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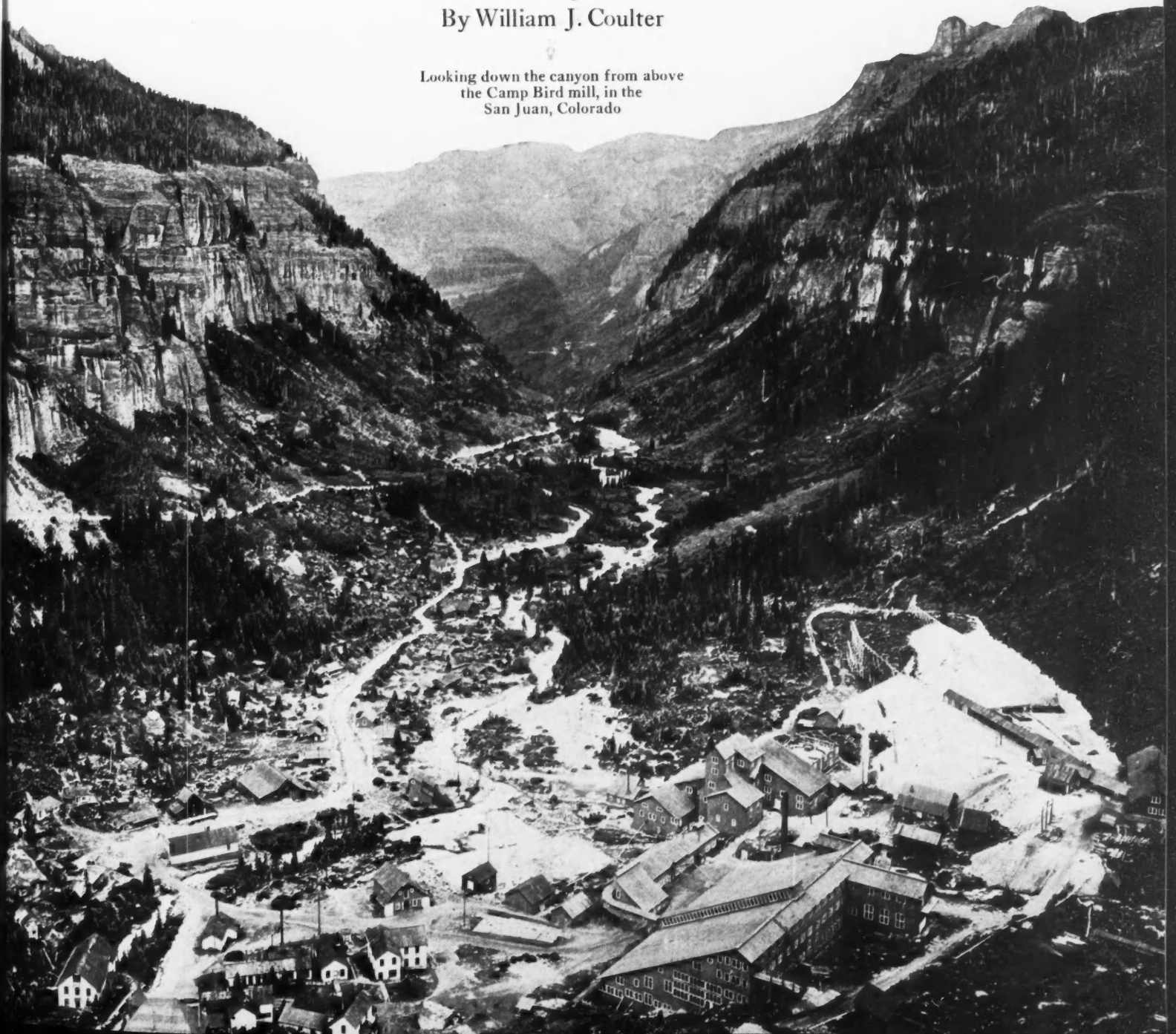
## The Camp Bird Compound Veindike

By J. E. Spurr

### Experimenting with Detachable Drill Bits at Anyox

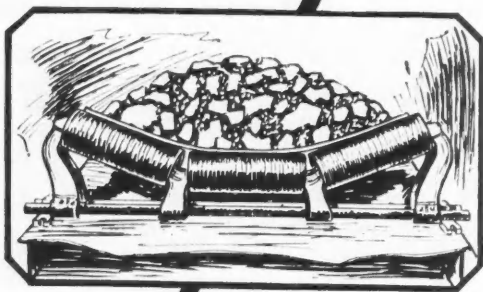
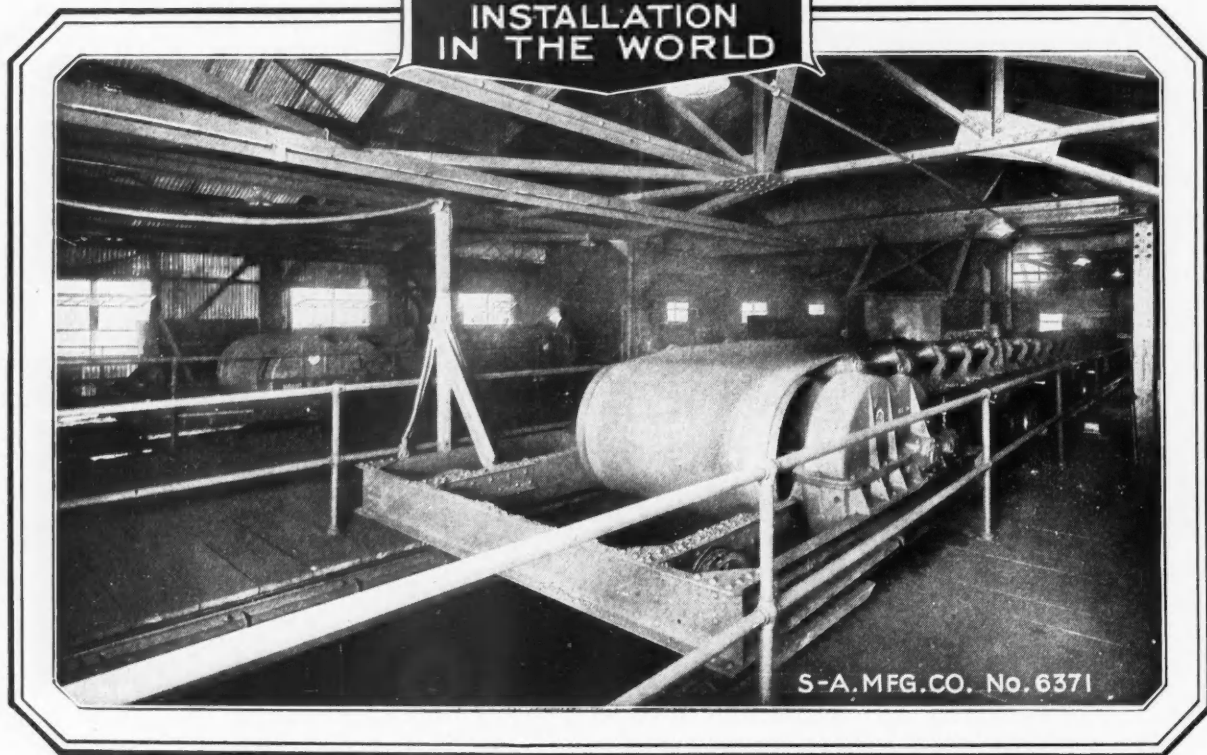
By William J. Coulter

Looking down the canyon from above  
the Camp Bird mill, in the  
San Juan, Colorado



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# ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 119

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Number 13

## The Price of Lead

**D**OWN IN DARKEST WASHINGTON the Department of Justice has started an investigation to determine whether the high price of lead is due to unlawful collusion in defiance of the Sherman Law. We do not know what progress has been made into the inquiry, which was instigated by a lead consumer who is having to pay high for his lead and naturally feels aggrieved. The inquiry is worth while, in so far as it will doubtless make clearer the economic situation of lead; it is not so worth while in that it may spend some of the taxpayers' funds in an inquiry which might have been solved by asking someone who knows.

To the geologist, mining engineer, and economist, as well as to the lead producer and consumer, the price of lead is a very interesting thing. The United States is the greatest lead-producing country in the world, yielding in 1923 three-sevenths of the world's output. The other principal lead-producing countries are Mexico, Australia, Spain, and Germany. The three first-named countries, together with the United States, produce 80 per cent of the world's lead. In the United States one-fourth comes from the Coeur d'Alene district, in Idaho, and one-third from southeastern Missouri. The three chief producing states in the United States are Missouri, Idaho, and Utah.

The price of lead is high. Study of the price curves of *Mining Journal-Press* shows that though lead fluctuated in general between 4 and 5 cents per pound from 1900 to 1918, war demands ran the price up to high levels, from which it returned to apparent normalcy between 4 and 5 cents in 1921. Then it began climbing, tending persistently higher, in spite of slumps, averaging between 7 and 8 cents in 1923 and between 7 and 9 cents in 1924 and now standing at 9 cents. There is to the best of our knowledge no artificial support of the price. It is a natural one, resulting from the relation of supply and demand.

The curve showing the world production of lead reveals the cause for the high price. World production reached its peak in 1912, with some 1,200,000 metric tons. The war demand did not markedly stimulate production, which was not higher in 1918 than in 1914; hence the war demand resulted in high prices, rising from around 4 cents in 1914 to as high as 11 cents in 1917. When in 1921 the price had dropped to below 5 cents, it was responded to by a world production which was phenomenally low, around 850,000 metric tons. Eventually, industry, needing lead in so many ways, could not do with a lead supply so much lower than that of pre-war years; so the demand has bid up the price to its present figure, and the price (and that alone) has stimulated the production, so that in 1923 it reached above the pre-war normal, with the average price of over 7 cents.

Unless new sources of lead production are opened up in the world, the price of lead will probably never re-

turn to pre-war levels. The fact is that a comparative world shortage has developed and is likely to be intensified unless new lead mines are developed. Unless this happens, lead prices, with all their fluctuations, will tend higher rather than lower.

The largest producer of lead in the United States is now the St. Joseph Lead Co., whose purchase of the Flat River mines, from the American Smelting & Refining Co., left the latter company a smaller lead producer.

The present commodity index of prices of a broad list of commodities stands at about 160, or 60 per cent higher than pre-war prices. It has been a matter of disappointment that the price of copper stands around 14 cents or at about 100 per cent of the pre-war level; but miners may find comfort in the price of lead being 200 per cent of the pre-war price. The reason is not obscure enough to justify a government investigation of one or the other. Indeed, if the high price of lead is suspiciously sniffed into, the low price of copper should also be investigated by the Department of Justice. Much the same groups are important factors in both: the American Smelting & Refining Co., for example, is a very large producer of both copper and lead, as are the American Metal Co. and other large organizations. But the well-known fact is that the demand for copper has not yet fairly caught up with the increased supply let loose on the world by the development of great low-grade mining properties in North and South America, and, latterly, in Africa; while the world has been caught short of lead.

## Deep Workings on the Mother Lode

**A**T THE KENNEDY MINE, near Jackson, Calif., the principal working shaft has been recently deepened to 4,462 ft., including a sump 112 ft. in depth. The lowest working level, which is just being extended, is 4,350 ft. from the collar. The shaft is vertical. At the neighboring Argonaut mine, the shaft, including a sump, is 5,210 ft., measured upon the slope of the shaft, which is an incline slightly less than 60 deg. to the horizontal. The vertical distance is 4,510 ft. The collar of this shaft is approximately 105 ft. above the collar of the Kennedy vertical shaft. The bottom of the Kennedy shaft is thus 57 ft. below the bottom of the Argonaut shaft. The depth of the Kennedy shaft is about 2,962 ft. below sea level. The lowest level of the Argonaut mine is 5,100 ft. measured along the incline, or about 4,300 ft. vertically below the collar. Both shafts are the deepest in California and probably deeper than any mine shaft in the United States outside of the Michigan copper district.

The Central Eureka mine, near Sutter Creek, is slightly more than 4,000 ft. in vertical depth, the shaft being an incline and the lowest level being at 4,400 ft. on the incline. The Plymouth mine is served by a combined vertical shaft and incline, the present depth

of which is 3,920 ft. vertically below the collar, or 2,870 ft. below sea level. At the Carson Hill mine the vertical depth of the lowest working is 3,706 ft. below the outcrop of the vein, or 1,756 ft. below sea level. The vertical depth of the main incline working shaft, the collar of which is at the level of the Melones adit, is 2,580 ft. A three-compartment winze gives access to the lowest workings from the lowest shaft level. The Eagle Shawmut, at Shawmut, has attained a depth of 3,000 ft. below its adit level, which connects with an underground shaft. The vertical depth of the lowest workings below the outcrop is 3,400 ft. The shaft is 2,300 ft. in depth and a winze extends from the lowest level.

The two important mines in the Grass Valley district, the Empire and the North Star, are now at an approximate depth of 3,000 ft., or about 600 ft. below sea level.

The foregoing facts are worthy of recording here, both for their geologic significance and also as an indication of one of the major conditions under which lode gold mining in California is now conducted.

### The Asbestos Merger

**R**UMORS OF AN AMALGAMATION of all the asbestos-producing companies in Quebec have become more persistent of late, and the project seems to have better prospects of success than it had a few months ago. The longer the delay, the more the various units in Quebec appear to realize the need of collective action to meet their difficulties. Although Canadian asbestos, before and during the war, had a practical monopoly of the American market, the situation has changed in the last few years with the growth of strong competition from South Africa, where new deposits have been opened. Whereas Quebec companies have either suspended dividends or reduced them, the principal Rhodesian producer paid last year 15 per cent in dividends. The entire output of Rhodesia amounts only to about 25,000 tons per year, compared with the 225,000 tons from Quebec; yet the tonnage produced is very disturbing to the market, being of the long-fibered grades, which command the highest price, and is shipped to the United States and Europe.

The Rhodesian properties are already well organized and controlled by one organization, the Rhodesian and General Asbestos Corporation (in which the Goldfields Rhodesian Development Co. has a quarter interest), while in Quebec there are many independent factors, among them being the Asbestos Corporation, Asbestos Mines, Consolidated Asbestos, Maple Leaf, Black Lake Asbestos, and Chrome, Johns-Manville, and other groups.

No law as drastic as the Sherman Act exists in Canada, so that nothing prevents these companies, from getting together, should they care to, for the purpose of fixing prices to consumers. But they have never done this. Keen rivalry, intense competition, and lack of technical co-operation have taken the place of friendly action for mutual benefit, probably much to the delight of South African producers. This explains why progress in the direction of a merger is so slow and troublesome.

Many conflicting views have had to be reconciled by the bankers behind the movement. If the amalgamation is finally consummated it is likely that no one, except those directly interested in the industry, will understand the many difficulties that stood in the way. Time

works to the advantage of the promoters as Rhodesian competition becomes more intensified rather than diminished, and the Canadian producer meditates over the attractions of a consolidation and the prospect it has of putting the industry on its feet again. For it would be a simple matter to meet Rhodesian competition by lowering the price of Canadian long-fiber or crude grades, which bear the brunt of Rhodesian competition, and at the same time raising the price on the shorter stocks to make up for a loss on crudes. Rhodesia is too far away to be able to compete in the lower-grade market. One large Canadian corporation could take care of this situation. It is such an easy path out of the woods that a merger is a likely outcome of the present negotiations.

### Salt and Iodine

**T**HAT MINERS who have to work in uncomfortably warm and humid places may possibly avoid fatigue by drinking at intervals a weak solution of salt in water was pointed out editorially in the issue of Nov. 8, 1924, page 721. This suggestion was based on the results published abroad of experiments made in British mines and boiler plants. Since then word has come that the expedient has been tried with success in at least one Western mine, and it is likely that elsewhere it has been repeated with results that would be interesting to learn.

Another use for salt, this time of much wider application, is referred to in the March *Bulletin* of the Canadian Institute of Mining and Metallurgy. More exactly, this is an iodized salt in which the salt acts as a carrier of a minute trace of iodine. The absence of iodine in the food has been found to be responsible for goitre, or the enlargement of the thyroid gland, which is often widely prevalent in inland regions. The source of most of the iodine used commercially today is the mother liquor from the refining of soda niter, but the great storehouse of this element is the sea, and those who live along its shore apparently secure their iodine requirements from sea foods and vegetables grown in seaboard soil, gaining thus a seeming immunity from goitre. According to the *Bulletin*, this disease is prevalent in the mining districts of central Canada, where fresh sea food is not readily available. Reports of its wide occurrence also in Utah have recently come to hand.

Responding to suggestions from the medical profession for a universally used article of food containing iodine, the Canadian Salt Co. of Windsor, Ont., has produced an iodized salt for general use, with the approval of the Ontario Provincial Board of Health. This salt is quite like ordinary salt except for the minute quantity of iodine it contains, and can be used with perfect freedom. It will probably be of benefit in many an inland camp, though individuals using it will scarcely notice results save over a considerable period of time.

### The Gold Tide Turns

**A**T LAST the flow of gold to the United States has stopped, and in the last two or three months exports of that metal have reached large proportions. This is a much desired circumstance, coupled, as it is, with the fact that many foreign nations are getting back to the gold standard. Not only Germany but Greece, Poland, Hungary, and Czechoslovakia have

taken steps to tie up their currencies to gold. South Africa will soon be officially on a gold basis, and England, Sweden, Switzerland, Australia and Holland are not unlikely to be on a gold basis before the close of the year. This will allay the fears of some who believed that the United States might be allowed to hold the bag while the rest of the world adopted some other precious metal or commodity, or even an engraved piece of paper, as its standard of value. It will also have a good effect on sentiment in other countries; no one likes a miser; and the impression was rather general in foreign countries, we suspect, that because the United States had so much gold every American had all the wealth he needed and had no worries about income taxes or such disagreeable things.

The amount of the metal held by the Federal Reserve banks has been so great that it has seriously interfered with their earning capacity. But as the gold goes out, as it is likely to continue to do for some time, the natural tendency will be toward higher money rates, less speculation, and deflation. So far there cannot be said to have been much connection between minor fluctuations in gold stocks and prices, owing to the steadying influence which has been exerted by the Federal Reserve system.

The direct cause of the gold shipments has, of course, been the appreciation of some foreign moneys above dollar parity, and the consummation of foreign loans. Australia has been perhaps the chief recipient from the first-named cause. Gold has also been shipped to Germany, India, England, Venezuela, Holland and Poland.

### Zinc No Longer the Goat

CONSTRUCTION of a new \$500,000 concentrator as an adjunct to its lead smelter at Midvale, Utah, will be started this spring, according to a recent announcement by the United States Smelting, Refining & Mining Co. This is an important project. The significance lies in the fact that the company proposes to enter the market for lead-zinc-silver ores and to pay for the zinc as well as the lead. The concentrator will be equipped to make a selective separation by flotation of the two base metals. Last summer the International Smelting Co. started a similar plant in conjunction with its smelter at Tooele, Utah. A third custom plant for the purchase of lead-zinc sulphide ores is that of the Combined Metals Reduction Co. at Bauer, Utah. The small producer who has no concentrator of his own can market certain classes of so-called complex ores and under existing market conditions he can realize on the zinc content.

Not so many years ago the reason most frequently assigned for shutting down a Western lead-silver mine was the increasing zinc content of the ore. The owner was sure that if the zinc were only absent the lead and silver would make a profitable shipping ore; but the high penalty imposed by the smelter on account of the zinc made it impossible to mine at a profit. Though the smelting companies may sometimes have been more severe than necessary in their penalties, they did not recover any of the zinc in marketable form, and the zinc undoubtedly increased the cost of smelting the ore in a lead blast furnace. Zinc in his orebody was poison in the cup of many a mine operator.

The introduction of the flotation process started the

change. By the old methods of concentration it was impossible, when the metals were intimately mixed, to get a good recovery and at the same time keep the zinc out of the lead and the lead out of the zinc concentrate. As progress was made in the development of the flotation process, as new reagents and better machines were devised, and as methods of economical fine grinding were improved, millmen gradually bettered the results of their selective floating. Among outstanding examples are the work of Bruce Marquand at the Sunnyside plant at Eureka, Colo.; of T. M. Owen at the Morning mill, in the Cœur d'Alenes; and W. N. Rossberg and his staff at the Timber Butte mill, at Butte. The plants at Anaconda and at Trail, in British Columbia, should be mentioned. Each of these concentrators was designed primarily for the treatment of a particular ore.

The Consolidated Mining & Smelting Co., at Trail, has for several years, we understand, been treating occasional shipments of custom ore by selective flotation, and the Anaconda company has purchased zinc-lead ores. However, the last year has witnessed definite progress in improving the results obtained in selective work; and recently, for the first time there has been a definite effort by smelting interests to stimulate the production of zinc-lead ore. Not only has the penalty on zinc in ores of many classes been abolished, but the zinc is being paid for as well as the lead. The new plant of the United States company marks the entry of another competitor for such ores in the Salt Lake district, and demonstrates that a market is available, especially to the small producer, for many ores that once were valueless. The high prices for zinc and lead are a factor, of course, but the technical progress in concentration and ore dressing is very important. At any rate, the old cry that zinc spoiled the mine will not be so plausible and convincing as it once was. Zinc has ceased to be the goat.

### California Engineers' Licensing Bill

PERSISTENT ATTEMPTS are being made to railroad an engineers' licensing bill through the California State Legislature, which is now in session. Two years ago a similar effort was made, but the bill failed to pass.

We have expressed our opinion upon the state licensing of engineers before, and we do not know of any sound argument in favor of it. It falls clearly into the division of unnecessary legislation. If it passes it will entail the maintenance of new state machinery for its administration. Necessarily all breeds and kinds of engineering will have to be considered; and an attempt to administer a law of this kind equitably and with due regard to the exclusion of the unfit and incompetent is a large-sized job and would entail unusual ability on the part of the members of the commission who were intrusted with its enforcement.

The new law, if it is passed, would merely place an Oregon boot upon the legs of the engineers, good, bad, and indifferent. It would be a source of irritation to everyone and could serve no useful purpose. Right now, when attention is being directed to the mass of unnecessary state and federal legislation, the engineers' licensing bills are excellent subjects for the waste-paper baskets of every legislature.

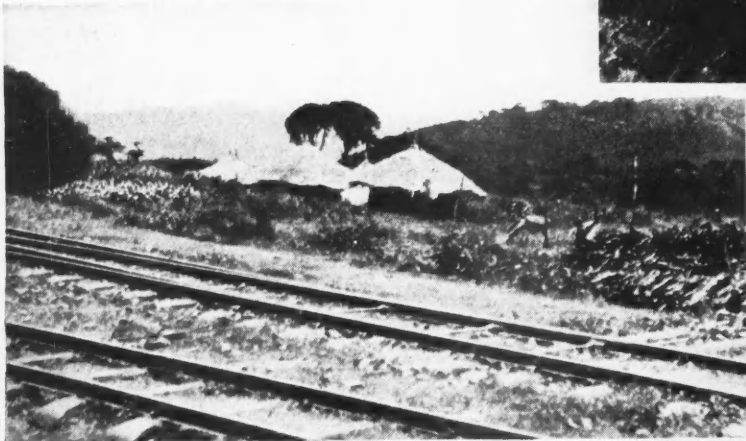
# From KENYA COLONY to CAIRO



Falls of Thika near headwaters of Tana River, Kenya Colony



Above - Looking southwest across the Great Rift Valley in Kenya Colony

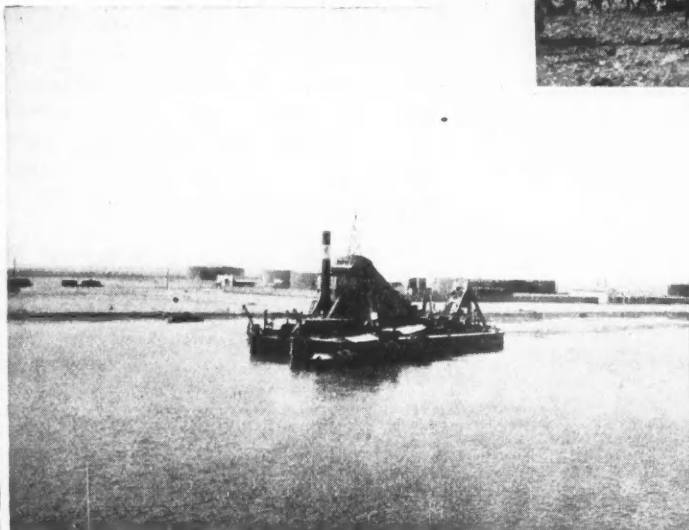


Above - Abyssinia - Along the railway between Addis Ababa and the coast

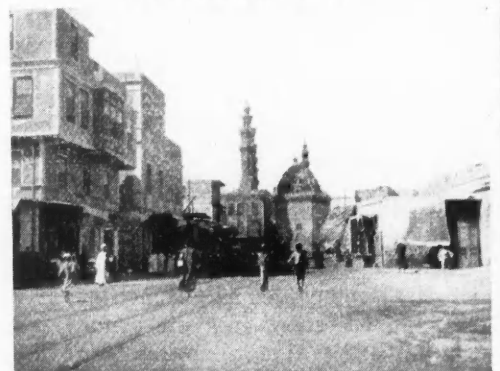
Below - Hanging tree at Addis Ababa, the capital of Abyssinia. The lower branches of this tree were used as late as 1921 for the execution of murderers and bandits.



Suez Canal near Port Said



A Street in Cairo



**THE END OF A MINING ENGINEER'S JOURNEY THROUGH AFRICA**

*These photographs with others published in earlier issues were taken by A.W. Newberry, of New York, on a recent trip through mining regions in Africa, from the Cape to Cairo*

# The Camp Bird Compound Veindike\*

By J. E. Spurr

AS A GOLD MINE that has been extraordinarily rich and profitable, the Camp Bird in Colorado warrants attention, and interest in its geology. Now that it has closed down, probably forever, it is of advantage to science to record some further notes as to the occurrence of the ore, before its glory shall quite have faded into the past. The conclusions stated below were the results of careful instrumental geological surveys,<sup>2</sup> and repeated examinations.

The mine is in the Ouray district, and was located by Thomas Walsh in 1896, and operated by him till 1902, when it was sold to an English company, the Camp Bird Limited, who operated it till its ores were exhausted. It practically closed down in 1916, though development work was carried on until within two or three years. It produced many millions of dollars, and yielded many millions of profits, being during its best

U. S. Geological Survey. These mountains represent a domical uplift,<sup>3</sup> probably due to the pressure of magma up from below; and smaller parasitic domes occur as details on the main dome. Due to the uplift, erosion has been swift and deep and has cut down through a great range of formations.

Starting at the town of Ouray, for the 8-mile ride

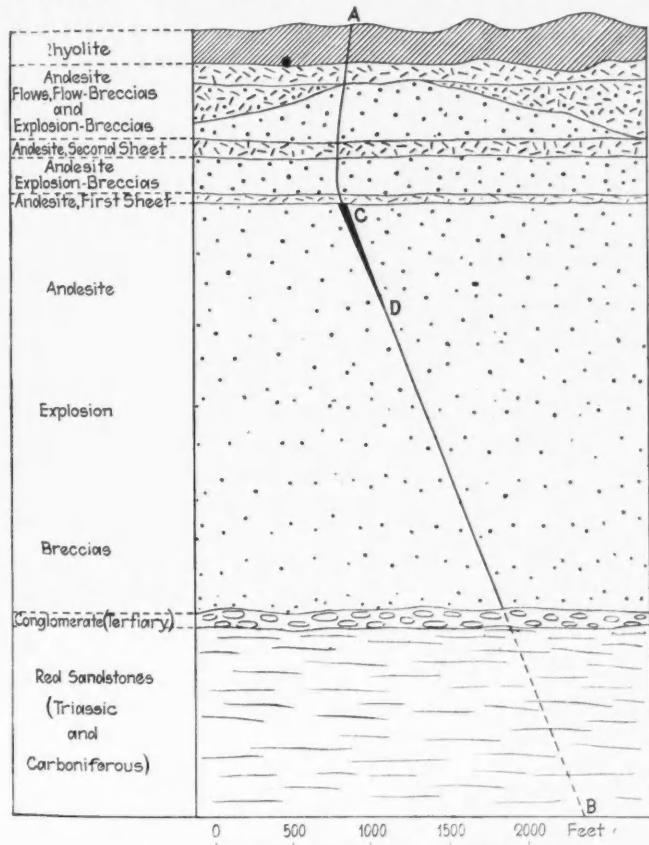


Fig. 1—Camp Bird vein and enclosing rocks. A B, Camp Bird vein; C D, productive portion of same.

period one of the well known gold mines of the world. *Sic transit gloria mundi.*

The geology of the San Juan Mountains, in a section of which the mine lies, need not be gone into here. It has been well described in the publications of the

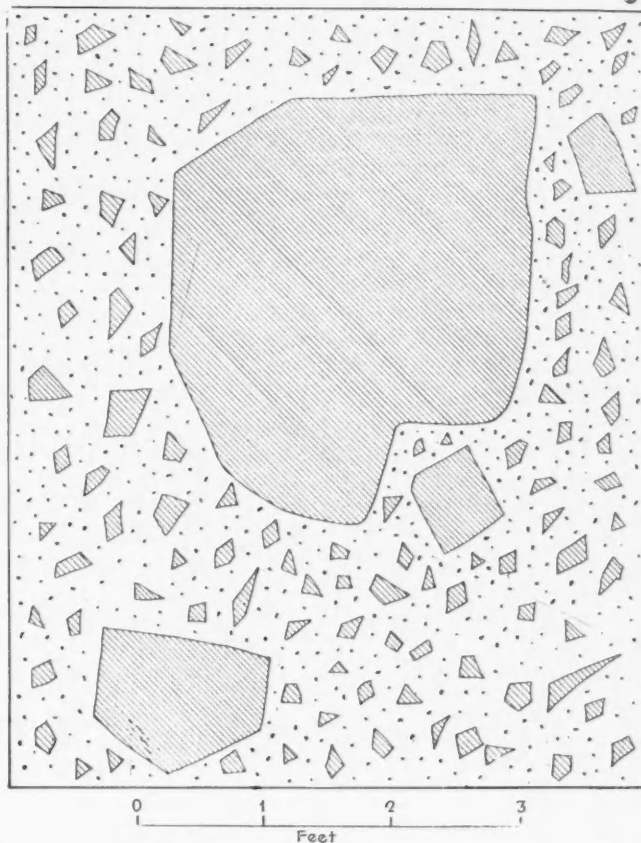


Fig. 2—Sketch of andesite breccia (angular green fragments in fine red matrix) showing explosion origin. Camp Bird mine.

up to the Camp Bird mine, one passes through Paleozoic limestones and sandstones and through sandstones and conglomerates of the Mesozoic, amounting to several thousand feet, to where a thin early Tertiary conglomerate overlies the Mesozoic (Triassic) red beds unconformably. (Fig. 1.) Then comes a vast accumulation from Tertiary volcanic outbursts. Explosive eruptions rapidly piled up over 2,000 ft. of andesitic breccia, containing angular fragments of andesite of all sizes, imbedded in finer-grained andesitic material, with only a rude layering such as would naturally arise from its accumulation under the open sky. (Fig. 2.) As seen underground, the fragments are typically green, and the matrix is red, a striking contrast, showing that much of the fine material became oxidized during the process of expulsion and accumulation. Near the vein, however, the red matrix is turned green, so that fragments and matrix are difficultly distinguishable. These

\*Republished from the March, 1925, issue of *Economic Geology*, by permission.

