addition to limited resources, the rate of exchange is heavily against them. The subscription to a \$5-a-year American magazine delivered in France, costs them, for example, the equivalent of an entire week's wages for a first-class machinist.

I wonder if there are not some subscribers to your magazine who do not permanently file or clip their copies who would be willing to send them regularly to some French technical school which would appreciate greatly this addition to their teaching material. If there are any such, and they would send their names and addresses to me, 52, Bd. Pasteur, Paris (XV), France; after Sept. 1, 1925, 5529 University Ave. (Chicago, Ill.), or to Monsieur Firmin Roz (96, Bd. Raspail, Paris (VI), France), Directeur de l'Office National des Universités et Ecoles Françaises, we should be glad to give to each the name and address of a school to which to send his copy. Monsieur Roz has gladly consented to handle this matter permanently at his end, and as he has a thorough command of English, subscribers will have no difficulty in corresponding with him. They may rest assured that when I leave France, any information which they may desire can easily be obtained from a competent source.

I can assure the readers of this letter that in sending their copies of this magazine to a French school, they will be aiding French technical education more than they realize and they will be helping France in a fashion which will be most gratefully appreciated by all Frenchmen who know of it as well as by those who benefit directly by it.

PAUL M. ATKINS.

Bdellium and Onyx Stone

THE EDITOR:

Sir—May I call the attention of your younger readers to an interesting old mining report? It is the oldest report of repute that I have ever read. It has been translated into many languages, read by millions of interested people in every land on this globe, is a model in form; and it may be familiar to some of the older mining engineers, as it was once used in schools of all kinds, public and private.

The report will be found in the twelfth verse of the second chapter of Genesis. It gives the mineral sought, the quality, and the associated minerals. No tonnage is estimated. The name of at least one mineral is mystifying. The report shows that little new is known by the men of this generation about the writing of mining reports.

Many a mine today could be reported on using this form, even using this verse. I suggest it as a form for a telegraphic report. Merely wire, "See Gen. II, 12," adding, "tonnage estimates later." W. H. STAYER.

New York City.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS 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.

Summary

THE American Smelting & Refining Co. earned \$11,186,990 in 1924, an increase of more than \$2,250,000 over 1923. Expansion of plants is a feature.

The Department of Justice is investigating alleged illegal marketing practices by producers and refiners of lead.

For the first time in many years the Arkansas Valley smelter at Leadville has all of its five lead furnaces in blast.

Heavier equipment, purchased by the Ray Consolidated Copper Co., is expected to reduce costs at the Chino mine.

Belgian zinc smelters are redoubling efforts to purchase concentrates in America to supply their plants.

Taxes totaling \$254,286, paid under protest on its tailing pile, have been refunded the Utah Copper Co., by Salt Lake County.

Two concentrators valued at \$300,000, belonging to the Philipsburg Mining Co., burned at Philipsburg Mont., on Feb. 20.

Production of 34,000 tons of \$9.60 ore established a new record for the McIntyre-Porcupine Mines Co. in January.

Recovery of dissolved zinc from mine water in the Joplin-Miami district is being considered.

Reduced rates for electric power have been put in effect by the Public Service Co., which serves many mines in Colorado.

A. B. Trites Bonds Silver-Lead Prospects in British Columbia

Spends Money Made in Premier—Property Long Way from Transportation

A. B. Trites has bonded the Emerald and the Glacier groups, consisting of fifteen claims, in the Ootsa Lake district of British Columbia, for \$150,000, and will begin development operations as soon as weather conditions allow supplies to be taken to the property. These claims were staked in 1915 to cover an important high-grade silver-lead showing that cropped at the surface.

The discovery attracted the attention of James Cronin, who interested first New York parties and later the Days, of Wallace, Idaho. The latter drove an adit for about 100 ft., which is said to be in good ore all the way, but the inaccessibility of the property, which is situated on the eastern slope of the Coast Range, disheartened them, and they allowed the option to lapse. Since then the property has been idle.

Mr. Trites has proved himself to be a good sport: he freely has been spending the riches won from his interest in the Premier mine in exploring prospects and abandoned mines in several parts of the province. Should the exploration that he will give to this property prove the orebody to persist to an important depth, an outlet to the coast could be made by using the waters of Ootsa Lake for 40 miles, Talsa River for 20, a tramway of a few miles over the divide, then the Kemana River and Gardner Canal to Hartley Bay, which is about

Arkansas Valley Smelter Runs at Capacity

FOR THE FIRST TIME in almost a decade, the Arkansas Valley plant of the American Smelting & Refining Co. is operating at capacity. The fifth furnace was blown in about Feb. 15, and it is expected that the entire battery will be in operation for some time.

The increased activity is due primarily to an overflow from the smelting plants in Utah resulting from the great revival of mining in the lead districts of that state. Increased production is also coming from Colorado mines, on account of the better prices for metals. The plant is now maintaining a daily capacity of about 900 tons.

100 miles south of Prince Rupert. The providing of this transportation would make a big hole in \$500,000, so it is necessary that an important orebody first should be proved.

Riverside Mill Operating

The new mill at the Riverside mine, situated 7 miles up the Salmon River Valley from Hyder, Alaska, is turning out fifteen tons of concentrate per day. The development of the mine has been under way for four years. Nearly a mile of drifting, tunneling and sinking has been done, and a considerable body of mill ore has been proved.

Peñoles Company Takes Over Natividad Property in Mexico

Gets Options on Surrounding Properties in Oaxaca—New Automobile Road Will Be Financed

The Compañía Minera de Peñoles has taken possession of the famous Natividad mine, which is situated about 40 miles northeast of Oaxaca, Mexico, and which has been in past years probably the heaviest producer in the state. B. J. Isgrig is in charge of the operations and will also act as manager of this company's operations in the state. A party of the officials of the Mexican interests of the American Metals Co. who recently visited the Natividad was composed of George H. Harbordt, general manager for Mexico; Ignacio Bonillas, chief of the department of geology and exploration; Basil Prescott, consulting geological engineer; A. B. Carstens, chief mechanical engineer, and a number of other officers and engineers.

The Peñoles company has taken options on a large number of properties surrounding the Natividad and covering an immense area. Among the improvements contemplated is the construction of the highway, already begun, which is intended to connect Oaxaca with the Natividad. Money will be advanced to aid the state in this work. At present the only means of communication is by pack animals, and two full days are required with light cargoes, whereas the completion of the road now under construction will enable the same trip to be made by automobile trucks in a few hours.

Better Power Rates for Colorado Mining Companies

Public Service Co. Hopes to "Re-establish" Mining Industry "on Sound Economic Basis"

The Public Service Co. of Colorado, which recently acquired the plants and transmission lines of the Colorado Power Co. serving the mining districts of Boulder, Clear Creek, Gilpin, Summit, Park, and Lake counties, has announced a new schedule of rates, effective Feb. 1, 1925, which will make possible a saving of from \$35,000 to \$50,000 annually to mine operators in that territory. Besides a flat reduction of about 10 per cent in the rates, the new schedule provides for other modifications which still further reduce the cost of power, particularly to the smaller users and prospectors.

The new schedule provides for a minimum service of three months in place of six, as required by the Colorado Power Co. The minimum amount of any monthly power bill has been reduced materially and the old arbitrary charge of \$30 for setting a transformer has been eliminated and only the actual cost of installation will be charged.

Action of the Public Service Co. in establishing new rates was the result of numerous conferences between representatives of the Colorado Mining Association and Public Service officials, and was made, according to the announcement of the company, "with the particular motive of assisting the metal-mining industry to re-establish itself on a sounder economic basis, and a desire to co-operate with mine operators to the fullest possible extent in all well-considered efforts to increase mining activity."

Ahumada Lead May Be Listed on New York Exchange

The Ahumada Lead Co. will make application for listing on the New York Stock Exchange, according to reports. Ahumada Lead is the newest and most important lead-silver mine that has been developed in the last ten years. It has an authorized capitalization of 1,300,000 shares, of which 1,187,018 are issued and outstanding. The company started dividend payments Jan. 2, 1924, and to date has paid a total of 70c. a share.

The Ahumada company is popularly believed to be earning \$2.50 a share, annually, and an increased dividend is posted for April. One feature of the Ahumada mine is that the ore reserves are mainly high grade, rich in lead, and with very satisfactory silver content.

Historic Mining Town to Vanish

Volcano, in Amador County, Calif., which was a noted placer mining camp in early days, will soon be a thing of the past. The holdings of the Crocker Estate Co., of San Francisco, have been purchased by the Pacific Gas & Electric Co., and the area now occupied by Volcano will become a storage reservoir. Little remains of the former glory of the village.

American Smelting & Refining Co. Earned \$11,186,990 Net in 1924

Expansion in Plants—Activity in Mexico and Peru—Various Mining Properties Under Option and Investigation—Policy to Expand Mining Operations

NET income of the American Smelting & Refining Co. available for dividends after deduction of charges, taxes, bond interest, depreciation, and depletion, was \$11,186,990.71 in 1924, an increase of \$2,262,409.15 compared to 1923. A comparison of income figures for the two years shows the improvement in 1924 as follows:

	1923	1924
Total net earnings...	\$19,557,000.29	\$21,471,506.08
Other income.....	597,914.48	1,469,422.90
Total income.....	\$20,154,914.77	\$22,940,928.98
General expenses, taxes.....	\$2,838,326.14	\$3,109,203.26
Interest, depreciation	8,392,007.07	8,644,735.01
Net income.....	\$8,924,581.56	\$11,186,990.71
Dividends.....	5,819,806.01	6,702,395.00
Surplus of income.	\$3,104,775.55	\$4,484,595.71

Simon Guggenheim, president, in his report to the stockholders explains that in view of the increased earnings and of favorable prospects for the future the directors felt justified at the end of the year in increasing the dividend payable on the common stock on Feb. 1, 1925, to the rate of 6 per cent per annum. The company is in a strong cash position, having on hand in cash, call loans, government securities, and bankers' acceptances, \$26,314,989.87, an increase of \$5,477,237.17 over Dec. 31, 1923. There are no outstanding bank loans or other loans.

During 1923 and 1924 the company appropriated for the purchase of mines, new undertakings, and improvements \$21,385,047, and expended \$15,687,076.

Regarding expansion and improvements the president says: "The Rosita coke plant, in Mexico, having a capacity of 18,000 tons of coke per month, was started in operation in December, 1924, together with the byproduct plant producing ammonium sulphate, benzol, tar, creosote, coke breeze, and gas. The new mine plant at Rosita will be completed by next June and will have a capacity permitting the mining of 50,000 tons of coal per month. The Rosita coal property has proved reserves of coal exceeding 50,000,000 tons, or more than eighty years' production if the mining plant is worked at its full capacity. "The new Rosita zinc smelter, operated by the gas of the byproduct coke plant, and the new acid plant should be in operation by the first of March, 1925. The acid plant operates on the fumes produced by the zinc smelter. The sulphuric acid output in turn reduces the ammonium sulphate produced by the byproducts plant, thus utilizing to the fullest extent coal extracted from the Rosita mine."

In northern Peru there have been constructed two concentrators. The concentrator at the Diana mine went into operation last October and the concentrator at the La Guardia mine will start operating about the first of March, 1925. These two mines—one

acquired a year ago and the other three years ago—produce principally silver and gold, and the two concentrators will permit materially enlarged production. The new copper smelter in Peru will be completed early in 1926, and this will allow operation of the important Quiruvilca copper-silver property purchased one year ago.

At Parral, in Mexico, lead, silver, and zinc ores are being treated at a concentrator, recently erected. A large increase in production from this new property is now possible. At the Charcas mine, which produces copper, lead, and zinc, a concentrator is being built and should be completed by the first of next October.

The first arsenic plant built by the company in Mexico began operating at San Luis Potosi late in 1924. The new copper smelter at that place should start operations next July. Early in 1924, the company decided to go into the copper rod and wire business and to install a plant at Baltimore. This is nearing completion, and should begin actual operation about the first of April. New Cottrell plants were completed during the year at the Asarco, Matehuala, and Tacoma smelters, and one is to be completed in 1925 at the Garfield smelter.

According to the report the production of various important metals in 1924 was as follows:

Copper, tons.....	522,472
Lead, tons.....	412,416
Zinc, tons.....	39,450
Silver, oz.....	92,229,349
Gold, oz.....	1,868,407

Concerning future undertakings, President Guggenheim says: "Your company is continuing actively in the search for new mining properties and has several under option and investigation. New mines are particularly desirable, as from them the company makes not only the profit of mining, but also that of smelting and refining as well."

Production Resumed at Norwegian Molybdenum Mines

Resumption of operations in the Kvina molybdenum mines, Christian-sand, Norway, is announced in press dispatches in Norwegian papers. These mines have been idle for nearly five years, principally because of poor market conditions. Last summer repairs were started on the property, and it is expected that during the coming spring work will be begun in the mines. The Knaben molybdenum mines, another Norwegian mining property which some time ago suspended operations, also expects to begin work again during the early spring. Neither mine at present plans to operate at maximum capacity, but will be in readiness to expand production with any improvement in the market.

Keystone, at Park City, Utah, Opens New Ore Bed

What appears to be an important orebody has been opened on the 500 level of the Keystone mine, at Park City, Utah. The new strike is in virgin ground previously unexploited by the Keystone.

Last year's production, which netted the company \$211,477.13 after expenditure of approximately \$35,000 for surface improvements, including better and enlarged living quarters, additional office space, augmented milling facilities, and erection of a new change room, came mainly from the 300 and 400 levels. Operations on the 500 level, the lowest level of the mine, began January first of this year.

The new orebody has been raised

Ray "Con" Ready for Big Year at Chino Mine

Larger and Better Equipment for Steam-shovel Operations

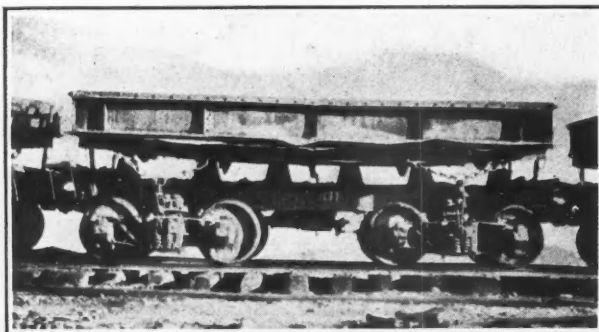
By L. A. Droste

Special Correspondent

THE YEAR 1924 proved the most productive one at the Chino mines of the Ray Consolidated Copper Co. in Santa Rita, N. M., since the years of the war, the output of copper exceeding that of 1923 by about 12,000,000 lb. This year, 1925, the company will make an effort to catch up on some of the development work neglected during the intensive effort to mine ore during the war, and necessarily restricted since that time because of the prevailing conditions in the copper market. The company begins the present year with

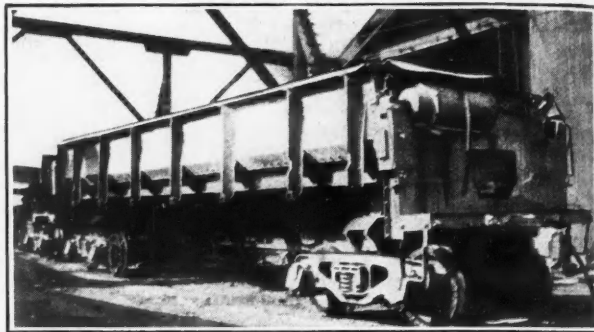
middle of 1924. This machine, made by the Marion company, is one of the largest shovels in the world. The adoption of the electric machine also was an innovation, for only steam had been used for power up to this time. The electrically driven shovel has proved its practicability, and another electric machine will be put in service during 1925; this, however, will be much smaller than the other, of a type similar to the crawling tractor steam shovels now in use at the mines.

Larger dump cars were introduced



A 12-yd. ore car

A sturdy, all-steel, hand dump car of which a few still remain in use at the Chino mine.



A 30-yd. ore car

This new car weighs 65,000 lb. and has automatic air dump. Thirty-five have recently been purchased.

through for a distance of 15 ft. without determining the thickness. The ore, a heavy galena, is typical of Park City deposits, particularly those found in the upper levels of the Keystone.

Tuolumne Copper Co. Ships from "East" Orebody

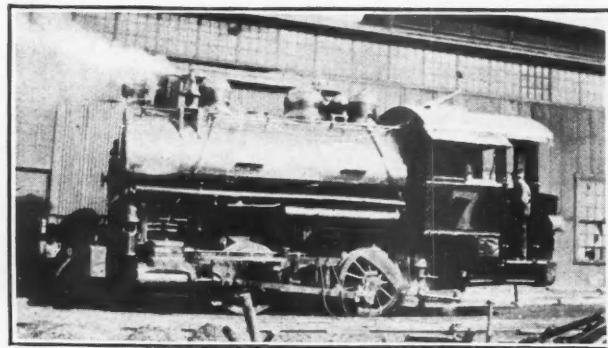
The Tuolumne Copper Co. at Butte, Mont., has finished loading its first car of copper ore from the No. 1 vein, on the 2,000 level, east of the Continental fault. Recent assays across 3 ft. of this ore are reported to be 19.5 per cent copper and 40.5 oz. of silver per ton. A pump station has been completed on the 1,200 level and a station will be installed at the 2,200 level, after which a crosscut will be run through the fault to tap the veins found on the 2,000.

larger and better equipment than it has possessed at any time since operations were begun in Santa Rita in 1910. Its force of workers and foremen is as well trained and experienced as can be found in similar enterprises throughout the country. With a fair copper market prevailing, 1925 should show a return to prosperity.