<sup>1</sup>The Camp Bird vein has been discussed by C. W. Purington (*Trans. A. I. M. E.*, Vol. XXXIII, 1903, pp. 499-528); by F. L. Ransome (*Bull. 182*, U. S. Geol. Survey); and H. A. Titcomb, *Columbia School of Mines Quarterly*, N. Y., Nov., 1902.

<sup>2</sup>The geological work was done mainly by myself and J. H. Farrell.

<sup>3</sup>F. L. Ransome, *Rico. Folio*, U. S. Geol. Surv., No. 130, 1905, p. 7.

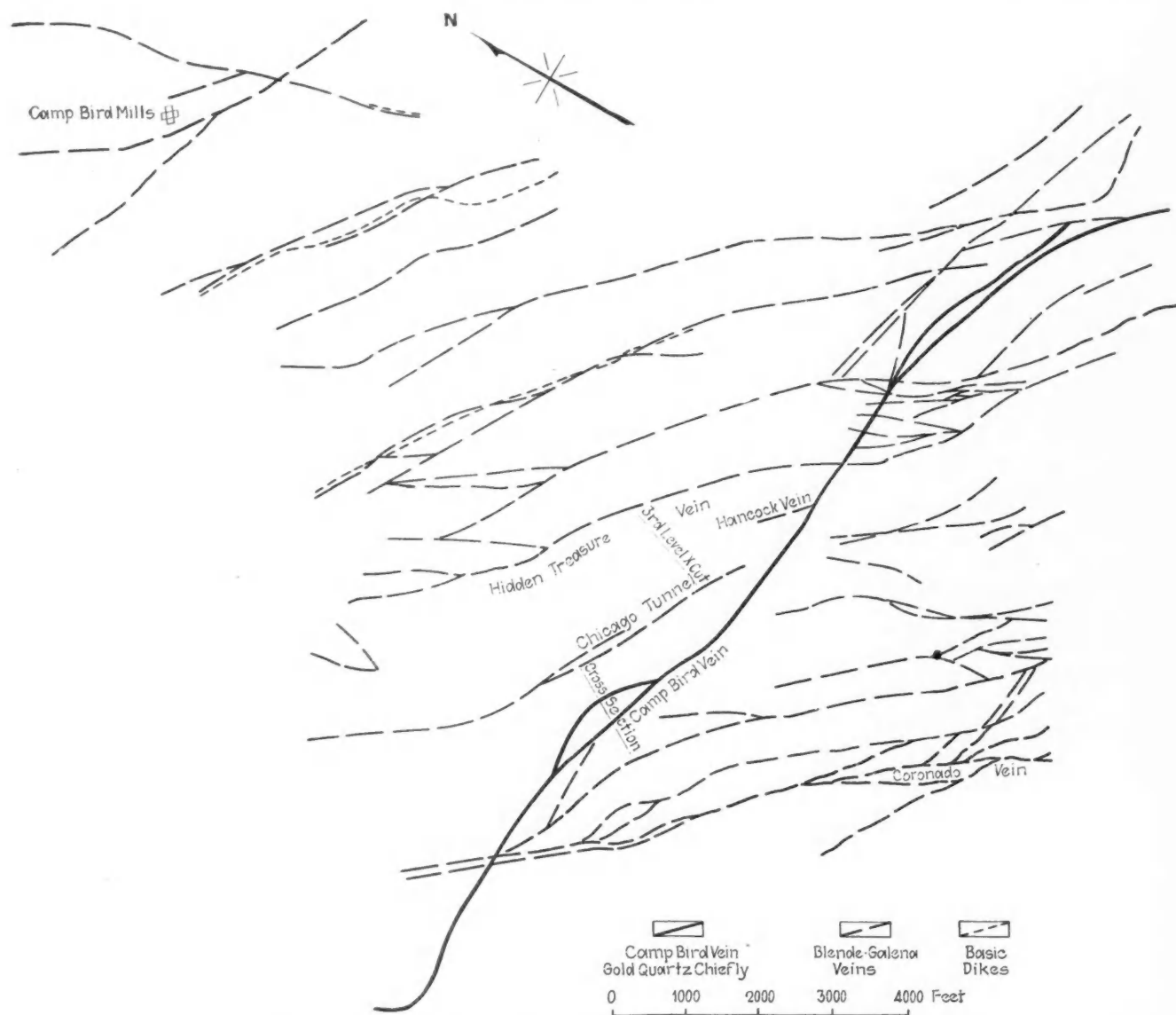


Fig. 3—Map of Camp Bird vein and other veins in the vicinity

breccias accumulated to the great thickness of about 2,600 ft. with little or no change of character.

At the top of this comes a sheet of andesite only about 50 ft. thick; above this sheet explosive andesite breccia entirely similar to that below comes in again for 200 or 300 ft.; and above this another andesite sheet, like that below, is encountered, this being upward of 150 ft. thick. Then comes about 500 ft., more or less, of andesite explosive breccias (some of them differing slightly from the thick explosive breccias beneath) with flow-breccias and andesite flows. Then come rhyolite flows, the uppermost formation of all. The maximum thickness of this rhyolite shown above the mine, or in the immediate vicinity, is about 600 ft. The total thickness from the bottom of the rhyolite down to the first andesite flow is about 900 ft. These rock distinctions should be borne well in mind, since they play a major rôle in the localization of the ore of the Camp Bird mine.

Erosion accompanied these volcanic accumulations, especially the later ones, so that toward the end the flows or breccias were laid down upon highly accidented erosion surfaces. This explains why the thickness of volcanic accumulations in Figs. 4 and 6 (actual sections) is less than the maximum, shown in Fig. 1.

The last lava emission consisted of a few straight parallel basic (andesitic) dikes. These have a nearly due northwest course, which is also the course of nearly all of the numerous mineral veins in the section—but not of the Camp Bird vein, which is a marked exception, as will be shown. (Fig. 3.) Indeed, these northwest veins came up along the same set of fissures as the basic dikes, so that they in several instances run along the side of such dikes, or even split them and run down their middle; but the veins are far more numerous than the dikes.

#### THE CAMP BIRD VEIN

The Camp Bird vein, the most notable one of the immediate vicinity, has an average direction only a little north of west, so that it cuts across the strike of nearly all the other veins at an angle of 45 deg. or so. It is not straight, but curves and wobbles, as the other veins do also, but to a less degree. Its extent is very persistent along the general strike, and has been mapped by myself and assistants for nearly five miles, as shown in the figure (Fig. 3); and this is probably far from being the total length. It dips, normally, about 65 deg. to the south. When will some brilliant investigator explain why veins usually dip 60 to 70 deg.?



The productive stretch of the Camp Bird vein, however, is only a fraction of the distance mentioned, being about a mile in length. And in this distance the ore is not continuous along the strike, stretches of ore alternating with almost absolutely barren stretches. (Fig. 4.) Two of these stretches form the principal shoots—the Discovery shoot and the Bluebird shoot each extends a thousand feet along the vein, and are separated by 600 to 700 ft. of barren lode. West of the Discovery shoot there is practically no ore: east of the Bluebird there occur at intervals two shoots, with less extent along the strike—the Gertrude shoot, one or two hundred feet long, and the Hancock shoot, some two or three hundred feet long, which are separated from one another by 500 or 600 ft.

The vertical extension of these shoots on this strong and steeply dipping vein was curious, and highly disappointing to the miners. This is best shown in the section on the plane of the vein. It will be seen on the projection of the plane of the vein (Fig. 4) that all the orebodies, *whatever the length along the strike of the vein, have about the same vertical extension, which is, roughly speaking, 600 to 700 ft. or thereabouts*: so that the longer shoots—the Discovery and the Bluebird—are longer than they are deep. All these shoots, it will be seen, moreover, have a flat top at almost precisely the same elevation, and a marked tendency to contract in length below that top, till they tail off downward like a turnip, the tail extending far down.<sup>4</sup> The vein itself continues with some strength in depth, but the ore shrinks in size and value till mining was not feasible. How deep the vein and spots of ore go I do not know. When I was at the property last (in 1910) the deepest workings were at an elevation (above sea level) of about 10,400 ft. or 1,500 ft. below the general top of the oreshoots, which general top is about 11,900 ft. Below this, andesitic breccia extends some 1,300 ft.; and in recent years a tunnel has been driven in at very much lower levels, and is reported to have found the vein, but no ore. Veins are found in other parts of this region also in the Mesozoic and Paleozoic rocks which underlie these Tertiary

volcanoes; so it is probable the Camp Bird fissure goes down through them also. The barren or low-grade vein filling also goes above the oreshoots and crops at the surface.

Some of these oreshoots, it will be observed, do not come to the surface at all; others have barely been exposed by erratic erosion. Here we have a case of pristine oreshoots, which have not undergone loss through erosion. The study of the peculiar limitations of these oreshoots is one which yields some definite results. The problem is resolvable into two elements—that of the horizontal distribution of the oreshoots; and that of the vertical distribution. Here is a vein traceable for over five miles—why does the ore have a total length of only about 3,000 ft. in separate shoots, all occurring in a stretch of vein less than a mile in length? Here is a vein which goes up to the surface, past the pay ore, and down in depth far beyond the limits of the pay ore—why the vertical restrictions?

*Horizontal Distribution of Oreshoots.*—Taking the horizontal extension first, the horizontal maps of the vein in the ore-bearing section show clearly that the *orebodies depend upon the local strike of the vein* (Fig. 5). The whole strike of the Camp Bird vein, as mapped on the surface, is about N. 70 deg. W.; the productive portion is about N. 77 deg. W. This productive portion is not straight, but zigzags along a succession of alternating stretches, of which one set strikes nearly east-and-west, and the other west-north-west (from N. 60 to N. 66 W., in different cases). This distinction is very important: the east-west stretches are typically barren, not only of ore but to a great extent of any vein material. Those stretches which become more northerly in strike (say N. 73 W., as in the case of the stretch near the extreme western end of the second level) show considerable amounts of vein material; while those bearing still further north are the stretches marked by orebodies. The three principal orebodies on the second level, named in the relative order of importance, have trends of N. 60 W., N. 65½ W., and N. 63 W.; and the first-named, which is most northerly, is that of the widest orebody—the Discovery.

<sup>4</sup>The reader, looking at Fig. 4, will perhaps wonder why all the "tails" tend to rake to the east. I do not know.

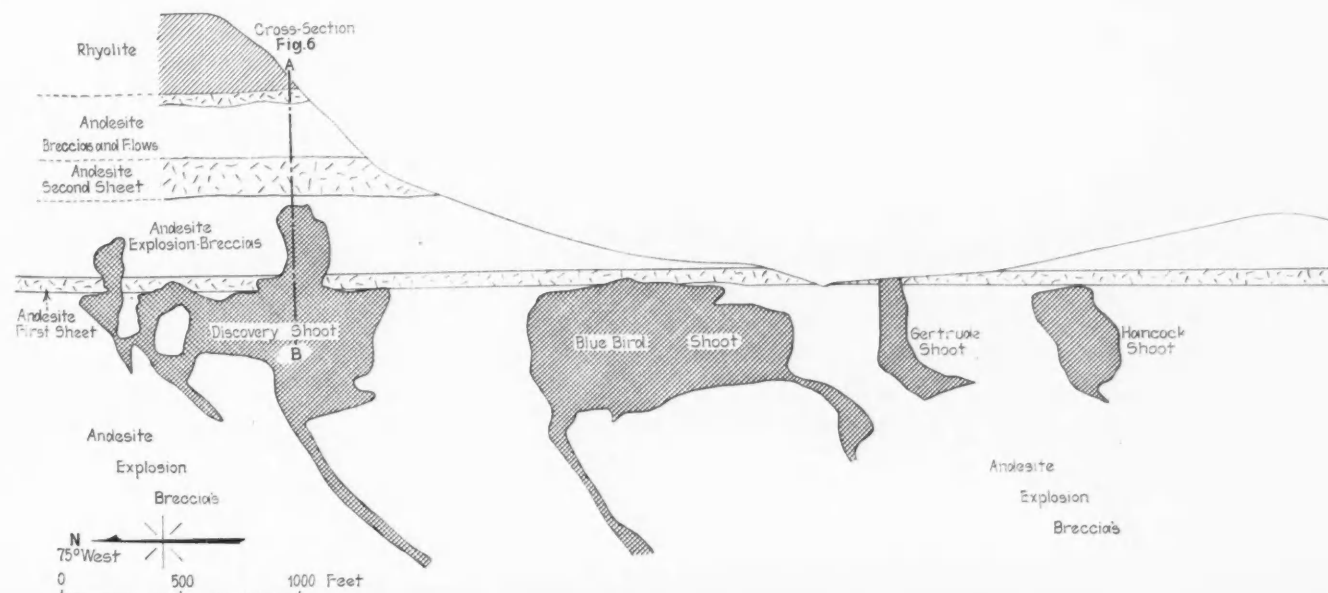


Fig. 4—Projection of stipes on plane of Camp Bird vein

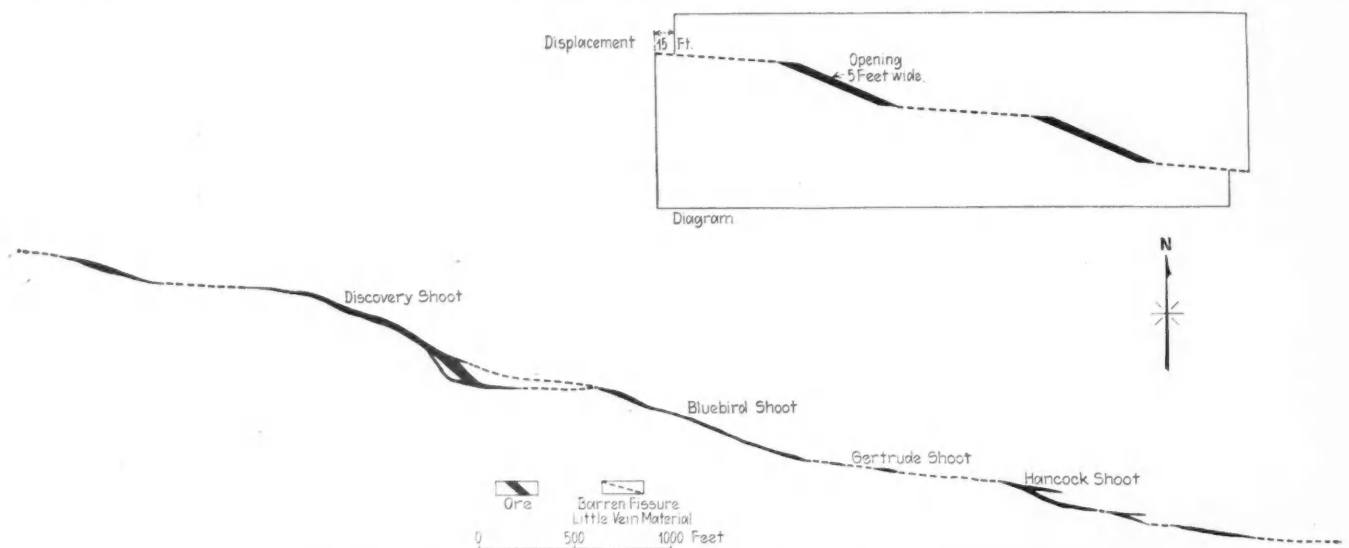


Fig. 5—Camp Bird vein, second level, showing different elements in strike

The explanation of these relations is plainly that after the formation of the long zigzag fracture that initiated the vein, the rocks on the south side were shoved in a due westerly direction 15 or 20 ft. horizontally past the rocks on the north side. Where the movement was parallel to the fracture, as along the east-west stretches, no openings resulted; where the fracture was oblique to the movement, the walls were separated, leaving fissures. These fissures of limited extent along the strike became the channels for ascending metalliferous solutions or ore magmas.

It is obvious that in any vein whose *dip* alternates from steeper to flatter pitches, as does the *strike* of the Camp Bird vein, alternations of pay ore and barren vein might occur. Thus it might be the alternating steeper dips which would carry the most ore. In this case a slight relative sliding down of the hanging wall rock past the footwall would have provided greater openness along the steep pitches and so induced the greater thickness of ore. If the footwall slid down relative to the hanging wall, the oreshoots would be on the flat pitches.

This was pointed out long ago by Von Cotta; and Purlington<sup>6</sup> referred changes in value of ore with change of dip, in the Camp Bird region, to this cause. Many examples of this in the Cornwall mines have been given by Collins;<sup>7</sup> and Mr. Bernard MacDonald has recently called attention to it in Mexico.<sup>7</sup> So far as I know, however, the case I describe is the first where the principle has been applied to *horizontal* alternations of ore and barren vein; although the extension of the explanation is obvious. Alternations of this sort on the dip are due to the vertical differential movement; such alternations on the strike are due to horizontal movements. Moreover, had the direction of the horizontal movement on the Camp Bird been to the east on the south side, the east-west stretches would have become oreshoots

instead of the reverse, which actually happened. On the third level (where the ore is strong and the vein has been followed a long distance in the mine) the western 5,500 ft. opened up has a general strike of N. 75 deg. W., and this stretch includes all the oreshoots; the strike of the eastern 2,000 ft., along which stretch no ore was found, is N. 85 deg. E.

*Vertical Distribution of Oreshoots.*—As to the vertical limitations of the ore, no such explanation is possible. The vein has the same dip below the orebody as in it. But a very definite and striking vertically limited factor was detected by our examination. The flat top of the ore (which is about at the same level, speaking generally, throughout the productive portion) coincides with the bottom of the lowest andesite flow. The vein fissure goes up through the andesite, as, indeed, does the quartz and other vein filling, but the gold is lacking. Similarly, below the oreshoots, the vein fissure goes down strong; and the vein filling is also strong beneath the oreshoots; but gold is lacking. In other words, the vertical limitations of the oreshoots, and their shape, depend upon a copious deposition of gold in the vein, only in the areas designated in the projection (Fig. 4), which areas correspond with the areas stoped. The concentration of gold was greatly in excess of that usually found in those gold-quartz veins which show oreshoots more persistent in depth, as the Mother Lode veins in California or the mines of Porcupine (Canada). In ores of this type the ore runs, say, \$5 to \$8 per ton, and the oreshoots (namely, the concentrations of gold in the quartz) have a vertical extent of several thousands of feet. The Camp Bird ore averaged \$27.91 in gold for the six years previous to my examination, and the vertical extent was only 600 to 700 ft.! Evidently, an unusual concentration has taken place in the case of the Camp Bird. If the ore were reduced to the average grade—say \$5—of the Porcupine or Mother Lode ores, the oreshoot would have had to be 3,500 to 4,000 ft. deep to contain the same amount of gold. The problem, I desire to repeat, is not in any of these cases one of the distribution of quartz or other vein filling, but of the distribution of gold within or near the quartz vein, for that is what makes the ore.

At the Camp Bird, therefore, we have a vein which came up through some 2,600 ft. of andesite breccia till

<sup>6</sup>Purlington, C. W., U. S. Geol. Surv. Telluride Folio, 1899, p. 16.  
<sup>7</sup>Collins ("West of England Mining Region," *Trans. Royal Society of Cornwall*, 1912, pp. 121-122) also quotes Capt. Charles Thomas' opinions that in many veins of Cornwall "changes in the bearings of the lodes appear to be the chief cause of productiveness or otherwise." "His remarks, however," observes Mr. Collins, "do not so much relate to the small 'turns' and 'warps' as to the larger inflexions often met with, when, for instance, the mean bearing of the lode being E. 22 deg. N., the bearing of the rich parts is more commonly east and west, and that of the poor parts is much further from east and west." No explanation for this condition is offered.

<sup>8</sup>*Engineering and Mining Journal-Press*, Vol. 117, p. 453.

it struck an andesite flow 50 ft. thick; in some way this andesite flow pulled the trigger and let off a delicately adjusted tension, and the gold was thrown down in the vein, just under the andesite sheet. One would not have believed it if one had not seen the clear evidence. In some way the gold was unable to pass through the vein fissure in andesite; in some way the obstruction was great enough to cause precipitation below. What caused the definite horizontal zoning of ore deposition? Was it chemical or physical?

*Cause of Distribution of Ore.*—The chemical explanation, to which we habitually turn, is in this case definitely excluded. The blocks in the andesite breccia, from top to bottom, are of the same andesite; and the

the deposition of gold—must therefore have been physical. And this is a conclusion which we would not expect, because andesite is as a rule a favorable wall rock for ore veins. It breaks cleanly, forming well-marked and straight fissures; it is sufficiently penetrable so that it can be replaced to a certain extent by ore solutions. Many of our best veins, of this same Tertiary shallow-formed type, are in andesite. Indeed, it is perhaps the most popular host-rock of all, in the Cordilleran region of North America. Why, therefore, has it inhibited the ascension of the gold in this case?

The breccia in which (just below the andesite flow) the gold was thus so suddenly and concentratedly dumped, does not seem, according to our habitual impression, so favorable a wall rock as the andesite. It is not so firm, in consequence of its origin; although, to be sure, we perceive that it was firm enough so that the vein fissures traversed it for great distances without scattering or weakening.

Discarding our expectations, therefore, we must get down on our hands and knees and inspect the present case. What physical difference is there between the andesite flow above and the andesite breccia beneath? Only that of *porosity*, apparently; the matrix of the breccia, being finely fragmental, is more porous than the solid lava. And this greater porosity must (by the process of elimination) be the reason for this important ore localization—for the pulling of the tension trigger which produced gold deposition. Let us note, however, that the porosity of the breccia is the same for the whole 2,600 ft. of breccia; and that the ore horizon of 600 to 700 ft. directly below the andesite flow has no especial advantage in this respect. The flat top of the ore, indeed, shows that *the andesite flow has acted as a dam to the gold*. But this is not the kind of a dam that we ordinarily find in ore deposition: where an impervious bed—such as a shale bed—blocks the fissure, so that the ore solutions or ore magma cannot pass up, but must spread out sheet-like below the impervious layer. The fissure went up cleanly through the andesite; and the vein solutions went up. The vein is as wide, or nearly as wide, in the andesite as below. The gold-bearing vein does not replace the walls to any noticeable extent; it is confined between the walls—a true fissure vein—whether these walls are breccia or andesite.

The longest and best available cross-section of the vein is through one of the two small oreshoots in the mine where the ore persists above the 50 ft. andesite flow—this upper oreshoot being, as seen on the plane section of the vein (Fig. 4) only some 150 ft. long, above the andesite flow, while immediately beneath the flow the oreshoot is over 1,200 ft. long. The plane section shows that this narrow shoot of ore runs up through the breccia which overlies the 50 ft. andesite flow, nearly to the thicker andesite flow 300 ft. above, but stops when it gets there; and that is the absolute top of the pay ore in the mine. A little ore occurred in the very bottom of this andesite flow.

The cross-section (Fig. 6) at this place shows that these andesite flows have actually influenced the dip of the vein also. They have tended to deflect it from its normal 70 deg. dip toward the vertical. As shown, the vein branches after penetrating upward through the 50 ft. andesite flow, and the thicker branch goes up about vertical. On penetrating the second andesite flow, it leans further back than the vertical so that its steep dip is slightly reversed. The narrower branch

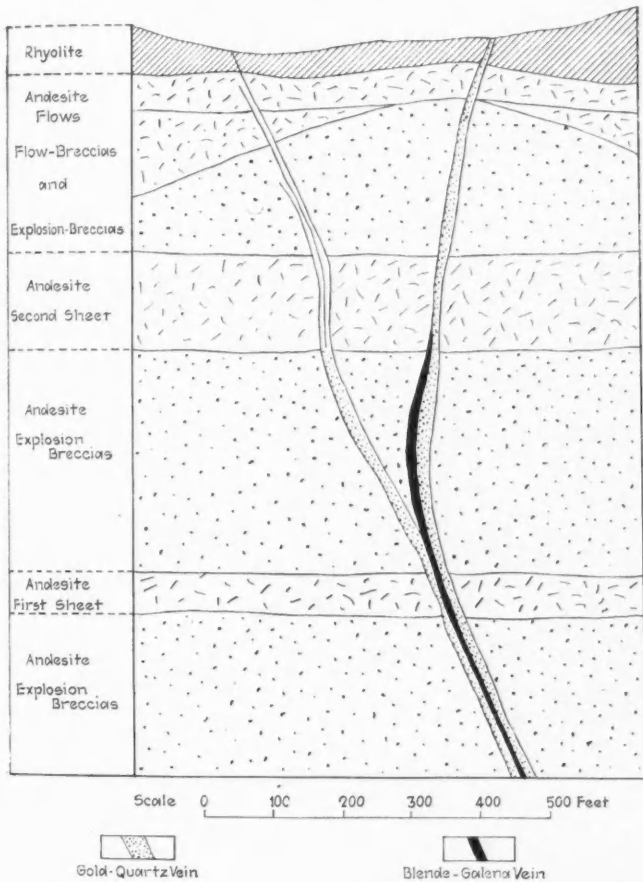


Fig. 6—Exceptional cross-section of Camp Bird vein, through line A-B of Fig. 4. Section line also shown on Fig. 3.

andesite of the flows is also of the same kind. That the flows came from the same volcanoes as the breccia is indicated by the interbedding of the breccia and the flows above the orebodies. The whole volcanic period of andesite eruption, from the bottom of the breccia to the bottom of the rhyolite, was a simple and short-lived one; the great thickness does not denote great time, but great intensity. Violent explosive eruptions of andesite breccia were followed, when the violence calmed down, by a flow; then a shorter explosive paroxysm; then more flows; and the andesite period was at an end. The rhyolite came later. But as regards this 50 ft. lowest andesite flow which has been the main factor in producing the Camp Bird oreshoots, the breccia above it is identical with that below; and it differs from these breccias only in being a solid flow and not a breccia.

Its influence upon the localization of the ore—upon

keeps its normal dip till it strikes the upper andesite flow, when it turns vertical and becomes much narrower, "petering out" into stringers; then, regaining its normal dip, keeps on, an insignificant vein, to the surface, where, like the other branch, it outcrops in the rhyolite. It will be noted that the main vein, where it crosses the upper andesite, is narrower than the underlying portion: it is also practically barren of gold here, although the quartz which carries the gold below goes on up—but without the gold. Where the vein enters the bottom of the rhyolite, it is still further constricted, and its outcrop is insignificant.

From this phenomenon of change of dip of the vein on penetrating the andesite flows, it is evident that these offered a slightly greater resistance to the breaking force than did the breccia. The change of dip indicates that. The temporary vertical direction is that assumed because following the direction of least strength of the flows—at right angles to their horizontal extent. Nevertheless, that does not offer any explanation as to why the quartz ascended through the fissures in the andesite, but the gold refused to follow. A vertical vein would invite the upward passage of ore solutions as urgently, surely, as a 65 deg. dipping vein. We must fall back again on the only remaining possible factor of relative porosity. Indeed, this occurrence seems to form a splendid and conclusive example of a principle which I have deduced for Porcupine<sup>8</sup> and again for Cobalt,<sup>9</sup> both in Canada. I quote from my Porcupine paper:

"Another thing which deserves to be carefully considered is the effect of wall rocks at Porcupine on ore deposition. The vein fissures and the veins are subsequent to the porphyry intrusion, into which they pass; but good ore rarely occurs in the porphyry, except near the contact with some other rock. Yet good ore in quantity may in places occur just under the porphyry, where an ore-bearing fissure intersects the contact, as in the Dome, whence Mr. Wright infers there a previous decomposition and softening of the porphyry, so that it obstructed and dammed the ore magma solutions. And indeed much the same relations may be observed elsewhere. But where a strong quartz vein does lie in the porphyry, as I observed it on the surface at the McIntyre, why is it low grade or nearly barren? Here I observed little or no replacement of the porphyry walls to ore. Yet the intruding ore magma was of the same age and stage, and therefore was of the same composition, as that which formed rich ores in the near-by Keewatin greenstone schists—ores carrying good gold values both in the quartz and in the dark replaced walls.

"The inference I draw is that the magmatic gaseous-tension pressure of these metalliferous sub-magmas was sufficient to allow it to penetrate and replace the Keewatin wall rock, and insufficient to allow it to penetrate the porphyry wall rocks, which in turn argues a relative imperviousness of the porphyry, and therefore, probably, as Mr. Wright inferred, a previous greater softening by decomposition. And this consideration, if it be true, as it appears to be, shows that relative pressures play a great part in the locus of actual deposition of ores (for apparently the temperatures were the same, whatever the wall rock). Considering this further, we note that in the Hollinger and McIntyre, where the ore had as its choice of wall rock only the Keewatin greenstones and the porphyry, (both schistose), it formed in the greenstones ores perhaps more important quantitatively and qualitatively than were formed elsewhere in the region; but in the Dome, where the choice lay not only between the Keewatin and the porphyry, but included the sedimentary rocks—especially conglomerates—of the Temiskaming as well, the selection fell overwhelmingly on the Temiskaming, out of which 80 or 90 per cent of the ore has been taken, with the remainder from the

Keewatin. We must infer, looking back to the Hollinger-McIntyre, that had there been no Temiskaming sedimentary rocks at the Dome, there would have been far more ores deposited there in the Keewatin than has actually been the case. The conglomerate is evidently a pervious rock—probably more pervious than the Keewatin, just as the Keewatin is probably more pervious, as above stated, than the porphyry, so that the critical conditions of wall-rock replacement in the district, and therefore of the formation of the wall-rock ore which forms the bulk of all the ore, was relative penetrability—the relative resistance offered to the gaseous-tension pressure of the residual ore magma. But, furthermore, as we have seen in the case of the barren quartz veindikes found in the porphyry, the lack of the deposition of ore by replacement of the wall rocks (where a relatively resistant or impervious rock has been penetrated by the ore-magma veindike) seems to be accompanied by a comparative lack of gold and pyrite deposition with the quartz itself, whether contemporaneously or in characteristic slightly later cracks and fissures. A connection between the two (white and black) classes of ore is thereby established, as if the relief of pressure in the ore magma which was attained by expansion into the wall rock not only allowed the crystallization of the metallic minerals in the penetrated rock, but, extending back into the uncrystallized ore magma between the walls of the veindikes, procured a similar deposition there also. Certainly, at any rate, the ore magma which formed these barren quartz veindikes in porphyry originally contained all of the ingredients of the productive quartz veindikes in other rocks, into which productive veindikes the barren veindikes pass; and the nature of the wall rock has determined the relative local concentration of metallic minerals."

And I quote from my Cobalt paper:

"The great influence of wall rocks in determining the locus of precipitation of the net final fraction of the ore magma is as striking at Cobalt as at Porcupine, or even more so. At Porcupine, it will be recalled, a gold-quartz veindike (for example, in the McIntyre mine) which runs from the (basic) Keewatin schists into the (siliceous) porphyry, is apt to lose most of its gold values, though the veindike itself may proceed bravely on. And at Cobalt 80 per cent of the ore has come from the conglomerates and other sediments of the Cobalt series, into which series the diabase has intruded. Most of these exposed sediments, at Cobalt, underlie the diabase sill, which has been partly stripped off by erosion; and veins pass down from the conglomerates into underlying Keewatin (basic) schists, representing ancient lava flows essentially like those of corresponding age of Porcupine. Many of the veins lose much or practically all of their silver values when traced (downward) from the conglomerates into the Keewatin, while the vein itself (of smaltite, nicollite, calcite, etc.) sometimes proceeds on in full width. The controlling influence of the wall rock on the precipitation of the final (silver) fraction of the ore magma is clear; and the explanation of this striking phenomenon is as nice a problem as in Porcupine—or still more exacting.

"Considering first, the chemical influence of wall rocks on silver deposition, I have pointed out<sup>10</sup> that the basic-derived ore magmas, being calcic, would be most influenced to precipitation by siliceous wall rocks, just as the siliceous-magma-derived ore magmas, being themselves siliceous, are best influenced to precipitation by basic wall rocks. This would appear to be upheld at Cobalt, where the conglomerate and other sediment of the Cobalt series, containing a large amount of granite material,<sup>11</sup> should precipitate from calcic solutions more readily than should either the Keewatin schists or the Keweenaw diabase, both basic rocks. Dr. Miller says:<sup>12</sup>

"Judging from the way in which silver is found in the minutest cracks in granite boulders of some of the conglomerate near the veins, this ore, at least, was precipitated no less readily in acidic rocks than in basic ones. With the exception of these boulders, there are few opportunities afforded of observing the relations of the ore to granite. But in the Temiskaming mine, a few hundred feet below the surface, narrow dikes of Lorraine granite intrude the Keewatin and are cut across by a vein. The surface of the granite is plated with native silver.'

<sup>8</sup>Engineering and Mining Journal-Press, Vol. 116, No. 15, p. 637, Oct. 13, 1923.

<sup>9</sup>Engineering and Mining Journal-Press, Vol. 116, No. 17, Oct. 27, 1923, p. 712.

<sup>10</sup>"The Ore Magmas," Vol. II., p. 654.

<sup>11</sup>W. G. Miller, "Guide Book," Ont. Dept. Mines, 1923, p. 69.

<sup>12</sup>Op. cit., p. 96.

"While this theory, as I have set it forth above, seems adequate to explain the influence of wall rocks on silver deposition at Cobalt, even more fully than the same theory does at Porcupine," I am still inclined to suspect, as at Porcupine, a physical reason also. At Porcupine I have found reason to suspect that relatively penetrable wall rocks induced not only replacement of walls by gold magma-solution, but a corresponding precipitation in the veindike itself, by relief of gaseous-tension pressure due to expansion into the wall rock; and that for this physical reason relatively impenetrable wall rocks were unfavorable, not only for replacement ore, but for the best values in the intrusive veindike also. And at the Dome mine I mentioned how where the choice lay between Keewatin and Temiskaming sediments (conglomerate), 80 to 90 per cent of the ore was deposited in the sedimentary rocks. Now, here at Cobalt, where the choice is between Keewatin (and diabase) and the Cobalt series of sediments (resembling in a general way the Temiskaming), 80 per cent of the ore, or more, again chooses the sediments. Since the two types of ore magmas, in my opinion, differed greatly chemically, one being siliceous and one calcic, the choice of the conglomerates over the Keewatin schists seems to me to indicate a physical reason, probably collaborating with the chemical reason which I have submitted above; and that physical property I should call penetrability. Accordingly, where the ore magma (at Cobalt) penetrated (upward) along fissures in the Keewatin, and entered the Cobalt conglomerates, the gaseous tension of the magma was able to overcome the resistance of the conglomerate wall rocks, and to penetrate them; and, by the consequent relief of pressure, silver was at once deposited not only in the wall rocks but to a greater extent in the veindike as well; and this process was doubtless accelerated by the favorable chemical composition of the wall rocks, as I have pointed out above, producing the unusually sharp governing influence of these wall rocks shown in Cobalt. The suggested pressure factor probably operated at a constant temperature, for the different formations, as it did at Porcupine; for while some of the veins (in both districts) are impoverished on passing *downward* into an unfavorable formation, others are correspondingly impoverished on passing *upward* into an unfavorable formation—such as those veins at Cobalt which lie in the Keewatin below the diabase but do not extend upward into the diabase."

The deduction of this principle, which I was thus enabled to make more definite from the Cobalt phenomena than for the Porcupine case, is finally pinned down to its ultimate limits by this Camp Bird occurrence; for while the walls at Porcupine and Cobalt differ chemically as well as physically, those at Camp Bird differ only physically. And the application of the principle is more astonishingly shown at Camp Bird than in these instances, for at Camp Bird the amount of ore in the wall rock—if, indeed, there is any—is not noteworthy. In Porcupine as much or more gold has penetrated the wall rock from the quartz veindikes which occupy the fissures, than was deposited in the veindikes themselves; in the Cobalt region most of the silver was precipitated in the calcite veindikes, but a large amount was also expelled into the wall rock and made the low-grade "milling" ores of the district. The hypothesis may therefore be tentatively stated:

In ore-magma veindikes, metals (especially gold and silver) are in a more volatile condition than the quartz or calcite; they are therefore highly migrative, and tend to concentrate, after veindike intrusion but before freezing, into certain portions of the ore magmas. Given about the critical temperature necessary for their deposition from solution, their solidification, and that of the rest of the ore magma, depends on the abstraction from the magma of the gaseous constituents which constitute an essential ingredient of the ore magma. These ingredients are abstracted by escaping from the ore magma, whether upward along

the fissure, or laterally into the wall rocks; and therefore the more penetrable wall rock is the most favorable for the precipitation of gold and silver *within the veindike*. Part of the gold and silver, being, as above stated, more volatile and penetrant than the gangue, may also penetrate the wall rock; or it may be only the non-metallic gaseous constituents (including aqueous vapor) that thus escape, and so accomplish precipitation of these metals within the veindike.

Where a veindike passes upward from a more penetrable to a less penetrable wall rock, the gases of the magma are suddenly confined by the less penetrable rock, which produces an excess of gaseous pressure in the ore magma, which excess pressure is transmitted to (backs up to) the ore magma standing immediately below the less penetrable rock; and the nearest relief of that pressure is by the escape of gases into the more penetrable rock immediately below the less penetrable rock. This is the case at the Camp Bird. Where the veindike passes upward again from a relatively impenetrable rock to a more penetrable rock, evidently ore deposition will take place again if there is any gold or silver left in the ore magma; and this occurs both at Cobalt, as stated in the above quotations, and (to a minor degree only) in the Camp Bird vein.

Another observation made for the Cobalt problem would seem also to have an important application to the Camp Bird vein:

"The explanation for the high migrativeness and concentration of native silver above given, involves, or course, an upward as well as outward pressure in the veindikes: and, accordingly, the tops of veindikes (for some of the veindikes have been found to terminate upward in the mines, constituting so-called 'blind' veins) are said to be ordinarily relatively high in silver."

The Camp Bird occurrence shows that in the standing fluid veindike, which had a vertical extent of several thousand feet, the gold tended to migrate upward to an unusual extent, and to travel thus thousands of feet; for below the horizon of oreshoots there are only low gold contents. Comparing this high degree of vertical concentration of gold in the Camp Bird gold-quartz vein with the less potent concentration in the deep-seated gold-quartz veins, such as the Mother Lode region in California and the Porcupine district in Canada, one is led to consider the possible reason. In the deep-seated veindikes the gravity pressure is more uniform; in the superficial veindikes the proximity of the surface to the top of the vein offers a great gravity pressure differential between the portion near the surface and that some thousands of feet down. The more volatile ore-magma constituents—among which are the metals gold and silver—therefore press upward actively as soon as the veindike is injected; and accomplish a far greater vertical differentiation between gangue and metal, in the interval between injection and freezing, than is possible for the deep-seated ores.<sup>14</sup> Thus, the

<sup>14</sup>On the other hand, the freezing process in the gold-quartz veins in depth is much slower than for the superficial gold-quartz veins, as is universally acknowledged to be the case for all plutonic magmas as compared with the volcanic ones. In the case of igneous rocks, this brings about a coarser and more complete crystallization in depth, and even a partial segregation of constituents, producing more or less advanced differentiation; while the volcanic magma freezes with dense texture and without differentiation. In the case of the deep gold-quartz vein, this slow cooling permits a fractional crystallization whereby the gold (and other sparse metals) is crystallized pretty distinctly later than the bulk of the quartz, producing the streaks of gold and sulphides which fill rifts and little fissures in the quartz and penetrate the wall rocks, and which are prone to be wrongly interpreted as indicating a distinctly later period of ore injection. In the superficial gold-quartz veins this phenomenon is much less common; though a transitional condition appears in some superficial veindikes, especially the thicker ones. An example of the last-named type is the Prospectus vein, Aurora, Nevada. See "The Ore Magmas," Vol. II., p. 692, Fig. 116.

<sup>13</sup>Engineering and Mining Journal-Press, Vol. 116, No. 15, pp. 637-638.

superficial bonanzas were formed, characteristic especially of Tertiary veins and veindikes; and they are correspondingly limited in vertical extent. If the \$30 Camp Bird ore had not been thus concentrated near the top of the vein, it would, as I observed above, have sufficed for a vertical extent of 3,500 to 4,000 ft. of \$5 ore like the ore of the deep-seated veins in the districts cited for comparison.

The ore in these superficial veins and veindikes never reaches the surface; therefore it cannot reach the surface, as I have argued:<sup>15</sup> Within 500 to 1,000 ft. of the surface, the relief of gravity pressure is so great that the ore magma disintegrates in any event, whatever the wall rocks; the gaseous ingredients escape upward as well as outward; and the metals (their carriers having thus deserted them) are precipitated in abundance. Now, in the case of the Camp Bird vein, the top of the ore was deposited some little distance below the surface. The rhyolite, into which the barren vein passes upward, is the uppermost formation, and underlies a gently eroded peneplain. This peneplain, since all volcanic activity (including the dike and ore injections) has been greatly uplifted (but without folding or faulting), so that erosion has been swift and the dissection stupendous. The maximum thickness of the Potosi rhyolite is given by the U. S. Geological Survey publications at 1,250 ft.; and the top of the principal ore horizon of the Camp Bird vein is 700 ft. or more beneath the bottom of the rhyolite, above which the little tongue of ore described above goes some 300 ft. It therefore appears that the top of the ore may have been 2,000 ft. or more below the surface; and that had there been no critical changes of formation, like those described as having pulled the tension trigger, the gold would have ascended further up—as the quartz did—before being precipitated.

I have discussed these principles before discussing the character of the gold veins, and have made the bald statement that they were veindikes.<sup>16</sup> The inclusion, in the veins, of numerous angular unsupported fragments of the wall rock, affords, as is so often the case, evidence that the quartz or magma was substantial enough to hold these fragments in suspension till it froze. An unusual and striking bit of evidence has been recorded by Purington:<sup>17</sup>

"A somewhat remarkable occurrence may be mentioned at this point which was brought to the writer's attention by Mr. Laurence Cronin, the mine superintendent. It was a jagged and angular inclusion in the vein (in the stope over No. 4 chute, in No. 3 level), about 12 in. long and 6 in. broad, and consisting of a mixture of very finely crystalline and amorphous silica, of laminated structure and slightly pinkish tinge. Closely examined, it was seen to contain very small druses lined with quartz crystals. Hydrochloric acid causes effervescence in all parts of the specimens taken. Two other similar but smaller inclusions were observed in the center of the vein (here 6 ft. wide), near the one described. In the largest mass, the laminations were nearly at right angles to the dip of the vein.

"These inclusions had, in fact, all the appearance of fragments of silicified sedimentary rock; and their position at this horizon seems almost inexplicable. An analogous occurrence was, however, found, several months ago, by Mr. Arthur Collins, manager of the Smuggler-Union property, in the upper workings of that mine, and consequently at a horizon fully as high as in this case. That was even more remarkable, since the inclusions, though smaller,

were, to all appearance, metamorphosed limestone, containing what appeared to be fossil crinoid stems. Mr. Collins kindly allowed me to examine the specimens shortly after their discovery.

"The writer is unwilling to adopt, without further evidence, the opinion that these fragments have been brought up from below. Yet from what nearer source they could have been derived it is impossible to see."

These inclusions were in the ore of the Camp Bird vein. The limestone fragments must have been brought up from the Paleozoic limestones, a vertical distance of 3,000 ft. or more! What was inexplicable on the theory of slow ore deposition from waters circulating along open fissures becomes easily understandable on the theory of the injection of relatively dense ore magmas.

#### OTHER FEATURES OF THE VEIN

It would be more satisfactory in some ways to the writer if he could end the analysis of the Camp Bird ore occurrence at this stage, and if there were no further confusing complications. Unfortunately, for this purpose, there is more to the history of the vein. The Porcupine veins and those of Cobalt are one-period veins. The slightly different stage of deposition of the constituent minerals, and especially the slight but all-important later (though overlapping) stage of crystallization of the metals as compared with that of the gangue, are to be referred to processes of differentiation within the body of veindikes injected at a single period, and these processes of differentiation have depended upon relative migrativeness of the different constituents, the metals as a whole being more migrative than the gangue fraction, on account of greater gaseous tension, and hence being concentrated by upward and outward flow. This is the same principle that I have appealed to in the above discussion of the Camp Bird vein, in which discussion I have treated the vein as a single gold-quartz vein. This is true for the Camp Bird gold ore—for the Camp Bird stopes, and in fact for the whole vital and significant history of the mine, as sketched above. But the morphology of the vein shows that the vein, seen as a physical entity in a close-up view, is not a single-period vein: it is, indeed, an excellent example of a compound vein (Fig. 6). The gold-quartz vein which I have discussed above was a definite injection, and an independent vein; but before this injection, and again after it, the same fissure was utilized for injections of vein material of distinctly different types.

*Galena-Blende-Pyrite Stage.*—I have noted above that most of the veins in the immediate vicinity of the Camp Bird have a N. 45 deg. W. trend, more or less, while the Camp Bird has a general trend, roughly speaking, of N. 70 deg. W., more or less (N. 77 deg. W. for 7,200 ft. measured on the second level). Practically all of the NW. (N. 45 deg. W.) veins (Fig. 3) near here are different from the Camp Bird; they are galena-blende-pyrite veins, carrying a little silver but practically no gold: the gold quartz of the Camp Bird vein is sparse or (usually) entirely lacking. Some of these galena-blende veins are strong, and have been prospected and mined in happier days, when silver commanded a higher price.

Study of the Camp Bird fissure shows that it existed before the galena-blende-pyrite vein period; and that it was first occupied by a vein of this type. Later the fissure was reopened, and the Camp Bird gold quartz was injected. There were later episodes also. A bar-

<sup>15</sup>"The Ore Magmas," Vol. II., pp. 549-557.

<sup>16</sup>Even though they occupied openings principally made for them by lateral differential movement along the fissure (p. 520).

<sup>17</sup>Trans., A. I. M. E., Vol. XXXIII., p. 514.

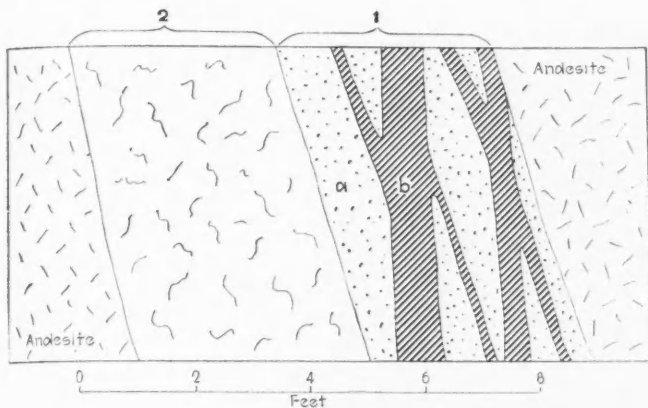


Fig. 7.—Sketch of Camp Bird compound vein, Chicago level, showing gold-quartz vein on footwall, and sulphide-rhodonite vein on hanging wall. 1, earlier sulphide rhodonite vein (a, rhodonite; b, sulphide). 2, gold-quartz vein.

ren often vuggy quartz partially occupied fissures in the vein caused by a reopening later than the arrival of the gold quartz. And a still later movement produced fissures which remained unoccupied, and are marked by gouge or breccia bands and open fissures (Figs. 7, 8, and 9).

In the horizontal direction, the earlier vein—the galena-blende-pyrite-rhodonite vein—was localized in a shoot by the same process of horizontal differential movement which has been described above for the Camp Bird gold-quartz vein. The Discovery shoot—the largest and westernmost—is the principal shoot of the galena-blende vein as well as one of the two principal shoots of the gold-quartz vein. But in the second of the two principal shoots of the gold-quartz—the Bluebird shoot—the galena-blende vein is insignificant and practically absent, and this is the case also in the two other principal lesser shoots further east—the Gertrude and the Hancock shoot (Fig. 4). But in the case of the Hancock shoot of gold-quartz ore on the Camp Bird vein, a crosscut into the footwall on a level near the top of the ore horizon has developed a vein—the Hancock vein—of the early galena-blende-rhodonite type above, with no gold quartz, and diverging only slightly to the northwest from the general strike of the Camp Bird vein at this point. It was of no economic value, like most of these galena veins. Nevertheless, the galena-blende ore extends thinly throughout the Camp Bird vein, showing that these ore solutions came up where feasible along the whole fissure. The Discovery shoot trends more to the north of west than any of the other shoots of the mine. Therefore a slight differential movement along the Camp Bird fissure, as above (p. 520) described, the south side moving relatively to the west, would open up the Discovery stretch of vein more than the other northwesterly stretches. Indeed, these other northwesterly stretches, including the Bluebird, were not opened up at all, at the galena-blende stage—the galena-blende vein as such does not exist in them, except in traces. I have estimated that a horizontal shifting of 5-10 ft. along the Camp Bird fissure took place to form the opening which concentrated the galena-blende vein in the Discovery shoot.

The details of the stages of the compound vein in the Discovery shoot are best shown in Figs. 7, 8, and 9.

**Barren Quartz Stage.**—The barren quartz, which suc-

ceeded, as a definitely later injection, the Camp Bird gold quartz, filled fissures apparently created by a slight renewal of the horizontal differential movement. The last movement, later than all vein material, also was due to a horizontal differential movement along the vein fissure.

**Horizontal Movements.**—Thus there were three distinct renewals of the horizontal differential movement, subsequent to the original formation of the fissure, and each stage of movement, except the last, was followed by penetration of vein material into the fissure. It is evident that each movement operated to pull out along the line of strike, the vein material already deposited: the result is that the vein broke and was separated along the strike: and the subsequent vein filling reigned nearly supreme in these intervals between the disjointed earlier vein stretches. And the final movement resulted, similarly, in the stretches of barren gouge or breccia along the vein, separating the stretches of the compound vein formed by the compounded injections of the three vein periods—galena, gold quartz, and barren quartz. The pulling apart of the shredded fragments of the vein amounts locally to as much as 60 ft. The last horizontal movement was apparently, as judged from the detailed mapping of the levels, to the west on the north side, a reversal of the previous movements. In the case of the last movement, abundant horizontal striæ show that the direction of movement was indeed horizontal. I have estimated from a study of the detailed mine maps that the sum of the two movements which opened the fissures for the sulphide vein and the later gold-quartz vein was not over 15-20 ft., as shown by the size of the openings in the Discovery shoot.

I have found no more definite measure of motion. Surface mapping did not show offsetting of the north-west veins where they cut the Camp Bird fissure, as they often do. The best conclusion we can come to is that the rocks on the two sides of the fissure, after having been separated slightly horizontally by a repeated differential strain, largely slipped back into

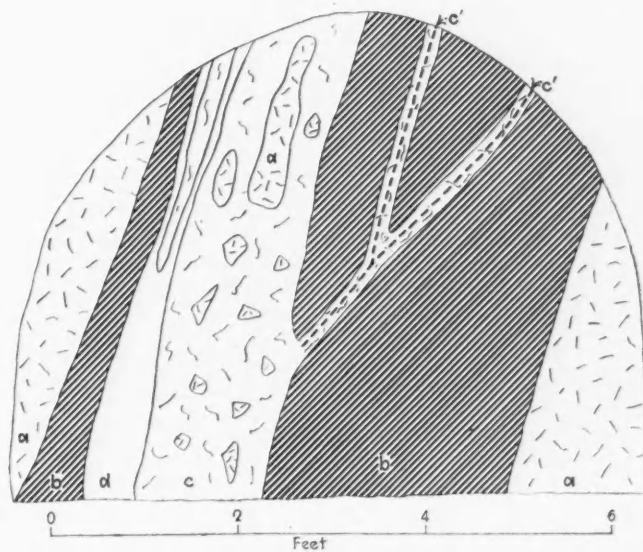


Fig. 8.—Cross-section of Camp Bird compound vein, at a point on the third level; a, andesite; b, sulphide (blende-galena) vein; c, gold-quartz vein; c', median band of contemporary sulphides in center of small c veins; d, barren quartz vein.

approximately their original relative position, by the reversed direction of the last movement.

At each of the stages of vein opening there is evidence that the openness of the fissure at different places varied greatly. In the more open parts fissures doubtless originated; while the closed parts were relatively tight, and allowed very little circulation.

The gold-quartz vein is characteristically very full of angular intrusions of the country rock. Certain vein exposures show how an ore magma, which in a region of relative openness or comparatively slight pressure injects itself in enough body to be called a veindike, gradually loses its penetrant power where the wall pressure is greater, the breccia-vein changing into a series of veinlets crisscrossing the rock of the vein

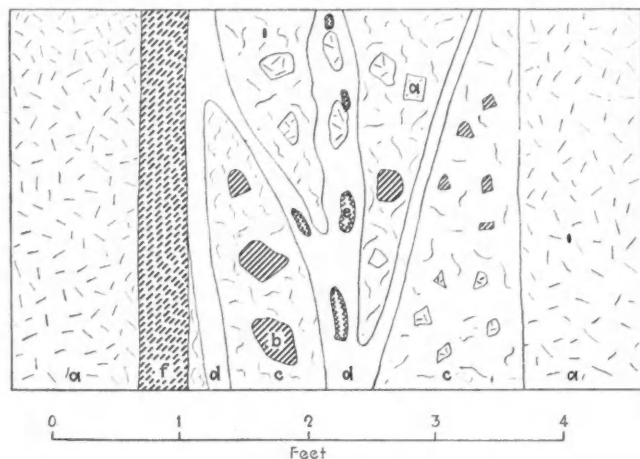


Fig. 9—Sketch of Camp Bird compound vein, Chicago level. Roof of drift (horizontal plan). Shows gold-quartz vein with included fragments of sulphide vein and of andesite. Later than the gold-quartz vein is barren quartz with central vugs, and still later a barren gouge band. a, andesite; b, sulphide vein fragments, inclosed in: c, gold-quartz vein, which is cut by: d, barren quartz, containing: e, central vugs. Last is: f, gouge band.

zone, till they gradually give way to the sheeted but impenetrable rock of the fissure zone.

The common, perhaps predominant, horizontal movement along vein fissures in many mineral districts (as shown by striæ) has yet to be clearly explained; as has, indeed, the tendency of veins to an east-west strike. As I have stressed repeatedly, igneous intrusion, deformation (folding and faulting), and ore deposition are closely allied phenomena, which generally go hand in hand. In the Camp Bird case there has been practically no folding and faulting; the beds and flows remain horizontal. Deformation in the marked sense therefore is wanting, the case in this respect remaining one of the lead-zinc deposits of the Upper Mississippi region.<sup>18</sup> Igneous activity of course is conspicuously present, the basic andesite dikes being very close to the veins in point of age, and barely preceding them. The observed repeated slipping along the Camp Bird vein fissure was contemporaneous with the broad domical uplift which elevated the whole region without much disturbing it, and which brought the rapid erosion which produced the wild San Juan scenery. Such an

uplift would of course involve a stretching tension in a horizontal direction, tending to stretch the horizontal strata and the horizontal volcanic layers. Under such a horizontal stress, what other slight differential movement took place along fissures would tend to be horizontal—provided the uplift is uniform and not differential. The same explanation may be applied to the vein fissures of the Upper Mississippi lead and zinc region. It remains to be seen how widely it can be applied. In this general San Juan region laccoliths of diorite porphyry and granite porphyry were intruded after the outpouring of the Potosi rhyolite, but before the injection of the basic dikes and the mineral veindikes;<sup>19</sup> and such intrusion may well have gone on in depth under the Camp Bird area also.

*Distribution of Galena-Blende Ore and Barren Quartz.*—The galena-blende-rhodonite ore deposition, in the Discovery shoot and elsewhere, had a greater vertical extent than did the gold-quartz vein which followed it, although the former has never been of any important economic value. The total Camp Bird ore, as broken down, had the following percentage of values: Au, 96 per cent; Ag, 3 per cent; Pb, 1 per cent; Cu, .02 per cent. The gold quartz, of course, was preferentially mined, although with some admixture of the galena vein, which is reflected in the above analysis.

In the galena-blende vein the galena is coarse, and the blende of the light "rosin" variety. Much of the ore ran only 8 to 10 oz. of silver, with as much as 20 per cent of lead—so that it was a low-grade argentiferous galena, with sometimes a sparse gangue, principally quartz. In many of the sections sketched these sulphides cut the rhodonite (which is dense and barren of values), showing the earlier formation of the rhodonite. In other localities, however, some rhodonite occurs intercrystallized with the sulphides. Even where the rhodonite is earlier than the sulphides, it accompanies them, not being present unless they are there; and the amount of earlier rhodonite is proportionate to that of the later sulphides. Rhodonite does not occur to any extent in the Bluebird and other shoots where the sulphides are not notably present. Much of the rhodonite appears to be probably an alteration of the andesite breccia wall rock<sup>20</sup> of the sulphide vein, which itself appears to be mainly a fissure filling or veindike of injection and not to have formed by replacement (Fig. 7). Some of the rhodonite, however, appears to have been a fissure filling. However, the crystallization of most of the sulphides was at least a slightly later stage than that of most of the rhodonite. Fig. 7 shows clearly these relations.

In the Discovery shoot, the sulphide-rhodonite vein is most developed at the top of the main stope, as compared with those portions of the stope lower down. As depth is gained in the mine, the galena-blende-rhodonite ore is found to be more persistent than the distinctively gold-bearing portion of the gold-quartz vein. Indeed, within the downward extension of the Discovery shoot, the older (sulphide) vein was present in good width to the lowest level (fifth) open at the time of my examination; but the length of the shoot diminishes rapidly—so that a projection of it shows

<sup>19</sup>J. S. Geol. Surv., Telluride Folio, No. 57, pp. 6-7.

<sup>20</sup>This coincides with Ransome's suggestion, for the possible origin of rhodonite in the Sunnyside mine; and his explanation for the rhodonite of the Saratoga mine, both in the general region. At the Saratoga the rhodonite has replaced limestone (Bull. 182, U. S. Geol. Surv., p. 132).

<sup>18</sup>J. E. Spurr, *Engineering and Mining Journal-Press*, Vol. 117, No. 6, Feb. 9, 1924, p. 246.



the same tailing off below as in the case of the gold-quartz shoot. With depth, however, the character of the sulphides was observed to change. While galena predominated at the top of the oreshoot, the proportion of blende and pyrite increased with depth, till on the fourth and fifth levels the vein is frequently blende and pyrite. Rhodonite also decreases with depth and is scant on the lower levels. This indicates that most of the rhodonite was formed by penetration of the wall rock by manganese emanating from the sulphide solutions which filled the fissures at the earliest stages of vein filling, although little manganese crystallized with the sulphides.