Larger and more up-to-date equipment was introduced during the last year. A new shovel of the crawling tractor type arrived at the mines just at the close of 1923; this new type quickly proved its superior efficiency, with the result that three of the old shovels were overhauled and equipped with the crawling tractor outfits. More of these tractors will be added during 1925.

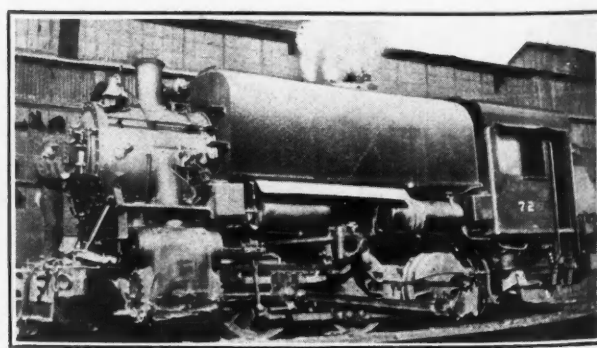
A huge revolving shovel, electrically operated, began operating about the

for the transportation of the ore and waste rock at the mines. Beginning with 6-yd. cars in 1910, the Chino company later used 12-yd. cars, then 20-yd. cars of various types up until 1924. The 6-yd. cars have been disposed of as unfit for efficient operation under present scale production. Some of the 12-yd. cars are still doing good work, fourteen of them having been rebuilt in El Paso during the year, and all of the 20-yd. cars of the lift-door type are in active service. After trials of various types of 30-yd. dump cars, the company finally adopted the Clark Car Co.'s latest side extension dump car, with a few of its own specifications. These cars are 30-yd. 70-ton size, and are considered the type best suited for conditions as they exist in Santa Rita. Thirty-five of these cars were purchased and put in operation during 1924. They



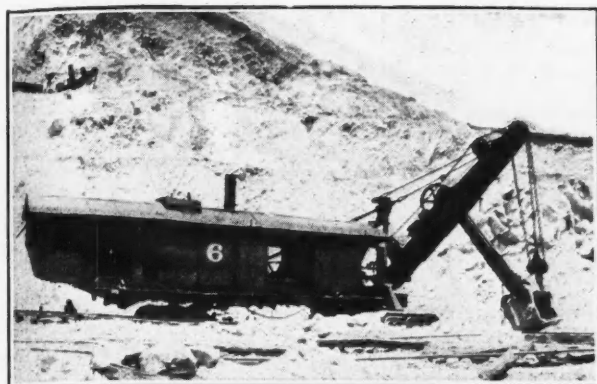
Early type of locomotive

Of this light four-wheel saddle back locomotive only four are now in active service at the Chino mine.



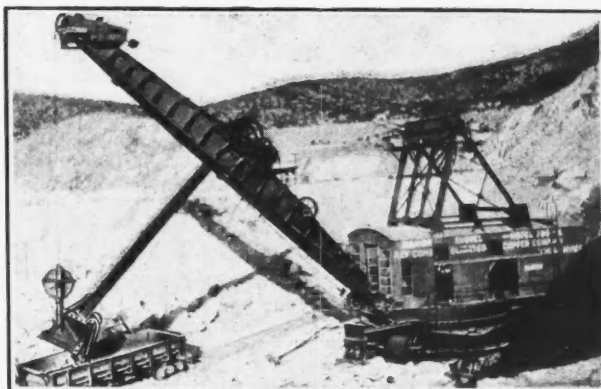
Newer type of locomotive

Superheaters, six wheels, and 2,000-gal. tank capacity are features of this 160,000-lb. machine. Eleven are in service.



Steam shovel, 3 1/2-yd. dipper

Four machines of this type, equipped with crawling tractors, are in use at Chino.



Electric shovel, 8-yd. dipper

This newest design has an 80-ft. boom, 55-ft. dipper handle and weighs about 490 tons.

are proving satisfactory and up to expectations.

Two new churn drills of the gasoline driven type were added to the equipment for blast hole drilling during the year. Fourteen of these machines are in active service at present. Deep-hole prospecting was resumed with the steam driven churn drills, while the diamond drilling—first introduced in 1923—was abandoned at the close of the year because of its unsuitability for the kinds of rock encountered at the mine. Two new air drills for bank and "dobe" shots also were added to the blasting equipment.

A new 6,000 gal. lime-barium water softener was added to those already in use for treating water for the boilers

of the shovels and locomotives. Two more of the large six-wheel super-heater type locomotives were added to the equipment, making a total of eleven of this type now in use. A new revolving locomotive crane of greater capacity than the old one was purchased and put in service, and a Paterson patent track shifter was added to the facilities for moving and ballasting the roadbed about the mine.

A new lathe, a radial drill, and a new air compressor were added to the shop equipment, besides various smaller machines adapted for different classes of work. Equipment for both Thermit and electric arc welding was purchased and put in use at the shops for the first time.

Will Prospect Lynn Creek Zinc Property, Near Vancouver

A. B. Trites and associates, who actively are engaged in the development of mines in many parts of British Columbia, have taken a lease and bond on the Lynn Creek Zinc Co.'s property and four adjoining claims, situated on Crown Mountain, about 10 miles north-northeast of Vancouver. The property was located many years ago, when a wide belt of ore carrying milling quantities of sphalerite was opened at several places. The maximum width was 45 ft. At that time, however, there was great difficulty in disposing of zinc concentrate in British Columbia, so operations ceased.

Two months ago, Mr. Trites' engineers made an examination of the property, with the result that he has taken a lease and bond of it on terms that as yet have not been announced. There is a good motor road to within 2 miles of the property, and from this a trail will be made. As soon as this is done a camp will be built and an aggressive plan of development will be started.

The property is well situated as regards timber for mining and water for milling and power purposes.

Aerial Tram at Alta Would Be Public Utility

J. P. Clays, acting under authority of a recent measure placing aerial tramways under supervision of the Utah Public Utilities Commission, has filed a petition for a certificate of convenience and necessity for the construction of such a tramway between Alta and Wasatch in Little Cottonwood Canyon. The tramway, which would serve as an ore and freight carrier between the terminals and intermediate points for a distance of more than 6 miles, will cost between \$300,000 and \$500,000, according to the petition.

Eastern capital, it is said, will finance such a tramway, now that it comes under the jurisdiction of the Utilities Commission. The mines of the Little Cottonwood district south and east of Salt Lake City have been hampered in their activities during a large part of the winter on account of inadequate transportation facilities. It is expected that they will be able to ship at a profit during the entire year if an aerial tramway is constructed.

Rich Silver Ore in Yukon

Percy Reid, acting Gold Commissioner for Yukon Territory, who has just returned to Dawson from a trip to Mayo and Keno Hill, states that Gammon & Greaves have opened a 4-ft. orebody in Lucy Queen Gulch that averages between 3,000 and 4,000 oz. silver per ton. The ore was found at the 30-ft. level.

Eagle-Picher Has Third Fire in Month of February

Fire of undetermined origin destroyed the barytes plant of the Eagle-Picher Lead Co., near Mineral Point, south of St. Louis, Mo., on Feb. 24. No official estimate of the loss has been made, but it is thought to be in excess of \$50,000.

The Eagle-Picher Co. has been having a run of bad luck with fires. It lost the Ellis mill, at Crestline, Kan., early in February, and lost its office at its Velton mine, near Brycefield, recently. The burning of the Ellis plant has held back development work generally in the Crestline camp, as the pumps which were holding the water down were being operated by the Eagle-Picher Co.

Utah Copper Recovers \$254,286 Taxes Paid on Tailing

The Utah Copper Co., of Bingham, Utah, is to receive from Salt Lake County a refund of \$254,286 for taxes erroneously levied on mill tailings of the Utah Copper Co. Litigation has been in progress over a period of five years, the copper company denying the right of the county to tax the tailings dump separately. The circuit court of appeals has held that assessment on the copper content of ore dumps cannot be made. A writ of error filed by the county in the Supreme Court will be withdrawn and steps taken toward refunding the amount of taxes to the Utah Copper Co.

Michigan College of Mines Plans To Diversify Curriculum

The proposal that the Michigan College of Mines, at Houghton, enlarge its curriculum to include diversified engineering courses is made in a bill introduced in the Michigan Legislature. The bill provides that courses equivalent to the first two years at the University of Michigan be added in civil, mechanical, electrical, and chemical engineering. The College of Mines now is offering courses in mining and metallurgical engineering only.

At the present time, a student in mining engineering at the Michigan College of Mines is required to take work in all of the proposed additional courses, so the college is prepared to enlarge its curriculum without increasing its faculty, equipment, or plant.

The institution, according to Dr. C. M. Carson, acting president, is prepared to offer a complete course in any of the proposed subjects with little increase in cost to the state. It would be necessary to add only a few instructors or professors.

May Extract Zinc Oxide from Mine Water

AN INTERESTING mine-drainage project is being considered in the Webb City camp in the Joplin-Miami district. The sheet ground mines in this vicinity have been idle since 1918, when the exodus to the Oklahoma section of the field was begun. It is estimated it would cost \$500,000 to drain the Webb City territory, and it is considered doubtful whether this sum could be raised.

In this situation George Waring, a chemist, residing at Webb City, with his son, Guy Waring, propose that the money spent in unwatering operations can be realized if a plant is erected to extract the zinc oxide from the water now standing in the mines. The chemists estimate at least \$500,000 worth of oxide could be extracted from the waters.

The Webb City Chamber of Commerce gave a nominal indorsement of the proposal at a meeting Feb. 25, but no definite start toward raising the funds to erect a plant has been made.

Finnish Government Plans Development of Copper Property

The Finnish Government has recently bought full control of the Outokumpu copper mine, in Finland, with a view to developing this property as fully as possible. The state previously owned a half interest in the mine, the other half having been owned by Hackman & Co., whose interest was bought for about 19,000,000 Finnish marks, according to Trade Commissioner Emil Ke Kich.

The Outokumpu property is reported to be large and valuable, incomplete surveys placing the quantity at 7,000,000 to 8,000,000 tons of ore having an average copper content of 4½ per cent. Thus far, work at the mine has been more or less superficial. In 1917 the Finnish Government and Hackman & Co. contracted with Norwegian interests for its development, but the failure of those interests prompted the owners to undertake the exploitation, which has been handicapped by the scarcity of capital.

Expand Operations in Veta Grande District in Zacatecas

Mining activities in the Veta Grande district of the state of Zacatecas, Mexico, are being stimulated by the construction of a new cyanide mill of 800-ton daily capacity by the Pittsburgh Veta Grande Mining Co. The same group of Pittsburgh, Pa., men who comprise this company have taken steps to form a new corporation for the purpose of acquiring and developing a number of rich claims in the district, it is stated.

To provide additional ore for the new cyanide plant the company is installing new machinery in its San Francisco mine.

Nitrate Producers Combine

Negotiations are under way for the consolidation of the Lautaro and Antofagasta nitrate companies, in order, among other things, to strengthen the position of the Chilean nitrate industry to meet competition from synthetic nitrate producers, says a cable dispatch to the U. S. Department of Commerce from Santiago. The combined production of these two companies amounts to approximately 25 per cent of the total nitrate produced in Chile.

Australian Gold Output Declines to 670,827 Ounces

Increase in Queensland Not Due to General Revival—Economic Conditions Adverse

The Australian gold yield for 1924 is set out in the following table, the production for the two preceding years being given for comparison. The figures are in ounces:

State	1922	1923	1924
Victoria.....	106,872	95,403	67,167
New South Wales.....	25,222	18,833	18,685
Queensland.....	80,584	84,214	95,703
Western Australia.....	538,246	504,511	485,035
South Australia.....	1,100	955	787
Tasmania.....	3,431	3,530	3,450
Total.....	755,455	707,446	670,827

It will be noticed that Queensland is the only state showing an increase, and this is due to larger production at the Mount Morgan copper-gold mine rather than to a general revival. With the gold premium reduced to vanishing point, the outlook for the industry is not bright. Known gold fields are not by any means exhausted, but the high wages now ruling, owing to the high cost of living and the increased cost of machinery and supplies, due to the protection policy of the country, help to make gold mining unattractive to investors. It is true, of course, that the grade of ore available has diminished gradually.

Burma Mined 29,095 Tons in January at Bawdwin

Cable advices via London report that during January the Burma Corporation mined 29,095 tons of ore at Bawdwin. Also, 23,360 tons of ore was milled in the treatment plant, producing 10,011 tons of lead concentrate; 13,095 tons of lead-bearing material was smelted in the blast furnaces, producing 5,349 tons of hard lead for treatment in the refinery. Refinery products were 4,553 tons of refined lead and 470,000 oz. of refined silver. Of the silver production 41,000 oz. was recovered from the treatment of copper matte.

The experimental zinc plant produced 1,328 tons of zinc concentrate, assaying 12 oz. silver, 5.5 per cent lead, and 42.6 per cent zinc. In addition to the above-noted output, 300 tons of copper matte was produced from the treatment of accumulated smelter byproducts and 1,388 tons of copper ore. The tonnage of ore mined includes 2,210 tons of high-grade ore, which, with 420 tons of stock, was smelted and is included in the figure of 13,095 tons of lead-bearing material smelted.

How Calumet & Hecla Will Lower Production Costs

IN THE Michigan copper district, Calumet & Hecla Consolidated's program in the direction of lower operating costs may be summarized as follows: The new Ahmeek railway under construction between the Ahmeek mine and stamp mill; construction of a haulageway to serve the conglomerate shafts at depth and centralize hoisting; building of a new reclamation plant on the Tamarack conglomerate sands for the recovery of copper from the tailings; the construction of a new melting furnace at the Calumet & Hecla smelter, providing ample capacity for mineral from all the consolidated properties; the project to make Tamarack No. 5 the main pump shaft for the conglomerate and Osceola lode departments; the extension of the use of electric power; the driving of drifts from Ahmeek into Allouez territory for the mining of Allouez ground; and a vigorous program of development work in the North Kearsarge property.

United Eastern Options Barbara Mountain Shares in Arizona

The United Eastern Mining Co., of Oatman, Ariz., has recently taken an option on practically all of the treasury stock of the Barbara Mountain Mining Co. whose property lies 4 miles east of Mayer, Ariz. The property has been examined for the United Eastern by Roy Moore, the company's chief engineer, and the company also has reports on the property by several other engineers. As a result of these investigations an option has been taken and development work contracted for which includes the sinking of a three-compartment shaft to a depth of 500 ft.

The Barbara Mountain group of claims was formerly owned by a group of mining men in Mayer and was taken over from them by A. S. Konselman, who has optioned the group to the United Eastern company.

Fire Destroys \$300,000 Manganese Concentrators

The Philipsburg Mining Co. sustained a \$300,000 loss on Feb. 20 when its two adjoining concentrators were completely destroyed by fire. The buildings and contents were partly covered by insurance.

It is not known whether the buildings will be rebuilt at an early date or not. The board of directors will be called together as soon as C. G. Ewing, president of the company, has looked over the situation.

This company has been one of the largest producers of manganese ore in the country. The fire will cause the stopping of all mining operations until it is definitely known about the rebuilding of the mill. About 250 men will be affected, including those employed in the mines and reduction works and outside activities of the company.

Toronto Letter

By Our Special Correspondent for
Northern Ontario

Crown Reserve Outlook Improved Since Issuance of Report

Barry-Hollinger Mill Financed—Beaver
Consolidated Has No Money—Nip-
issing Starts Prospecting

Toronto, Feb. 28—A more optimistic tone prevailed at the annual meeting of the Crown Reserve Mining Co. held in Montreal a few days ago. The president reported that on the company's property in Larder Lake, Ont., the new oreshoot on the 425 level had been opened up for a length of 80 ft., giving an average of \$14.32 over 4 ft. in width. A new level has also been started at the bottom of the winze 850 ft. deep, and the 40 ft. of drifting done to date gives an average of \$8.33 over the width of the drift, with the vein somewhat wider than this. The annual report shows the average grade at a little under \$7, but if these favorable new developments continue, the estimate will have to be increased. The consulting engineer, in recommending that the shaft be continued to a 1,000 level, expressed the opinion that higher-grade ore would be encountered at depth.

A Toronto brokerage house has underwritten a block of treasury stock of the Barry-Hollinger Mines, in the Kirkland Lake area, and the money so raised will be sufficient to complete the 50-ton mill and carry on additional development work. The shaft is down 625 ft. and will be continued to 900 ft. The length of the oreshoot is found to increase as depth is attained.