While the maximum deposition of gold in the gold-quartz magma was immediately under the lower andesite sheet, the maximum deposition of sulphide and rhodonite from the sulphide magma was immediately below the upper andesite sheet. The thin lower flow, which stopped off most of the gold from the quartz magma, appears to have acted less efficiently in impeding the upward course of the sulphide magma. On entering the upper flow, however, the size of the sulphide vein was at once greatly diminished.

The change from predominant galena in the upper levels to predominant blende in the lower levels is a primary condition, and evidently conforms to the Zonal Theory,<sup>21</sup> the blende being deposited at a higher horizon than the galena. The change is very marked in this vertical space of 1,000 to 1,500 ft., which is unusually short; and indicates an unusual degree of cooling toward the surface at the time of ore deposition, a close spacing of the isotherms, probably due to the relatively shallow depth at which the sulphide magma was injected—a depth apparently not greatly different from that which existed at the time of the gold-quartz injection.

The gold-quartz vein, where it cuts and lies alongside of the galena-blende-rhodonite vein, in the Discovery shoot, carries some sparse contemporaneous streaks of sulphides, mainly galena.<sup>22</sup> As this phenomenon is practically absent in the gold-quartz vein in the Bluebird and other shoots where the galena-blende-rhodonite vein is also practically absent, it is highly probable that the gold-quartz magma dissolved after injection a certain proportion of the constituents of the earlier vein. The earlier vein also appears to have acted as a precipitant for the gold and sparse native sulphides of the gold quartz vein, for where the gold-quartz vein includes fragments of the sulphide vein, a rich dark ring of sulphides in many cases appears as the first deposition on the fragment, followed by lower-grade quartz. The average grade of the gold quartz in the Discovery shoot was somewhat better than that in the other shoots, where these precipitants were lacking; in the east end of the Discovery shoot was the richest ore in the mine, some blocks averaging nearly \$100 per ton.

The gold quartz is of dense to medium texture, rather milky in appearance. The gold-quartz vein has produced a certain silicification of the wall rocks over

a narrow margin. The physical distinction between the gold quartz and the later barren quartz is clear. The earlier quartz is denser, and characteristically contains fragments of the wall rock, and also fragments of the earlier (sulphide) vein, angular but corroded or silicified by the quartz.<sup>23</sup> The later quartz is white and semi-transparent, is plainly a fissure filling, crystallizing from the walls inward, and where it adjoins the wall rock this wall rock is not much corroded or silicified. Angular fragments of the sulphide vein, the earlier gold quartz, and of the wall rock occur, but are uncommon; and in these cases the wall-rock fragments are little altered. The later quartz is *per se* typically barren of all values.

The movement which reopened the fissure for the gold-quartz magma to fill followed the entire course of the sulphide vein, but, in addition, sent out, both laterally and vertically, certain branches not before opened up. The most important of these is the split above the first level, parallel to the strike of the earlier vein, but diverging from it in dip and representing the upward continuation of the general dip below the first level (Fig. 6). But in addition to this divergence upward (which results in a one-period vein between the two andesite flows, consisting entirely of the gold-quartz period) the gold-quartz injection also followed the earlier sulphide vein, which after passing through the lower andesite flow had, above, a slightly reversed dip; and filled this fissure also, in equal or greater quantity than that in the one-period branch. These two veins outcrop on the surface (Fig. 3) where the gold-quartz one-period branch forms a loop, uniting, on the strike, with the main vein at both ends.

The barren (later) quartz vein which cuts the two earlier veins very frequently has central vugs lined with large crystals; and the vugs are often wide and continuous. The coarse crystals lining the vugs are generally quartz, sometimes fluorite, sometimes fluorite covered by later dense banded quartz, sometimes calcite. The vug linings reach 3 or 4 in. in thickness. They also carry in rare cases crystals of sulphides—galena, blende, and pyrite.

The barren quartz, which is older than these vug linings, often shows rough banding, with sparse metallic sulphides, and spotted free gold. In the lower levels, where the barren quartz lies alongside the earlier sulphide vein and contains fragments of it, it appears probable that the solutions which deposited the quartz of the later barren period have dissolved a little of the contents of the metalliferous veins, just as in the stopes above it is evident that the gold-quartz magma also dissolved something from the earlier sulphide-rhodonite vein. The later barren quartz veins, unlike the ore-bearing veins which preceded them along the same fissure, are stronger in the lower workings of the mine than in the upper ones. The barren quartz was relatively small in amount above the third level; and widest, so far as visible, on the fourth and fifth, where gaping fissures 3 to 5 ft. wide were formed, not only along part of the stretches occupied by the ore above, but also over the intervening stretches, which contain no vein material of any kind above.

It is evident that this barren quartz was formed from

<sup>21</sup>"The Ore Magmas," Vol. 1, p. 283.

<sup>22</sup>Ransome, F. L., (Bull. 132, U. S. Geol. Surv., pp. 89-90) has examined microscopically and described specimens of such gold ore, from the upper stopes of the Camp Bird mine. He describes it as fine-banded quartz, containing also fluorite, calcite, sericite, and chlorite, with small quantities of galena, blende, pyrite, chalcocopyrite, and much free gold, with a trace of tellurium. He concludes (p. 93) that the ore was partly crystallized in open spaces, partly due to replacement of the andesite-breccia country rock. He finds a certain association between the free gold and the sulphide bands in the ore.

<sup>23</sup>Purington, C. W., (Trans. A. I. M. E., Vol. XXXIII, 1903, p. 512) observes: "Countless examples may be seen, in the mine workings, of perfectly angular fragments included in the vein matter."

a quite different type of solution from those solutions out of which consolidated the sulphide vein and the gold-quartz vein. These metalliferous veins are characteristically solid and dense; where they show a banded arrangement, it is a local detail and not typical; they never show vugs. In most places the evidence is that the vein filling froze at one time. Moreover, each of these represents typical ore magmas—the gold-quartz magma and the galena-blende-pyrite magma. The gold quartz contains many angular supported fragments of the wall rocks. The surprising occurrence in the vein of fragments of the sedimentary rocks which belong thousands of feet below (p. 524) can be explained only by the assumption that the ore magmas were dense and semi-viscous, and that they were injected each at a single gush—that they were veindikes of a consistency comparable to certain pegmatite magmas. Along these same lines is evidence of the kind shown in Figs. 8 and 9, which are true sketches of local conditions and are not diagrams. In Fig. 8 the inclusions in the gold-quartz vein are of the andesite wall rock, although the immediate walls were formed by the sulphide vein, showing that the included fragments were brought in from outside the field of the section. The same thing is shown in Fig. 9, where the gold-quartz vein carries included fragments of the earlier sulphide vein and also of the andesite; but there is no sulphide vein in place in this section. In this case, also, the fragments of the sulphide vein must have been brought in from outside the plane of the section. Moreover, in Fig. 8 note the phenomena of the small branch vein, which carries a central streak of sulphides where it cuts the older sulphide vein. These sulphides in the quartz vein, as I have noted above, are characteristic only in the vicinity of the sulphide veins. In this case (Fig. 8) the explanation of the sketch seems to be that the fluid quartz magma which filled the branch vein dissolved some of the sulphides, which were crystallized, as the quartz magma froze from the walls outward, thus forming a central streak. The dense to moderate grain indicates a relatively rapid freezing. True banding is inconspicuous and local, the structure being typically massive. This is a condition true of mineral veins in general, and one that has been recognized and discussed with extraordinary perspicacity by F. L. Ransome<sup>24</sup> in 1901:

"In most of the important lodes of the Silverton quadrangle, no crustification can be detected. The fissures are filled by coarsely crystalline allotriomorphic aggregates of ore and gangue (massive structure), and there is no evidence to show that such a structure could result from successive deposition upon the walls of the fissure until the whole was finally filled. On the contrary, crystallization has proceeded simultaneously from many points within the solution. Quartz, galena, pyrite, sphalerite, chalcopryrite, and other minerals have formed practically contemporaneously about local centers of crystallization scattered irregularly throughout the solidifying mass. It is difficult to conceive all the details of a process which results in the formation from aqueous solutions of an irregular allotriomorphic aggregate of minerals differing so widely in specific gravity. But reasoning from analogy with similar structures met with in petrology and in the arts, it is fair to assume that this structure in veins is the result of the undisturbed crystallization of a nearly motionless saturated solution. In other words, it was the crystallization of a reservoir so large, in comparison with the current or currents which circulated through it, as to have been itself free from megascopic motion. The conditions which induced crystallization were present throughout the mass of ma-

terial which filled the fissure, and solidification, instead of proceeding gradually from the walls inward, took place almost simultaneously, although not necessarily with rapidity, throughout the mass. Obviously this massive structure and crustification may be present in the same vein. In such cases deposition appears to have begun by crustification next the walls, passing at a later stage into the more general mode of crystallization indicated by what has been described as massive structure."

The conclusion arrived at, of "crystallization from a nearly motionless saturated solution," is precisely the hypothesis I am putting forward for the Camp Bird vein. The process, so accurately reasoned out, was, as Dr. Ransome observed, "difficult to conceive" as the work of "aqueous solutions" which elsewhere (p 134) he assumes to have been modified "meteoric waters."

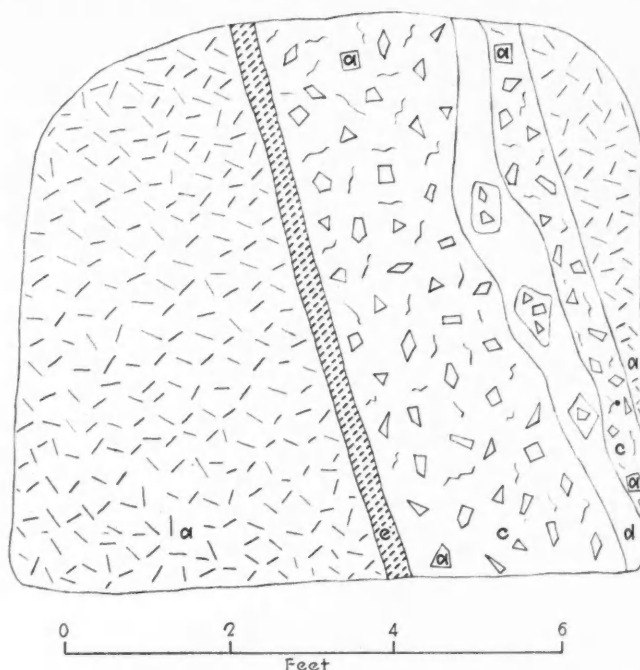


Fig. 10—Camp Bird vein. Third level. Showing barren quartz vein cutting and inclosing fragments of the gold-quartz vein. a, andesite wall rock; c, gold quartz with many angular fragments of a; d, barren quartz, with included fragments of c; e, gouge.

But this phenomenon of uniform and contemporaneous consolidation of the whole fissure filling, like the flotation of sedimentary rock fragments described by Purington, is readily understood under my hypothesis that the solutions were not "meteoric waters," nor even hot spring waters, but dense ore magmas, containing probably a subordinate quantity of water and other volatile constituents, and constituting a highly differentiated phase of the igneous magmas.

The later barren quartz must have formed from more dilute solutions than the gold quartz of the gold-quartz vein, and also from more dilute solutions than the blende-galena vein, and must have been deposited with greater comparative slowness. The ample fissures which these solutions occupy were characteristically only partially filled by the quartz crystals growing out from the walls. The vugs and empty fissures which remain offered shelter for the slow growth of quartz, calcite, and fluorite crystals from the walls, and the process was never completed.

I have been tempted to consider the possibility of

<sup>24</sup>Ransome, Bull. 182, U. S. Geol. Surv., p. 136.

the deposition of this barren quartz vein, and the vug linings, from ground water, but since the latest fissuring (marked by gouge and horizontal displacement) there has been no deposition whatever of vein material along the fissures: therefore the ground water is probably impotent. Indeed, it is quite unlikely that the ground water would deposit a quartz vein, even if this water were active in forming veins—the materials it takes into solution are chiefly lime, iron, and manganese, of which the last two are lacking, and the first is scant, in the barren quartz veins. Moreover, the strength of the barren quartz vein increases with depth. We must, therefore, I think, ascribe the formation as due to ascending solutions, probably hot, certainly siliceous, and as belonging to the close of the magmatic phenomena. The solutions may have been hot siliceous magmatic waters with no connection with ore magmas; or they may have been a highly aqueous and weak residual closing phase of the quartz magma which in its earliest injection carried gold and was not highly aqueous. I am inclined to the latter belief.

**BARREN QUARTZ VEINS ARE FISSURES  
FILLED AT A SINGLE GUSH**

Certain phenomena, indeed, suggest that the barren quartz veins were not formed from continuously circulating solutions or waters, but represent fissure filling at a single gush. The circumstance that this quartz carries sparse sulphides and even low gold values where it lies adjacent to the earlier metalliferous veins which it cuts, and from which it has evidently dissolved these metals, indicates a standing rather than a circulating solution. The habit shown in Fig. 9 suggests the same conclusion. The restriction of the vugs, as sketched, to the central widest barren quartz fissure, suggests that the interconnecting fissures at this stage were filled with a single standing solution, the solid precipitates



*In the hills near the Camp Bird*

from which completely filled the narrower fissures and the bulk of the main fissure; the volatile or permanently fluid constituents (including water), being residual and being driven to the middle of the central fissure, formed the solutions which filled the vugs, from which residual solutions, by slow crystallization, the vug-lining crystals were formed. From this conception, the fluid which filled these fissures may be compared as to consistency with those especially fluid pegmatites which have characteristic residual vugs in the center, which

vugs are lined with crystals of unusual perfection and variety; while the fluids from which the earlier sulphide and the gold-quartz vein crystallized must have been denser, and have contained a less proportion of volatile constituents: they must have had the consistency of the more ordinary pegmatites, which do not contain vugs, and have a medium texture. Judging from occurrences like that shown in Fig. 10, moreover, some of the barren quartz, at least in the stage immediately



*The Camp Bird mill; looking down the canyon toward Ouray, Colorado*

preceding consolidation, was dense enough to support isolated and suspended blocks of the earlier quartz long enough for freezing to lock them in this suspended position.

**Dutch Indies Reports on Banka  
Tin Production**

The report of the Netherlands Indies Government for the period 1923-24 ended March 1, 1924, states that the production of Banka tin for the period was fixed at 275,000 piculs (the Dutch Indies picul equals 136 lb.) in order to profit to a greater extent by the rising prices in the tin market at the time and help to contribute toward the financial stability of the government, according to the Minerals Division of the Bureau of Foreign and Domestic Commerce. More intensive production methods and a large earthwork per labor unit resulted in a total production of 284,700 piculs. The cost price again showed a considerable decrease, from 63.60 florins to 55.87 florins per picul. The average selling price for the period was 38 florins higher than that during the previous period. The quantity sold was 322,370 piculs; during 1922-23 it was 328,307 piculs.

The number of large mines worked was sixty-seven, of which thirty-six were experimental mines worked on contract at a fixed price for the product. The number of these test mines decreased by six from the number worked during the previous year. The number of small mines working was 209.

To maintain the reputation of Banka tin in the world market, the admissible percentage of impurities was reduced from 0.25 per cent to 0.10 per cent. This renders it impossible for any considerable percentage of iron to be present in the blocks.

## Experimenting with Detachable Bits at Anyox, B. C.

*Encouraging Results Obtained from the Use of a Socket-type Bit  
in Copper Mining*

By William J. Coulter

Assistant Mine Superintendent, Granby Consolidated Mining,  
Smelting & Power Co., Ltd., Anyox, B. C.

**T**HE FIELD OF OPPORTUNITY opened by the development of a detachable bit of genuine merit has drawn so much interest from the mining profession in recent years that it is anticipated that

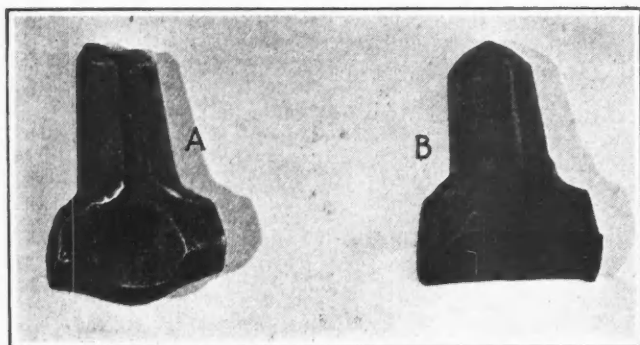


Fig. 1—(a) Detachable bit as first developed. (b) As modified by company experimentations

an accepted standard will soon make its appearance. Such a bit will play an important part in the further lowering of production costs, by reducing both the expense and inconvenience now incurred in the sharpening and distributing of mine steel.

Although much has already been done in an experimental way with detachable bits of various kinds, none, so far, have passed the acid test demanded of them for general adoption. For the last year the Granby Consolidated Mining, Smelting & Power Co. has contributed to this experimental work, with the Numa detachable bit, and the results of this work should be of interest.

A sample bit was brought to Anyox, B. C., by J. B.

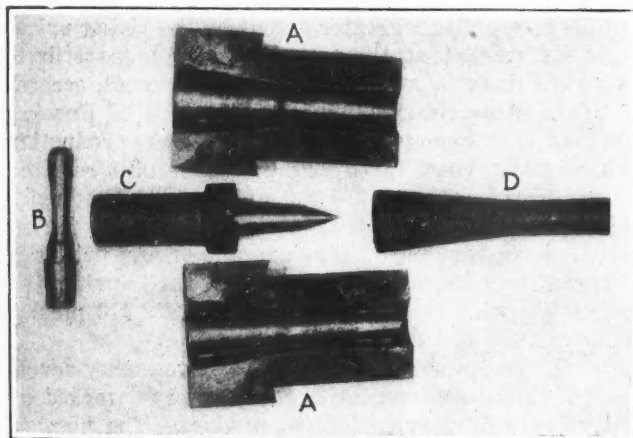


Fig. 2—Socket of detachable bit with dollies and punch to make it

Haffner in the fall of 1923, and he in turn obtained it from J. J. Brossoit, of Salt Lake City, who is the inventor of the bit and the president of the Numa Detachable Bit Co. The simplicity of the idea was appeal-

ing, and the performance of the trial lot created such a favorable impression that more were ordered, with the result that after a year's work they have been adopted in sections of the mine where the ground is of medium hardness, and further experimental work is being continued with them in hard rock.

The original is a single bit with a high center and a cutting angle of 110 deg. (Fig. 1—a). They come in seven different gages, ranging between 2½ in. for starters to 1½ in. for finishers, and weigh from 1½ to 1 lb. each. The shank of the bit is ½ in. long; it tapers down from a diameter of 1 in. on a 4½ deg. taper, and has two small waterways, embedded on opposite sides. This bit fits into a socket (Fig. 2—d) having a corresponding taper, with a minimum outside diameter of 1½ in. for the longer steel and a wall thickness of ¼ in. A slight increase of this stock is allowed in the shorter lengths. The bit is driven snugly into the socket by striking with the soft side of a hammer,

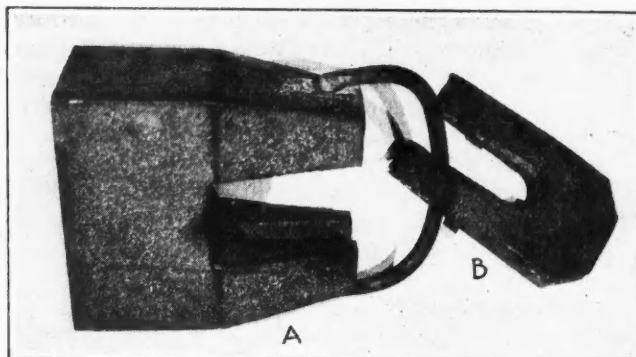


Fig. 3—Device for loosening bit from socket

and becomes more positively secure as the machine begins hammering on the steel. After the bit has been dulled, it is removed from the socket by putting both in the slot of a cast iron block (Fig. 3—b) and driving home a thin two-forked wedge (Fig. 3—a) between the face of the socket and the shank of the bit.

One of the selling points of this bit is that the manufactured bit can be delivered on the job for less than it costs to take a single mine steel through the circuit of sharpening and delivery, which would mean that the bit could be thrown away after being used once, or possibly sent in for resharpening, at a material saving over the present practice. Though this may be true for the small job without shop equipment, Granby experience has proved that it is decidedly more efficient to make the bits on the job and resharpen them, and as this is easily and quickly done, the details of doing the work will be here explained.

The bits made at Anyox (Fig. 1—b) vary somewhat from the original, and through the efforts of Martin McHale, the mine's master mechanic, the changes that have been made have contributed in a large measure to such success as has already been attained with them.

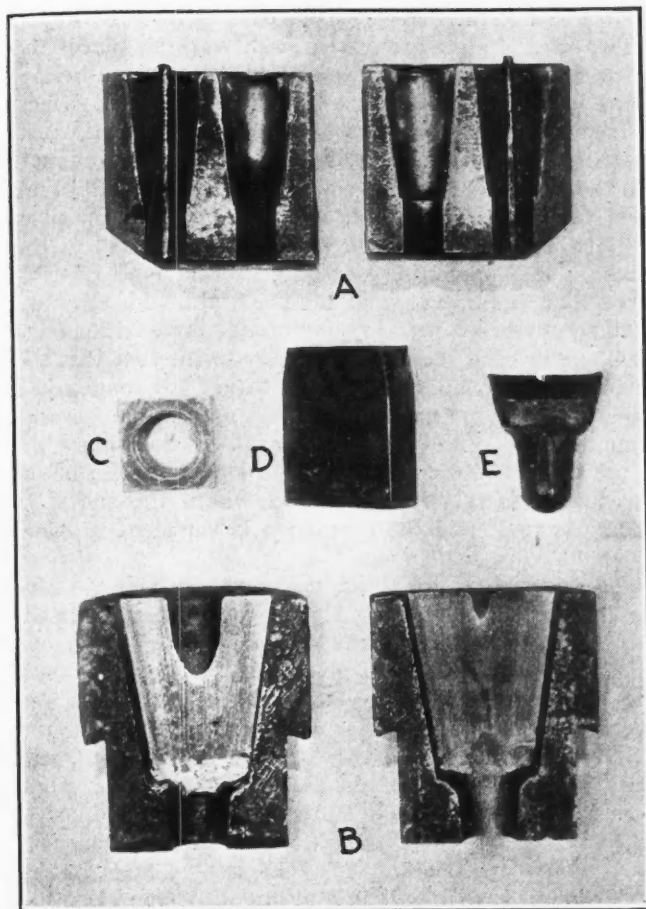


Fig. 4—Dollies used in manufacture of bits

A new bit is made in thirty seconds and less from a hot bar of steel, 2½ in. wide by 1 in. thick, on a Leyner sharpener. The high center has been eliminated, which simplifies the resharpener, and the amount of stock in the bit has been increased, thus permitting it to be sharpened many times before being discarded.

In making a new bit, the first operation is to put the hot bar into the sharpener under a set of dies that put on a 9 deg. single taper; it is then taken to another set of dies on the back of the machine (Fig. 4—a), where the tapered shank is formed; the next dies (Fig. 4—a) stamp out the waterways in the shank, and the final step consists in cutting off the bar with an upper and lower die (Fig. 5—a, b), each having a cutting angle of 90 deg. This last operation is not carried on in the sharpener, but is conducted under an old piston machine mounted vertically and used as a hammer. As the taper is constant, the initial gage of a new bit depends on how far from the shank the bar is cut. For example, in the case of a starter with a gage of 2½ in., the bar is cut off at 2¾ in. from the shank, and any shorter cut gives a bit of correspondingly smaller gage. This aids the miner to select his gage changes, as he knows at a glance that a shorter bit than the one he has dulled will be the next to follow.

The socket is made by putting the steel in a set of forming dies (Fig. 2—a) and then punching or dollying with a tapered dolly (Fig. 2—c) until the inside of the tapered socket is symmetrical. Because the original hole in the steel is occasionally off center, it is necessary to turn the steel several times, so as to center the socket longitudinally and to distribute the stock thickness around the walls evenly. To form perfect sockets it is

important that these dollies be kept in first-class condition, and as they are subjected to rapid heating they are frequently changed and allowed to cool. It has been suggested that the possibility of the socket splitting is lessened by making the inside of the socket slightly oversized for a short distance in from its outer face, thus throwing the strain further in. In practice, however, it has been found that loose bits cause more trouble, as a result of wear and expansion of the socket, than comes from the splitting of sockets, so that the use of all available bearing surface has given the best results.

The bit is sharpened in the same machine by changing the dies. The corners are first pinched out and the bit is then placed in a set of taper dies (Fig. 4—b), where it is sharpened or dollyed up in the regular way with dollies of variable-gage sizes (Fig. 4—d). As it is not possible to get the full stock in the wings of the bit by using a correct or corresponding dolly for that gage, an undersized dolly is used. This leaves a small burr on the wings that is afterward dressed off on an emery wheel. The bits are then reheated in an ordinary oil forge for tempering and are tempered in a tin trough of running water, where the water comes up on the bits at three-fourths of an inch to one inch from the cutting edge.

Although the bits are extremely simple, their successful operation depends entirely upon the care used in making both the socket and bit shank. It has been found that the minimum outside diameter must not be less than 1½ in., and that the minimum inside diameter should not be less than 1¼ in. at the face of the socket; otherwise it is likely to expand under continual hammering in hard rock. The best taper to be used on the inside of the socket, and on the corresponding bit shank, has been found to be 4½ deg. The depth of the socket is 2¼ in. and the length of the shank is a little less, in order to allow it to take up a certain amount of wear. Forming the socket and shank carefully and accurately is a matter of great importance, and the dolly used in making the socket as well as the dies for making the shank must be closely watched for irregularities and wear. For the purpose of assuring accuracy on these points a gage (Fig. 4—c and Fig. 2—b) is used for testing both in the shop after they have been made, and the nipper looking after the steel underground also has a set of the gages, which he uses to aid him in keeping his equipment up to its best efficiency. Socket and shank are air cooled, and all attempts at tempering have failed.

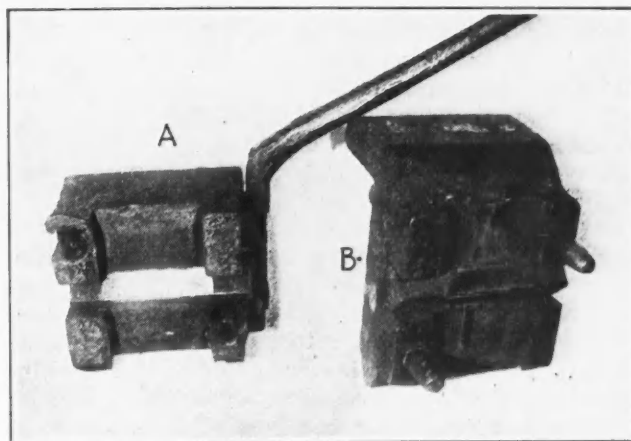


Fig. 5—Dollies used to cut finished bits to size

To determine the most suitable steel for making the bits considerable experimenting was done with several brands of 1½ in. hollow round, to be used for the drill rods, and bar steel to be used in making the bits. As the property most desired in a drill rod was its resistance to breaking, six different brands were tested to establish this point; this was done by drilling with a rock drill on a steel plate, using a 40-in. steel without a bit. The bit end was kept cool with a jet of water, and the average breaking time in each brand for six steels was the figure used for comparison. On this information the steel which showed the greatest resistance to breaking has been adopted for the drill rods. In deciding on the steel to be used for the bits, bars of different widths and composition were tried, and it was found that a bar 1 in. by 2½ in. having a carbon content of approximately 0.85 per cent was best suited for the purpose. In experimentation with high-carbon and vanadium steels, the shank breakage of the bit, possibly due to hardness, made their use prohibitive.

During the time the detachable bits have been under observation they have been tried and are now working in ground of various hardness, which may be indicated by the drilling speed of an M21 Turbo as between 2 in. per minute and 10 in. per minute, and by a further classification of a penetration of 4 in. per sharpening up to 8 ft. per sharpening. Comparing the performance of this bit with that of a double-tapered cross-bit, both having a cutting angle of 90 deg., it has been found that the drilling speed of the single bit is 85 per cent to 90 per cent that of the cross-bit, which is due chiefly to the drilling of a larger hole made necessary by the size of the socket. The penetration per sharpening for the single bit, however, is 30 per cent more than for the cross-bit, as it has more stock behind the wings and consequently holds the gage longer. Where an 80-deg. cutting angle was tried on the single bit only, the drilling speed equaled that of the cross-bit, but the penetration per sharpening dropped down to about the same. For the harder ground, particularly, the advantage is in favor of the 90-deg. cutting angle, and this has been adopted as standard at Anyox.

With only three-fourths of an inch to go on in gage changes, it is difficult to drill a deep hole with these bits. The stock behind the wings, however, permits of small gage loss, and the edges of the cutting angle behind the wings act as reamers, especially with independently rotated machines, so that this type of machine easily handles an oversized bit up to one-eighth of an inch. In one case an 8-ft. hole was drilled with bits of the same gage, where the drilling speed was 3 in. per minute, and the penetration per sharpening was only 8 in. The mine steel is made up in lengths up to 14 ft. for regular work, in addition to which there are extra sets made up to 20 ft. for special work, and the average depth of the holes drilled ranges between 10 and 12 ft.

Because of the shape and size of the socket, it was expected that trouble would be encountered in removing cuttings from the hole. This, however, did not prove to be the case, as to date the experience has been that there is no more trouble with stuck steel when using the detachable bits than is common with the cross-bits. Down holes have been successfully drilled from a tripod, to a depth of 12 ft. in heavy sulphide ore, without trouble, and the socket throws the mud from the hole in splashes a good deal as the old piston machines does. In any case, a flat water hole seems to give the most

trouble from stuck steel, especially beyond 9 ft. depth.

Two sets of steel are left in each working place, and are removed only in the case of a broken steel, a broken shank left in the socket, or a broken or expanded socket. In medium ground where 6 in. per minute or better can be drilled a new steel will stay in a stope for a month, and the chances are about equal that the steel will break from fatigue as quick as it will develop socket trouble. In hard rock, where 4 in. or less can be drilled, the cracking and spreading of the socket is more in evidence than the breaking of the steel, although the steel is likely to break in three or four days. Excessive breakage in hard rock is due largely to the fact that the tendency of the miner is to try to get too long a run out of each bit, with the result that much time is spent hammering on a dull bit, and the full shock is absorbed in the steel. When occasionally a shank breaks off in a socket, it is taken to the shop, where the socket is quickly heated; and the expansion is sufficient to allow the shank to be shaken out.

The advantages found in using the detachable bits are briefly as follows: (1) Nippers are eliminated. (2) Steel stock carried and consumption of steel are reduced. (3) The cost of sharpening is reduced. (4) The larger hole drilled permits more burden on the holes in stoping and a better placing of powder near the bottom of the hole in development work. (5) On small jobs of a few machines, the steel can be bought made up and the bits purchased as wanted, thus eliminating the cost of a steel shop. (6) More drilling per sharpening is made practicable. (7) The loss of steel in the muck due to handling it in and out of a stope is overcome. Different advantages recognized in a cross-bit have led to some experimentation having for its object a modification of both bits, but at present information on the success of this bit is inconsequential.

The disadvantages of the detachable bit may be summed up as follows: (1) It is harder to collar a hole on a sloping face with the single bit. (2) The drilling speed is slower. (3) Fishing for broken or loose bits in the hole is more common than with the cross-bit. (4) Care must be taken in fitchery ground to avoid getting a "Dutchman" in the hole.

It has been found that the cost of taking a regular mine steel through the cycle of sharpening and delivery at Anyox is 26c. per steel, without taking into account the capital expense of the steel shop and equipment. With this fact in mind, it has been found that for rock whose hardness will permit a drilling speed of not less than 4 in. per minute or where not less than 8 to 10 in. per sharpening can be had from each bit, there is no question as to the success of the detachable bits, and they have been adopted in parts of the mine where those conditions prevail. At present sixteen machines are using them, and more are being added.

In hard rock a decision is still to be made, the breakage of shanks, sockets, and steel is high, but this same trouble is also evident with the regular steel to a lesser degree, and because of the amount of steel used in these places the economy of using the bits is apparent providing the drilling efficiency is not too low. Several machines are now working with the detachable bits in hard rock. They are able to get the holes to the required depth, and the work accomplished compares well with that being done with the cross-bit. The tests in hard rock have been postponed, however, until the present time, and data now at hand are insufficient to form the basis of a decision.

## 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.*

### A Mining Engineer's First Impressions of Germany

#### THE EDITOR:

Sir—Most of the things of which I write are my first impressions and I undoubtedly will have reason to alter many of them as time passes. But I thought you would be interested in knowing just how Berlin sizes up to me. For a large city—four millions in Greater Berlin—it is spread over a great territory, seeming all the greater to one who has lived in Manhattan. The rapid transit takes about three times as long to cover the same distance as a New York subway. The business section is spread over a large area; the two largest department stores are at least two miles apart.

All the railways, subways, "el's," surface, and omnibus lines are government owned. A striking difference in the elevated and subway trains to those in New York is that no guards are used to close the train doors, the last man in being supposed to do that. This would work fine in a New York jam. Heaven help the last forty or fifty in!

The buildings are very ornate, and utility has been sacrificed in every case to external decoration. And when it comes to the public buildings, and those of the imperial regime, they fairly groan with every kind of statue and decoration possible. French windows are used throughout, mostly for light, seldom for air. In the older buildings old porcelain stoves, glazed and decorated, about five feet square and five to ten feet high, in the corners of the rooms, give the heat from coal briquets. The hotel rooms are all large and ceilings high. Many still use these old stoves. Everywhere they use feather beds instead of blankets and quilts as we do. This in the very best hotels. They use an ordinary mattress and springs, with a feather bed over the mattress, then a sheet, and for cover another feather bed, which is about two feet thick when it is fluffed out. These are warm but heavy.

The buildings, homes, monuments, and statues have all fallen on hard days. They all need a sand bath to clean them up, but they will go without, at least for a while. The government and the property owners have no money for repairs. The streets are principally of asphalt, and are all in good repair, remarkably clean, and all have heavy traffic. Most of them are of good width, some very wide, and many are lined with trees. Many horses are used: I'd say there were about one-twentieth as many automobiles as in New York City. They range in size from the vest-pocket make up to the largest. These real small ones make an ordinary Ford look like a moving van. The cheapest ones sell

for about \$300, and have canvas stretched on pipes for bodies.

Prices are very close to those of New York, not more than 10 per cent lower on the cheapest things. This is caused by an excess of merchants, each one with a small turnover and looking for a large profit. Wages are very low. We pay one maid the high salary of \$12 per month, which is more than she would get if she worked for a German family, and skilled mechanics in the metals trades seldom get over \$25 per month. The low prices of goods manufactured do not get through to the consumer. High taxes and high cost of the middleman doing business absorb the difference, so that the prices are about up to the American levels, and sometimes above.

The people look glum. Very few carry a smile; life is a hard battle; many of them show the effects of ten years of poor food in flat, colorless, expressionless faces, and poor teeth. Everyone is polite and friendly, and I have not found as yet any marked feeling of vindictiveness, such as one would expect. They seem to look at life in about this way: "We are here; we're whipped; there's no use crying, and none in laughing. There's no use getting in a hurry, or excited. We will live until we die. Work enough to get enough to live on, and take life as it comes. Get out of the country if we can, but if we can't we can't."

The thing I've missed most is water—plain water. The Germans have it, but it is a case in the office buildings of going out into the streets, walking two or three blocks, turning to the right or left, going down two or three flights of stairs, to get a good old-fashioned drink—of water. On the train coming from Hamburg we couldn't get any drinking water—the nearest was soda water. The beer, I'll say, is excellent. I've been here only about two months, and have tasted only about 400 kinds. As yet I haven't found a poor one. Of course I realize that I've only made a start. They say a good man can sample them all in about eighteen years, and so I may find a poor one in the lot. But I can say, so far, that, outside of the water, the drinking facilities are excellent.

In Lichterfelde-Ost are many villas which show that in the Good Old Days they must have been very swank, and judging from the size of the stables, gardens, and number of rooms, must have employed a great many servants. Now their owners are down and out. The places are for sale, but no one will buy them, on account of the high taxes. Like our landlord, they have been forced to rent all or part of their places, in order to exist. He is a retired "Herr Doktor," I believe a professor, and also a retired major from the army. He was also a sportsman, or "Jager," and has the house filled with antlers of deer, little and big, which he shot on his own preserve. Needless to say, he is an out and out Monarchist of the old Prussian school, known as "junkers," and even now is still crying out for "Our Kaiser."

A good many of the Americans here have been into all sorts of troubles with the Germans, always over money. The Germans look on the Americans as a chance to make some *easy money* and lose no time in planning a way to do that.

It takes some time to understand things European, as they are very different from things American, and so as time passes I may come to a better understanding of how the German mind works. But just now it is somewhat of a puzzle. A good many of them speak of "when the next war comes," but at the same time they all acknowledge they have had all they want of war. They all talk poverty, how they are taxed, how little they earn, but they spend every cent they can get hold of. This is possibly a hang-over from the inflation period, when the worst thing you could do was to *save* money. Now the habit is hard to overcome. Prices are too high, and I can't see how the people buy what they do. The Christmas celebration this year lasted for five days; no one worked, everything was closed but cafés and places of amusement.

T. PILGER

Berlin, Germany. American Trade Commissioner.

### An Application of the "Bubble Column" Flotation Process

THE EDITOR:

Sir—Without intending any comment as to the probable operating efficiency of the Simpson flotation machine described in your issue of March 7, 1925, page 423, I question whether there may not be, as evinced by the description, a somewhat confused idea as to the underlying principles involved in its operation, particularly in the cell, the bottom of which is the porous medium over the "air box" shown in the cross-section, in which cell the separation must be that of the ordinary porous cell machines, in which the process is "the bubble column process." The term "bubble column" originated with Robert S. Towne as descriptive of the operation of the Towne-Flinn process, U. S. Patent 1,295,817, and is a name so absolutely descriptive of the manner of operation as to seem almost an inspiration. The most clearly stated description of the way in which the "bubble column" effects the separation is that of Professor Taggart ("Manual of Flotation Processes," page 7), as follows: "(5) Concentration begins at the bottom of the bubble column (i.e., the surface of the pulp body) and progresses upward. . . . Such study shows that in the bubble walls there is a differential draining of the gangue and sulphide particles; that the average downward velocity of the sulphide is less than the average upward velocity of the bubbles; that the average downward velocity of the gangue is greater than the average upward velocity of the bubbles; and that, as a result, the sulphides are lifted up and away from the gangue." Towne, in the Towne-Flinn patent, refers to superimposed horizontal layers, which conception we should have in mind in the visualization of Taggart's observation of the differential descent of gangue and sulphide particles over the surfaces of a vertical line of superimposed bubbles, in contact each with the one above and below.

Taggart also points out that: "the sulphide particles in the bubble column are nowhere adherent to bubbles, as they are in what he has termed the 'pulp-body' process, that is the agitation froth process, which depends upon local supersaturation of the water of a pulp with

air by the mechanical action of a swiftly revolving beater and simultaneous precipitation of air in form of bubbles. . . ." These are much more minute bubbles than those of the bubble column, and the coherent froth has its maximum value when it reaches the surface of the quiescent pulp.

One should have clearly in mind the difference between the agitation froth process and the bubble-column process in the study of such an apparatus as the Simpson. And, having the conception of the bubble column in mind, it is by no means out of the way to question whether the term "froth" would not better be replaced by "bubbles" in the first line at the top of the second column, on page 423. In the first column of the page, in referring to "the second function of the compressed air," the bubble column would be described were it not for the confusion of the idea of a "froth" at "the surface of the water." The confusion also as to the air performing the function of "rotors or impellers" is misleading. It is, however, also an unfortunate fact that, in the patents relating to the Callow cell in which the "bubble-column process" is so largely carried out, a somewhat similar statement is made as to the air performing the function which had previously been done by impellers. The point at which the pulp from the air-lift agitating device enters, as shown in the cross-section of the Simpson machine, is inconsistent with the theory of the bubble-column operation of the porous-bottomed cell, over the air box. It may be, however, that in actual practice this opening is placed lower down. It is unfortunate that Mr. Towne's term "bubble column" has not been more generally used. That he himself fully appreciated its wonderful significance is indicated by his having reincorporated his process company, immediately upon its discovery, as "The Bubble Column Corporation."

Wallingford, Conn.

R. C. CANBY.

### General Motors Not Interested in Livingston Mines

THE EDITOR:

Sir—In your issue of March 14, 1925, on page 455 of that issue, you have an article entitled "Ford Motor and General Motors Companies Help Revive Idaho Mining." What you say in reference to the Ford Motor Co. is perfectly true, but in regard to the Livingston Mines I wish to say that the General Motors Co. is in no way interested in the Livingston Mines Corporation, that the Livingston Mines Corporation is owned and controlled by a group of New Yorkers who have no motor affiliations whatever, but who have been in the mining game for many years.

The property is equipped with its own hydro-electric plant, concentrating flotation mill, three-mile aerial tramway, sawmill, planing mill, and shops necessary for operation at that distance from railhead. The entire plant with the exception of the flotation unit is now in operation, and the flotation unit will be placed in operation within thirty days.

The Why Not property, mentioned in the same article, is being opened up at the present time and operated by myself.

I hope that you will make this correction in an early issue.

A. W. WALKER,

President, The Livingston Mines Corporation.



## Consultation

### Sulphur Addition to the Soil

"I have noted with interest several citations printed lately in the *Mining Journal-Press* regarding pyrites as a source of sulphur for the soil, especially the encouraging results obtained at the experimental station at the Oregon Agricultural College. Accepting their bulletin as authority, I have succeeded in getting several of the farmers in the Durham district, where sulphur is notoriously lacking, to try out some of the pyrites cyanide tailings produced adjacent to this district.

"This week I note another article which states that iron sulphate, instead of pyrites, was used in the experiments. The Oregon bulletin's misinformation checkmates me until I now find out whether or not pyrites will oxidize sufficiently fast to furnish the sulphur required within economic limits.

"I am willing to start some weathering tests here in Oroville to accumulate this important data, but first I would like to know whether or not any work has been done in this field of research or investigation. I suppose there exists some information on the rate of oxidation of pyrite, which, though it might vary in districts, owing to the many natural conditions such as temperature, humidity, and altitude, I would like to study if such information is available.

"It has occurred to me that you may be able to refer me to some data, or possibly be familiar with what has been done on this subject. For instance, if 20 per cent per year increase could be expected, the use of pyrite as a fertilizer would be interesting. Of course, the composition of the soils treated is also a function of the rate of oxidation, and this would require study. However, I am simply looking for a starting point, and any information you may have will add to my present meager supply."

We are informed by the Department of Agriculture that pyrite is not in general use as a fertilizing material and that the department has not done any experimental work on its use. In practically all the eastern section of the United States, acid phosphate is used either directly or as a basis for mixed fertilizers, and as this contains approximately 50 per cent of gypsum, the soil is continually receiving sulphur in this form.

The following excerpts from a paper by C. C. Fletcher, of the Bureau of Soils, discusses the use of sulphur as a soil amendment:

"Sulphur has been used as a soil amendment in the United States since Colonial days. It is one of the essential elements for plant growth, but is usually found in sufficient quantities in most soils for normal crops. However, with the cultivation of soils there is a large loss of sulphur through drainage waters, which is partly but not completely corrected by its addition through rainfall.

"In the early days, due to faulty chemical methods, the presence of sulphur in plants was minimized, but with improved technic it has been found that the percentage of sulphur is very much higher than was formerly supposed. This would make many chemists theoretically believe that sulphur should be added to the soil as a fertilizer. Aside from theory, experimental work, particularly in Oregon, has shown very good returns from the use of sulphur on special soils and crops. Apparently sulphur, or a number of its compounds, may have this beneficial effect.

"The following table shows some of the common fertilizer materials with the approximate amount of sulphur present. In addition, the organic ammoniates (such as tankage, fish scrap, and cottonseed meal) and manure all contain sulphur:

Material	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	NH <sub>2</sub>	S
Acid phosphate.....	16	..	..	9
Ammonium sulphate.....	..	..	25	24
Potassium sulphate (90 per cent).....	..	50	..	16
Double potash manure salt.....	..	27	..	13
Gypsum.....	..	..	..	18

"Possibly the fact that in the East large amounts of acid phosphate and mixed fertilizers are employed has held back

the use of sulphur in this region. Acid phosphate contains approximately 50 per cent gypsum, and most mixed fertilizers use acid phosphate as a base; consequently the farmers who employ either of these fertilizer materials are continually adding sulphur to their soils, although they pay nothing for it. It has been suggested that possibly some of the experimental work in which acid phosphate gave more favorable returns than raw rock phosphate may be interpreted to mean that the increased crop yields were due in some cases to the sulphur present in the acid phosphate. Elemental sulphur is relatively cheap; it is in a concentrated form and will thus stand transportation charges more readily than some of the other forms of sulphur; however, it has to have a favorable soil or be artificially inoculated to give its best returns.

"It might not be amiss to note here that many other commercial fertilizer materials that are applied either separately or in the form of mixed fertilizers contain appreciable amounts of sulphur. Notable among these are potassium sulphate, double manure salts, ammonium sulphate, and the organic ammoniates, containing protein, such as tankage, fish scrap, dried blood, and cottonseed meal. A survey of the experimental work on crops would indicate a wide diversity of results. Alfalfa and peanuts stand out as two crops especially benefited by the use of sulphur. Many crops, however, such as corn and cotton, show no consistent returns from its use. As sulphur has a tendency to render the soil more acid, it may have to be used in connection with lime where acidity is an adverse factor. However, this very quality renders it a benefit in alkaline soil, and it has been recommended for the treatment of black alkali, with the object of changing the highly deleterious sodium carbonate to less harmful compounds.

"As in the case of most of the soil amendments and fertilizers, it is difficult even to indicate the proper amount to apply. The soil type, crop, climate, previous cropping history of the soil and other factors have to be considered. In some instances experiments indicate a loss rather than a gain in the crop yield. Taking the conditions in Oregon, where sulphur has been recognized for some time as a valuable soil amendment, an application of 40 lb. per year per acre of sulphur has been found satisfactory. A comparable amount in the form of superphosphate or gypsum can be used.

"While we believe that sulphur will in the future have a very much more extended use, outside of limited areas, at the present time it should be considered in an experimental stage and most certainly a wide spread propaganda to substitute it for the conventional commercial fertilizer materials might do grave harm. In this statement, however, I am not referring to its acknowledged value as a treatment for various deleterious animal and vegetable pests of the farm, but merely to its direct use as a soil amendment. To anyone wishing to follow up the experimental work done in this country, we suggest that he consult the experimental station and Department of Agriculture of New Jersey, Wisconsin, Illinois, Kentucky, Iowa, Texas, Oregon, and California, or obtain from the U. S. Department of Agriculture a copy of a bibliography of the publications on this subject."

### An Opportunity for a Non-metallic Mineral

"Do you know of any non-metallic material—waste product from asbestos mills or other light-weight material—which, by the addition of a suitable binding agent, could be molded into boards or slabs which might be made into packing boxes? The loss from pilferage in shipment is a very serious and expensive item in the conduct of the business of most manufacturers, particularly those doing an export business. Many attempts are being made to devise a packing case which cannot be opened and then resealed without evidence of having been tampered with. Is it possible that there is in this avenue of consumption an outlet for waste material of light weight if the matter be given some research and study?"

Not knowing of any efforts which may have been made to devise such a material, we submit this inquiry to our readers, who may be able to supply the information sought.

# 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

**SECRETARY HOOVER**, through the Department of Commerce, probably will undertake to continue the investigation of mining costs started by the Senate Gold-Silver Commission, which expired by limitation on March 4.

An offer of \$350,000 in cash has been made by the Tintic Standard Mining Co., of Utah, for the Iron Blossom holdings.

Production by the Annapolis Lead Co., in southeast Missouri, has been stopped as a consequence of damage done by the tornado.

Transfer of the U. S. Bureau of Mines to the Department of Commerce is expected to be accomplished at once.

The East Butte Copper Co. is financing development work in the Tonopah silver district in Nevada.

Revaluation of copper and silver mines for basing depletion allowances on 1919 taxes has been ordered.

British Canadian Mines, Ltd., is building a mill at its Foley mine in Ontario.

The Antamina copper-silver deposit in Peru, according to recent geological examinations, is a potential world-beater.

Gold production on the Rand declined 1,581 oz. in January compared with December.

The National Association of Battery Makers has discussed the purchase of lead mines if the price of the metal gets "too" high.

### East Butte Copper Finances Tonopah Development Project

**Tonopah Western Has 1,100-Acre Tract—Two Shafts on Property—Unwatering First Work**

The property of the Tonopah Bonanza Mining Co., consisting of 420 acres of patented land in the western part of the Tonopah district, in Nevada, has been purchased by the Tonopah Western Consolidated Mining Co. for a consideration of 300,000 shares of stock of the latter company. This transfer of property gives the latter company 1,100 acres, covering the area to the west of the Tonopah Extension Mining Co. on the strike of the known productive area. The Tonopah Western Consolidated is controlled by the East Butte Copper Mining Co., of which Robert H. Gross is president. This company will underwrite 500,000 shares of stock of the Tonopah Western at 20c. to provide a working fund.

Mining in this area will be at considerable depth, there being from 1,000 to 1,500 ft. of caprock overlying the ore-bearing formation, and a large amount of water will have to be pumped. In this connection, it is expected that a working agreement will be made with the Tonopah Extension Mining Co. for pumping water which will be mutually beneficial.

There are two shafts on the property of the Tonopah Western. The Great Western shaft is 1,130 ft. deep, and a vein carrying some values was cut on the 1,100 level, just before a large flow of water was encountered which was more than the pumping equipment

### Mining Lead and Making Batteries Are Different Jobs

**T**HE National Association of Battery Manufacturers at a meeting conducted recently at Cleveland, Ohio, discussed plans for the purchase of lead-mining properties in the event the price of pig lead goes to a level the association considers too high. The manufacturers of storage batteries use about 20 per cent of the lead consumed in the United States. Henry Ford has already gone into the lead-mining business on a considerable scale and expects to purchase more mines. Battery manufacture is the important use to which he puts lead.

could remove. No work has been done since then. The Bonanza shaft is 1,680 ft. deep and is about 3,600 ft. north of the Great Western shaft. Work was stopped by the Bonanza company when the flow of water became greater than could be handled.

### Excavate for Katherine Mill

The force of men employed at the Katherine mine, near Kingman, Ariz., has been increased from thirty-five to fifty men, and excavation has been started for a new mill, which is expected to be in operation by July. It is understood that the Tom Reed Gold Mines Co. is financing the work and controls the Katherine company.

### Tintic Standard Offers \$375,000 for Iron Blossom

**Old Tintic Property Which Has Earned \$3,500,000 in Dividends—Sale Seems Likely**

On April 16, stockholders of the Iron Blossom Mining Co., of Eureka, Utah, will meet to ratify the sale of the property to the Tintic Standard Mining Co. The Tintic Standard is offering \$375,000 for the property, and this sum has been accepted by the directors. The bid is regarded by the management as a fair and attractive one, in view of the condition of the company.

The offer is a cash offer, and each stockholder will receive 37½c. per share for his stock. This sum will be raised to 46c., from cash on hand Dec. 1 amounting to \$31,037, and quick assets of \$54,608.

The mine has been operating under the leasing system, and during 1924 dividends amounting to \$50,000 were paid. Ore sales for the year amounted to \$340,907 and total receipts to \$392,252. Disbursements were \$361,214. Extensive development work was done during the year, and numerous minor orebodies were opened.

The eastern section of the Iron Blossom has been comparatively little worked; and in this part of the ground the showings from more recent development are regarded as favorable to the future of the mine. In the past the property has paid over \$3,500,000 in dividends.

Tintic Standard has declared a dividend for April 1 of \$461,166 making a total of \$4,369,798.

**Increase of 30 per Cent in  
Arizona Copper Mine  
Employees**

A RECENT survey made by the mining committee of the Tucson Chamber of Commerce indicates that 30 per cent more men are employed in copper mining in Arizona today than were employed a year ago. One favorable indication noted by the committee is that development work has been started on a large number of small prospects, employing ten to twenty men, all over the state.

At present 65,000 men are employed in all camps of the state and 400 plants are in operation, including 70 of major importance. The committee estimates that 50,000,000 lb. of blister copper, with a valuation of \$7,250,000, has been produced in Arizona in the last month.

**Who's Who Among Joplin-Miami  
Zinc Producers**

The Federal, Eagle-Picher, and Commerce companies have been shipping concentrates in the Joplin-Miami district at the rate of 1,000 ton a week, a summary of the year's shipments discloses. The thirty leaders sent out 106,000 tons of the 135,000 consigned during the first nine weeks. Ten of this group are operating only one mill; the other twenty operate from two to twelve each.

The Anna Beaver is leading the list of single mill companies. The district's thirty leading shippers with tons of zinc ore shipped during the first nine weeks of the year, are:

Federal M. & S. Co.	12,498
Eagle-Picher Lead Co.	9,879
Commerce M. & R. Co.	9,651
Golden Rod M. & S. Co.	8,377
St. Louis S. & R. Co.	6,939
Skelton L. & Z. Co.	5,125
Underwriters Land Co.	4,658
Vinegar Hill Zinc Co.	4,597
Cortez-King Brand-N. Y.	3,486
Anna Beaver M. Co.	3,261
Butte Kansas M. Co.	3,002
Admiralty Zinc Co.	2,633
Dorothy Bill M. Co.	2,572
Barnsdall Zinc Co.	2,311
Rialto M. Co.	2,270
Quapaw M. Co.	2,226
New Chicago M. Co.	2,015
Black Eagle M. Co.	1,946
Consolidated L. & Z. Co.	1,891
S. R. & W. M. Co.	1,807
Cherokee L. & Z. Co.	1,698
Bosca M. Co.	1,690
Huttig L. & Z. Co.	1,543
Vellie-Lion M. Co.	1,489
Kansas Explorations Co.	1,424
American Zinc L. & S. Co.	1,373
Childress L. & Z. Co.	1,321
C. Y. Semple	1,314
F. W. Evans	1,307
Lawyers M. Co.	1,294
White M. Co.	1,263

**Reopen Drum Lummon Mine**

The Paisley Point Mines, Ltd., has been organized to take over and develop the Drum Lummon mine, on Douglas Channel, Hartley Bay, British Columbia. A low-level tunnel, about 300 ft. below the present bottom workings and 700 ft. below the outcrop, will be started at once. The ore is gold-bearing chalcopryrite in a pegmatite.

**Revaluation of Copper and Silver Mines  
by Treasury Department**

Review of Situation on Which Attention Is Focused by Couzens  
Investigation—Reopening of 1917-18 Cases Unlikely

By A. B. Parsons

Assistant Editor

WHEN the big daily papers feature headlines like "See \$50,000,000 Lost in Copper Men's Tax by High Valuations" (*N. Y. Times*), and include many mining companies among big corporations that have received tax refunds of \$562,000,000 under alleged questionable methods of recalculating amortization, some of Senator Couzens thunder hurled at Secretary Mellon and the Internal Revenue Bureau necessarily bounces off onto the mining industry. It is perhaps inaccurate to infer that the Senator is making charges. Technically, he is only ascertaining facts, but the investigation has focused public attention on the question of war and post-war excess profits and income taxes with which many mining companies are still wrestling. The Treasury Department has expressed its intention of "revaluing" copper and silver mines for the purpose of determining depletion allowances in computing taxes for 1919 and succeeding years.

**Significance of March 1, 1913**

To understand this situation it is necessary to go back to the first income-tax law. The Constitutional amendment that validated income taxation was ratified on March 1, 1913—as a consequence of which that date plays an important part in all discussions of income taxation. The revenue act of 1913 imposed a tax of 1 per cent on net income and provided an allowance for "exhaustion" not to exceed 5 per cent of the value of the ore at the mouth of the mine. In the act of 1916 the rate was increased to 2 per cent and a reasonable allowance for depletion of the orebody was provided substituting for the 5 per cent the limitation of "the capital originally invested, or in case of purchase made prior to March 1, 1913, the fair market value as of that date."

In 1917, after the United States entered the war, drastic taxation was imposed for the first time, war and excess profits levies ranging up to about 65 per cent, and in 1918 the rates on corporations were as high as 80 per cent, with additional taxes on the dividends of individual shareholders. The rates were reduced thereafter, and as the profits of most mines declined the matter of income tax became less important. So far as most copper mines are concerned, the question of taxation since 1919 has been largely academic.

Although dozens of complicated problems in application have arisen, the theory of depletion allowance is simple. If a man bought fifteen acres of farm land after March 1, 1913, for \$15,000, and subsequently sold one acre for \$1,500, the \$1,000 capital investment would be deductible, and only the \$500 would be subject to tax. The case of an orebody was recognized in 1916 to

be comparable. The working of the mine was considered a sale of the orebody by piecemeal. The net operating profit is represented by the \$1,500, and depletion, or the "cost" of the portion of the orebody removed during any year, by the \$1,000. If, however, either the acreage or the ore deposit had been acquired prior to March 1, 1913, it was necessary to make an appraisal of the property as of that date. Otherwise any excess of the fair market value on March 1, 1913, over the purchase price would be taxed; and this was contrary to law because the income-tax amendment was not then in force.

Most mines were in the hands of the same owners in 1917 and 1918 as before March 1, 1913, so that the problem arose of making an appraisal as of that date. Obviously, the higher this valuation was, the greater would be the allowable deduction as depletion and, assuming no variation in tax rates, the smaller the resulting tax. The theory that the appraisal should not be based on stock-market quotations, but on sound engineering principles, was generally accepted: this meant that the present worth as of March 1, 1913, of the anticipated future profits would control. However, the returns filed in 1917 for the year 1916 were computed on nearly as many sets of factors as there were companies making returns.

In 1919 officials of the Revenue Bureau took steps to straighten out the tangle. J. C. Dick, L. C. Graton, and other engineers formulated a code of regulations, and among other things fixed 17.4c. per pound of copper and 65c. per ounce of silver as the market price for the metals on which to base present worth. There were other factors, but this one was vital.

**Copper at 17.4c. per Pound**

The 17.4c. selling price was assumed to carry with it the estimated increase of 1.50c. per pound in cost of copper production. In the earlier valuations the 17.4c. selling price was used and 1.15c. was added to cost. This was manifestly equivalent to using a 16.25c. selling price, and later valuations stated the selling price as 16.25c. and used costs without the 1.15c. addition.

Important producers were heard in the matter, and though some advocated higher prices, 17.4c. for copper and 65c. for silver finally were accepted. In 1919 and 1920 hearings were held, changes and adjustments were made, and a great many of the 1917 and 1918 cases were closed and the revised taxes paid.

The so-called discovery clause appeared in the 1918 act. By this the owner of a property on which a distinctly new ore deposit had been found and developed subsequent to March 1, 1913, was permitted to base his depletion allowance on the fair market price

of the property within thirty days after the date of discovery. The soundness of this provision has been questioned by some, but at the time it was desired to stimulate mineral production, particularly of petroleum, and this provision had that end in view. The present law limits the deduction, based on discovery, to 50 per cent of the net profits of any year.