At the annual meeting of the Beaver Consolidated Co. of Cobalt, held in Toronto on Feb. 26, the three contending factions got together and elected a new board, with representatives from the different groups. The company's Cobalt property has been closed since the Coniagas dropped its option, and the cash in the treasury amounts to only \$733. Its holdings in the Kirkland Lake Gold mine are, however, carried at \$815,034, which is given at cost. The Kirkland Lake Gold was financed by the Beaver and was recently reorganized when the Anglo-French Exploration Co. assumed control. The new shaft is now down 1,600 ft., and cross-cutting at that level has disclosed two veins carrying low values, but the cross-cut has not yet reached the main vein. A new and larger hoist, capable of carrying operations to 3,000 ft., has been purchased and will soon be installed.

The Nipissing Mining Co. has started work on the claims which it recently optioned in the Bass Lake section, four miles from Cobalt. High-grade ore was found on the adjoining property, and a shaft has been sunk to a depth of 50 ft. The ore dipped out of the shaft at 30 ft., and a crosscut is now being run to catch the vein.

The McKinley-Darragh-Savage company, of Cobalt, has found a new high-grade vein, showing 1½ in. of ore. Recent results on this property have been better and milling heads have been as high as 14 oz. per ton.

News from Washington

By PAUL WOOTON
Special Correspondent

Department of Justice Investigates Alleged Illegal Lead Marketing

Producers See Early Collapse of Charges—Market
Highly Competitive

THE U. S. Department of Justice is investigating charges that illegal methods are being used to keep the price of lead at artificial levels. Though the department is making no announcements in connection with its probe of the situation, it is known that proof is being laid before its attorneys in an effort to show that the charges are groundless.

The department has been informed that in no industry is competition keener than among the producers of lead. In most industries competing producers meet occasionally to discuss common problems, but the lead producers are more meticulous. There is practically no personal contact among them. In a business way it is notorious, the department has been informed, that competition is exceptionally keen.

Under the conditions created by the dwindling of reserves of lead, there frequently is a threat of a runaway market—a situation which all the large producers are anxious to avoid. Though they realize that the trend of lead prices can only be upward unless large new deposits are opened, they are anxious to eliminate violent fluctuations in prices.

The large consumers of lead realize just how open is the competition among the lead producers, and no large consumer is a party to this complaint. No announcement has been made as to the source of the charges, but they are understood to have originated with

certain small consumers in the Middle West. It is believed that they jumped to the conclusion that there was collusion between the producers at the time of the recent price advance. Without acquainting themselves with the facts, complaints were filed with the Federal Trade Commission and the Department of Justice. The contentions looked plausible to the Department of Justice, which does not happen to be an authority on the lead industry, and the investigation was begun. The fallacy of the charges is becoming apparent to the complainants and to the department, it is thought.

Though the lead producers say that they have no fear whatever of any investigation, those who are trying to squeeze some of the waste out of our economic processes recognize that unwarranted investigations create needless confusion in business.

In connection with its investigation of the case, the Department of Justice is learning that the paint and electrical equipment manufacturers are making such demands on the lead producers that they are scouring the earth in search of new deposits. Mexico, Brazil and Siberia are being combed in an effort to find new supplies. Probabilities point to the fact that the education of the department in matters pertaining to the lead industry soon will have reached a point where the fallacy of its quest will have become apparent.

Development of Potash Deposits Stopped by Budget Program

The bill introduced in Congress proposing to appropriate \$500,000 for a major effort to attempt to develop potash supplies sufficient for the needs of the country, within our own borders, has been pigeonholed by the House Committee on Mines and Mining because the bill "is contrary to the President's financial program," calling for strict economy in all departments of the federal government.

The committee was ready to report out the bill, which already had passed the Senate, when the word was handed down that it did not meet with executive favor. It had been planned to spend a considerable part of the money in drilling the Red Beds of the Southwest, where deposits of potash have been revealed in the drilling of oil wells and where geological evidence points to the existence of large deposits. "The legislation must go over until next Congress," said Senator Sheppard, of Texas, the author of the measure, "because we could not budge the budget." It may be revived later.

Sulphur in General Leasing Act

Sulphur will be added to the minerals covered by the general leasing act if the national House of Representatives acts on a bill which has been passed by the Senate and reported favorably by the Committee on Public Lands.

The recovery of sulphur from deep strata makes it entirely comparable to petroleum, it is pointed out. By allowing a 640-acre limit it is believed the production of sulphur in the public lands will be encouraged. Sulphur beds frequently are encountered in the drilling of oil wells.

This legislation will allow the oil operator to take advantage of his discovery of sulphur.

Good Year for Ohio Copper

The Ohio Copper Co. during 1924 had the best year in its history, when "leaching-in-place" operations were carried on steadily. Total operating profits amounted to \$784,759. The cost of copper production, including smelter, railroad, and mine operation charges, was 5.815c. per pound; and the operating profit per pound was 7.061c.

London Letter

By W. A. Doman
Special Correspondent

See Possible Merger of Globe & Phoenix and Neighbors

Rhodesian Gold Producer Finds New Ore—Transvaal Holding Companies Face Tax Difficulties

London, Feb. 17—The Rhodesia Exploration Co. owns fifty-five claims adjoining the property of the Globe & Phoenix Gold Mining Co., including the John Bull claims (ten), in which the Globe and Phoenix holds a 50 per cent interest. The latter company having made a strike of reef supposedly in the John Bull claims, the Rhodesia Exploration engineer has been allowed to inspect the workings. No decision has yet been announced. At one of the annual meetings of the Globe & Phoenix, J. D. Hope, the chairman, stated that the John Bull claims were vital to his company. The position, therefore, has become distinctly interesting, especially in view of the dwindling ore reserves. Another adjoining mine, the Gaika, desires to come to an arrangement with the Globe & Phoenix, though its terms are nothing less than control, which the Globe & Phoenix directors do not wish to concede. It would perhaps not be surprising if an amalgamation of all three mines were to be brought about.

San Francisco Mines of Mexico has had rather a hard knock, and the reason for it is difficult to see. People who evidently desired the price to go lower started a rumor that the expense of sinking a new shaft would prejudice dividends. According to the report recently issued, the company has ample funds, and long before the present ore reserves (sufficient for two years) are exhausted, development, checked by an influx of water, should be in full swing again on an increasing scale.

Mining investors have been rather perturbed at a decision given in South Africa that the Transvaal Provincial Council has power to tax the income of mining finance companies. The Johannesburg Consolidated Investment Co., which paid over £57,000 under protest, brought a test action, and the judge has decided against it. All finance companies are of course affected. The matter will not be left where it is, because double taxation of the same profits, once at the mines, and secondly on the amounts disbursed to the finance companies, is not allowed, and the Transvaal Provincial Council is specifically forbidden by law to tax mining profits. The case is, in reality, rather more complicated than would appear from the facts as stated. If a Transvaal finance company lends money to an individual in London, the income resulting therefrom is not taxable; if, however, it lends to a limited liability company the income is taxable.

There is evidently going to be a struggle in the diamond world. The Union Government intends introducing legislation to compel the big producers to hand over their stones for the government to sell. This is interfering

McIntyre Porcupine Made Record Production in January

IN JANUARY the McIntyre-Porcupine Mines, of Porcupine, Ont., milled 34,000 tons, averaging \$9.60 per ton, which is a new high record. Of the total amount, 300 tons a day was obtained from development work. The Jupiter shaft will soon be reopened, from which it is expected to obtain an additional 6,000 tons a month.

The new central shaft is down about 200 ft., and as operations are becoming more systematized better speed is obtained. On the 1,875 level the old Jupiter vein system has been picked up, showing \$12 ore over a width of 8 ft. This is an important development, as it is 875 ft. below the nearest workings.

with private capital—not to say vested interests—and should this capital, together with the experience attaching to it, be withdrawn, the government would not have an easy task. The government's adviser may have some knowledge of diamonds but not of the diamond trade.

On the property of the Zambesia Mining Development an important discovery of magnetite is reported. Specimens tested in London show 72.26 per cent metallic iron.

Belgium Sadly in Need of Zinc Concentrate

Renewed efforts are being made by Belgium to secure American zinc for smelting. England, with its new smelter at Avonmouth, and the expansion of facilities elsewhere, now is in a position to handle all the Australian concentrates.

With 40 per cent of its smelting capacity dead and cold, the United States is in no position to lose business to Belgium, it is pointed out. The Belgians in their strenuous efforts to secure concentrates are said to be figuring on the possibilities of handling Joplin concentrates by barge to the gulf, where they would be transferred for the overseas part of the haul.

W. A. Harriman Will Get Russian Manganese Concession

Negotiations for a Russian manganese concession by the W. A. Harriman interests, of New York, have been halted by the refusal to pay \$1,000,000 in advance. However, Petakoff, head of the Concessions Committee, said full agreement had been reached on all other points and the disputed point is not sufficient to prevent the consummation of the transaction. Soviet officials say they have decided to close with the Harriman interests. Under the terms, the Harriman company must spend \$4,000,000 for plant and railroad building and guarantee a minimum output of 800,000 tons a year, paying minimum royalty of \$3,200,000.

Brisbane Letter

Special Queensland Correspondence to Mining Journal-Press

Saint-Smith Estimates 3,000,000 Tons at Mount Isa

This Is Assured Ore—"Insignificant" as Compared to Potential Tonnage—Water Is a Problem

Brisbane, Jan. 25.—E. C. Saint-Smith, Queensland Government Geologist, in a report on recent developments at the Mount Isa silver-lead field in the Cloncurry section of that state, says that operations on the main lines of lode up to the present largely confirm the encouraging reports already published as to the importance of this extensive field as a large producer of silver-lead ore. He adds, however, that it is recognized that extensive development work—including not only the further sinking of main shafts but the installation of mining and metallurgical equipment and power plants, rail connection and provision of a water supply—will precede actual production.

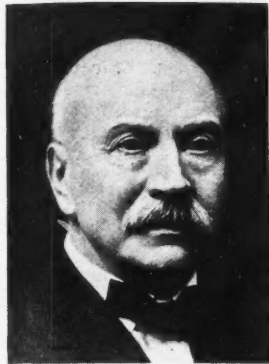
The water-supply problem of this field is considered serious, but Mr. Saint-Smith, who has had six months' practical experience there as superintendent of the Mount Isa Mines, Ltd., considers that the present indications below the 190 level practically assure that most, if not all, of the water needed for concentrating purposes will be attainable from the deep workings.

The geologist before operations began expressed the opinion that the important Black Star-Ibus-Starlight lode channel would continue to a depth. He now states that when seen in November last it had persisted to 190 ft. on the Black Star lease, and later news from the field showed that it had gone to 200 ft. in this mine, and that on the adjoining Ibus lease the same orebody had been penetrated to a depth of 180 ft. On all the shafts upon this lode a gradual but constant increase in the silver values on the whole face is being recorded. Occasional assays of the shales which separate the individual bands of high-grade carbonate of lead ore, and which generally contain but negligible values in silver and lead on the surface, now show silver values as high as 300 oz. per ton, with quite insignificant percentages of lead, strongly suggesting secondary enrichment in silver.

Taking into account only the more important lodes opened up, the government geologist estimates the ore of payable grade at a minimum of 3,000,000 tons, and, in addition, a considerable quantity of "probable" ore can safely be relied on from other lines of lode. He adds that, owing to the magnitude of the prospecting operations involved and to the decision of the two operating companies to test the lodes to the primary sulphide zone as rapidly as possible, the tonnage of actually "developed" ore is of course at present insignificant.

The four shafts on the Black Rock lease proved the fine oreshoot here for a total of 550 ft. to a maximum depth of 165 ft., at which point the ore assays 26 per cent of lead and 12 oz. of silver.

Men You Should Know About



Colonel Henry C. Rizer

Colonel Henry C. Rizer, chief clerk of the U. S. Geological Survey, resigned from the service of the Survey on March 1. On the occasion of his retirement George Otis Smith, Director, issued to all members of the Survey the following memorial of appreciation: "To the Survey members: On Feb. 5 our chief clerk, under whom all of us in the Geological Survey have served for varying periods of time, presented his request for retirement, to be effective March 1. The members of the Survey who know Colonel Rizer from intimate association year in and year out could write pages of loving and deserved tribute. All of us, however, will be interested in Secretary Work's résumé of the Colonel's service in his letter of Feb. 10 approving the request for retirement: 'The records of the department show that you have been continuously in the government service since July 1, 1883, with the exception of a period of separation from Dec. 1, 1886, to June 14, 1889, about two and a half years. Your continuous service will total at the date of retirement thirty-nine years, one month, and fourteen days—as the Director of the Geological Survey states, "an exceptional record of faithful service." The records also show that you served your country in the time of war from Sept. 16, 1861, to May 29, 1865. I congratulate you upon this period of long and valuable service rendered to the Geological Survey almost from its organization. I hope that you will enjoy the release you so well merit from the cares of the responsible position you have filled so satisfactorily for so long. The knowledge that you gave your best to the service of your country in the time of war when a young man and in a civil capacity in the prime of life, will, I am sure, fill many a leisure moment with satisfaction and happy reflections.'"

Hugh McCrorie, formerly of Fairbanks, Alaska, is in British Guiana prospecting for diamonds, Mr. McCrorie's present address being Kamakusa, via Georgetown, British Guiana, South America.

James S. Douglas and T. A. Rickard sailed on the steamship "France" on Feb. 28 for England, on their way to South Africa, where they have arranged to visit the principal mining districts of the Transvaal and Rhodesia.

George E. Farish, consulting mining engineer of New York, is in Sicily, where he will remain until March 15, after which date he will be in Sardinia and Italy until September. His European address is Maquay & Co., bankers, Florence, Italy.

William Lawrence Saunders, past president of the A.I.M.E., has been awarded the honor cup of the University of Pennsylvania, which is each year given to the most distinguished alumnus of the institution. The presentation took place at the University of Pennsylvania Club in New York on March 3. Mr. Saunders is deputy chairman of the board of the Federal Reserve Bank of New York and a director of various large industrial corporations, and an inventor of various devices used in mining.



C. L. Burdick

E. A. Cappelen Smith and C. L. Burdick, both of Guggenheim Brothers, sailed from New York, on Feb. 19, on the steamship "Santa Luisa," for Tocopilla, Chile, on professional business.



E. A. Cappelen Smith



E. C. Saint-Smith

E. C. Saint-Smith, government geologist and one of the staff of the Geological Survey of Queensland, Australia, early last year, by special arrangement with his employers, temporarily severed his connection with that survey to fill the position of superintendent of the Mount Isa Mines, Ltd., the company owing the majority, and the principal, mines in the newly discovered Mount Isa silver-lead field. In the latter capacity he organized and for six months supervised the important prospecting and development campaign now being carried out by the Mount Isa company. He has written four geological reports on the Mount Isa field—three while in the employ of the Queensland government and one for the company by which he was for a time engaged. The last of these reports, dealing with the latest developments on the new Queensland field, was published by the Queensland Mines Department in January last, and is epitomized in the Brisbane news letter on page 420 of this issue of *Mining Journal-Press*. Mr. Saint-Smith has given special attention to silver-lead, tin, artesian water, coal, and iron ores, as well as to rare metals, and has examined and reported on many Australian mineral regions and mines. He has also carried out mining investigations in Tasmania (Australia) and on the French island of New Caledonia. Wielding a facile pen, his reports are lucid and interesting alike to the scientist and layman.

Obituary

Frederick Crabtree, professor and head of the Department of Mining and Metallurgical Engineering at Carnegie Institute of Technology, died on Feb. 14.

William Andrews Clark, president of the United Verde Copper Co., and one time miner, prospector, and Senator from Montana, died at his home in New York City, on March 2, from pneumonia. A sketch of Senator Clark's career will appear in our March 14 issue.

Societies, Addresses, and Reports



Provincial Mineralogists of British Columbia—Present and Past
Left, John D. Galloway, 1925. Center, W. Fleet Robertson, 1898-1925.
Right, W. A. Carlyle, 1896-1897

Western Meeting of the Canadian Institute

By T. A. Rickard

THE MEETING of the British Columbia division of the Canadian Institute of Mining and Metallurgy was held at Vancouver Feb. 18-20. The sessions started auspiciously with a welcome from the Mayor of the city and a gracious response by the chairman of the division, W. A. Carlyle. In his speech Mr. Carlyle referred to the old days when the independent consulting engineer was in his prime, and he attributed his diminished scope not only to the growth of big corporations, but also to the fact that so much of his work was now done by engineers on the spot. He dwelt upon the ubiquitous character of the British mining engineer's activities in former days and the American engineer's more recent participation in world-wide mining operations. Mr. Carlyle quoted the rise in the prices of metals as an encouraging sign.

The secretary, H. Mortimer-Lamb, read his annual report, of which it can be said that in matter and manner it was a model for such records. He had to acknowledge a decrease of membership, due to inauspicious industrial conditions, but he claimed that there had been no abatement of the interest shown by members in the work of the Institute. In these respects the British Columbia division of the Canadian Institute is by no means peculiar; for all professional organizations of a similar kind have suffered somewhat of late, for obvious reasons.

The secretary was followed by the Provincial Mineralogist, W. Fleet Robertson, who presented a statistical record of mining in the province during 1924. An increase of 11 per cent in the value of the production is to be noted, the total being \$46,000,000. Metals show an increase of \$6,888,000, whereas the coal output decreased \$2,610,000 in value, partly on account of labor troubles, but partly also by reason of the competition of oil fuel from California.

H. G. Nichols presented a concise summary of recent discoveries such as give promise of successful development. He referred to the pockets of rich ore uncovered in the Engineer mine, in the Atlin district, the recent interest in the gold finds near Dease Lake in the Cassiar district, and the discoveries of high-grade silver-lead ore in the Babine country. The Omineca, Hazleton, and

Portland Canal districts were mentioned in connection with significant developments, so that Mr. Nichols gave ample warrant for his conclusion that the mining industry of the province was distinctively alive and growing.

At the afternoon session, Frank H. Probert, dean of the College of Mining in the University of California, delivered a most interesting address on "Science in Mining," placing particular emphasis on the need for applying the one to the other. Mining, he said, is a business guided by organized common sense, which we call science. "Science," he said, "is the great emancipator of labor." The urge to produce has given excuse for wasteful procedure. Science must be applied to financial methods. He made a plea for sensible legislative enactment, for rational taxation, and for truth and justice in the relations between employer and employee. The human aspect of the problem needs to be understood, and a scientific study of human nature must be made for the purpose of allaying the friction that impedes the working of the wheels of industry. This address received close attention and keen approval.

Next G. G. Aitken discoursed pleasantly and instructively on "Comparative Geography Applied to British Columbia." The restriction of immigration to the United States would cause a diversion of European emigrants to Canada, and proportionately to British Columbia. The population of Canada is 2.35 per square mile; of Washington, Oregon, Idaho and Montana, 7.86, and of British Columbia, only 1.41. Next he touched upon climatic conditions, and proved to the satisfaction of most of his audience that Vancouver "has it all over New York." In short, the paper was an excellent piece of propaganda.

Then the present writer was asked to start a discussion on "Metal Supplies and Markets," a subject surely big enough for a long talk. He started by referring to the comprehensive article on "The Evolution of Mining," by Mr. Spurr, appearing in a recent issue of *Mining Journal-Press*, and made the statement that the production of the principal industrial metals (iron, copper, lead, and zinc) has trebled in the last thirty-five years, and doubled in the last twenty-five years. The tremendous growth of production reflects

a commensurate growth of consumption, and makes clear the fact to what an extent our material civilization rests upon a metallic basis. As the outlying parts of the world become civilized, their inhabitants begin to use metals, and develop the demand for them; the Standard Oil five-gallon can is the symbol of a civilization that encroaches upon the wood and stone culture of primitive peoples. The prospect of an exhaustion of the principal metals was discussed by the speaker, who, however, saw no imminent danger of a failure of supply, except in respect of lead and tin, for both of which substitutes would be found in due course. A reference to the alloy-steels was made, and the fact was noted that some of the metals—such as iron, aluminum, and magnesium—can be derived from rock-forming minerals, the supply of which is inexhaustible. C. P. Browning discussed the prospects of an adequate supply of copper, coming to a favorable conclusion.

At this session, the secretary presented a medal given by R. W. Leonard for the best paper in the *Transactions* of this Institute and of the Engineering Institute of Canada. The winner was W. L. Uglow, professor of mineralogy in the University of British Columbia, to whom the award was made in recognition of his paper on the "Undiscovered Mines of British Columbia." In the evening R. W. Brock, dean of the mining department of the University of British Columbia, gave an interesting lecture on the mineral resources of Canada.

The two sessions next day were devoted entirely to a symposium on the economics of the Pacific Great Eastern Ry., and the question whether it was desirable or not, in the interest of the people of British Columbia, that this railroad be maintained and extended. The opinion of the members of the Institute appeared favorable to the enterprise. To an onlooker the need of north-south railroad lines in western Canada is obvious, for as yet the building of railroads has taken the form of an unnecessary duplication and paralleling of east-west lines of communication.

At the luncheon of the Kiwanis Club, to which the members of the Institute and their guests were invited, an address was delivered by Milnor Roberts, Dean of the School of Mines in the University of Washington. His discourse on "Legitimate Mine Promotion" was compounded of good fun and sound sense.

At the banquet on the last day a presentation was made to W. Fleet Robertson, on his retirement from the office of Provincial Mineralogist after a service of twenty-seven years. His successor is J. Galloway. Mr. Carlyle preceded Mr. Robertson. His retirement is a notable event to British Columbia, for he has conducted his duties with an integrity of character and a sincerity of purpose such as have won the support and commendation of the mining public in the province, and in Canada generally. He deserves the rest that he needs, and he takes with him the affectionate esteem of his profession, not only in Canada but also in the United States.

New Machinery and Inventions

Flotation Cell Has Features of Value in Differential Separation, It Is Claimed

A new flotation unit known as the Simpson pneumatic flotation cell has recently been introduced, the operation of which is controlled entirely by means of compressed air, which serves to perform two separate and distinct functions. The pulp is fed into the bottom of the first compartment, which connects with the bottom of the air lift. The air lift is so arranged that the air is introduced into the pulp through a series of small openings in the air pipe, forming jets or sprays of air which thoroughly aerate the lower portion of the air-lift compartment.

The violence of this operation is con-

By carrying a deep layer of froth, there is a tendency for the mineral particles to stratify themselves within the froth according to their amenability to flotation. Thus by regulating the rapidity of the flow of froth by means of controlling the volume of air in the frothing compartment, the froth, containing only the lighter or more readily floatable mineral particles, is taken off the first few compartments of the cell. In the succeeding compartments, the baffle boards are lowered, thus maintaining a thinner layer of froth, and with a slightly increased amount of air the froth is discharged more rapidly, thereby carrying the heavier and less readily floatable mineral particles.

In the quiet water spitzkasten into which the froth is discharged as it cascades over the baffle boards the bubbles tend to rearrange themselves in the froth, as they are temporarily submerged before passing over the overflow lip of the cell into the concentrate launder. At this point, much of the silica or other gangue material which has been carried over the baffle board entangled in the froth is given an opportunity to drop out. This froth-washing arrangement gives a much higher-grade concentrate over the overflow lip of the machine than that which comes over the baffle board.

These features, it is claimed, are of value in the matter of differential flotation, as three operations are accomplished in one machine—namely, collection of mineral from the gangue, separation of the minerals one from the other, and washing the concentrates before discharging.

The arrangement of the discharging device for the tailings provides for the discharging of the solids, with but a small percentage of moisture, through a valve at the bottom of the machine, and for the overflow of the majority

of water over an adjustable weir which regulates the depth of water in the body of the machine and which carries only a small percentage of solids. The machine is free from mechanical difficulties, for there are no moving or mechanical parts in or on the machine. There is no clogging of the air mat, as the pulp is kept in constant motion by means of the air lift. The inventor of the new cell is Gerald R. Simpson, who has associated himself with the Baker-Hickman Co., of Long Beach, Cal., manufacturers of mill products. The manufacturing and

selling rights on Mr. Simpson's patent have been purchased by the company, and preparations to make and distribute the cell are going forward. A number of different mills and laboratories have used the cell with satisfactory results, Mr. Simpson states.

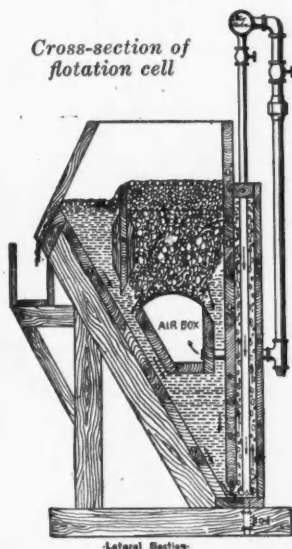
A New Pencil for Draftsmen

Color plays a part of increasing usefulness throughout the engineering and commercial world in connection with maps, plans, charts, blueprints and a great many other uses not foreseen when the old-style colored pencil with thick lead was first introduced. Realizing how many occasions in modern industry called for the use of colored lead of the same diameter as ordinary drawing and writing pencils, the American Lead Pencil Co., 220 Fifth Ave., New York City, has originated a new product called the Unique thin lead colored pencils. These pencils are available in blue, red, green, and yellow and can be used exactly the same as an ordinary black lead pencil, for writing, figuring, checking, drawing, marking blueprints, sketching, and the like.

The pencil is full 7 in. long, made of carefully selected wood, colored the same as the lead for easy identification. A free sample will be sent to companies requesting it.

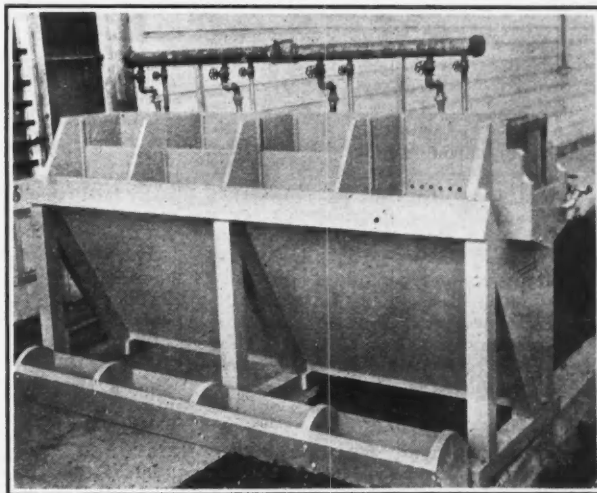
New Electric Meters

Three new types and two improvements in existing types are among the recent developments in the various lines of meters and instruments marketed by the General Electric Co. The new devices are a totalizing watt-hour meter; a three-element, four-wire, three-phase watt-hour meter, and a complete line of alternating- and direct-current switchboard instruments. Improvements include a modified terminal assembly for three-wire, single-phase watt-hour meters and a new contact device for watt-hour meters when used with demand meters. The three-element watt-hour meter was developed to give a device independent of a balanced condition of voltage for correct registration.



trolled by the pressure and volume of air admitted. This provides a thorough stirring and agitating action, which in mechanically agitated machines is accomplished by rotors or impellers. It also serves to maintain the pulp in a constant state of circulation, carrying it to the top of the cell and distributing it in a thin film at the surface of the water within the body of the machine. At this point the second function of the compressed air becomes operative, as the column of bubbles, which is forced through the porous medium in the body of the pulp, rises to the surface of the water, forming a froth which carries with it the floatable part of the ore. Thus we have a continuous operation in which the pulp is raised from the bottom of each compartment, fed through a thin layer over the rising column of bubbles, which carries the floatable particles upward, leaving the gangue material to settle on an inclined partition, which conveys it to the bottom of the succeeding air lift, where the same operation is repeated.

The adjustable baffle board constituting one wall of the froth compartment regulates the depth of froth which is formed above the surface of the water.



This flotation machine operates entirely by compressed air and has no moving or mechanical parts

An Improvement in Carbide Lamps

Some time ago a miner's carbide lamp made of aluminum, die-cast, was introduced by the Fred R. Belt Co., Inc., 355 West Ontario St., Chicago. Since then a further improvement consisting of a locking device without screw threads has been made in this lamp. The device is strong and rigid without movable parts. The carbide cup is put on quickly and locks tight with a slight turn. The annoyance that is sometimes caused by the screw thread ordinarily used is obviated.

Hooks, water caps, valve levers, and other parts can be replaced on this lamp, which is known as the Lu-Mi-Num lamp, and there are no soldered seams to leak. It is claimed that it is the only lamp that can be taken completely apart for cleaning and repairing.

Many New Grades of Wire Cloth

Some interesting developments have taken place in the manufacture of wire cloth and screen during recent months, according to a statement by the Ludlow-Saylor Wire Co., of St. Louis. The first of these was the increasing of the wire-cloth assortment available to users by more than 200 new grades not heretofore listed by any manufacturer. Modern industrial developments have produced many new uses for wire cloth, and it is to meet the increasing variety of needs that the Ludlow-Saylor company has developed new grades of screen.

Other developments of importance in the wire-cloth field include the success resulting from the efforts of the U. S. Bureau of Standards, the American Society for Testing Materials, and the American Institute of Mining and Metallurgical Engineers, to arrive at and adopt workable standards for testing sieves. The broadening of the Bureau of Standards series to permit the employment of regular standard market grades has produced a series which it is thought has possibilities of wide adoption.

New Laboratory Equipment

During the last year several minor improvements have been made by the Denver Fire Clay Co., Denver, Colo., in the mechanical construction of the D.F.C. assay furnaces. A more important improvement is the adoption of super-refractory material for all special fireclay tile that constitute the muffle supports. Refractories now supplied with this support can withstand a temperature above 3,400 deg. F. and give about double the service of the best fireclay refractories furnished heretofore. They are also said to insure longer life of muffles by virtue of more uniform and permanent support.

The company has also developed a new plastic firebrick known as "plastofrax," mixed ready for use, shipped in 200- and 700-lb. containers. This, it is claimed, has practically the same refractory qualities and coefficient of expansion and other important physical and chemical properties as a first-

quality firebrick; it has passed the U. S. Navy requirements. It is said to be especially desirable for molding special shapes for emergency repairing, saving the time required by the ordinary method.

The company also announces that it is now prepared to supply all standard shaped bricks and special tile of all description made of its Ibex super-refractory material. Its softening point is about 3,400 deg. F. Ibex refractories are very tough, and will stand considerably more abrasion than the stiff-mud brick or hand-molded fireclay tile, it is claimed. Ibex refractories are said to have been found especially useful for cement kilns, water-gas machines, billet forges, drill steel forges, and many other high temperature, heavy-duty applications.

Filter Design Modified

Development of its apparatus used in the mining, chemical and allied fields is reported by the United Filters Corporation, of Hazelton, Pa., to have been along lines of further improvement and perfecting of its various standard types of filters. A device used in the American continuous filter for removing the cake has been improved by mounting the rollers on tempered steel leaf springs. This is said not only to insure removal of practically 100 per cent of the cake, but at the same time reduces bag wear to a minimum. Another modification in the same filter has been the placing of a partition in the filter pan which permits filtering two or more different products simultaneously. That is, the same machine can handle lead concentrates, for example, on one side, and zinc concentrates on the other. This feature is of particular interest to small mills having several different products to filter.

A comparatively new application of continuous vacuum filtration is in the recovery of blast-furnace flue dust. In conjunction with the Dorr Co., the United Filters Corporation has been a pioneer in this field, and the general system is thoroughly described in a report that it has issued entitled "The Recovery of Blast Furnace Flue Dust."

Improvements have been made in the lead lining of the Sweetland filter and in otherwise acid-proofing them for handling acid, caustic, or other corrosive materials. Details of these improvements are explained in Bulletin No. 108, issued by the company.

Eötvös Torsion Balance —A New Type

A new type of Eötvös torsion balance in which readings can be obtained either photographically or visually is now being constructed by L. Oertling, Ltd., of Turnmill St., London, E. C. 1, England. With the balance already made by the company visual readings only are possible. Next month the company hopes to be able to give a demonstration of the balance to certain government departments, scientists, and the principal mining and oil companies. The *Mining Journal-Press* expects to be able to print a description of the improved instrument in an early issue.

Trade Catalogs

Couplings—Bulletin 35 issued by the Falk Corporation, Milwaukee, Wis., describes the Falk-Bibby flexible coupling.

Pumps—A report by Robert L. Daugherty on the "Investigation of the Performance of Centrifugal Pumps When Pumping Oils" to the Gould's Manufacturing Co., Seneca Falls, N. Y., has been issued in pamphlet form by the company.

Shovels—Bulletin 250, on revolving and railroad shovels, 16 pages, illustrated, has been received from the Osgood Company, Marion, Ohio. Circular 253, on the Osgood power shovel, and circular No. 251, entitled "Better Roads and Streets with an Osgood," have also been received.

Reduction Gears—New types of reduction gears are described in Bulletins 105 and 106 issued by the Poole Engineering & Machine Co., Baltimore, Md., No. 105 covers the Type H speed transformer and No. 106 the Type K speed transformer.

Classifier—The Fahrenwald constant-density hydraulic classifiers are covered in Bulletin No. 12, issued in February, 1925, by the Coeur d'Alene Hardware & Foundry Co., of Wallace, Idaho.

CO₂ Meter—Bulletin 118-A, describing the principal of operation of the Apex pneumatic CO₂ meter, and Bulletin 118, describing the Apex CO₂ recorder, have been issued by the Uehling Instrument Co., 473 Getty Ave., Paterson, N. J.

Shovels—A folder received from the Thew Shovel Co., Lorain, Ohio, describes the Thew center drive truck.

Vibrating Screen—Bulletin 12 of the Deister Concentrator Co., Fort Wayne, Ind., is devoted to the latest type Leahy No-blind screen, with special reference to the re-designed heavy-duty vibrating mechanism.

Dust Removal—Bulletin DA 201 of the Northern Blower Co., Cleveland, Ohio, covers "Norblo" dust-removal equipment for cement mills and other plants.

Valves—Homestead valves are described in Catalog 32, 48 pages, issued by the Homestead Valve Manufacturing Co., Homestead, Pa.

Soot Blowers—Catalog 50R of the Marion Machine & Foundry Supply Co., Marion, Ind., describes the Marion line of soot blowers.