In 1922 the Revenue officials reached the conclusion that the valuations of copper mines had been too high, principally because of the 17.4c. figure, used as the selling price of the metal. A new figure, 14.92c., which was the average price for ten years prior to 1913, was decided upon as being more reasonable. The contention was advanced that only information available on March 1, 1913, (when no one foresaw the war) should be used in determining this figure, as that would afford the closest approach to the market value of the properties as of that date. Graton and Dick theoretically eliminated consideration of the war, but it may have influenced their calculations made in 1919, before the market collapsed.

The Treasury Department, however, took the stand that it would not reopen the 1917 and 1918 cases, on the ground that the valuations made were the honest expression of judgment of competent authorities, and that, since the sums involved were very large, the entire copper-mining industry would be disrupted. The fact that producers had suffered severely during four years of depression in their industry would make further taxation a still greater hardship.

Some of the copper companies protested against any blanket change, on the ground that the valuations involved many factors that were based entirely on opinion. They argued that competent engineers differed on various points and that the benefit of the doubt should go to the taxpayer.

#### Copper Companies Oppose Change

As the matter stands now, the mining companies are opposed to any change, whereas Senator Couzens, presumably, would reopen the 1917 and 1918 cases, when large amounts were involved, and get the \$60,000,000 which his experts say has been "lost to the government." Of course he would use the lower valuation for computing depletion in taxes for the years since 1918 and for the years to come. Mr. Mellon takes a middle course. He says he will not reopen cases of 1917 and 1918, but that the lower valuation will apply for 1919 and for the years following.

The question arises whether reopening would be possible. The five-year period for the 1918 returns expired on March 15, 1924, and in the regular course of events the matter is automatically closed. However, there are many exceptions, as waivers have been agreed to by some of the large companies in connection with claims for refund or readjustments.

One phase of the situation is illustrated by a statement of John D. Ryan, of the Anaconda Copper Mining Co., in reply to published testimony to the effect that the Anaconda company had

been allowed to figure its depletion for 1917 and 1918 on a valuation of \$188,713,192, or \$4,560,227 more than the company originally claimed, whereas the chief of the Metal Valuations Section of the Internal Revenue Bureau had calculated the valuation as only \$54,865,832. Mr. Ryan's statement says: "The Anaconda company returned as taxable income, before depletion, for the three years of 1916-17-18, \$108,746,488, and, after deducting depletion, returned as taxable net income, on which it has paid its taxes, \$76,654,418. In other words, the Anaconda company returned as taxable net income in three years 150 per cent of the amount the chief of the Valuations Section now says the orebodies were worth on March 1, 1913.

"During the years 1911-12-13, the three years considered as typical pre-war years by the Treasury Department, the Anaconda company earned \$35,223,552, or \$11,741,184 per year. In other words, the earnings for five years at this rate would exceed the valuation as of March 1, 1913, now proposed by the chief of the Valuations Section."

#### Amortization Claims for 1918

The other proceeding the validity of which is questioned by the Couzen's experts has to do with the refund of \$562,000,000 on amortization claims for 1918. Similar claims now pending are alleged to total \$300,000,000. The 1918 law made a special amortization allowance to apply to plants and equipment installed to facilitate "the production of articles contributing to the prosecution of the present war." This apparently was overlooked by most companies when the original returns were being made, but in 1922 and 1923 the tax experts saw the opportunity and claims for refund were instituted. Among the circumstances that, it was argued, would justify this action were: overexpansion in excess of post-war requirements; paying of excessive prices for materials and equipment; doing construction in a way that would not meet future needs; rushing construction with inefficient and high-priced labor.

The United States Steel Corporation and its subsidiary companies have been allowed refunds of \$55,063,000 on this account. The Aluminum Company of America has received refunds of \$15,589,614 and many copper and other metal mining companies have received refunds. The two amounts just mentioned are at least \$27,926,014, and \$6,500,000 in excess of what they should have been, according to the allegations of Senator Couzens' investigators.

The amount of these refunds is not susceptible of precise determination according to any rules or even definite principles. The judgment of the engineer making the examination and estimate is a most important factor, and naturally there is wide difference of opinion. It is the contention of the Couzens experts that in general the investigators were too generous in their dealings with the large corporations. Unless there be proof of fraud there seems to be no ground for reopening the matter, however.

To summarize the present status of the "revaluing" of mining properties,

there is no intention of making any change with respect to lead and zinc, the reason being that the original appraisals are none too high. As to silver, there seems to be some uncertainty as to whether the recalculation will begin with 1922 or go back to 1919. Officials of the Bureau have fixed upon 57.78c. as the reasonable selling price for silver, instead of the 65c., used in making the original valuations on which to base depletion.

#### Jeopardy Assessments for Silver Producers

Unless fraud is provable, a case cannot be opened after five years from the filing of the original return. It is understood that prior to March 15 last waivers were asked of silver producers for 1919, and that when these had not been given jeopardy assessments were imposed. These are for arbitrary amounts, large enough to protect the government. A fair inference is that the readjustment will begin with 1919. It is estimated that about \$5,127,096 will be realized from the silver mining companies in additional taxes for 1919 and subsequent years.

Regarding copper, as I have said, the additional taxes will not be great, for the reason that since 1919 large net profits in most cases have been conspicuous by their absence. As to the future, producers hope, no doubt, that they will have occasion to pay taxes on bigger earnings because dividends to shareholders and taxes to the government go hand in hand.

#### Hydro-electric Power Project in Northern British Columbia

A hydro-electric installation involving \$1,500,000 on the Salmon River, in the Portland Canal district of British Columbia, will be constructed this year by the Helmar interests of Wisconsin, according to reports in Victoria, B. C. The plant will be situated on Glacier Bay, on the Portland Canal just below the Salmon River, and power will be distributed to the mines in that area. It is claimed the plant will cut in two the power cost of the mines in northern British Columbia and greatly speed up development. At present, except for the few miniature water-power plants on mountain streams, fuel oil is the source of power for most of the properties, and the cost is high. The Premier Gold Mining Co. now develops its own power, but it is understood here that it will buy electric power from the new plant.

#### Charles Peter, Idaho Mine Promoter, Convicted of Fraud

Motion for a new trial for Charles Peter has been denied by Judge Tillman D. Johnson of the federal court at Salt Lake City. Peter was found guilty by a jury in the federal court on Jan. 26 and convicted on six counts charging the use of the mails to defraud in connection with the exploitation of the Mascot Mines Corporation, which purported to operate mines near Hailey, Idaho. Peter has been ordered to appear for sentence.

**British Canadian Co. Builds Mill at Foley Mine**

**Diamond Drilling Finds Ore—Production Anticipated by July—Drifting Progressing**

The Foley gold mine, on which work was begun by the British Canadian Mines, Ltd., one year ago, will be producing early in July of this year. Underground workings have been largely extended on the 400 level, north shaft, and on the 200 level, south shaft. The mill now being built will be operated at less than full capacity for some months pending the development of the Bonanza vein on the 500 and 600 levels. Meanwhile drifting alone is expected to provide the mill with some tonnage.

No. 1 diamond drill hole, spotted 1,800 ft. south of the south shaft, cut both the Bonanza and Lucky Joe veins, thus proving their extension through the southern part of the company's property. At a depth of slightly over 100 ft. a change of formation was encountered, the core showing transition from the so-called "protogene," to carbonated basalt. Much green schist was cut. This indicates the essential similarity between these deposits and those of Northern Ontario.

A second hole is being drilled from the 400 level to cut the Sulphide vein at a depth of about 900 ft. This is the beginning of a systematic diamond-drilling campaign, the first, with the exception of a few sporadic shallow holes, ever conducted in the gold-bearing areas of northwestern Ontario.

Later it is planned to drill under Shoal Lake, on the shore of which the mill is situated, and where the British Canadian has secured mining rights over 330 acres.

J. C. Houston is in charge of mill construction.

**Four Utah Lead-silver Mines Pay \$870,766 on April 1**

Lead-silver mines in Utah will on March 31 and April 1 pay nearly a million dollars in dividends. The Tintic Standard, of Eureka, will make the largest single payment: the regular dividend of 20c. a share and an extra dividend of 20c.; making a total disbursement of \$461,166. Dividends by the company thus far—including the present payment—will be \$4,369,798. The Park City Mining & Smelting Co., of Park City, on April 1 will pay 15c. a share, or \$131,400. This brings the total by the company to \$12,716,900. The Silver King Coalition pays 20c. a share or \$243,200 on the same date, bringing the total of dividends to \$17,813,175. The Bingham Mines on March 30 will pay \$35,000, or 50c. a share.

**Superior & Boston Deepens Shaft**

The Superior & Boston Copper Co., operating at Globe, Ariz., is sinking its McGaw shaft from the 1,400 level to the 1,700 level. Upon the completion of this work development work will be started on the new low level. The company owns a large area east of the Arizona Commercial property.

**Depreciation Not Deductable in Computing Nevada Bullion Tax**

AT TONOPAH, Nev., Judge F. T. Dunn has rendered a decision, which finally removes the uncertainty that Nevada mining companies have experienced in computing their bullion tax. The law provides that the bullion tax shall be computed on "net proceeds." Judge Dunn ruled that actual costs of extraction, actual costs of transportation, and actual costs of reduction or sale only could be deducted. Depreciation, taxes, insurance, construction costs, and maintenance of offices outside of the state are classified as incidental or indirect costs and not actual costs, and are therefore not deductible. The decision was rendered in a test case brought by the Tonopah Extension Mining Co., and by reason of the decision, the Tonopah Extension company must pay to the state the sum of \$6,716, together with \$671, the latter amount being the 10 per cent damages provided by law.

**Utah Ore Shipments Up; Surplus Forwarded to Colorado**

Shipments by Utah mines for the week ended March 14, follow:

Eureka—Shipments, 202 cars of ore, compared with 192 cars the week preceding. Shippers were: Chief Consolidated, 62 cars; Tintic Standard, 51; Bingham Mines, 35; Bullion Beck dump, 13; Tintic Milling Co. dump, 10; Iron Blossom, 8; Empire Mines, 7; Colorado, 6; Mammoth, 6; and Plutus, 4.

Bingham—This camp shipped (exclusive of shipments by Utah Copper and Utah Consolidated) 144 cars. Shippers were: United States mine, 66 cars; Utah-Apex, 66; Bingham Mines, 10; and Ohio Copper, (precipitates), 2.

Park City—Shipments were 8,446 tons of ore and concentrates, compared with 7,239 tons the week preceding. Shippers were: Silver King Coalition, 3,081 tons; Park-Utah, 2,992; Park City Mining & Smelting, 1,308; Ontario, 775; Keystone, 230; American Flag, 60. Surplus ores from this camp are being sent to the Arkansas Valley plant of the A. S. & R., in Colorado, for treatment.

**Start Electric Smelting of Iron Ores in California**

Electric smelting of iron ores is to be resumed at Heroult, Shasta County, Calif., by the Shasta Iron and Steel Co., a new incorporation that acquired an option on the Noble Steel Co.'s plant and iron mine at Heroult. Local reports state that one 50-ton furnace is to be operated late in March. Five additional furnaces are to be provided.

The operating plan provides for the enrichment of the iron ore by magnetic concentration and direct smelting to steel in electric furnaces. J. L. Mayberry is superintendent of the company.

**Prince Mine, at Pioche, Unwatered, Will Be Developed Work on 800 Level—Tungsten Comet Mill, Overhauled, Makes 45 Per Cent Lead Concentrate**

The Prince mine, at Pioche, Nev., has now been completely unwatered to its lowest depth of 835 ft., and operations will soon be started to develop the mine from the 800 ft. level. Three different divisions of work will be prosecuted. A drift will be run east to the section of ground indicated by diamond drilling to contain a bed of ore averaging 25 oz. in silver and 15 per cent lead. Another drift will be run in a northerly direction under the Virginia Louise orebody an approximate distance of 1,000 ft. This drift will give 300 ft. of virgin stoping ground. A further drift will be run west to the Great Western fault country, from which a large tonnage of high-grade ore was taken in the upper levels of the mine. The unwatering of the mine has taken just two months.

In the Virginia Louise mine, which adjoins the Prince and is now under the same management, a sublevel will be run from the present winze below the 500 level under the existing orebody, which will give ample stoping ground while the development at depth from the Prince mine is being prosecuted. The ore below the 500 level is of higher grade than in the upper levels, carrying 35 per cent excess iron and lime over insoluble, with 3.5 oz. silver and 3.8 per cent lead.

The mill at the Tungsten Comet mine has been completely overhauled, and test runs made during the last week have produced a concentrate assaying 3.0 oz. gold, 80.0 oz. silver, and 45 per cent lead, the ore being sized and concentrated with no further treatment at present. This property is being operated by the mining firm of Squires & Gemmill, of Los Angeles, Calif.

**Quincy Mines Richest Ore in History on 85th**

The Quincy mine, in the Michigan copper district, is opening the richest rock in its career below the 85th level in No. 2 shaft. The vein is impregnated with heavy mass copper. Openings at depth in No. 6 shaft show no diminution in values, the lode containing good stamp rock and considerable mass. The showing in the deepest levels is encouraging, inasmuch as Quincy is one of the deepest mines in the Michigan district. In addition to cheaper power, obtained through utilization of exhaust steam from the stamp heads in the mill, improvements in regrinding practice also are contributing to lower costs through recovery of a larger percentage of copper.

**New Gypsum Plant in Utah**

The Mammoth Plaster & Cement Co., of Cedar City, Utah, owning large gypsum deposits in the canyon east of Cedar City, plans to construct a 100-ton mill during the coming year. Assays and tests of the deposits show that an exceptionally high-grade product can be made.

### Union Minière Plans New Refinery in Belgium

One Link in Program of Expansion—  
New "Reverbs" at Panda—Labor  
a Problem

Details of the projected leaching plant and reverberatory furnace smelter in the Congo, and of an electrolytic plant in Belgium, were given at the recent meeting of the shareholders of the Union Minière du Haut-Katanga at Brussels. This is part of the program to increase the annual output to 440,000,000 lb. annually. Monsieur Jadot, the chairman, said:

"We contemplate the immediate erection of a first unit for treatment by sulphuric acid leaching and electrolysis, capable of producing 30,000 tons of copper a year, to be followed later on by the erection of two further units of similar capacity. These units will be run with power obtained from the Lufira Falls. We have now the satisfaction of telling you that further investigations enable us to count upon a considerable higher capacity of production [of water-power] which may reach 90,000 tons, corresponding to the capacity of three leaching units.

"Our previous reports have referred to our tests with reverberatory smelting, which appears to us the most economical process for the treatment of certain classes of fine ore. The test reverberatory furnace, which has just completed a campaign of eight months during which it produced 5,500 tons of copper, has given entire satisfaction, and demonstrated the advantages of this process. Having regard to these advantages, we intend to erect, near the Panda concentrator, a reverberatory furnace plant capable of producing annually a further 30,000 to 40,000 tons of metal by smelting.

"Having regard to the necessity of ensuring on good conditions the sale of such large quantities of copper as those we are now producing, and shall produce in the future, we have considered it indispensable to erect an electrolytic refinery. It will be erected at Oolen for our account with a participation of the Hoboken Co., and is intended to have an initial capacity of about 30,000 tons a year.

"We would draw your attention to the fact that this program is for the development of our southeastern deposits; the working of our western mines is to be the object of a special program based on the harnessing of the great falls on the Lualaba.

"This program should enable us to increase gradually our total production up to above 200,000 tons a year, and will evidently take several years of assiduous effort. We estimate that the time required for its execution, which will be commenced immediately, will not exceed a period of five or six years, but this period depends above all on the native labor which will be at our disposal.

"This question of labor is very important; Union Minière is employing at present about 14,000 natives, of which 7,000 came from Rhodesia. Of the latter there are, perhaps, 1,000 or 2,000 volunteers who would probably stay permanently in the colony."

### Nichols Copper Co. Absorbs Balbach Interest in Linndale

The Nichols Copper Co. has purchased the interest of the Balbach Smelting & Refining Co. in the Linndale Reduction Co. This gives Nichols complete ownership of the Linndale interests. The new general manager is E. H. Simonson, and W. Brenton Boggs continues as general superintendent of the reduction works, which are situated at Cleveland, Ohio.

### London House Buys Two British Columbia Mines, Report

Cable advices from London state that the British-American & Foreign Corporation has purchased the Yankee Girl and the Dundee mines, situated at Ymir, in the Nelson division of British Columbia, for \$750,000. British engineers examined and thoroughly sampled these mines last summer. Both are gold mines, and generally are considered to be promising properties. They have been idle for some time.

### Change Mine Plant From Steam to Electricity

The McKinney Steel Co. has changed over from steam to electric operation the underground shaft at its Stevenson mine on the Mesabi iron range. A high-speed Ingersoll-Rand direct-connected compressor supplies the air, an old Jeffrey D. C. generator direct-connected to a 150-hp. Westinghouse motor takes care of underground and top tram haulage, and a new Ottumwa Iron Works second-motion hoist driven by 150 hp. G.E. motor operates the skips in balance. All motors operate on 2,300 volts.



*Tintie Standard headframe*  
The company may purchase the Iron Blossom mine (see p. 536)

### Tornado Damages Plant of Annapolis Lead Co.

Serious damage to the milling plant of the Annapolis Lead Co., in Iron County, in Southeastern Missouri, caused by the tornado of March 18, has stopped production. According to available reports buildings and some equipment were badly wrecked, but the heavy machinery is not seriously injured. The power and crusher houses are said to have suffered damage, as did minor buildings including the change house, carpenter shop, machine shop, and many dwelling houses. The company has been producing about 250 tons of lead per month, but operations have ceased, and no definite statement has been made as to the probable time of resumption.

### World's Next Big Copper Producer in Peru?

Preliminary geological reports on the new Antamina copper-silver deposit in the Department of Ancash, in Peru, make the copper content average 4 and 6 per cent, but claim the presence of some ore running as high as 10 and 12 per cent. The ore is said to contain silver and gold, although these do not equal ore from Cerro de Pasco.

The transportation of the ore involves the building of 256 km. of railroad, 118 of which is still to be built, and this stretch includes the Canon del Pato, which is considered to involve the most difficult piece of railway construction ever undertaken in Peru. It is estimated that several years more will be taken for the completion of this line and that a total investment of \$20,000,000 would be required before shipments of copper could be started. Those interested in the Antamina project claim that if developed this mine will become the second greatest copper property in the world, surpassed only by Katanga, Africa, and will be a much greater producer than Cerro de Pasco or Chuquicamata, Chile, according to H. Bentley MacKenzie, Commercial Attaché at Lima, Peru.

### Bid of \$5,000,000 for British America Nickel Property

The properties of the British America Nickel Corporation, in the Sudbury district in Ontario, put up for sale by public auction, by the liquidator, brought a bid of \$5,000,000. This was not sufficiently high to meet the reserve bid fixed by the courts. The receiver will now negotiate for a private sale of the property, and the court has fixed May 7 as the date on which bids are to be submitted.

The company has \$29,000,000 of securities, included in which are \$6,000,000 first-mortgage bonds, \$6,000,000 "A" security, and \$12,500,000 "B" security. The largest interests in the property are held by Norwegians, and the British Government invested \$3,000,000 in the enterprise as a war-time measure, to increase the production of nickel for armament purposes and also to provide that the Germans should not get an increased supply through the increase of the Norwegian plant.

## News from Washington

By PAUL WOOTON  
Special Correspondent

### Hoover and Advisory Committee Likely to Continue Gold-silver Inquiry

Senator Oddie Has Confidential Cost Data Carefully Locked Up—  
Relates Importance of Work

CONTINUATION of the mining cost investigation conducted by the Senate Commission of Gold and Silver Inquiry, under the auspices of an advisory committee and in co-operation with the Department of Commerce, has been discussed by Secretary Hoover of the Commerce Department and Senator Tasker L. Oddie, of Nevada, the chairman of the Senate Committee on Mines and Mining, who also served as chairman of the Gold and Silver Inquiry. This action was made necessary by the fact that the Commission of Gold and Silver Inquiry expired by limitation on March 4. Senator Oddie made an exhaustive report on the work of the commission and pointed out the need for its continuation, in an extended speech on the floor of the Senate. Through parliamentary maneuvering, however, he was prevented from securing a vote on his resolution which would have authorized the continuance of the work during the Sixty-ninth Congress. It is conceded very generally that had he been able to bring the resolution to a vote it would have been adopted. In connection with the pursuit of the mining cost investigation, Senator Oddie has laid before Secretary Hoover the following statement:

"In view of the very great importance to the industry of this particular branch of the commission's work, I feel that an explanatory statement should be made to you with respect to the extreme care which has been—and will continue to be—exercised in the handling of the highly confidential information developed by the commission in its mining cost investigation.

"When this work was initiated, I gave my pledge to the mining industry that if its members would furnish answers to certain fundamental questions concerning mining costs, mining investments, and the yield on investments, those answers would be held in the strictest confidence and used only for the purpose of helping the industry.

"In order to develop the required information in proper form, I, as chairman of the Senate Gold and Silver Inquiry Commission, requested that questionnaires, covering in great detail the subjects above mentioned, be carefully prepared by the commission's engineers and accountants and distributed to the producers. The industry responded splendidly, and expended over \$150,000 in providing the data needed by the commission."

Senator Oddie explains that only the most trusted, reliable and competent experts, under the direction of H. A. C. Jennison, have had access to the ques-

tionnaires and other papers containing confidential data. Mr. Jennison has always kept them locked in a safe, of which he only has the combination, and there have been no leaks. The Senator has taken measures to see that these documents will continue to be locked up very safely even if the commission is out of existence. He says: "The obligation to preserve inviolate the confidential nature of this material has been scrupulously observed, and none of it has at any time fallen into improper hands.

#### Aggregates Only Published

"It was further agreed between the commission and the industry that the completed tabulation of the questionnaire data shall show only aggregates and totals, that nothing shall appear which will in any way serve to identify the operations of any individual or company, and that when the compilation of this data shall have been completed, the questionnaires will be destroyed."

Senator Oddie in the course of his address on the floor of the Senate commented on the work being done by the commission on non-ferrous metal-mining costs:

"Nothing whatever is known about the actual investment in the metal mining industry as a whole, and such data as are published by individual companies are obscure and in no case representative.

"The compilations on investment will consist of the actual investment, less depletion and depreciation in mines, mills, smelters, refineries, transportation facilities, and in all other agencies necessary in the recovery of the metals from the ore. The compilations and analyses of yield on investment will show this yield by the various types and groups of mines. The comparisons on investment and yield on investment will be between various groups and types of mines and between the industries producing gold and silver and the other basic industries.

"In this connection I wish to call the attention of the Senate to the fact that while the commission has expended \$31,040.94 in its mining cost investigation—which is about two-thirds complete—the gold and silver producing industries have expended no less than \$150,000 for auditing expense, in answering the commission's questionnaire. The response of the producers has been general and enthusiastic, and a very large percentage of the producing agencies is represented by the questionnaires, which have been compiled and returned."

### Forecast Transfer of Bureau of Mines to Commerce Department

TRANSFER of the U. S. Bureau of Mines from the Interior Department to the Department of Commerce by Presidential order is expected to follow the action of President Coolidge on March 19 of transferring the Patent Office to the Department of Commerce.

The Bureau of Mines is a scientific bureau intended as a direct aid to industry and commerce. Its usefulness depends largely on its ability to co-operate with industry.

The organic act of the Department of Commerce gives the President legal authority to transfer to that department those bureaus whose major purpose is along the line of the department's function. This administration and its predecessor have been active in an effort looking to the better organization of the executive departments. As an indication of its faith in its policy, it is felt that the administration should carry on reorganization to the extent that it may under the authority already vested in it by Congress.

As to the expenses of the commission, Senator Oddie said:

"The impression seems to have gained ground in some quarters that the work of the Gold and Silver Commission has been unduly expensive. If a comparison of the cost of this commission with that of other investigational agencies of the Senate during the Sixty-seventh and Sixty-eighth Congresses should be made, the commission will in nowise suffer through such comparison. It should be remembered in this connection that the work of this commission has been almost entirely of a research nature, as contrasted with the activities of practically all the other select committees and special commissions at work during the period of the Sixty-seventh and Sixty-eighth Congresses.

#### Commission Comparatively Inexpensive

"The expenses of the committee to investigate the United States Veterans' Bureau, for a period of nine months, were \$46,218.59, an average of \$5,135.39 per month; of the naval oil leases investigating committee, for a period of seven months, \$35,395.33, an average of \$5,056.47 per month; of the committee to investigate the charges against Harry L. Daugherty, for a period of four months, \$32,395.04, an average of \$8,098.76 per month; of the committee to investigate the Bureau of Internal Revenue, for a period of six months, \$38,891.28, an average of \$6,481.88 per month; of the committee to investigate the election of Senator Mayfield, for a period of nine months, \$63,215.44 an average of \$7,023.93 per month; and of the Joint Commission of Agricultural Inquiry, for a period of

seven months, \$40,381, an average of \$5,768.61 per month.

The Senate Commission of Gold and Silver Inquiry, during the twenty-two months of its existence, has spent \$110,000, or an average of but \$5,000 per month.

"In connection with this discussion, I think it may be profitable and interesting to call attention to the expenditures by the government on account of the mining industry and the government expenditures on account of the Department of Agriculture, for the purpose of making a direct comparison. This will serve to indicate the extent to which the government has supported the agricultural industry and to what extent it has supported the mining industry. My computations are based on figures obtained from the Department of Agriculture, Bureau of Mines, and Geological Survey.

"I have taken the twenty-year period from 1903 to 1922. I find that the total appropriations during this period for the Bureau of Mines and the Geological Survey, together with other activities that have been administered by the Bureau of Mines but appropriated for other bureaus and departments, amounted to \$44,000,000; while the Department of Agriculture, over the same period, received \$458,000,000—a little over ten times as much. While I deplore the limited work the government has done on behalf of the mining industry, I am of course heartily in favor of the extensive and important work done for the agricultural industry.

"To be as accurate as possible in the comparison, I decided it would be well to develop what these appropriations had been per dollar of value of production, in order that any variations arising from intangible items might be omitted. I find on this basis the mining industry received nine one-hundredths of a cent per dollar of value of mineral products in 1903, and in 1922 it received eight one-hundredths of a cent. The Department of Agriculture in 1903 received one-tenth of a cent per dollar of value of production—just about the same as the mining industry. In 1922 it received a little better than three-tenths of a cent per dollar of production value, or three times as much. The mining industry for the entire period of twenty years has received an average of \$1 for every \$2.70 which the Department of Agriculture has received. In the years 1922 and 1923, however, the ratio was one dollar to four. Obviously, the mining industry has not been getting its proper share of governmental support.

"Little is known concerning the relationship of the metal-mining industry to our economic system, and still less is known concerning the precise influence of domestic and world economic changes on the industry itself. From a purely industrial standpoint, more than half the states in the Union are engaged in some degree in the non-ferrous metal-mining industry; and gold and silver, the monetary metals of the world, are of great importance both to the nation and to the world. It is therefore unreasonable that there should be opposition to the well-directed expenditure of from \$100,000

to \$200,000 in an investigation of the gold and silver mining industry and the effect of the decreased production of these metals upon prices and exchange.

"It must be remembered that hundreds and hundreds of millions of dollars of capital are invested in the mining industry, and that scores of thousands of people are employed in that industry, and if we can complete this work it will result in better conditions in the mining industry, which will mean better conditions generally for those men. We all hope that such conditions will be brought about, which will mean better markets for the agricultural products of the country.

### Commission Reopens Hearing on Magnesite Tariff

Crude and Caustic Calcined Only To Be Investigated—Present Duties are \$6.25 and \$12.50 per Ton

As the result of applications by domestic interests for an increase in the duty on magnesite, under the terms of the flexible tariff, the Tariff Commission has reopened its investigation into costs of production of this mineral.

The original inquiry was ordered in August, 1923, as the result of applications for a reduction in duty filed by Austrian and Czecho-Slovakian producers. A preliminary hearing was held in December, 1923, but as the original applicants did not appear, and there was considerable difference in the testimony of domestic producers and importers who were present, the case was indefinitely postponed by the commission, and little field work has been done.

In its original order, the commission directed an inquiry into crude magnesite, caustic calcined magnesite and dead-burned and grain magnesite, not suitable for manufacture into oxychloride cements, and magnesite brick. In its revival of the case, the commission restricts the investigation to the costs of producing crude and caustic calcined magnesite, omitting the dead-burned and grain and the brick.

Declaring that the domestic magnesite industry is threatened with extinction by increasing imports, applications for the maximum increase, 50 per cent, were filed last December by C. S. Maltby, of San Francisco, and by the Sierra Magnesite Co., of Chicago, with its plant near Porterville, Calif. These applications dealt with all forms of caustic magnesite, and the crude.

The present duty on crude magnesite, on the pound basis, is equivalent to \$6.25 a ton, and on caustic calcined magnesite it is equivalent to \$12.50 a ton.

### North Star to Sink

The North Star Mines Co., operating at Grass Valley, Calif., has decided to sink its vertical shaft an additional 2,000 ft. Our correspondent inadvertently reported that the Empire Mines Co., neighbor of the North Star, was planning to sink, and this report is reflected on page 461 of our issue of March 14.

### Chilean Nitrate Industry Has Hard Fight Ahead

Synthetic Product Big Factor—Duponts May Retire From Chile—Guggenheims Ready To Join Association

The Chilean producers of nitrate of soda and the European producers of synthetic nitrogen gradually are drawing tighter their battle lines. So rapidly has the synthetic industry grown that it now is challenging the control the Chilean association continues to hold over prices.

To meet the encroachment of synthetic nitrogen, the Chileans already have embarked on a program of research looking to the improvement of its processes and to the putting of its business on the most efficient basis. None would be surprised by an early move toward securing a reduction of the export tax. Such a concession has been made less likely by the political disturbances which have been rending Chile. The government is in no position at this time to forego any of its revenue. This fact, together with the demoralization and increased costs which are certain to accompany such a state of affairs as now exists in the southern republic, is recognized as giving the synthetic industry a distinct advantage at a psychological time.