Ball Mill—The Herman screening ball mill is described in Bulletin No. 424 just issued by the Braun Corporation, 363 New High St., Los Angeles, Calif. This mill is the invention of John Herman. The catalog contains statements which, it is claimed, are based upon actual operating data, with carefully verified results of tests. An effort has been made to throw some light on certain disputed points of ball milling.

Skip Hoist—Book No. 546, issued by the Link-Belt Co. (Philadelphia, Indianapolis and Chicago) explains the function of the skip hoist and its relation to other types of mechanical equipment. Details of operation and design are given.

The Market Report

Daily Prices of Metals

Feb. Mar.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
26	14.375	56.125	56.875	9.15	8.80	7.45
27	14.30	55.625	56.375	9.00@9.25	8.75@8.80	7.375
28	14.25	55.50	56.125	9.00@9.25	8.75	7.35
2	14.25	54.00	54.625	9.00@9.25	8.70@8.75	7.20@7.35
3	14.35	54.25	54.875	8.975	8.55@8.75	7.35@7.40
4	14.35	54.625	55.30	8.975	8.65@8.75	7.40
Av.	14.313	55.021	55.696	9.079	8.733	7.371

*The prices correspond to the following quotations for copper delivered: Feb. 26th, 14.625c.; 27th, 14.55c.; 28th and Mar. 2d, 14.50c.; Mar. 3d and 4th, 14.60c.
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. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.
The quotations are arrived at by a committee consisting of the market editors of Mining Journal-Press and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Feb. Mar.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
26	64½	65½	69½	261½	264½	38	36½	37	35½
27	64½	65½	69½	258½	261½	38½	36½	37	35½
2	63½	64½	68½	250½	253½	37	35½	35½	34½
3	64½	65½	68½	251½	254½	37½	36½	36½	35½
4	64½	65½	69	253½	257	37½	36½	36½	35½

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

Silver, Gold, and Sterling Exchange

Feb. Mar.	Sterling Exchange "Checks"	Silver		Gold London	Mar.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
26	4.75½	68½	32½	87s 1d	2	4.76½	68½	32½	86s 10d
27	4.75	68½	32½	87s 3d	3	4.75½	68½	32½	86s 10d
28	4.76½	68½	32½	.....	4	4.76½	68½	32½	86s 9d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Prices Slightly Higher, with Increased Sales

New York, March 4, 1925—The recent reaction in metal prices seems to have culminated on Monday, March 2, when extremely unfavorable cables were received from London; since then, the market has been somewhat stronger, sales having been slightly more active than last week, especially in lead, zinc, and tin. The pronounced drop in the London market on Monday is generally attributed to the death of President Ebert of Germany, and to the uncertainty of the European political situation, which was accentuated by that event; also, the discounting of a rise in the Bank of England rate.

Copper Advances Slightly from Recent Low

Copper lost ground in an inactive market until Monday, when several sellers booked a few orders at 14½c. delivered, though most of the larger producers continued to quote either 14½ or 14¾c. without expecting to get much business. With the stronger tone of the foreign market on Tuesday morning, offers of 14½c. were all withdrawn, and yesterday and today the lowest sellers were asking 14¾c. A fair tonnage was sold at that level, but some sellers found it necessary to make con-

Average Metal Prices for February

Copper:	
New York Electrolytic.....	14.463
London Standard.....	64.713
London Electrolytic.....	69.525
Lead:	
New York.....	9.423
St. Louis.....	9.126
London.....	37.944
Silver:	
New York.....	68.472
London.....	32.245
Sterling Exchange.....	476.886
Zinc:	
St. Louis.....	7.480
London.....	36.528
Tin:	
99 per cent.....	56.517
Straits.....	57.068
London.....	262.181
Quicksilver.....	79.386
Antimony.....	19.795
Platinum:	
Refined.....	117.000
Crude.....	114.216

cessions of a few points. March metal seems to be pretty well cleaned up, and no concessions were offered on prompt deliveries below the prices asked for April, which latter month seemed to be most in demand. Some ingots have been offered in the last two days at around 14.575c., but wire bars seemed to be pretty well held at 14.60@14.625c. this afternoon, even though the day had been a very quiet one.

The foreign market has been unusually quiet, large interests holding at 14.95c., c.i.f., which was not at all attractive to buyers. Small tonnages have found a market around 14.75c.

Lead More Active at Reduced Prices

On Tuesday, March 3, the American Smelting & Refining Co. reduced its contract price of New York lead from 9.25 to 9.00c. This reduction had been expected in the trade for several days, as 9c. was all that most others could obtain for more than a week, and in fact some lead was sold for even less than 9c., as we reported last week. Some Western lead was marketed at around 9.10c. in the East, before the Smelting company's reduction was made. Today, it might be difficult to cut much under the 9c. level in the New York market, as sentiment is better, though yesterday a fair tonnage was sold at 8.90c. In the St. Louis market, conditions were more active than for some time, but this activity was only stimulated by small daily reductions in prices which were made by the various producers. These reductions culminated in a price of 8.55c., at which at least one order was placed by a producer yester-

day; he apparently felt that this was too much of a concession, however, for no more was offered at less than 8.65c., at which price a good tonnage was sold. One large producer has refused to go below 8.75c. and reports daily sales at that level. The market is somewhat firmer today.

Corroding grades of lead command a premium of \$2@3 per ton.

Correction—Forward lead in London, Feb. 12, was incorrectly cabled. The correct price was £37½ instead of £37¾.

Galvanizers More Active in Zinc Market

The marked decline in zinc on Monday attracted a lot of buying by galvanizers, who have been largely out of the market for some weeks. Early on Monday, as low as 7.20c. was done for March shipment, but by late afternoon the metal had sold up to 7.35c., at which level it opened on Tuesday morning. Sales today have not amounted to much, but sellers are bullish, and 7.40c. was about the best that could be done for March. The export market has again been unattractive to American producers, but it is unlikely that European prices will remain long below domestic parity. As with lead, domestic consumers have been buying for early delivery recently, and in only small tonnages, so that a good potential market is in prospect should business conditions improve.

Prime Western zinc in New York continues at the freight differential of 35c. per 100 lb. above St. Louis. High-grade zinc has been inactive at unchanged prices, 83c. per lb. delivered in the East.

Tin at 55c. Finds Ready Sale

The decline of £8 in the London tin market from Friday to Monday was of course reflected in the New York market, in which prices declined below 55c. for the first time since Dec. 11. Chinese tin, of 99 per cent grade, has recently been offered at more than the usual ¼c. discount from Straits, especially on forward shipment. Forward deliveries were quoted at the same prices as spot Straits till yesterday, since when prices have been from ½ to ¾c. higher on June tin.

World's visible supplies of tin at end of February were 23,591 long tons, an increase of 642 long tons for the month. Supplies for January and February were as follows:

	1925	
	January	February
Straits	7,635	7,818
Chinese	1,205	734
Banka and Billiton	850	1,336
Standard	651	1,648
Australian	129	132
	10,470	11,668

Classification of tin imports into the United States:

	1925	
	February	Two Mos.
Straits	5,625	13,195
English	485	1,085
Chinese	585	960
Australian	30	125
Banka and Billiton	35	100
	6,760	15,465

Foreign Exchanges Weak

French and Italian exchanges were particularly weak, though sterling held

steady, and in fact, gained a little over last week. Closing cable quotations on Tuesday, March 3, were: francs, 5.045c.; lire, 3.9925c.; and marks, 23.81c. Canadian dollars, ½ per cent discount.

Silver Steady

There is no change in market conditions, the price both here and in London continuing steady on Indian bazaar support.

Mexican Dollars—Feb. 26th, 52½c.; 27th and 28th, 52¾c.; March 2d, 3d, and 4th, 52½c.

Zinc Blende and Lead Ore Both Lower

Joplin, Mo., Feb. 28, 1925

Zinc Blende	Per Ton
High	\$57.70
Premium, basis 60 per cent zinc	\$54.50@55.50
Prime Western, 60 per cent zinc	\$53.00
Fines and slimes, 60 per cent zinc	\$52.00@54.95
Average settling price, all	\$52.25

Lead Ore	Per Ton
High	\$129.30
Basis 80 per cent lead	\$115.00
Average settling price, all	\$124.93

Shipment for the week: Blende, 16,818; lead, 2,590 tons. Value, all ores the week, \$1,236,550.

Shipment for two months: Blende, 137,352; calamine, 316; lead, 24,805 tons. Value, all ore two months, \$10,757,630.

Lead settlements are still being made on \$125 basis, but all the purchases on a higher basis have been delivered.

Production of blende has fallen behind shipments, which have absorbed 7,320 tons of reserve ore since the first of the year. Of the thirty-odd thousands of tons of stock all but approximately 11,000 tons are sold.

Platteville, Wis., Feb. 28, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	\$56.50

Lead Ore	Per Ton
Lead, basis 80 per cent lead	\$126.00

Shipments for the week: Blende, 762 tons; lead, 80 tons. Shipments for the year: Blende, 6,129; lead, 366 tons. Shipments for the week to separating plants, 1,420 tons blende.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £125 long ton.

Antimony—Per lb.: Chinese brands, 17.50@18c. Nominal. Cookson's "C" grade, 21c. Chinese needle, lump, nominal, 10c. Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb₂O₃, 16@16½c.

Bismuth—\$1.95 per lb. in ton lots. London, advanced on March 2 to 7s. 6d.

Cadmium — 60c. per lb. London, 2s. 2d.@2s. 6d.

Price furnished by Foote Mineral Co. Philadelphia.

Cobalt—\$2.50@3 per lb. Discounts on contracts. Oxide, \$2.10@\$2.25. London, 12s. 6d. for metal; 11s. 6d. for black oxide.

Germanium Oxide—25 to 50 gm. lots, \$7.50 per gm.

Iridium—\$325 per oz. Nominal.

Lithium—95@96 per cent grade in 1 to 5 lb. lots, \$75 per lb.

Magnesium—Sticks, 1½ in., 99.9 per cent, 90c.@\$1 per lb. London quotes 4s. 6d. for 99 per cent.

Molybdenum—99 per cent, \$25 per kg.

Monel Metal—32c. per lb.

Nickel—Ingot 31c.; shot, 32c.; electrolytic, 38c. (99.75 per cent grade). London, £175 per long ton.

Osmiridium—Crude, \$58.50 per oz.

Osmium—\$100@\$104 per oz.

Palladium—\$79@\$83 per oz. Crude, \$60 per oz. London, £19.

Platinum—Refined, \$117 per oz.

Crude, \$114@\$116. London, £24 per oz.

Quicksilver—\$79 per 75-lb. flask. San Francisco wires \$81.65. Quiet. (Last report Feb. 25). London, £12½.

Radium—\$70 per mg. radium content.

Rhodium—\$85@\$90 per oz.

Ruthenium—\$40@\$45 per oz.

Selenium — Black powdered, amorphous, 99.5 per cent pure, \$2.20 per lb.

Tantalum—Metal sheets, \$275 per lb.

Tellurium—\$2 per lb.

Thallium Metal—Ingot, 99 per cent pure, \$5 per lb. in 25-lb. lots.

Tungsten Metal—Powder, 97 to 98 per cent, 95c.@\$1 per lb. contained tungsten.

Zirconium Metal—98 per cent grade. per lb., \$30.

Metallic Ores

Chrome Ore—Per ton, c.i.f. Atlantic ports:

Indian, \$20.
Rhodesian, \$22.
New Caledonian, \$24.
Market nominal.

Galena Radio Crystals—Best quality (50 per cent of sized fragments good) 50c. per lb. in 500-lb. lots, f.o.b. Philadelphia.

Iron Ore—Prices for iron ore and magnetite for 1924 season were published Aug. 9.

Manganese Ore—42c. per long ton unit, seaport, plus duty. Market steady. Chemical grades, powdered, coarse or fine, 82@87 per cent MnO₂, Brazilian, and Cuban, \$70@\$80 per ton in carloads.

Molybdenum Ore—60@70c. per lb. of MoS₂ for 85 per cent MoS₂, concentrates. Nominal.

Tantalum Ore—Foreign, 30@50c. per lb. of Ta₂O₅, contained, c.i.f. New York, according to quality.

Tungsten Ore—Per unit, N. Y.: High-grade wolframite, \$9@\$9.50. High-grade scheelite, \$9.50@\$10.

Vanadium — Minimum 18 per cent V₂O₅, \$1@\$1.25 per lb. Nominal.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can only serve as a general guide as to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can only be ascertained by direct negotiation between buyer and seller.

Amblygonite—8@9 per cent lithium oxide, \$50@\$60 per ton, f.o.b. mines.

Asbestos:

Crude No. 1—\$350@\$425.

Crude No. 2—\$200@\$275.

Spinning fibers—\$100@\$175.

Magnesia and compressed sheet fibers—\$65@\$100.

Shingle stock—\$45@\$55.

Paper stock—\$35@\$40.

Cement stock—\$15@\$25.

Floats—\$9@\$12.

Sand—\$6@\$8.

All per short ton, f.o.b. mine, Quebec, tax and bags included.

No. 1 Rhodesian crude, \$280; No. 2, \$200 per short ton c.i.f. New York.

Prices of crudes show advance. Business has been good. Rumors of merger have caused strengthening of market, production is moderate.

Barytes—f.o.b. Kings Creek, S. C.:

Crude, \$7@\$8 per gross ton.

Ground, off color, \$14 per ton.

White, bleached, \$17 per ton.

Waterground, 300 mesh, bags included, \$22 per ton, Charlotte, N. C.

Crude, \$8.50, f.o.b. Ga.

Crude, \$8.50, f.o.b. Mo.

Water ground and floated, bleached, \$23@\$24, f.o.b. St. Louis.

In Canada, 94@96 per cent BaSO₄, \$9 per net ton, f.o.b. mine.

Demand steady. Market good.

Bauxite—American, f.o.b. shipping point per gross ton:

Crushed and dried, \$5.50@\$8.50.

Pulverized and dried, \$14.

Calcined, crushed, \$19@\$20.

Foreign, per metric ton, c.i.f.:

French red, 5 per cent SiO₂, \$5@\$7.

Adriatic, low SiO₂, \$4@\$6.50.

Beryl—\$65@\$80 per ton, hand-sorted crystals, f.o.b. Vermont. Nominal.

Borax—Granulated or powdered, in bags, 4½c. per lb., delivered. Crystals, 5c. Market normal.

Celestite—90 per cent SrSO₄, finely powdered, \$40 per ton in carload lots.

Chalk—F.o.b. New York, per lb.:

English, extra light, 5c.

Domestic, light, 4½@4¾c.

Domestic, heavy, 3½@3¾c.

In bulk, \$5@\$5.50 per ton.

China Clay (Kaolin)—F.o.b. Virginia mines, per short ton:

Crude No. 1, \$7.

Crude No. 2, \$5.50.

Washed, \$8.

Powdered, \$10@\$20.

Powdered (Blue Ridge), \$12@\$15.

Imported English, f.o.b. American ports:

Lump, \$12@\$20.

Powdered, \$45@\$50.

1A grades, domestic, \$16@\$17, f.o.b. mines. Market slow.

Corundum—South African, \$65 per ton, New York.

Diatomaceous Earth—Per short ton, f.o.b. plant, California:

Kiln-fired brick, \$65.

Kiln-fired aggregate, ½ in., \$45.

Insulating powder, \$30.

Natural aggregate, ½ in., \$20.

Air-floated powder, \$40.

Business reported satisfactory.

Emery—Per lb., f.o.b. plant:

Greek Naxos, 6½c.

Turkish, 6½c.

Khasia, 5½c.

American, 3½c.

Market good.

Feldspar—Per long ton, f.o.b. cars,

North Carolina:

No. 1 pottery grade, \$6@\$7, depending upon quality.

No. 2 pottery grade, \$4.50@\$5, depending upon quality.

No. 1 soap grade, \$6.75@\$7.25.

In **Connecticut**, per net ton, f.o.b. mines:

40 to 200 mesh, \$16@\$30.

Market better than in December.

In **New Hampshire**, per net ton, f.o.b. mines:

No. 1, not over 10 per cent SiO₂, \$7.70.

No. 2 pottery grade, \$7.

Ground, \$17@\$20, f.o.b. mill.

Market fair.

In **New York**, per ton, f.o.b. cars:

No. 1 crude, \$8. Market fair.

In **Maine:**

No. 1 ground, \$19. Market good.

In **Tennessee:**

Pottery grades, \$16@\$21.

Tile grades, \$14@\$16.

Enameling grades, \$11@\$16.

Crude, \$7 for ordinary grades. As high as \$7.25 offered for exceptional quality.

Market improving.

No. 1 Porcelain grade (Virginia) 140 mesh, \$22; No. 1 Body spar (Maryland) 120 mesh, \$17; Enamellers' grade (Maryland) 80-100 mesh, \$13.50@\$16;

Enamellers' grade (Virginia) 100 mesh, \$20; Glassmakers' grade (Virginia) 30-100 mesh, \$19; Glassmakers' grade (Maryland) 30-100 mesh, \$13@\$15.

In **Canada**, f.o.b. mine:

Crude, No. 1, over 12½ per cent potash, less than 5 per cent SiO₂, \$7.25@\$7.50 per net ton.

Crude, No. 2, 20 to 25 per cent SiO₂, \$5@\$5.50 per net ton.

Ground, No. 1, 180 mesh, \$20 per net ton, bags included.

Ground, No. 2, 180 mesh, \$15 per net ton, bags included.

Fluorspar—F.o.b. Middle Western mines, per net ton:

Gravel, not less than 85 per cent CaF₂, and not over 5 per cent SiO₂, \$21. Market very quiet.

Lump, No. 2, not less than 85 per cent CaF₂, and not over 5 per cent SiO₂, \$22.50.

Lump, No. 1, 95@98 per cent CaF₂, not over 2½ per cent SiO₂, \$30.

Ground, 95 to 98 per cent CaF₂, and not over 2½ per cent SiO₂, \$35 in bulk, \$40 in bags or barrels.

Acid, ground, not less than 98 per cent CaF₂, and not over 1 per cent SiO₂, \$45 in bulk, \$50 in packages.

In **Canada**, 84@86 per cent CaF₂, less than 5 per cent silica, \$18 per net ton, f.o.b. mine.

¹Price furnished by Foote Mineral Co., Philadelphia.

Fuller's Earth—Per ton, f.o.b. Midway, Fla.:

16 to 30 mesh, \$16.50.

16 to 60 mesh, \$18.

30 to 60 mesh, \$18.

60 to 100 mesh, \$14.

Plus 100 mesh, \$7.50.

Powdered, imported, duty paid, \$23 @ \$25 per ton.

Garnet—Per short ton:

Spanish grades, \$60, c.i.f. port of entry.

Domestic Adirondack, \$85, f.o.b. shipping point.

Market firm.

Canadian, \$70@\$80, f.o.b. mines.

Gilsonite—Per ton, f.o.b. Colorado:

Jet asphaltum, \$36.

Selects, \$33.

Seconds (ordinary grades), \$25.50.

Graphite—First quality, per lb.:

Ceylon lump, 6½@7c.

Ceylon chip, 5@5½c.

Ceylon dust, 2½@4c.

Crude amorphous, \$15@\$35 per ton. Flake, No. 1 and No. 2 from New York, 12@30c.

Manufactured grades:

Flake, 12@30c. per lb.

Extra fine ground, 12@30c.

Medium fine ground, 5@14c.

Facings, 4@8c.

Amorphous, 4@8c. per lb.

Market on crystalline variety has increased over 50 per cent during last eight or ten months owing to exhaustion of old war stocks plus slightly increased demand, but prices still low compared with pre-war levels.

Gypsum—Per ton, depending upon source:

Crushed rock, \$2.75@\$3.

Ground, \$4@\$6.

Agricultural, \$6@\$7.

Calcined, \$8@\$16.

Ilmenite—Concentrates, 52 per cent TiO₂, 1½c. per lb., f.o.b. Virginia points. \$60 per short ton, Florida mines.

Iron Oxide (See Ocher) — Ground, 95 per cent through 200 mesh, Standard Spanish red, \$40 per ton.

Kaolin—See China Clay.

Lepidolite—\$20@\$30 per ton for ordinary grades. Nominal.

Limestone—Depending upon source, f.o.b. shipping points; per ton:

Crushed, ½ in. and less, \$1.10@\$1.70.

Crushed, 3 in. and larger, 90c.@\$1.50.

Agricultural, \$1.50@\$5.

Magnesite—Per ton, f.o.b. California mines:

Calcined lump, 85 per cent MgO, \$35.

Calcined ground, 200 mesh, \$42.50.

Dead burned, \$29@\$31, Washington.

Dead burned, \$40@\$42, Chester, Pa.

Caustic calcined, Grecian, \$50@\$51, c.i.f., New York.

Manjak—Barbados, in 1 to 5 ton lots:

Grade "A," 6c. per lb.

Grade "AC," 7c. per lb.

Grade "AA," fine, 8c. per lb.

Grade "C," fine and lump, 9c.

Grade "C," lump, 12c.

Mica—

North Carolina prices:

Scrap, \$17@\$20 per net ton.

Sheet, per lb., No. 1 quality, clear:

Punch, 1½ in., 7c.

1½ x 2 in., 16c. 3 x 4 in., \$1.75.

2 x 2 in., 30c. 3 x 5 in., \$2.35.

2 x 3 in., 75c. 4 x 6 in., \$3.

3 x 3 in., \$1.25. 6 x 8 in., \$4.50.

Ground, 60 mesh, \$65 per ton.
Ground, 80 mesh, \$70.
Ground, 120 mesh, \$120.
Ground, 140 mesh, \$125.
Dry ground, roofing, \$30.
Dry ground, 80 mesh, \$35.
Dry ground, 100 mesh, \$67.50.
Dry ground, 160 mesh, \$70.00.
Roofing grade, 20 mesh, \$35.
Roofing grade, 100 mesh, \$70.
Market good.

In *New Hampshire*:
Washer and disk, \$320 per ton.
Scrap, \$24 per ton.

Madagascar, amber, dark, free from iron, per lb., f.o.b. New York:
No. 1..... \$2.75 No. 4..... \$0.75
No. 2..... 2.25 No. 5..... .50
No. 3..... 1.35 No. 6..... .30

¹Monazite—Minimum 6 per cent ThO₂, \$120 per ton.

Ocher—"Yellow Peruvian," \$25@\$30 per ton, Georgia mines. Market good.

Ozocerite—Per lb. in bags, New York:

Black, 160 deg. melting point, 24@25c.
Green, 170 deg. melting point, 26@30c.

Phosphate — Per long ton, f.o.b.,

Florida export prices:
76@77 per cent, pebble, \$5.75.
75 per cent, \$5.25.
74@75 per cent, \$5.
70 per cent, \$3.50.
68 per cent, \$3.10.
Market fair.

In *Tennessee*, per long ton:
78 per cent lump, \$8.
75 per cent hand-mined lump, \$6.75 @ \$7.
75 per cent washed lump, \$7.
72 per cent washed run of mine, \$5 @ \$5.50.

65 per cent ground 95 per cent through 100 mesh, \$7 per short ton.
Not much change in prices. Exports fair.

Potash—	Bags	Bulk
Muriate of potash 80@85 per cent, basis 80 per cent.....	\$34.55	\$33.30
Sulphate of potash 90@95 per cent, basis 90 per cent.....	45.85	44.60
Sulphate of potash-magnesia 48@53 per cent, basis 48 per cent	26.35	25.10
Manure salt 30 per cent.....	19.03	17.33
Manure salt 20 per cent.....	12.55	10.55
Kainit 14 per cent	10.25	8.25
Kainit 12.4 per cent.....	9.75	7.75

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

For prompt shipment:
5 per cent on minimum quantity of 50 short tons K₂O
6 per cent on minimum quantity of 100 short tons K₂O
7 per cent on minimum quantity of 300 short tons K₂O
10 per cent on minimum quantity of 500 short tons K₂O

The calculations are on total quantity of foreign potash salts imported during the present fertilizer year ending on April 30, 1925.

Pumice Stone—Imported lump, 3@40c. per lb.
Powdered, in bbl., 3@5c.
Lumps, in bbl., 6@8c.

Pyrites—Tharsis, per long ton unit, c.i.f. U. S. ports:
Furnace size, 12c.
Lump, 11c.
Fines, through ½ in., 11½c.

Cinder from ore to remain property of buyers.

Quartz Rock Crystals — Colorless, clear and flawed, pieces ½ to ½ lb. in weight, 30c. per lb. in ton lots.

For optical purposes, double above prices.

Rutile—F.o.b. Virginia points, per lb.:

Granular, 94@96 per cent TiO₂, 12@15c.
Pulverized, 100 mesh, 94@96 per cent, 17@30c.
93 per cent TiO₂, \$200 per ton, Florida.

Silica—Water ground and floated, per ton, f.o.b. Illinois:
400 mesh, \$31.
325 mesh, \$26.
250 mesh, \$22.
200 mesh, \$20.
100 mesh, \$8.
Market good.

Quartzite, in Canada, 99 per cent SiO₂, \$3 net ton.

Glass sand, \$2@\$2.25 per ton; brick and molding sand, \$2@\$2.25. Dull.

Spodumene — \$20@\$30 per ton, depending upon lithium content. Nominal.

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

Talc—Per ton, in 50-lb. paper bags, Vermont mills, carloads:

Ground, 200 mesh, extra white, \$10.50, bags extra.
Ground, 180 mesh, medium white, \$9.50@\$10, bags extra.
Ground, 160 mesh, medium white, \$10@\$11.

Demand improved since Feb. 15. Prices firm.

In *New York*, double air-floated, including containers, per net ton:

200 mesh, \$13.75.
325 mesh, \$14.75.
100 mesh, \$11, not air-floated.
Demand good.

In *California*, \$20@\$30 per ton, ground.

In *Georgia*, powdered, per ton:
Gray or yellow, \$7.50@\$10.
Red or white, \$10@\$14.

Market good for powders.
White, \$12@\$15.
Grayish white, \$8@\$10.
Red, \$12@\$14.
Yellow, \$8@\$12.
Roofing, \$7.50@\$8.
Market good.

Tripoli—Per short ton, burlap bags, paper liners, per minimum carload 30 tons, f.o.b. Missouri:

Once ground:
Rose and cream colored, \$16@\$25.
White, \$18@\$27.
Double ground:
Rose and cream, \$17@\$25.
White, \$19@\$30.
Air-float:
Rose and cream, \$25@\$30.
White, \$35.
Zircon—Freight allowed east of Mississippi River:
99 per cent, 6c. per lb., f.o.b. Florida.
Powdered, 7c. per lb., f.o.b. Florida.

¹Price furnished by Foote Mineral Co., Philadelphia.

Mineral Products

Arsenious Oxide (white arsenic)—5½@5¾c. per lb. delivered.

Copper Sulphate—4¾c. per lb.

Sodium Nitrate—\$2.65 per 100 lb., ex vessel Atlantic ports.

Sodium Sulphate—\$17@\$19 per ton, New York.

Zinc Oxide—Per lb. in bags:

Lead free, 7¾c.
5 per cent lead sulphate, 6¾c.
10 to 35 per cent lead sulphate, 6¾c.
French, red seal, 9¾c.
French, green seal, 10¾c.
French, white seal, 11¾c.

Ferro-Alloys

¹Ferrocromium—\$7 per lb.

Ferrosilicon—1 to 2 per cent carbon, 23c. per lb.; 4 to 6 per cent carbon, 11¾c. per lb.

Ferromanganese—Domestic and foreign, 78@82 per cent, \$115 per gross ton. Spiegeleisen, 19@21 per cent, \$33 f.o.b. furnace; 16@19 per cent, \$32.

Ferromolybdenum—\$1.50 per lb. of contained molybdenum for 50 to 55 per cent grades.

Ferrosilicon—10 to 12 per cent, \$39.50 @\$44.50 per gross ton, f.o.b. works; 50 per cent, \$85 delivered.

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

Ferrotungsten—86@90c. per lb. of contained W, f.o.b. works. Nominal.

¹Ferro-uranium—30 to 40 per cent U, \$4.50 per lb. of U contained, f.o.b. works.

Ferrovandium—\$3.25@\$3.75 per lb. of V contained, f.o.b. works. Market very active.

Metal Products

Rolled Copper—Sheets, 22¾c.; wire, 16¾c.

Lead Sheets—Full lead sheets, 13c. per lb.; cut lead sheets, 13½c. in quantity, mill lots.

Nickel Silver—29¼c. per lb. for 18 per cent nickel Grade A sheets.

Yellow Metal — Dimension sheets, 20½c. per lb.; rods, 17½c. per lb.

Zinc Sheets — 10½c. per lb., f.o.b. works.

Refractories

Bauxite Brick—\$140@\$145 per M., Pittsburgh, Pa.

Chrome Brick—\$48@\$50 per net ton, f.o.b. shipping point.

Firebrick—First quality, \$43@\$46 per M., Ohio, Kentucky, Central Pennsylvania; second quality, \$36@\$40.

Magnesite — Brick, 9-in. straights, \$65@\$68 per net ton, f.o.b. works. Dead-burned grain magnesite, \$40@\$42 per net ton, Chester, Pa.; \$29@\$31, Chewelah, Wash.

Silica Brick—\$40@\$42 per M. Pennsylvania; \$45@\$47 Alabama; \$49@\$51, Indiana.

¹Zirkite—Powdered, 80 per cent ZrO₂, 3c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 80c.@\$1 each.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1924	1925	1924	1925	1924	1925
January.....	63.447	68.447	33.549	32.197	425.524	477.702
February.....	64.359	68.472	33.565	32.245	430.457	476.886
March.....	63.957	.....	33.483	.....	428.769	.....
April.....	64.139	.....	33.065	.....	434.788	.....
May.....	65.524	.....	33.870	.....	435.716	.....
June.....	66.690	.....	34.758	.....	431.675	.....
July.....	67.159	.....	34.509	.....	436.649	.....
August.....	68.519	.....	34.213	.....	449.510	.....
September.....	69.350	.....	34.832	.....	445.740	.....
October.....	70.827	.....	35.387	.....	448.274	.....
November.....	69.299	.....	33.775	.....	460.543	.....
December.....	68.096	.....	32.620	.....	469.115	.....
Year.....	66.781	.....	33.969	.....	441.397	.....

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

Copper

	New York Electrolytic		Standard London		Electrolytic London	
	1924	1925	1924	1925	1924	1925
January.....	12.401	14.709	61.273	66.065	67.193	70.607
February.....	12.708	14.463	63.113	64.713	68.167	69.525
March.....	13.515	.....	66.137	.....	72.087	.....
April.....	13.206	.....	64.338	.....	70.150	.....
May.....	12.772	.....	62.006	.....	67.648	.....
June.....	12.327	.....	61.375	.....	66.313	.....
July.....	12.390	.....	61.652	.....	65.815	.....
August.....	13.221	.....	63.481	.....	67.800	.....
September.....	12.917	.....	62.750	.....	67.125	.....
October.....	12.933	.....	62.641	.....	66.620	.....
November.....	13.635	.....	63.731	.....	68.063	.....
December.....	14.260	.....	65.295	.....	69.762	.....
Year.....	13.024	.....	63.149	.....	68.062	.....

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

Lead

	New York		St. Louis		London	
	1924	1925	1924	1925	1924	1925
January.....	7.972	10.169	8.002	9.953	31.528	41.443
February.....	8.554	9.428	8.643	9.126	34.589	37.944
March.....	9.013	.....	8.891	.....	37.161	.....
April.....	8.263	.....	7.932	.....	32.819	.....
May.....	7.269	.....	6.973	.....	29.426	.....
June.....	7.020	.....	6.848	.....	32.138	.....
July.....	7.117	.....	6.886	.....	32.916	.....
August.....	7.827	.....	7.764	.....	32.728	.....
September.....	8.00	.....	7.876	.....	33.023	.....
October.....	8.235	.....	8.118	.....	35.715	.....
November.....	8.689	.....	8.590	.....	39.425	.....
December.....	9.207	.....	9.106	.....	41.583	.....
Year.....	8.097	.....	7.969	.....	34.421	.....

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

Tin

	New York 99%		Straits		London	
	1924	1925	1924	1925	1924	1925
January.....	48.250	57.692	48.750	58.250	246.790	265.560
February.....	52.772	56.517	53.272	57.068	272.399	262.181
March.....	54.370	.....	54.870	.....	277.429	.....
April.....	49.457	.....	49.957	.....	250.863	.....
May.....	43.611	.....	44.111	.....	218.511	.....
June.....	42.265	.....	42.765	.....	219.219	.....
July.....	45.750	.....	46.250	.....	233.332	.....
August.....	51.409	.....	51.909	.....	254.638	.....
September.....	48.595	.....	49.095	.....	243.511	.....
October.....	50.038	.....	50.538	.....	248.543	.....
November.....	53.848	.....	54.348	.....	257.738	.....
December.....	55.721	.....	56.245	.....	261.875	.....
Year.....	49.674	.....	50.176	.....	248.737	.....

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

Zinc

	New York 99%		St. Louis		London	
	1924	1925	1924	1925	1924	1925
January.....	6.426	7.738	6.426	7.738	34.761	37.917
February.....	6.756	7.480	6.756	7.480	36.518	36.528
March.....	6.488	.....	6.488	.....	35.298	.....
April.....	6.121	.....	6.121	.....	32.588	.....
May.....	5.793	.....	5.793	.....	30.648	.....
June.....	5.792	.....	5.792	.....	31.788	.....
July.....	5.898	.....	5.898	.....	32.193	.....
August.....	6.175	.....	6.175	.....	32.544	.....
September.....	6.181	.....	6.181	.....	32.926	.....
October.....	6.324	.....	6.324	.....	33.514	.....
November.....	6.796	.....	6.796	.....	35.022	.....
December.....	7.374	.....	7.374	.....	36.932	.....
Year.....	6.344	.....	6.344	.....	33.728	.....