Significance is attached in Washington to the reported intention of the Duponts to retire from Chile and sell their nitrate lands. They have embarked in the synthetic industry at Clinchfield, W. Va. Evidently, too, the Guggenheims are impressed with the need for close co-operation among nitrate producers in Chile, as they have transferred their interests to a British company in which they are interested and which will bring their lands into the association.

### Federal Trade Commission Alters Policy

The Federal Trade Commission will not entertain proceedings of alleged unfair practices where the alleged violation of law is a private controversy redressable in the courts, except where such practices substantially tend to suppress competition as affecting the public, according to a ruling concurred in by Chairman Van Fleet and Commissioners Hunt and Humphrey. Hereafter in all such cases there must be three parties involved, the respondent, the competitor injured, and the public. In cases where the alleged injury is one to a competitor only, and is redressable in the courts by an action by the aggrieved competitor, and the interest of the public is not substantially involved, the proceeding will not be entertained.

Another change in procedure is that a proposed respondent shall be given a hearing to show cause why a complaint should not issue. Under the old rule a notice and hearing is given after the complaint is issued. A majority of the commission is of the opinion that the mere issuance of a complaint often is of damage to a respondent, even though it shall be found that the respondent is not guilty of the practices charged.



## London Letter

By W. A. Doman  
Special Correspondent

### See Possible Alteration of Burma Mines Orebody

Fire May Change Treatment Problem—  
Little Ore From Chinaman Stopes  
—Falcon Outlook Dark

London, March 11—Several mining engineers still fail to understand the condition of affairs at the Burma Corporation mine, at Bawdwin. The latest official information is to the effect that the barricades are made effective, that the fire is confined to the sealed area, and is now under control. Very little smoke is now issuing from this area, which is being kept full of gas to assist in the process of extinguishing the fire. It is the gas item that mystifies, and the view is still held that if the fire continues sufficiently long the character of the ore may change, necessitating an alteration in the treatment plant. Other technical men rely upon Mr. Marmion, who, being on the spot, is regarded as knowing how best to deal with the disaster. Only a small section of the Chinaman orebody is available for stoping, and the value here is "considerably below average grade."

Shareholders in Falcon Mines (Rhodesia) are scarcely likely to be surprised at the results for the last eighteen months, contained in the report of the directors, just issued, for warning notes have been sounded on previous occasions. The grade of the ore treated has been low, 200,562 tons yielded only 2,879.66 short tons of copper, 27,338 oz. of fine gold, and 57,751 oz. of silver, or 30s. 2d. per ton of ore treated. Costs at the mine were 33s. 3d., and after making adjustments there was a net operating loss of £27,336. These figures were to June 30, while a further loss was incurred to Dec. 31. The mine may yield ore for another four months, but not at a profit, and unless an improvement in grade occurs, shutting down must be considered. To test the remaining ground thoroughly, the Rhodesian Government has agreed to advance the company £1,000 monthly for six months as from February, and the Rhodesian Railways, the Wankie Colliery Co., and the Gold Fields Rhodesian Development Co. have also in combination agreed to advance an equal amount. The company has one more string to its bow; it has obtained a working option on a copper property in Northern Rhodesia by arrangement with the Gold Fields Rhodesian Development Co.

Though the Ashanti Goldfields Corporation returns to the dividend list with 25 per cent for the twelve months to Sept. 30 last, the most important and most interesting part of the annual report is that of the consulting engineer, W. R. Feldtmann. The method of treatment has been changed from wet to dry crushing and roasting—in fact, it is a reversion, and the alteration has entirely justified itself, both from the standpoint of costs and extraction, these being 2s. and 10s. respectively,

in favor of dry crushing. The trouble was the fuel problem, an ever-present source of anxiety and frequently the cause of absurdly high costs. Mr. Feldtmann is clearly not satisfied even now, for he says: "The course at present indicated seems to be to make the best of the 'all-roasting' treatment unless and until such time as some further advance in metallurgical knowledge gives grounds for reconsidering the problem afresh."

## Johannesburg Letter

By John Watson  
Special Correspondent

### January Gold Production Down in Ounces and Value

Platinum Deposits Described by P. A. Wagner—Conditions Resemble Those in Urals

Johannesburg, Feb. 17—The following crushing results for the month of January, arranged in order of profits earned, have recently been published:

	Tons Crushed	Value or Revenue £	Costs per Ton Milled s. d.	Esti- mated Profit £
Government				
Areas.....	166,500	318,408	16 4.4	185,138
New Modder	126,000	270,428	17 5.7	160,313
Crown Mines	230,000	303,676	18 9.3	87,758
Modder Deep	45,200	102,802	15 10.0	67,010
Van Ryn				
Deep.....	68,000	123,644	17 6.5	65,004
Springs.....	68,300	130,065	20 4.6	60,457
Brakpan.....	82,000	133,251	19 4.2	53,927
Geduld.....	77,800	115,934	18 0.0	45,776
City Deep...	99,000	157,069	22 7.6	45,024
Modder B...	63,500	108,121	20 1.3	44,272
New State				
Areas.....	66,000	108,874	20 10.7	40,249
Robinson				
Deep.....	81,000	108,874	16 11.2	40,232
West Springs	45,000	76,501	18 2.7	35,448
Randfontein				
Estates....	187,000	203,413	19 4.3	25,047

The output of gold for January was declared on Feb. 10 by the Transvaal Chamber of Mines as 823,692 oz., having a realizable value of £3,498,821. The January price was approximately 85s. per ounce, which is a drop of 3s. compared with December. The January output shows a fall of 1,581 oz., the decrease in value being £132,380. The native labor returns show an increase of 3,678 "boys" working on the gold mines of the Witwatersrand.

At the February meeting of the Geological Society of South Africa, P. A. Wagner read the paper on "Platinum-bearing Hortorolite-dunite of the Lydenburg District," prepared by E. T. Mellor and himself. Within the last five months, promising discoveries of platinum have been made in the Lydenburg district, over a strip of country nearly 60 miles long. The platinum occurs as a constituent of ultra-basic and basic rocks in the norite zone of the Bushveld igneous complex and in alluvial deposits derived from their disintegration, the conditions under which the metal is found being very similar to those in the Ural Mountains and Colombia. An occurrence of dunite, on the farm Onverwacht, carried platinum in considerable quantity, one assay of 33.8 dwt. to the ton having been obtained. Prospectors in the Waterberg district had been discouraged because they could not see the platinum, though high assays were obtained over a limited area.

## Toronto Letter

By Our Special Correspondent for  
Northern Ontario

### Quebec Bids for Smelting Plant for Rouyn Ores

Reports Are That Tax on Exported  
Ores Will Be Higher—  
Bounty on Iron Ore

Toronto, March 21—In connection with the proposed new Tax Act in the Province of Quebec, details of which were given in these columns a short time ago, it is understood that the province will exact a higher rate of taxation when and if ores are smelted outside the province. It is understood that in the latter case the rate will be three times the normal rate. This provision is apparently with the object of providing for the establishment of a smelter in the province to treat gold-copper ores of the Rouyn section. It is also understood that there is a proposal by the Duke interests, associated with the American Cyanamid Co., to erect a smelter near the Duke-Price power development, where one of the largest hydro-electric plants in the country is being constructed. The province also proposes to introduce a measure to provide for a bounty of 40c. per ton on iron ore produced in Quebec.

Drifting on the 115 level of the Cobalt Contact property, in Cobalt, has disclosed a substantial width of high-grade ore. Developments also continue on the Violet property of the La Rose, the winze now showing 80 ft. of high-grade mill rock and high-grade ore. A new level will be established at 880 ft. About twenty-five tons a day of mill rock is being shipped.

With the 12 per cent dividend checks of the Keeley Silver Mines, is a financial statement showing cash, investments, and net value of ore on hand, in transit, and at the smelter, amounting to \$1,218,970. This will be reduced by the amount of the dividend—\$240,000.

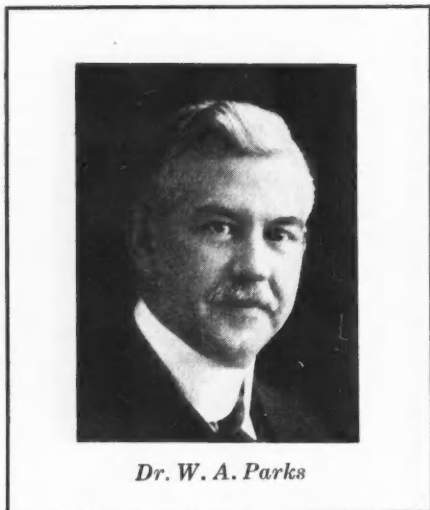
The Huronian Belt Co. states that during February the Keeley produced 125,281 oz. of silver and 13,350 lb. of cobalt. During the same period, the Vipond Mines, of Porcupine, produced \$47,200 from 4,737 tons. The good results obtained by diamond drilling below 1,000 ft. were checked and amplified by similar work done during February. Further work on the No. 10 vein above the 1,000 level has proved the oreshoot for a length of 100 ft., averaging \$9 over a width of 5 ft.

Rumors regarding the Dome Mines, of Porcupine, are once again laid at rest by the declaration of the regular quarterly dividend of 50c. a share payable April 20 to shareholders of record March 31.

Better results have been obtained on the Coniaurum property in the McIntyre section of the Porcupine district, where diamond drilling has recently indicated \$8 ore over a width of 6 ft., in the basalt underlying the porphyry. During the last seven months, approximately 6,000 ft. of cross-cutting and drifting has been done on this property, in addition to a considerable amount of diamond drilling.

## Men You Should Know About

**J. M. Hill**, geologist, U. S. Geological Survey, recently addressed the California Commonwealth Club's Section on Mineral Resources on the California High Grading bill, now under consideration by the California State Legislature.



*Dr. W. A. Parks*

**Dr. W. A. Parks**, professor of geology at the University of Toronto, has been elected president of the geology section of the British Association for the Advancement of Science in succession to the late Dr. Willet G. Miller.

**Victor G. Hills**, mining engineer, of Denver, is making a mine examination in southern Arizona.

**J. A. Burgess**, mining engineer of San Francisco, has returned from a mine examination trip to Venezuela.

**A. Wende** has resigned his position as manager of the Wright-Hargreaves gold mine, of Kirkland Lake, northern Ontario.

**G. L. Sheldon**, of the Jauja mine, Choix, Sinaloa, Mexico, is in Los Angeles on a business trip. He will return to Mexico about April 1.

**Norman Carmichael**, formerly general manager of the Arizona Copper Co., has been visiting the Morenci and Bisbee districts.

**G. G. Oberfell**, inventor of the charcoal process for the recovery of gasoline from casinghead gas, has become director of research for the Phillips Petroleum Co.

**C. Lorimer Colburn**, for many years Assistant Chief Mining Engineer of the U. S. Bureau of Mines, has resigned from the Bureau and will take up mining at Cripple Creek, Colo.

**D. C. Jackling** has been in Salt Lake City, from which point he has made trips of inspection to the mine and mills of the Utah Copper Co., at Bingham, Garfield, and Magna.

**George E. Beavers** has recently been promoted from superintendent of the acid department to general superintendent of the Tennessee Copper Co.'s plants and mines at Copperhill, Tenn.

**Edward D. Adams**, well known as a financier and a member of engineering

societies, will be tended a testimonial dinner by his many friends on April 9, at the Waldorf-Astoria, in New York.

**Enoch A. Barnard**, superintendent of the Cottrell plant of the Anaconda Copper Mining Co., recently paid a visit to the School of Mines of the University of Idaho, of which he is a graduate.

**Hugh Hamilton**, a director of the Vacuum Oil Company Proprietary, Ltd., left Sydney on Feb. 18 on a visit to America. He intends to return to Australia by way of England and the Continent.

**John M. Sully**, general manager of the Chino mines, in Santa Rita, N. M., has returned from a month's trip to New York in the interests of the company. Mrs. Sully accompanied her husband on the trip.

**R. W. Norrington**, of New York, accompanied by several others interested, has arrived at Amos, Que., to make an inspection of the Clark claim in Bourlamaque Township, in northwestern Quebec.

**R. L. Feagles**, metallurgical engineer and assistant general manager of the Deister Machine Co., with which he has been associated for twelve years, has resigned to accept a position as general manager for the Chalfant Can Co.

**Daniel M. Drumheller**, manager of the Hewer mine, on Pend Oreille Lake, Idaho, recently addressed the associated miners at the University of Idaho, giving them a detailed description of the mining operations at the Hewer property.

**Prof. William Morris Davis**, geologist and geographer, and for many years a member of the faculty of Harvard University, was in Riverside, Calif., recently for the purpose of making an inspection for fault lines near Beaumont, Hemet, and San Jacinto, in California.

**W. G. Hanson**, of Iron River, Mich., has been advanced from superintendent of the mines of the Verona Mining Co. to assistant to the general manager, **C. E. Lawrence**, of Iron River. The company is a subsidiary of Pickands, Mather & Co. and operates five iron mines.

**Loomis, Suffern & Fernald**, of 50 Broad St., New York City, announce the retirement of **J. S. Morris Goodloe** from this firm, and that Loomis, Suffern & Fernald will henceforth be composed of the following members: **Edward L. Suffern**, **Henry B. Fernald**, **W. Homer Conkling**.

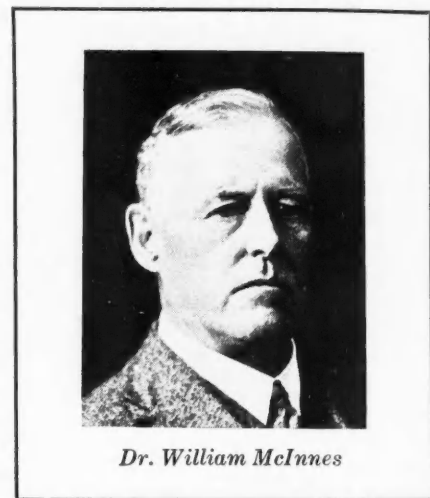
**A. L. Gordon**, vice-president and general manager of the New York & Honduras Rosario Mining Co., is in New York on a short visit. He will return to Honduras in a month. His company stands about seventh among North American producers of silver from silver ores.

**R. S. Sterling**, of Houston, Tex., has resigned as president and chairman of the board of directors of the Humble Oil & Refining Co. **Wallace E. Pratt**, chief geologist since 1918, has been

elected to fill Mr. Sterling's place on the board of directors, and **W. S. Farish** has been elected president.

### Obituary

**Dr. William McInnes**, of Ottawa, died on March 10. Dr. McInnes was appointed to the staff of the Geological Survey of Canada in 1882 and spent several years in the study of the Palaeozoic sedimentary formations of New Brunswick. The years 1890 and 1900 inclusive were spent in mapping the Pre-Cambrian formations of western Ontario. During the next ten years he was engaged in exploratory work in the district of Patricia, in northern Ontario, and in northern Manitoba and Saskatchewan. The results of his work are set forth in numerous publications of the Canadian Geological Survey. He was one of the editors of the three-volume work on the "Coal Resources of the World" and the "Compte-Rendu" of the twelfth International Geological Congress, which met in Canada in 1913. In 1915 he was made "Directing Geologist in



*Dr. William McInnes*

charge of all geological and field parties," and in 1919 was created Director of the Geological Survey of Canada, the highest position in the gift of the Survey. From this post he was transferred in 1920 to the position of Director, Victoria Memorial Museum, and Editor-in-Chief, Department of Mines. This office he held until his death. He was elected Fellow of the Geological Society of America in 1889 and Fellow of the Royal Society of Canada in 1912.

**George Middleton**, head of the Dominion Government Assay Office at Vancouver since 1907 and connected with the staff since its inception, in 1901, died at San Diego, California, on March 8. Mr. Middleton has been in failing health for some time.

The Association of American State Geologists, at a recent meeting held at Ithaca, N. Y., passed a memorial resolution for **Dr. Thomas L. Watson**, late State Geologist of Virginia, who died in November last.

**Austin Goodard Gorham**, metallurgist and widely known as an expert on iron and coal, died recently at Buxton, Me.

## Recent Technical Publications

Reviews, Abstracts, and References

### Geology for Civil Engineers

**Engineering Geology.** H. Ries and T. L. Watson. Third Edition. Revised. John Wiley & Sons, Inc., New York. Price \$5.

This is a useful and comprehensive volume, containing those characteristics of rocks and those features of geology which it is essential that an engineer should understand. The book is written for the civil engineer, and to such will be a mine of information. There is some question, indeed, whether it is not too comprehensive for easy assimilation by the type of engineer to whom it is addressed. This suggestion will not hold, of course, if the book is used as a reference book. As a textbook for civil engineering students, also, it should prove adequate. J. E. SPURR.

### Four German Publications

**Mitteilungen des Chemiker-Fachauschusses der Gesellschaft Deutscher Metallhütten und Bergleute.** I. Teil. Ausgewählte Methoden für Schiedsanalysen und kontradiktorisches Arbeiten bei der Untersuchung von Erzen, Metallen und sonstigen Hüttenprodukten. Selbstverlag der Gesellschaft Deutscher Metallhütten und Bergleute e.V., Königgrätzerstr. 106, Berlin SW 11, Germany. Preis \$2.

This book contains chapters on lead, copper, zinc, antimony, arsenic, aluminum, precious metals, and the steel-hardening metals, and will be of interest to chemists who read German.

**Hydromechanik.** Eine Einführung mit durchgerechneten Aufgaben und Beispielen. Von M. Samter. Buchhandlung Kiepert am Knie, Charlottenburg, Germany. Preis Mk. 3.20. A short book of 96 pages giving a theoretical discussion of the important principles of hydrostatics and hydrodynamics.

**Weltmontanstatistik.** Die Versorgung der Weltwirtschaft mit Bergwerkserzeugnissen. I. 1860-1922. 1 Teil. Kohlen, Erdöl, und Salze. Bearbeitet von M. Meisner. Preis Mk. 12.60.

A statistical study of the coal, petroleum, and salt industries of Germany and the world.

**Das technische Eisen.** Konstitution und Eigenschaften. Von Paul Oberhoffer. Zweite auflage. Verlag von Julius Springer, Berlin. Preis Mk. 31.50.

An exhaustive book of 600 pages, well illustrated, on the metallography and heat treatment of iron and steel.

**Wyoming Phosphate—Bulletin 764** of the U. S. Geological Survey, Washington, D. C., 39 pages, obtainable for 15c. from the Superintendent of Documents, Washington, D. C., describes the "Phosphate Deposits in the Wind River Mountains, near Lander, Wyoming." This phosphate is somewhat more accessible for the wheat belt of the Great Plains than are the Idaho deposits. The bulletin is by D. Dale Condit.

**Diamond Mining—M. Harbottle** in the *Zeitschrift des Vereines deutscher Ingenieure* for Aug. 9, 1924, gives a detailed description of the extraction of blue earth in the diamond fields of South Africa.

**Sulphur—The Explosives Engineer** for January (Wilmington, Del.; price 25c.) has an article by Albert G. Wolf on "Sulphur," explaining the mechanism of the Frasch process of extraction, and how the solid brimstone is blasted for shipment.

**Antimony Ores—The Mines Branch,** Department of Mines, Ottawa, Canada, recently issued a mimeographed bulletin of 6 pages (Bulletin No. 17; memorandum series) on "The Lake George Antimony Ores and Their Concentration," by C. S. Parsons. From the experimental work, straight flotation was recommended. The bulletin may be obtained on request.

**Precious Metals—"Der Edelmetallhandel im Jahre 1923,"** 103 pages, has recently been issued by Jacob & Scheidt, Berlin, NW. 7, Germany. This is a statistical summary of production, prices, exports, and stocks of the precious metals for all of the various countries of the world.

**Alaska — "Mineral Resources of Alaska,"** 1922, 222 pages, by A. H. Brooks and others, was recently issued by the U. S. Geological Survey, Washington, D. C., as Bulletin 755, obtainable on request. In addition to a general report on mining in that territory, special chapters are included on the metalliferous deposits of Chitina Valley, by F. H. Moffit; geology and mineral resources of the region traversed by the Alaska Railroad, by S. R. Capps; and the Cold Bay-Chignik district, by W. R. Smith and A. A. Baker.

**Chinese Iron Ore—Iron Trade** for Jan. 15 (Cleveland; price 25c.) has a 5-page article by Olin R. Kuhn, entitled "China's Ore Reserves Prove Small: Far East's Three Billion Tons: Modern Blast Furnaces Coming Into Use." Brief descriptions are given of the iron-ore deposits of the various provinces of China and other sections of the Far East.

**Ontario Geology—"Geology of the Upper Part of the English River Valley,"** 12 pages, by E. L. Bruce, and "Geology of the Basin of Red Lake, District of Patricia," also by Mr. Bruce, 28 pages, make up Part 4, Vol. 33 of the Annual Report of the Ontario Department of Mines, Toronto, Ont., obtainable on request. Colored maps are included.

**Newfoundland Mining—"Mining and Metallurgy in Newfoundland"** is discussed in an 8-page paper by D. James Davies in the *Bulletin* of the Institution of Mining and Metallurgy for December. Several iron, copper, and lead deposits are promising. There are no metallurgical operations in the colony. Copies of the paper are obtainable for 1s. from the offices of the Institution, Cleveland House, 225 City Road, London, E. C. 1, England.

### Patents

**Vanadium—No. 1,521,607.** Jan. 6, 1925. J. L. Dixon, Wolverhampton, England, assignor to B. R. Shover, Pittsburgh, Pa. Vanadium is extracted from vanadium-bearing iron ore by reducing the ore to metallic iron, oxidizing the iron to form a slag richer in vanadium oxide than the original ore, and subsequently reducing the slag to a metallic alloy containing vanadium.

**Smelting—No. 1,523,044.** Jan. 13, 1925. Isaac Van den Broek, Boston, and F. S. Nisbet, Roslindale, Boston, Mass. A process of treating ore, comprising sintering a mixture of ore, flux, and fuel, with subsequent smelting in a reverberatory furnace.

**Copper Extraction—No. 1,523,444.** Jan. 20, 1925. P. W. Nevill and Herbert Soanes, Perth, Western Australia, assignors to the Australian Minerals Recovery Co. Oxidized copper ores are ground and treated with metallic iron and an electrolyte in amount insufficient to dissolve all of the copper, thereby converting the oxidized copper contents of the ore into metallic copper, which is separated from the remainder of the pulp.

**Sintering—No. 1,523,550.** Jan. 20, 1925. R. L. Lloyd, New York, assignor to Dwight & Lloyd Sintering Co., New York. A method of sizing the product of a sintering machine, returning the fine material for a second treatment.

**Nickel Refining—No. 1,523,779.** Jan. 20, 1925. N. V. Hybinette, Wilmington, Del., assignor to National Trust Co., Toronto. Lead is removed from nickel by smelting the nickel or alloy with an oxidizable material, and oxidizing the molten bath to remove substantially all the oxidizable material and the lead.

**Mine Signaling—No. 1,523,805.** Jan. 20, 1925. A. J. Gurney, Canton, Ohio, assignor to the American Mine Door Co., Canton, Ohio. Apparatus for a mine-signaling system.

**Lead Refining—No. 1,523,980.** Jan. 20, 1925. F. F. Colcord, New York, assignor to United States Smelting, Refining & Mining Co., Portland, Me. A method of purifying antimonial lead by subjecting the molten alloy to the action of an alkali at temperatures to cause the arsenic in the alloy to unite with the alkali without affecting the antimony.

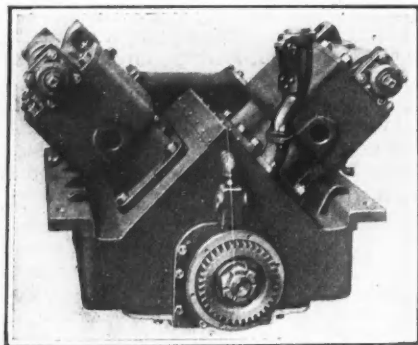
**Ore Reduction—No. 1,524,182.** Jan. 27, 1925. J. A. Kjölberg, Svelgen, near Bergen, Norway. Finely powdered ore is mixed with gas in a mixing chamber the mixture maintained in a whirling motion, and projected into a heated reaction space through constricted discharge openings.

**Smelting Furnace—No. 1,524,359.** Jan. 27, 1925. E. E. King, Centerton, Ark. Design of a smelting furnace with an externally heated ore chamber.

No. 1,524,397. Jan. 27, 1925. Arthur Jones, Belleville, Ill., assignor to U. S. Smelting Furnace Co., Belleville. Design for a combustion and smelting chamber.

**Dezincing—No. 1,526,910.** Feb. 17, 1925. Wolfgang Job, Berlin-Dahlem, Germany. A method of removing volatizable metal from slag or ores in a blast furnace.

## New Machinery and Inventions



Arranging the compressor cylinders at right angles gives a counterbalancing effect that secures marked reduction in vibration

### Angle-Type Portable Compressor Is Smooth Running

Counterbalancing of Cylinders Reduces Vibration—Construction Simple—Capacity 220 Cu.Ft.

A new portable air compressor of 220 ft. capacity that has recently been introduced by the Sullivan Machinery Co., of Chicago, embodies a number of interesting features. Compressor cylinders of the same size have been utilized as in the 110-ft. Sullivan portable—namely, 5½-in. diameter by 5-in. stroke, single-acting, but there are four of these cylinders, and instead of being arranged in a line vertically, they are set in pairs, each pair being at right angles with the other, forming a "V." Each pair is thus at an angle of 45 deg. with the vertical axis of the machine.

The pairs of cylinders are slightly offset lengthwise, which permits operation from a single crankshaft. There are only two crank pins, but each pin accommodates two connecting rods, side by side. The rods for the two forward cylinders are attached to one pin, and the rods for the two rearward cylinders are connected to the other. Counterweights are provided on the crankshaft, as in the case of the 110-ft. unit, and the construction also follows that machine in providing a heavy square-rim flywheel at the rear end of the compressor, inside the housing.

It is obvious that the 90 deg. arrangement of the pairs of cylinders provides an excellent counterbalancing effect, similar to that in the Sullivan angle compound compressors of the stationary pattern. This balancing secures a marked reduction in vibration. The two-cylinder vertical 110-ft. unit operates on its cast-steel frame with markedly little perceptible vibration, but the four cylinder WK-314 angle, or "V" type compressor, whether mounted on the standard steel-wheeled truck, on the trailer-type rubber-tired truck, or on skids, runs as smoothly and with as little vibration as if bolted to a concrete base set in a permanent power plant.

This compressor will operate two or three Rotator rock drills, three or four concrete breakers or tampers, or seven to nine riveters or clay spaders.

### Flywheel Synchronous Motors for Driving Compressors

The results gained by applying the direct-connected synchronous motor to air compressors of the larger capacities have led to the development of synchronous motors suitable for driving compressors of smaller size. Until recently the high first cost of the small direct-connected motor placed it at a great disadvantage in competing with belted induction motors. This handicap was due largely to the weight per horsepower of the synchronous motor, which ascended very rapidly in the smaller sizes.

The general standard construction of synchronous motors necessitates large diameters for slow speed ratings such as are encountered in air-compressor operation. This is due to the fact that pole space must not be too crowded and that a certain amount of flywheel effect is required, which must be concentrated in the rotor, resulting in unusually heavy bearing pressures because of the weight necessary at a small radius to give the required effect, thus making the rotor unsuitable for mounting on an overhung shaft as in the case of a center crank compressor without outboard bearing.

To overcome the disadvantages of the present general construction there has been designed a line of synchronous motors known as the "Flywheel type," which are adapted to single straight-line air-compressor operation. This motor is designed with the rotating element outside the stator. The stator is mounted in a cradle support bolted to the compressor frame. This cradle support is bored concentric with the compressor bearings to assure perfect alignment of the stator and a uniform air gap when assembled. The rotor presents the appearance of an ordinary flywheel. Its face is crowned for driving an exciter or other auxiliary, and on the inner surface of the rim are mounted the poles, adding flywheel effect, of which there is an abundance.

The air gap in this motor is relatively small, and the question of maintaining a uniform gap naturally arises. This has been met by designing the stator so that the magnetic pull is upward, relieving the bearings of excessive downward pressure and giving, in effect, a floating rotor. In addition, the main bearings of the compressor are fitted with removable die-cast bushings,

which may be quickly and cheaply replaced at the first sign of wear. With these precautions little trouble may be expected from the air gap source.

With such construction as that outlined, the weight and consequently the cost of the motor have been greatly reduced; sufficient flywheel effect for steady, smooth operation has been obtained; a uniform, correct air gap has been secured; foundation expense has been reduced, and because of the simplicity of construction and the machined assembly parts, erection costs and repairs are reduced to a minimum. The floor space required to accommodate a machine so equipped is even less than if belted to a line shaft, and at least 30 to 75 per cent less than required for short belt motor drive, and the cost of the two types of electric drive are practically the same.

The Chicago Pneumatic Tool Co., 6 East 44th St., New York, is introducing direct-connected compressor units with this type of motor in sizes ranging from 139 to 1,000 cu.ft. displacement, for 100 lb. discharge pressure up to 125 lb.

### Trade Catalogs

**Fans and Blowers**—American "Sirocco" fans and blowers are described in Bulletin 1801, dated December, 1924, but just received from the American Blower Co., Detroit, Mich.; 72 pages illustrated. With the bulletin are copies of 2-page leaflets dated February, 1925, describing the American direct-fired unit heater and the "ABC" air-washing and cooling fan, respectively.