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

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)		
	New York 1924	New York 1925	New York 1924	New York 1925	Refined 1924	New York 1925	Crude 1925
January.....	10.279	17.428	59.500	81.596	122.115	117.00	111.663
February.....	10.935	19.795	59.565	79.386	124.739	117.00	114.216
March.....	11.442	.....	64.269	.....	121.692	.....	.....
April.....	9.952	.....	74.308	.....	115.577	.....	.....
May.....	8.755	.....	76.962	.....	115.731	.....	.....
June.....	8.403	.....	73.720	.....	116.000	.....	.....
July.....	8.477	.....	72.173	.....	118.231	.....	.....
August.....	9.839	.....	72.096	.....	120.000	.....	.....
September.....	11.022	.....	72.423	.....	118.923	.....	.....
October.....	11.519	.....	70.654	.....	118.000	.....	.....
November.....	14.385	.....	68.708	.....	117.792	.....	.....
December.....	15.024	.....	72.750	.....	117.000	.....	.....
Year.....	10.836	.....	69.761	.....	118.817	.....	.....

(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	
	1924	1925	1924	1925	1924	1925
January.....	24.76	24.66	23.76	23.76	23.88	23.76
February.....	25.26	.....	23.76	.....	25.06	.....
March.....	25.14	.....	23.76	.....	24.70	.....
April.....	24.56	.....	23.26	.....	23.80	.....
May.....	23.89	.....	22.08	.....	22.91	.....
June.....	22.90	.....	21.49	.....	21.48	.....
July.....	21.90	.....	20.76	.....	20.76	.....
August.....	21.76	.....	20.76	.....	20.99	.....
September.....	21.76	.....	20.76	.....	21.68	.....
October.....	21.76	.....	20.26	.....	21.26	.....
November.....	22.08	.....	21.44	.....	21.17	.....
December.....	23.65	.....	22.04	.....	22.86	.....
Year.....	23.28	.....	22.01	.....	22.55	.....

In dollars per long ton.

Monthly Crude Copper Production

	Domestic			1925 January
	October 1924	November 1924	December 1924	
Alaska shipments.....	11,651,471	8,902,042	6,633,986	2,565,375
Calumet & Arizona.....	4,444,000	4,028,000	3,630,000	3,788,000
Miami.....	4,895,000	4,732,000	4,699,547	4,800,000
New Cornelia.....	5,069,899	5,703,506	6,713,520	6,906,512
Old Dominion.....	3,004,000	2,937,000	2,956,000	2,921,000
Phelps Dodge.....	13,156,156	12,260,000	12,242,000	9,002,000
United Verde Extension.....	3,539,538	3,136,660	3,687,440	3,739,542
A.S. & R. & Tenn. Copper	13,500,000	11,750,000	15,500,000	16,700,000
Imports: Ore and concentrates, matte.....	4,127,986	19,703,976	15,080,051	11,229,750
Partly from.....	.....	.....	.....	.....
Chile.....	.....	.....	.....	1,309,814
Cuba.....	.....	.....	.....	.....
Canada.....	.....	.....	.....	4,942,710
Mexico.....	.....	.....	.....	3,519,950
Imports of black and blister, unrefined.....	33,852,068	48,686,075	37,707,825	15,858,570
Partly from.....	.....	.....	.....	.....
Chile.....	.....	.....	.....	3,934,732
Peru.....	.....	.....	.....	3,282,503
Africa.....	.....	.....	.....	.....
Mexico.....	.....	.....	.....	3,681,048
Imports of refined and old.....	7,055,806	17,030,588	9,905,642	5,652,729
Foreign.....	.....	.....	.....	.....
Roleo, Mexico.....	1,572,165	1,552,320	1,551,769	1,530,273
Falcon Mines, Rhodesia.....	.....	419,400	425,200	.....
Furukawa, Japan.....	3,494,394	2,446,745	2,899,650	.....
Cons. M & S., Canada.....	.....	.....	.....	.....
Granby Cons., Canada.....	2,312,348	3,006,550	2,776,365	3,282,570
Katanga, Africa.....	16,638,930	17,386,152	17,221,050	15,866,025
Mount Morgan, Aust.....	.....	498,000	544,000	298,000
Mount Lyell, Aust.....	1,066,000	1,036,000	1,036,000	.....
Phelps Dodge, Mexican.....	3,487,000	3,712,000	3,226,000	3,134,000
Sumitomo, Japan.....	2,997,801	2,911,254	2,274,146	.....

Comparative U. S. Copper Mine Production

	1922	1923	1924	1925
January.....	32,010,292	112,267,000	133,356,000	.....
February.....	45,957,530	102,725,000	128,260,000	.....
March.....	55,705,760	121,562,000	129,816,000	.....
April.....	76,601,000	118,157,000	131,928,000	.....
May.....	88,714,000	125,438,000	130,644,000	.....
June.....	93,740,000	125,479,000	127,506,000	.....
July.....	91,000,000	125,249,000	129,574,000	.....
August.....	101,188,000	131,088,000	133,512,000	.....
September.....	96,408,000	124,523,000	126,346,000	.....
October.....	103,273,000	132,481,000	137,924,000	.....
November.....	102,845,000	127,963,000	136,626,000	.....
December.....	103,003,000	129,354,000	136,244,000	.....

Company Reports

St. Joseph Lead Co.

In 1924, dividends to the amount of \$3,098,758.50 were paid to stockholders of the St. Joseph Lead Co., and to minority stockholders in subsidiary companies \$140,754 was paid. The earnings for the year, after deducting all charges for depreciation, depletion and reserve for federal taxes, resulting from the operation for the fiscal year, were \$7,559,345.06. Production was 4,498,727 tons of ore and 230,219 tons of concentrates. Smelter production was 148,225 tons of pig lead. Sales of pig lead for the year amounted to 147,830 tons. (This does not include sales of lead purchased from the Bunker Hill & Sullivan Mining & Concentrating Co.) The increased production and sales are the result of the purchase of the mines and property of the Federal Lead Co.

The company has paid four of the five serial notes of \$1,000,000 each which it gave in part payment for the mines of the Federal Lead Co. and has purchased \$5,000 additional bonds of the Mississippi River & Bonne Terre Ry., and 952-8/21 additional shares of stock of the Missouri-Illinois R.R. Co.

Consolidated Balance Sheet Dec. 31, 1924

Assets			
Capital assets.....		\$31,871,543.04	
Investments.....		483,669.98	
Sinking fund and reserve fund assets—cash and accrued interest.....		9,959.29	
Current assets.....		9,563,961.60	
Deferred debit items.....		568,507.04	
Total.....			\$42,497,640.95
Liabilities			
Capital stock			
St. Joseph Lead Co.:			
Authorized—2,000,000 shares of \$10 each, of which there have been issued 1,605, 744.6 shares.....	\$16,057,446.00		
Less held in treasury, 56,332 shares.....	563,320.00	\$15,494,126.00	
Subsidiary companies—minority stock held by the public.....			
Funded debt.....	235,950.00		
Purchase money note payable Oct. 23, 1928.....	748,000.00		
Current liabilities.....	1,000,000.00		
Deferred credit items.....	5,042,347.95		
Reserves.....	111,756.29		
Surplus.....	2,322,369.46		
Balance March 1, 1913.....	\$3,925,000.00		
Less amortization.....	3,523,665.00		
Remainder.....	\$401,335.00		
Undistributed profits and increase due to revaluation of properties, March 1, 1913, to Dec. 31, 1923.....	15,145,997.19		
Balance, Jan. 1, 1924.....		\$15,547,332.19	
Net income for the year ended Dec. 31, 1924, after provid- ing for depreciation.....	\$11,163,022.44		
Miscellaneous credits.....	49,410.49		
Total.....		\$11,212,432.93	
Less			
Provision for depletion.....	\$2,384,163.59		
Provision for federal taxes.....	1,030,940.86		
Provision for employees' pensions.....	106,399.88		
Miscellaneous charges.....	131,583.54	3,653,087.87	
Profit-and-loss surplus for the year ended Dec. 31, 1924.....	7,559,345.06		
Total.....		\$23,106,677.25	
Less			
Dividends declared and paid in 1924.....	\$2,464,824.00		
Dividends declared Dec. 16, 1924, payable quarterly in 1925.....	3,098,762.00	5,563,586.00	17,543,091.25
Total.....			\$42,497,640.95

The Portland Gold Mining Co.

Gold; Cripple Creek, Colo.

Net earnings of the Portland Gold Mining Co. during the first half of 1924 were most satisfactory, making possible the payment of the entire indebtedness of the company, besides leaving a cash balance on hand of \$60,244.65. Unfortunately, the net results of operations during the last half of the year fell far short of expectations, the value of the gold produced during that period having been less than the cost of production, of sinking the shaft, and of the development work being carried on, according to the annual report of the company.

On Feb. 10, 1925, the station at the 3,000-ft. level had been completed and was ready for the installation of the pumps, and within the next month or two connection should be made with the main vein, which is very rich at the bottom of the 2,700 level.

The production from the mine was as follows:

	Dry Tons	Gross Value
Company ore to Golden Cycle.....	11,947	\$412,953.86
Lessee's ore to Cycle and Independence.....	10,879	256,360.66
Estimated tonnage shipped to Independence mill.....	164,574	792,429.00
High grade treated at the mill.....	7	28,715.67
	187,407	\$1,490,459.28

Balance Sheet, Jan. 1, 1925

Assets		
Cash on hand and in banks.....		\$44,728.85
Bills received.....		8,500.00
Accounts receivable.....		5,669.84
Stores and supplies at mines and mills.....		108,176.23
Property.....		5,363,068.72
Permanent equipment.....		573,459.11
Stocks, bonds and securities.....		66,568.41
Prepaid expenses.....		19,236.72
		\$6,189,407.88
Liabilities		
Accounts payable.....		\$1,742.74
Reserve for depreciation and depletion.....		1,984,337.40
Capital stock.....	\$3,000,000.00	
Surplus.....	1,203,327.74	4,203,327.74
		\$6,189,407.88

Profit-and-Loss Account for the Year 1924

Net profit from operation.....		\$246,418.35
Interest.....	\$6,442.17	
Bills collectible.....	1,946.18	8,388.35
		\$238,030.00
Miscellaneous.....		875.59
Net profit before depreciation and depletion.....		\$238,905.59
Depreciation.....	\$96,435.28	
Depletion.....	84,334.72	180,770.00
Net profits to surplus.....		\$58,135.59
Surplus		
Net profit for 1924.....		\$58,135.59
To adjust property values and to restore depreciation and de- pletion.....		1,598,508.24
		\$1,656,643.83
Less balance Jan. 1, 1924—debit.....		453,316.09
Balance Jan. 1, 1925.....		\$1,203,327.74

Ray Consolidated Copper Co.

A report covering the operations of the Ray Consolidated Copper Co. for the fourth quarter of 1924 states that production totaled 36,288,645 lb., compared with 32,911,783 lb. for the third quarter.

The total ore milled at both properties was 1,423,000 dry tons, of an average copper tenor of 1.58 per cent, against 1,394,300 tons, averaging 1.54 per cent copper, treated during the previous quarter.

The average mill extraction was 81.70 per cent, corresponding to a recovery of 25.80 lb. of copper per ton of

ore treated, compared with 78.60 per cent and 24.25 lb. in the three months ended Sept. 30, 1924.

The cost per net pound of copper produced from all sources was 10.87c., compared with a cost of 11.82c. for the third quarterly period. These costs include all operating and general charges of every kind, except depreciation and reserve for federal taxes. They also include the usual charges for retirement of prepaid mine development expense and take into account credits for miscellaneous income applicable to operations and the value of the gold and silver recovered.

Financial results are as follows:

	Fourth Quarter 1924	Third Quarter 1924
Operating profit from copper produced.....	\$917,629.07	\$443,499.83
Miscellaneous income, including value of precious metals.....	70,113.28	61,238.20
Total.....	\$987,742.35	\$504,738.03

The above-tabulated earnings are based on an average carrying price for copper of 13.46c., compared with 12.85c. for the third quarter, 13.01c. for the second quarter, and 12.81c. for the first quarter.

San Francisco Mines of Mexico, Ltd.

The initial plant of San Francisco Mines of Mexico, to treat 250 tons per day, started regular milling in June, 1922, and the extension, bringing up the capacity to 500 tons, was completed in September, 1923, although not fully utilized until 1924.

Financial and operating results follow:

Issued Capital: £751,979 10s., in 10s. Shares, Fully Paid

Yr. to Sept. 30	Ore Milled Tons	Concentrates Lead Tons	Concentrates Zinc Tons	Value Per Ton	Costs Per Ton	Profit £	Dividend %
1923	88,653	22,444	16,159	67/1	27/2	137,256	112,690 15
1924	133,590	26,169	28,010	71/4	26/9	285,752	244,355 32 1/2

Financial Notes of the Mining Companies

Carson Hill Gold—Defaulted interest due March 1 on its \$374,200 7 per cent bonds outstanding. Company has not recently been able to meet its sinking fund payments and owes about \$70,000 in current notes payable. Plan of reorganization being considered by bond and stock holders.

Seneca Copper—About 250,000 of the 350,000 shares have been deposited for reorganization, and the first installment of \$6 assessment paid. Underwriters are paying assessment on remaining stock, less \$1 underwriting fee. Stock to be listed on New York Stock Exchange.

San Francisco Mines—In January treated 10,930 tons lead-zinc ore, smelter returns being \$220,798, expenses, \$68,262, and operating profit, \$152,536, compared with \$151,756 in December. Capital expenditure, \$28,690.

South American Copper—Produced 4,394 tons ore in January. Smelted 4,027 tons, producing 454 tons 28 1/2 per cent copper matte. Also produced 253 tons matte from 503 tons matte re-treated.

Howe Sound—New York Curb has admitted to trading, voting trust certificates representing newly authorized shares of capital stock of no par value.

Kennecott Copper—Stephen Birch says, for the benefit of income tax payers, that of 1924 cash dividends, \$2.42 per share is return of capital and 58c. is from surplus earnings, but this allocation has not yet been passed on by Treasury Department.

Imports and Exports of Ores and Metals in January, 1925 and 1924

	Imports	
	January, 1924	January, 1925
Antimony		
Ores.....	164,720	283,369
Liquated, regulus or metal.....	629,954	832,587
Copper		
Ores.....	8,598,414	8,303,379
Concentrates.....	1,279,633	2,163,010
Regulus, coarse metal and cement copper.....	290,019	763,361
Total.....	10,168,066	11,229,750

Imports of Ores and Metals—Continued

Imported from	1924	1925
Spain.....	1,111,103	401,209
Canada.....	94,167	4,942,710
Mexico.....	1,271,400	3,519,950
Chile.....	6,755,405	1,309,814
Colombia.....	74,821	53
Peru.....	253,127	40,327
Other countries.....	608,043	1,015,687
Unrefined, black, blister and converted copper in pigs, bars, and other forms.....	41,962,680	15,858,870
Imported from		
Spain.....	1,908,271	
United Kingdom.....	714	1,250,189
Canada.....	1,555,188	3,709,998
Mexico.....	7,229,476	3,681,048
Chile.....	1,664,624	3,934,732
Peru.....	7,538,508	3,282,903
Portuguese Africa.....	20,525,910	
Other countries.....	1,539,489	
Refined copper.....	16,776,131	4,493,754
Old and clippings for remanufacture.....	112,307	1,153,365
Composition metal, copper chief value.....	50,000	894
Copper manufactures.....	3,027	3,216
Brass		
Old and clippings for remanufacture.....	1,094,887	1,893,724
Manufactures of brass.....	54,168	59,717
Lead		
Ore and matte.....	10,455,463	9,695,195
Bullion or base bullion.....	15,869,856	12,864,185
Pigs, bars, and other forms and old.....	180,643	
Pigs and bars, lead content.....		1,000,189
Scrap lead, babbitt metal, solder and other forms.....		59,371
Manufactures of, except type metal.....	12,962	19,237
Manganese ore, long tons.....	23,081	15,498
Pyrites, long tons.....	31,843	9,249
Tin		
Tin ore, tons.....	1	5
In blocks, bars, and pigs.....	12,851,970	19,519,305
From: Hong Kong.....	241,075	833,933
United Kingdom.....	3,293,856	2,746,690
British Straits Settlements.....	8,329,544	14,003,044
China.....		33,615
Dutch East Indies.....	118,320	56,037
Australia.....	123,200	369,781
Other countries.....	745,975	1,476,205
Zinc		
Ore Free.....		421
Dutiable.....	62,151	480,134
Blocks, pigs and other forms.....	17,007	25
Zinc dust.....	1,457	4,595

Exports of Copper, Lead and Zinc

	In Pounds	
	January, 1924	January, 1925
Copper		
Ores, concentrates, matte, and regulus.....	6,048	190,030
Copper and manufactures of.....	70,744,210	100,523,621
Refined in ingots, bars, and other forms.....	64,616,780	90,404,114
Exported to		
Belgium.....	4,584,906	7,627,274
France.....	11,901,166	9,634,840
Germany.....	5,359,085	26,490,067
Italy.....	9,058,685	12,412,648
Netherlands.....	324,733	10,011,731
Spain.....	142,057	426,635
Sweden.....	1,693,392	2,105,100
United Kingdom.....	16,278,410	16,904,961
Canada.....	3,029,267	1,271,449
British India.....	593,395	
China.....	7,672,000	
Japan.....	2,687,307	223,994
Other countries.....	1,292,377	3,295,415
Old and scrap copper.....	92,932	1,674,487
Pipes and tubes.....	168,457	170,443
Plates and sheets.....	366,701	936,669
Rods.....	3,994,480	4,213,626
Wire.....	642,135	1,825,295
Insulated copper wire and cable.....	678,406	1,157,232
Other manufactures of copper.....	184,319	141,755
Lead		
Pigs, bars, and other forms:		
From domestic ore.....	1,041,126	228,432
From foreign ore.....	9,433,431	15,005,230
Exported to:		
France.....	2,568,104	2,664,630
Germany.....	672,712	4,983,550
Netherlands.....	448,129	672,252
United Kingdom.....	2,371,805	4,940,837
Other Europe.....	4,145,639	1,500,629
Argentina.....	134,524	15,170
Brazil.....	22,659	392,092
Other countries.....	110,985	64,502
Zinc		
Ores and concentrates.....		7
Dross.....	863	1,346,691
Zinc (spelter) in slabs, blocks, or pigs.....	5,676,540	25,947,672
Exported to:		
Belgium.....	336,001	570,511
France.....	1,400,270	4,513,706
Germany.....	314,645	2,308,767
Italy.....	627,281	336,086
United Kingdom.....	2,072,430	16,006,348
Canada.....	3,573	89,190
Other countries.....	922,340	2,123,064
In sheets, strips, and other forms.....	852,456	645,207
Zinc dust.....	389,624	356,308
Other zinc manufactures.....	64,347	268,638
Tin in bars, blocks or pigs.....	25,786	66,156
Tin manufactures.....	705,131	281,782

Mining Stocks

Week Ended February 28, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Alaska-Br. Col.	N. Y. Curb			*6	
Anaconda	New York	43 1/2	42 1/2	42 1/2	Ja. 17, Fe. 16, 0.75
Arcadian Consol.	Boston	13 1/2	13	13	
Ariz. Com'l.	Boston	13 1/2	13	13	Ja. 19, Ja. 31 0.50
Calaveras	N. Y. Curb	5 1/2	5 1/2	5 1/2	Mh. 6, Mh. 28 Q 0.50
Calumet & Hecla	New York	51 1/2	51 1/2	51 1/2	Ja. 30, Mh. 4 0.50
Canario Copper	Boston	4	3 3/4	4	
Cerro de Pasco	N. Y. Curb	52 1/2	51 1/2	51 1/2	Ja. 22, Fe. 2, Q 1.00
Chile Copper	New York	36 1/2	35 1/2	36	Mh. 3, Mh. 20, Q 0.62
Chino	New York	25 1/2	25	25	Sept., 1920 0.37
Con. Coppermines	N. Y. Curb	3 3/8	3 1/8	3 1/8	
Copper Range	Boston	28 1/2	27 1/2	27 1/2	May, 1924 1.00
Crystal Copper	Boston Curb	*62	*57	*59	
Davis-Daly	Boston			*78	Mar., 1920 0.25
East Butte	Boston	5	5	5	Dec., 1919 0.50
First National	Boston Curb	*33	*33	*33	Feb., 1919 0.15
Franklin	Boston			*14	
Gadsden Copper	Boston Curb	*65	*65	*65	
Granby Consol.	New York	19 1/2	18 1/2	19 1/2	May, 1919 1.25
Greene-Canaan	New York	16 1/2	15 1/2	15 1/2	Nov., 1920 0.50
Hancock	Boston			*14	
Howe Sound	N. Y. Curb	4 1/2	3 3/4	4	April 1924 0.05
Inspiration Consol.	New York	28 1/2	27 1/2	28	De. 20, Ja. 7, Q 0.50
Iron Cap	Boston Curb	2 1/2	2 1/2	2 1/2	May, 1923 0.15
Isla Royale	Boston	17	16	16	Sept., 1923 0.50
Jerome Verde Dev.	N. Y. Curb	1 1/2	1	1 1/2	
Kennecott	New York	54 1/2	53 1/2	54 1/2	Mh. 6, Ap. 1, Q 0.75
Keweenaw	Boston	*75	*75	*75	
Lake Copper	Boston	2 1/2	2 1/2	2 1/2	
Magma Copper	New York	40 1/2	38 1/2	40	Jan., 1919 0.50
Mason Valley	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Mass Consolidated	Boston			1	Nov., 1917 1.00
Miami Copper	New York	*2 1/2	2 1/2	2 1/2	Fe. 2, Fe. 16, Q 0.50
Mohawk	Boston	36	36	36	Ja. 13, Mh. 2 1.00
Mother Lode Co.	New York	8 1/2	7 1/2	8	De. 12, De. 31 0.37
Nevada Consol.	New York	14 1/2	14 1/2	14 1/2	Sept., 1920 0.25
New Cornelia	Boston	22 1/2	21 1/2	22 1/2	Fe. 6, Fe. 23 0.25
New Dominion	Boston			*70	
North Butte	Boston	2 1/2	2 1/2	2 1/2	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	1 1/2	1 1/2	1 1/2	Nov. 14, De. 2 0.05
Old Dominion	Boston	24 1/2	24	24 1/2	Dec., 1918 1.00
Phelps Dodge	Open Mar.	1120	1117	1120	De. 2, Ja. 2, Q 1.00
Quincy	Boston	31 1/2	30 1/2	31 1/2	Mar., 1920 1.00
Ray Consolidated	New York	15 1/2	15 1/2	15 1/2	Dec., 1920 0.25
Ray Hercules	N. Y. Curb			*8	
St. Mary's Min. Ld.	Boston	42	41	41 1/2	May 1924 3.00
Seneca Copper	New York			*97	
Shannon	Boston	1	*97	*97	Nov., 1917 0.25
Shattuck Arizona	New York	6	6	6 1/2	Jan., 1920 0.25
Superior & Boston	Boston	1 1/2	1 1/2	1 1/2	
Tenn. C. & C.	New York	8 1/2	8 1/2	8 1/2	De. 31, Ja. 15, Q 0.25
United Verde Ex.	N. Y. Curb	26 1/2	26	26 1/2	Ja. 2, Fe. 2 0.50
Utah Copper	New York	90	88 1/2	88 1/2	De. 12, De. 31, Q 1.00
Utah Metal & T.	Boston	*85	*80	*80	Dec., 1917 0.30
Victoria	Boston			*60	
Walker Mining	N. Y. Curb	3 1/2	3 1/2	3 1/2	
Winona	Boston	*20	*20	*20	
NICKEL-COPPER					
Internat. Nickel	New York	27 1/2	26 1/2	26 1/2	March, 1919 0.50
Internat. Nickel pfd.	New York			97	Ja. 15, Fe. 2, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	8	6 1/2	7 1/2	
National Lead	New York	160 1/2	158	158 1/2	Mh. 13, Mh. 31, Q 2.00
National Lead pfd.	New York	117 1/2	117 1/2	117 1/2	Fe. 2, Mh. 14, Q 1.75
St. Joseph Lead	New York	43 1/2	42	43 1/2	Mh. 5, Mh. 20 0.50
ZINC					
Am. Z. L. & S.	New York	9 1/2	9 1/2	9 1/2	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	32	31 1/2	32	Nov., 1920 1.50
Butte C. & Z.	New York	7 1/2	7 1/2	7 1/2	De. 10, De. 24 0.50
Butte & Superior	New York	19 1/2	19	19	June, 1923 0.50
Callahan Zn-Ld.	New York	4	3 3/4	3 3/4	Dec., 1920 0.50
New Jersey Zn.	N. Y. Curb	191 1/2	190	190 1/2	Ja. 20, Fe. 10 2.00
United Zinc	N. Y. Curb	*40	*40	*40	
Yellow Pine	Los Angeles			*72	De. 10, De. 15 Q 0.04
SILVER					
Alvarado	Boston Curb	1	1	1	Oct., 1920 0.50
Beaver Consol.	Toronto	*36 1/2	*33 1/2	*35	May, 1920 0.03
Castle-Trethewey	Toronto	*77 1/2	*75 1/2	*77	
Coniagas	Toronto	2.02	1.98	2.00	May, 1924 0.12
Keeley	Toronto	2.22	2.03	2.20	Mh. 1, Mh. 15 SA 0.12
Kerr Lake	N. Y. Curb	1 1/2	1 1/2	1 1/2	Oct. 1, Oct. 15, 0.12
La Rose	Toronto	*49 1/2	*44 1/2	*48	Apr., 1922 0.10
Lorrain Trout Lake	Toronto	1.16	1.15	1.15	
McKinley-Dar-Sav.	Toronto	*27 1/2	*22	*26 1/2	Oct., 1920 0.03
Mining Corp. Can.	Toronto	2.65	2.61	2.64	Sept., 1919 0.12
Nipissing	N. Y. Curb	6 1/2	6 1/2	6 1/2	Ja. 18, Ja. 20, QX 0.30
Ontario Silver	New York	7 1/2	6 1/2	7	Jan., 1919 0.50
Temiskaming	Toronto	*28 1/2	*28	*28	Jan., 1920 0.40
GOLD					
Alaska Juneau	New York	1 1/2	1 1/2	1 1/2	
Argonaut	Toronto	*42 1/2	*37 1/2	*40 1/2	
Carson Hill	Boston			*45	
Consol. W. Dome L.	Toronto	*17 1/2	*17 1/2	*17 1/2	
Cresson Consol. G.	N. Y. Curb	3 1/2	3 1/2	3 1/2	De. 31, Ja. 10 Q 0.10
Crown Reserve	Toronto	*48	*44 1/2	*47	Jan. 1917 0.05
Dome Mines	New York	16 1/2	15 1/2	15 1/2	De. 31, Ja. 20, Q 0.50
Golden Cycle	Colo. Springs	1.52	1.51	1.51	Dec. 11, 1924 0.03
Hollinger Consol.	Toronto	14.90	14.55	14.80	Mh. 9, Mh. 25, M 0.05
Homestake Mining	New York	44 1/2	43 1/2	43 1/2	Fe. 20, Fe. 25, M 0.50
Jib. Consol.	N. Y. Curb	*29	*19	*20	
Kirkland Lake	Toronto	*48 1/2	*46	*48	

Stock	Exch.	High	Low	Last	Last Div.
GOLD AND SILVER					
Black Oak	N. Y. Curb			*81	
Con. Cortez	N. Y. Curb	*25	*14	*20	
Con. Virginia	San Francisco			*5 1/2	
Continental Mines	N. Y. Curb			1 1/2	
Dolores Esperanza	N. Y. Curb	*70	*60	*70	July, 1923 0.05
Premier Gold	N. Y. Curb	2 1/2	2 1/2	2 1/2	De. 22, Ja. 5, QX 0.10
Tonopah Belmont	N. Y. Curb	*80	*59	*80	Mh. 15, Ap. 1 0.05
Tonopah Divide	N. Y. Curb			*26	Se. 22, Oc. 10 0.10
Tonopah Extension	N. Y. Curb	3 1/2	3	3	Mh. 11, Ap. 1, Q 0.05
Tonopah Mining	N. Y. Curb	1 1/2	1 1/2	1 1/2	Fe. 12, Fe. 25, 0.50
Unity Gold	N. Y. Curb	*60	*50	*50	
West End Consol.	N. Y. Curb			*46	Mar., 1923 0.05
Yukon Gold	N. Y. Curb	*35	*35	*35	June, 1918 0.02
SILVER-LEAD					
Abumada	Boston Curb	11 1/2	10	10 1/2	Mh. 16, Ap. 2, X 0.25
Bingham Mines	Boston	35	34 1/2	34 1/2	Mh. 20, Mh. 31 0.50
Cardiff M. & M.	Salt Lake	1.35	1.30	1.30	De. 16, No. 18 0.10
Chief Consol.	Salt Lake			3 1/2	May, 1924 0.10
Columbus Rexall	Salt Lake	*25 1/2	*25	*25	Aug., 1923 0.05
Eruption	Boston Curb	3 1/2	3 1/2	3 1/2	Mh. 16, Ap. 2, X 0.20
Federal M. & S.	New York	6 1/2	5 1/2	5 1/2	Fe. 26, Mh. 15, Q 1.75
Federal M. & S. pfd.	New York	4 1/2	4 1/2	4 1/2	No. 25, De. 15, 1.75
Florence Silver	Spokane	15 1/2	14	14 1/2	Apr., 1919, QX 0.0
Hecla Mining	N. Y. Curb			14 1/2	Fe. 15, Mh. 15 0.5
Iron Blossom Consol.	Salt Lake	*32	*32	*32	Oct. 25, 1924 0.01
Iron King Mining	Salt Lake	*78	*76	*78	
Keystone Mining	Salt Lake	*78	*75	*75	
Mammoth Mining	Salt Lake	1.10	1.10	1.10	
Marsh Mines	N. Y. Curb			*6	June, 1921 0.02
Park City	Salt Lake	5.50	5.50	5.50	De. 15, Ja. 2 0.15
Park Utah	Salt Lake	3.90	3.90	3.90	April, 1924 0.15
Prince Consol.	Salt Lake	*23 1/2	*20	*21	
Silver King Coal	Salt Lake	6.25	6.00	6.00	De. 20, Ja. 2, Q 0.20
Silversmith	Spokane	*28 1/2	*28	*28	Ja. 1, Ja. 10 0.02
Tamarack-Custer	Spokane	*90	*65	*65	Se. 22, Se. 29 0.25
Tintic Standard	Salt Lake	9.00	8.75	8.75	Ja. 2, QX 0.50
Utah-Apex	Boston	6 1/2	6 1/2	6 1/2	Ja. 10, Ja. 15, 0.25
IRON					
Bethlehem Steel	New York	48	46	47	Jan. 1, Jy. 1, Q 1.25
Char. Iron	Detroit			*20	
Char. Iron pfd.	Detroit	*85	*80	*85	
Colorado Fuel & Iron	New York	45 1/2	43 1/2	44	May, 1921 0.75
Gt. North'n Iron Ore	New York	37 1/2	36 1/2	37	De. 10, De. 27 2.00
Inland Steel	New York	46 1/2	45 1/2	46	Fe. 14, Mh. 20 Q 0.625
Mesabi Iron	N. Y. Curb	3 1/2	3 1/2	3 1/2	
Replogle Steel	New York	18 1/2	17 1/2	18	
Republic I. & S.	New York	56 1/2	52 1/2	54	May, 1921 1.50
Republic I. & S. pfd.	New York	91	90 1/2	91	Mh. 8, Ap. 1, Q 1.75
Sloss-Sheffield S. & I.	New York	92 1/2	89 1/2	90 1/2	Mh. 10, Mh. 20, Q 1.50
Sloss-Shef. S. & I. pfd.	New York			97	Mh. 20, Ap. 2, Q 1.75
U. S. Steel	New York	125 1/2	122 1/2	122 1/2	Fe. 28, Mh. 30, QX 1.75
U. S. Steel pfd.	New York	123 1/2	122 1/2	123 1/2	Fe. 1, Fe. 27, Q 1.75
Virginia I. C. & C.	New York			40	De. 15, Ja. 2 1.50
Virginia I.C.&C.pfd.	New York	77	77	77	De. 13, Ja. 2, Q 2.50
VANADIUM					
Vanadium Corp.	New York	28 1/2	26 1/2	27 1/2	Jan., 1921 1.00
ARSENIC					
Western Utah Copper	N. Y. Curb	*22	*20	*20	
ASBESTOS					
Asbestos Corp.	Montreal	41 1/2	41 1/2	41 1/2	Fe. 1, Fe. 15 Q 2.00
Asbestos Corp. pfd.	Montreal	81	80	80	Ja. 2, Ja. 15, Q 1.50
SULPHUR					
Freeport Texas	New York	10	9 1/2	10	Nov., 1919 1.00
Texas Gulf	New York	107 1/2	100 1/2	107	Mh. 2, Mh. 14, 1.75
DIAMONDS					
De Beers Consol.	New York			2 1/2	Ja. 6, Fe. 2 0.95
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	3	3	3	
MINING, SMELTING AND REFINING					
Amer. Metal	New York	50 1/2	49 1/2	50 1/2	Fe. 18, Mh. 2 Q 0.75
Amer. Metal pfd.	New York			115	Fe. 19, Mh. 2, Q 1.75
Amer. Sm. & Ref.	New York	100 1/2	98 1/2	99	Ja. 16, Fe. 2, Q 1.50
Amer. Sm. & Ref. pfd.	New York	109 1/2	109	109 1/2	Fe. 6, Mh. 2, Q 1.75
Consol. M. & S.	Montreal	68	67 1/2	67 1/2	De. 11, Ja. 15 SA 0.75
Federated Metals	N. Y. Curb			37 1/2	
Southwest Metals	N. Y. Curb			1	
U. S. Sm. R. & M.	New York	34 1/2	32 1/2	34	Jan., 1921 0.