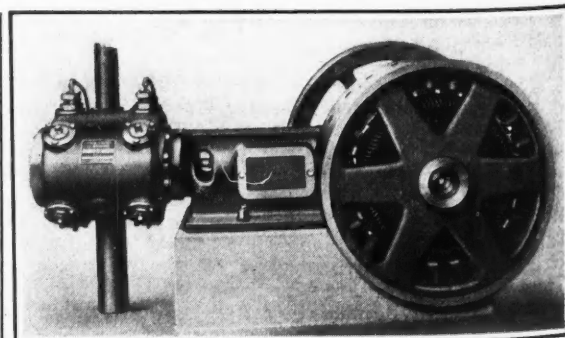
**Tube Mills**—Bulletin No. 18 of the Hardinge Company, York, Pa., describes the conical tube mill made by the company for fine grinding. It comprises 8 pages, illustrated. With it is received Bulletin No. 19, describing in 12 illustrated pages, both the cylindrical and the conical batch mill for grinding and mixing.

**Double-discharge Ball Mill**—The Fairchild double-discharge ball mill, the design of which was described in *Mining Journal-Press* of May 31, 1924, pages 904-905, has now been announced in Bulletin BM-2, 24 pages, illustrated, by the manufacturer, the Vulcan Iron Works, of Wilkes-Barre, Pa.

**Motor Trucks**—No. 67 of "The Albacross," published by the White Company, Cleveland, Ohio, is dedicated to the progress of motor transportation and to the users of it. It is issued as a record of the first quarter century of White transportation.

A direct-connected synchronous motor for driving small compressors

New design makes possible reduction in weight per horsepower and cost, which have hitherto been handicaps in competing with belted induction motors.



# The Market Report

Daily Prices of Metals

Mar.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
19	14.00	52.625	53.25	9.00	8.60	7.30
20	14.025	53.625	54.25	8.95@9.00	8.60	7.35
21	14.025	53.875	54.50	8.90@9.00	8.60	7.35
23	14.00	52.75	53.375	8.85@9.00	8.50@8.60	7.35@7.40
24	13.75@14.00	52.875	53.50	8.85@9.00	8.50@8.55	7.30@7.35
25	13.75	53.25	53.875	8.85@9.00	8.50	7.35
Av.	13.946	53.167	53.792	8.95	8.563	7.342

\*The prices correspond to the following quotations for copper delivered: March 19th, 14.25c.; 20th and 21st, 14.275c.; 23d, 14.25c.; 24th, 14@14.25c.; 25th, 14c.  
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

Mar.	Copper		Electrolytic	Tin		Lead		Zinc	
	Standard			Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
19	62 1/2	63 5/8	67 1/2	242 3/4	246 1/4	36 1/2	35 1/2	35 1/2	34 1/2
20	63	64 1/8	67 1/2	247 1/2	251	37 1/2	35 1/2	35 1/2	34 1/2
23	62 3/8	63 3/8	67 1/2	245 3/4	249 1/2	36 1/2	35 1/2	35 1/2	34 1/2
24	62 1/2	63 1/2	67 1/2	245	248 1/4	36 1/2	35	35 1/2	34 1/2
25	62 1/2	63 1/2	67	246	249 1/4	36 1/2	34 3/4	36	34 1/2

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

Mar.	Sterling Exchange "Checks"	Silver		Gold London	Mar.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
19	4.77 1/2	68	32 1/8	86s 8d	23	4.77 3/8	67 3/8	31 3/4	86s 7d
20	4.77 3/8	67 3/4	32	86s 8d	24	4.77 7/8	67 1/2	31 9/16	86s 6d
21	4.77 3/8	67 3/8	31 3/4		25	4.78 1/2	67 1/2	31 9/16	86s 4d

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.

## Volume of Metal Sales Increases, but at Low Prices

New York, March 25, 1925—The week ending today has been another one of slightly declining prices for copper and lead, though zinc and tin held firmly at about the levels of last week. Sales of copper, however, were much larger, and the total volume of lead business was somewhat better than in the previous weekly period.

### Copper at 14c. Delivered

A comparatively large tonnage of copper was sold on Thursday, Friday, and Saturday, when producers were almost without exception quoting 14c. delivered. The wire drawers were the chief buyers, though the brass mills

were also actively in the market. A large electrical company was rumored to have bought 5,000 tons at 14c., but the alleged seller disclaimed all knowledge of the transaction. Practically all inquiries were for April or May shipment; small lots of spot copper might have been picked up at slight concessions. On Friday afternoon there was some tendency to raise the price to 14 1/2c., which was secured even for Valley delivery on a part of the tonnage sold Friday and Saturday, even though some sellers complained of not being able to sell at 14c. On the three days, several million pounds were sold in the Middle West at 14 1/2 to 14.45c.

In the last three days there has been less interest in the market, owing to the decline in London copper prices, with a weak stock market having a deleterious sentimental effect. Over a million pounds of May copper was sold as early as yesterday at 14c. delivered, and more was offered by the same seller today at that price. At least two other sellers were trying to get 14 1/2c. without success, while most of the producers were out of the market at 14 1/2c.

In the week ending today, 34,000,000 lb. of copper was reported to us as sold in the domestic market.

The foreign buying, especially in France and England, has been better, but there also at declining prices. On Thursday and Friday, close to 14 1/2c., c.i.f., was realized, but today the price ranges from 14.225 to 14.325c.

### Lead Market Grows Weaker

The official contract price of the American Smelting & Refining Co. continues at 9c. per lb., New York.

The lead market was quiet all week, with one producer making most of the sales. In St. Louis the price of lead was shaded downward nearly every day, the metal finally being sold on Monday a full half cent below the official New York figure of 9c. It is available today at 8.50c. per lb. Naturally, with the weakness displayed in the West, the New York market has felt the effect. Lead was sold for 8.95c. in the New York district on Friday, whereas on Monday and Tuesday several hundred tons sold on 8.85c. basis. The bulk of the business placed by consumers was for prompt shipment of moderate-sized tonnages, indicating that the trade is not well covered, but is waiting for steadier prices or an upward turn before ordering larger amounts. In Chicago desilverized lead was sold for 8.65c. on Friday, a price that may be high now.

The weakness in London makes it possible to import lead in ores into the United States for forward shipment, but no one seems to be interested in future metal to any great extent.

### Zinc Holds Steady

Zinc prices improved somewhat a few days ago, inspired perhaps by better London cables, and as high as 7.40c. was done for April zinc on Monday. Yesterday and today the price has shaded off a little, though London has advanced enough to make export business possible for some producers. The export market has been disappointing lately, but is expected to take some of the domestic surplus off the market soon. Meanwhile, even the smaller producers are hanging on well, and there is little tendency to force sales by cutting prices. Spot zinc commands a premium of from 2 1/2 to 5 points, but most of the metal sold was for April. High-grade zinc is slightly weaker, 8 1/2@8 3/4c. about representing the market, though producers continue nominally

at the 8½c. level. It is impossible to obtain more than 8½c. in the Middle West, it is said.

### London Buys Tin Here

The feature of the tin market has been the buying of tin by London dealers in New York. Consumers have not been active, but have left the field almost entirely to dealers. At times the market has been below the cost of import, but without stimulating interest in the market or causing the London price to adjust itself.

### Silver Weaker

Silver has shown pronounced weakness, London rates declining ¼d. for spot and ⅓d. for future, and the New York quotation dropping from 68c. to 67½c. during the week. Throughout the period London has reported a quiet market, with little business done, India appearing as the buyer and China as the seller in these operations. In the New York market London bids have frequently been below the "fixed" quotation, and India, although a moderate buyer for forward delivery, is interested only at a considerable discount. The decline in price has tended to curtail local sales, and the tone of the market at the lower level appears somewhat better.

Mexican Dollars: March 19th, 52½c.; 20th, 52½c.; 21st and 23d, 52c.; 24th and 25th, 51½c.

### Foreign Exchanges Quiet

Foreign exchanges were substantially unchanged during the week. On Tuesday, March 24, closing cable quotations on francs were 5.24c.; lire, 4.0725c.; and marks, 23.81c. Canadian dollars, ⅓ per cent discount.

### Other Metals

Quotations cover large wholesale lots unless otherwise specified.

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

#### Antimony—

Chinese brands, 14½@14¾c. per lb.

Cookson's "C" grade, 17½@17¾c.

Chinese needle, lump, nominal, 10c.

Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb<sub>2</sub>O<sub>3</sub>, 16@16½c.

**Bismuth**—\$1.95 per lb., in ton lots. London, 7s. 6d.

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

**Iridium**—\$350@375 per oz. London £70.

**Nickel**—Ingot, 31c.; shot, 32c.; electrolytic, 38c.; London, £170 per long ton.

**Palladium**—\$79@83 per oz. London £17. Crude, \$60@65.

**Platinum**—\$117 per oz. for refined. London, £25 per oz.

Crude, \$115.

**Quicksilver**—\$81 per 75-lb. flask. San Francisco wires \$81. Quiet. London, £14. No spot metal available.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthen-**

**ium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium** are unchanged from the prices given in the March 7 issue.

### Metallic Ores

**Chrome Ore**—\$22.50@23 per ton, c.i.f. Atlantic ports.

**Tungsten Ore**—Per unit, N. Y.:

Chinese wolframite, \$10.50@11.

High-grade Western scheelite, \$11@11.50 nominal.

**Iron Ore, Galena Radio Crystals, Manganese, Molybdenum, Tantalum, and Vanadium Ores** are unchanged from March 7 quotations.

### Lead Ore \$5, Zinc Blende \$1, Lower

Joplin, Mo., March 21, 1925

Zinc Blende	Per Ton
High .....	\$57.25
Premium, basis 60 per cent zinc .....	\$55.00@56.00
Prime Western, 60 per cent zinc .....	\$52.50@53.00
Fines and slimes .....	\$52.00@50.00
Average settling price, all..	\$52.11

#### Lead Ore

High .....	\$119.90
Basis 80 per cent lead .....	\$110.00
Average settling price, all ores...	\$115.28

Shipments for the week: Blende, 13,531; calamine, 87; lead, 2,577 tons. Value, all ores the week, \$1,171,880.

News was received here today of the destruction by fire of a large part of the smelting works of the Quinton Spelter Co., at Quinton, Okla. Three-fourths of the plant was destroyed. Jesse G. Starr, of Joplin, a large stockholder in the company, says reconstruction work will be started as soon as possible, and in the meantime no ore purchases will be made. An expenditure of \$200,000 in improvements was recently completed.

Purchases were increased 2,000 tons more than last week, with the Quinton out of the market on account of the fire, and the Empire, a subsidiary of the New Jersey Zinc Co., withdrawing from the field.

### Platteville, Wis., March 21, 1925

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

#### Lead Ore

Lead, basis 80 per cent lead.....	\$112.00
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Shipments for the week: Blende, 676 tons; lead, 40 tons. Shipments for the year: Blende, 8,134; lead, 446 tons. Shipments for the week to separating plants 1,099 tons blende.

### Non-Metallic Minerals

**Diatomaceous Earth**—\$65, pulverized grade, \$75, air float, per ton, f.o.b. mill.

Other quotations in March 7 issue.

**Mica**—White, dry ground, f.o.b. mill: 20 mesh, \$30 per ton.

40 mesh, \$50.

60 mesh, \$65.

100 mesh, \$80.

200 mesh, \$90.

Other mica prices in March 7 issue.

**Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet,**

**Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon** are unchanged from March 7 prices.

### Mineral Products

**Arsenious Oxide (white arsenic)**—5½@5¾c. per lb. Meager business.

**Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide** are unchanged from March 7 prices.

### Ferro-Alloys

**Ferromanganese**—Domestic, German, and English, \$115 per gross ton, f.o.b. works, or duty paid at seaport.

**Ferrotungsten**—Advanced to \$1 per lb.

**Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrouranium and Ferrovandium** are unchanged from the prices given in the March 7 issue.

### Metal Products

**Rolled Copper**—Sheets, 22¼c.; wire, 16½c.

**Lead Sheets**—11½c. per lb.

**Nickel Silver**—18 per cent Grade A sheets, 28¾c. per lb.

**Yellow (Muntz) Metal**—Sheets, 19¾c. per lb. Rods, 16¾c.

**Zinc Sheets**—10¼c. per lb.

### Refractories

**Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and Zirkite** are unchanged from March 7 prices.

### Steel and Iron Dull

Pittsburgh, March 24, 1925

Steel-mill operations in the Chicago district have decreased a trifle, but in general production is holding up better than expected. The quarter now ending will show an average operation of about 89 per cent or about 20 per cent above the average of the past two years.

With recent weakening in prices, sheets in the open market are below some of the contract prices, and in such cases consumers refrain from specifying and buy afresh. In bars, shapes, and plates the weakening has not extended as far as that.

**Pig Iron**—The market has continued quiet and is not especially firm, with bessemer at \$22, basic \$21, and foundry at \$21, Valley.

**Connellsville Coke**—Wage reductions by the pioneers in the movement, who announced a reduction averaging fully 30 per cent March 14, passed off so smoothly that practically all independents have now made the reduction. Most of the contracting for second-quarter furnace coke was done recently at \$3.40@3.50, but there are offerings now at \$3.25, and the spot market has declined to that figure. Spot foundry coke has weakened slightly, being now \$4@4.50.

## Company Reports

### Premier Gold Mining Co., Ltd. Gold, Silver; Premier, B. C.

The 1924 annual report of the Premier Gold Mining Co. for 1924 summarizes operations as follows:

	1923	1924
Ore mined, dry tons.....	145,665	159,014
Ore milled dry tons.....	57,796	61,965
Ounces gold produced.....	117,294	139,288
Ounces silver produced.....	2,746,551	3,015,382
Pounds lead produced.....	62,191	452,010
Broken ore reserve, Dec. 31, tons.....	93,000	147,880
Ore broken during year, tons.....	166,042	213,894

The estimated general average of the 147,880 tons broken in stopes as at Dec. 31, 1924, is 0.55 oz. gold and 17.3 oz. silver. With gold figured at \$20 per ounce and silver at 60c. per ounce, this represents a gross value of \$21.38 per ton.

A conservative estimate of the assured and probable unbroken ore down to the fourth level of the present mine workings is 420,000 tons averaging 0.54 oz. gold and 14.1 oz. silver per ton. With gold figured at \$20 per ounce and with silver at 60c. per ounce, this represents a gross value of \$19.26 per ton.

Also, there has been indicated by the diamond drilling so far done below the fourth level, 146,000 tons averaging 0.39 oz. gold and 3.2 silver per ton.

#### Balance Sheet Dec. 31, 1924

Assets		
Mining property.....		\$6,056,657.70
Investment in capital stock of B. C. Silver Mines, Ltd.—562 844 shares at cost.....		129,616.76
Current assets.....		1,979,786.15
<b>Total assets.....</b>		<b>\$8,166,060.61</b>
Liabilities		
Capital stock (par value).....	\$5,000,000.00	
Capital surplus.....	1,246,829.84	
Unrealized surplus from appreciation.....	4,000,000.00	
	\$10,246,829.84	
Less capital distribution.....	2,931,527.84	
Balance (par value \$5,000,000).....		\$7,315,302.00
Current liabilities.....		835,733.72
Workmen's compensation reserve.....		15,024.89
<b>Total liabilities.....</b>		<b>\$8,166,060.61</b>

#### Summary of Income and Profit-and-Loss Account

Value of ore sold.....	\$3,857,328.52
Operating and miscellaneous expenses.....	1,082,783.70
Earnings from mine operations.....	\$2,774,544.82
Miscellaneous losses—net.....	52,938.91
Total earnings.....	\$2,721,605.91
Deduct, administrative expenses, taxes, depreciation and depletion.....	1,633,430.92
Balance of profits available for dividends.....	\$1,088,174.99

Distributions to shareholders of \$1,715,000 were authorized in 1924.

### Butte & Superior Mining Co.

The operating results of the Butte & Superior Mining Co. for 1924 follow:

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Zinc ore produced, tons.....	70,305	65,544	72,236	186,773
Total silver in ore, oz.....	270,800	251,765	263,351	327,331
Total zinc in ore, lb.....	13,437,912	12,841,838	13,480,261	18,739,003
Copper ore produced, tons.....	44,948	40,848	37,241	44,275
Total silver in ore, oz.....	300,594	278,158	226,287	254,721
Total copper in ore, lb.....	3,811,785	3,533,937	3,056,875	3,394,660

Financial results compare as follows:

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Net value of zinc ore.....	\$433,378	\$372,043	\$351,271	\$556,555
Net value of copper ore.....	379,445	330,217	261,359	284,989
Miscellaneous income.....	10,331	9,989	9,898	10,459
Operating costs.....	\$823,155	\$712,250	\$622,529	\$852,004
	621,025	590,534	620,057	749,057
Operating profit.....	\$202,129	\$121,716	\$2,471	\$102,947
Depreciation and reserve for taxes.....	9,461	68,523	60,541	81,366
Net to surplus.....	\$192,668	\$53,193	\$58,069	\$21,580
(a) Deficit.....				

No provision has been made in the above figures for depletion.

A summary of the results for the four quarters shows an operating profit for the year 1924 of \$429,265.05; after depreciation and reserves for taxes and mill shutdown expense, amounting to \$219,892.88, the results for the year show a profit of \$209,372.17.

Exploration work which proceeded normally during the quarter did not disclose any important new body of either copper or zinc ore, nor did it result in any material extensions of orebodies already known, although on upper levels of the copper ore deposit considerably more ore was opened up and put in measurable form than was mined, thus resulting in some increase in recorded reserves of copper ore available for mining.

### Vanadium Corporation of America

The fifth annual report of the Vanadium Corporation of America, for 1924, states that the reduction plant at Bridgeville, Pa., continued in operation throughout 1924 at practically the same rate as in 1923, and sales of alloy for the year were slightly in excess of those of 1923. The mines in Peru have maintained a steady and satisfactory output; the stock of ore in this country has been materially increased; and the corporation is in a most favorable position to meet increased future demands for its chief product.

On Dec. 20, 1924, the Vanadium Corporation of America acquired the entire capital stock of 30,000 shares of the par value of \$100 of the United States Ferro Alloys Corporation, together with its properties and other assets. The consideration was \$2,500,000.

#### Income and Surplus Accounts, 1924

Net earnings from operations.....	\$908,743.18
Other income.....	119,297.73
<b>Total.....</b>	<b>\$1,028,040.91</b>
Total income charges (depreciation and depletion).....	297,207.89
Net income for year.....	\$730,833.02
Earned surplus—balance, Jan. 1, 1924.....	766,879.18
Balance, being earned surplus at Dec. 31, 1924.....	\$1,497,712.20

#### Balance Sheet, Dec. 31, 1924

Assets		
Current assets.....		\$6,343,557.19
Investment in stock of associated company.....		20,000.00
Real estate mortgages receivable.....		32,000.00
Total deferred charges.....		171,673.08
Capital assets.....		12,453,241.37
		\$19,020,471.64
Liabilities		
Current liabilities.....		\$445,091.42
First-mortgage 6 per cent bonds.....		1,161,184.50
Total reserves.....		592,786.85
Capital and equity:		
Capital stock.....	\$15,323,696.67	
Surplus, per annexed account.....	1,497,712.20	
Total capital and equity.....		16,821,408.87
		\$19,020,471.6

### Hecla Mining Co.

The Hecla Mining Co.'s ore-sorting plant at the mine was placed in operation in September of 1924, and brought ore production to the same rate as prevailed before the fire which destroyed the surface plant in July, 1923. During 1924 a winze was sunk to the 2,400 level, 100 ft. below the lowest point previously reached on the Hecla vein. At the lower level a crosscut was extended to the vein and the vein was drifted on for 100 ft. A substantial ore showing was disclosed, of the same character as that on higher levels. The company has stopped work on this level and has resumed sinking in the winze, which will be advanced to the 2,800 level. Work of raising on the Wide West vein has been started, but at the time of making the report it had not been completed.

Ore reserves are estimated at 1,831,900 tons, without tak-

ing into the estimate any tonnage disclosed in the winze below the 2,000 level.

**Balance Sheet, Dec. 31, 1924**

Assets		
Current assets.....		\$976,657.70
Working assets.....		235,590.60
Investments (Sullivan Mining Co.).....		515,138.43
Total fixed assets.....	\$2,353,909.49	
Less depreciation reserves.....	722,265.78	
		\$1,631,643.71
Liabilities		
Current liabilities.....		\$281,312.80
Capital and Surplus		
Capital stock.....		\$3,077,717.64
		\$3,359,030.44
<b>Income and Expenditures for 1924.</b>		
Income		
Ore sales—net receipts.....	\$3,019,836.76	
Interest.....	23,096.09	
Rents.....	9,997.28	
Miscellaneous.....	16,301.41	
		\$3,069,231.54
Expenditures		
Mining and development.....	\$928,631.86	
Crushing, conveying and ore sorting.....	41,663.78	
Ore haulage—mine to mill.....	28,613.01	
Milling.....	118,990.71	
Miscellaneous.....	191,492.71	
		1,309,392.07
Operating income.....		\$1,759,839.47
Depreciation.....	\$144,780.49	
Depletion.....	9,232.84	
		154,013.33
		\$1,605,826.14
Use and occupancy insurance and adjustment of permanent improvements, account of fire.....	\$309,418.72	
Fire loss and extraordinary expense.....	19,895.08	
		289,523.64
Net profit.....		\$1,895,349.78
Dividends.....	\$1,000,000.00	
Taxes.....	52,579.58	
		1,052,579.58
Addition to surplus.....		\$842,770.20
Surplus, Dec. 31, 1923.....		1,984,947.44
		\$2,827,717.64
Surplus, Dec. 31, 1924.....		

**Kirkland Lake Gold Mining Co., Ltd.**

The year 1924 has assured the Kirkland Lake Gold Mining Co. ample funds to carry on a strong campaign of development, according to the company report issued under date of Feb. 17.

**Balance Sheet Dec. 31, 1924**

Assets		
Capital.....		\$1,313,151.64
Current.....		59,691.37
Deferred.....		460,241.53
		\$1,833,084.54
Liabilities		
Capital Stock		
Preferred shares.....	\$680,561.00	
Common shares.....	2,361,123.00	
		\$3,041,684.00
Wages payable.....	\$3,358.09	
Accounts payable.....	8,410.73	
		11,768.82
Reserves		
Depreciation on buildings, plant and equipment.....	62,916.77	
		3,116,369.59
		\$1,283,285.05
Discount on shares.....	\$1,094,066.42	
Profit and loss account.....	189,218.63	
		1,283,285.05

**Mining Account, Dec. 31, 1924**

Earnings		
Rents.....	\$1,360.73	
Bullion sales—four months milling.....	46,512.73	
		\$47,873.46
Operating loss.....		20,457.51
		\$68,330.97
Expenses.....		\$68,330.97
<b>Development Account—Dec. 31, 1924</b>		
Balance forward from Dec. 31st, 1923.....		\$357,424.84
Operation.....	\$89,514.31	
Administration.....	10,654.33	
		100,168.64
Development expenditures undistributed.....		\$457,593.48
<b>Profit-and-Loss Account, Dec. 31, 1924</b>		
Balance forward from Dec. 31st, 1923.....		\$169,587.38
Transferred from Mining Account, Dec. 31st, 1924.....		20,457.51
		\$190,044.89
Interest on bank and other accounts.....		826.26
Debit balance, Dec. 31st, 1924.....		\$189,218.63

**Victoria Copper Mining Co.**

Copper; Michigan

The directors of the Victoria Copper Mining Co. submit the following report and statements for the year ended Dec. 31, 1924:

As there was no change indicating conditions under which the mine could be operated profitably in the near future, it was decided early in the spring to remove the pumps so as still further to reduce expenses. All the movable machinery, belting, and tools have been carefully stored and the buildings protected.

The prospects of resuming mining operations are not encouraging.

**Current Assets and Liabilities, Dec. 31, 1924**

Assets		
Cash at Boston.....		\$3,846.36
Copper on hand, 1920 and 1921 production.....		30,097.44
Treasury stock.....		28,585.04
Cash at mine.....		657.57
Supplies and stock in store at mine.....		20,493.82
		\$63,680.23
Liabilities		
Notes payable.....	\$15,000.00	
Accounts payable.....	18,587.86	
		33,587.86
Balance of assets.....		\$50,092.37

**Several Dividend Resumptions and Increases in March**

The following dividends were paid by mining and metallurgical companies during March:

Companies in the United States	Situation	Per Share	Total
American Metal.....	U. S. and Mex.	\$0.75 Q	\$443,657
American Metal, pfd.....	U. S. and Mex.	1.75 Q	87,500
American Smelting & Refining, pfd.....	U. S. and Mex.	1.75 Q	875,000
Bingham Mines, s, l.....	Utah	0.50	29,370
Butte & Superior, l, c, s.....	Mont.	0.50	145,098
Calumet & Arizona, c.....	Ariz.	0.50 Q	321,266
Calumet & Hecla Consolidated, c.....	Mich.	0.50	1,002,751
Eagle-Picher Lead, l, s.....	U. S.	0.40 Q	400,000
Federal Mining & Smelting, pfd., s, l.....	Idaho	1.75 Q	210,000
Gladstone Mountain, l.....	Wash.	0.005	6,609
Hecla Mining, s, l.....	Idaho	0.50 Q	500,000
Homestake Mining, g.....	S. D.	0.50 M	125,580
Inland Steel.....	Minn.	0.625 Q	629,379
Mohawk Mining, c.....	Mich.	1.00	115,000
National Lead.....	U. S.	2.00 Q	413,108
National Lead, pfd.....	U. S.	1.75 Q	426,433
St. Joseph Lead.....	Mo.	0.50 Q	774,690
Sloss-Sheffield Steel & Iron.....	Ala.	1.50 Q	150,000
Texas Gulf Sulphur.....	Texas	1.75 Q	1,111,250
Tintic Standard, s, l, c.....	Utah	0.40 Q	459,766
U. S. Steel.....	U. S.	1.75 Q	8,895,294
United Verde Copper.....	Ariz.	2.00 Q	600,000
Utah Copper.....	Utah	1.00 Q	1,624,490
Companies in other countries			
Chile Copper.....	Chile	0.625 Q	2,375,000
Hollinger Consolidated Gold.....	Ont.	0.05 4 wks.	246,000
Keeley Silver.....	Ont.	0.12 SA	240,000
Lake Shore, g.....	Ont.	0.05 Q	100,000
McIntyre-Porcupine, g.....	Ont.	0.05 Q	199,500
Patino Mines & Enterprises, t.....	Bolivia, Chile	5 sh.	£345,079
Total.....			\$22,506,746

Q, quarterly; M, monthly; SA, semi-annually; s, silver; l, lead; c, copper; z, zinc; g, gold; t, tin.

Dividends paid in March were not so large as those paid in December, inasmuch as several extra distributions were made for Christmas, and several irregular dividend payers unburdened themselves in that month. On the other hand, no regular dividend payers omitted or decreased their distributions in March, and several items of good news may be noted, to wit: Bingham Mines made its first payment since October, 1919, and Butte & Superior resumed with the same dividend last paid in December, 1922. Eagle-Picher Lead paid twice as much as last December. Gladstone Mountain, a lead carbonate mine out in Stevens County, Wash., makes its bow in our dividend list in a modest way, but it is reported expects to be present there every month, along with Hollinger and Homestake. Hecla is again standing on both feet after its bad fire and doubles the previous dividend of 25c. Mohawk and Calumet & Hecla indicate that there is some money in Michigan copper at 14 or 15c. per lb. by paying their first dividends since October, 1923, and June, 1924, respectively. Tintic Standard doubled its December dividend. The recent Patino consolidation, in which the National Lead Co. is interested, paid the same dividend as on Nov. 5, 1924, which went unreported at that time. It is said that this stock may soon be listed on the New York Stock Exchange.



# Current Prices of Mine Materials and Supplies

## RISE AND FALL OF THE MARKET

Price declines are greatly in excess of advances in the current market for mine materials and supplies. Weakness has developed during the past month in steel sheets, track supplies, structurals, c.-i. pipe, hemlock timbers and linseed oil. Firmness is being retained, however, in such materials as, clay products, long-leaf yellow pine timbers and steel bars.

**SHEETS**—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed	\$2.70	\$3.90	\$3.80	\$4.20	\$3.89
No. 10					
Black					
No. 28	3.50@3.60	4.65	4.50	5.25	4.75
Galvanized					
No. 28	4.65@4.75	5.65	5.50	6.25	5.75

**STEEL RAILS**—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh		Birmingham	Chicago
	Current	Year Ago		
Standard beamer rails	\$43.00	\$43.00	\$43.00	\$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

**TRACK SUPPLIES**—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh		St. Louis	San Francisco	Birmingham
	Current	Year Ago			
Standard spikes, 1/2-in. and larger	\$2.90	3.05@3.15	\$3.55	\$3.55	\$4.35
Track bolts	3.90@4.25	4.00@4.25	4.45	4.55	5.85
Standard section angle bars	2.75	2.75	3.30	3.40	4.00

**STRUCTURAL MATERIAL**—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham, Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	\$2.00@2.10	\$2.05	\$3.34	\$4.15	\$3.25	\$3.10	\$3.15
Channel, 3 to 15 in.	2.00@2.10	2.10	3.34	4.15	3.25	3.10	3.15
Angles, 3 to 6 in., 1/2 in. thick	2.00@2.10	2.10	3.34	4.15	3.25	3.10	3.15
Tees, 3 in. and larger	2.00@2.10	2.10	3.34	4.15	3.25	3.10	3.15
Plates	2.00@2.10	2.00	3.34	4.15	3.25	3.10	3.15

**WIRE ROPE**—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7 1/2%
Round strand iron and iron tiller	5%
Flow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12 1/2%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	50%

**WROUGHT PIPE**—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD	1 to 3	62	50 1/2	1 to 1 1/2	30	13
LAP WELD	2 1/2 to 6	59	47 1/2	3 to 6	28	13

**STEEL PIPE**—From warehouses at the places named the following discounts hold for steel pipe:

	New York	Chicago	St. Louis
3 1/2 to 6 in. lap welded	48%	56 1/2%	46%

**CAST-IRON PIPE**—The following are prices per net ton for carload lots:

	New York		Birmingham	Chicago	St. Louis	San Francisco
	Current	Year Ago				
6 in. and over	\$52.60-53.60	\$61.60-63.60	\$42.20-50.20	\$50.20	\$48.00	\$53.00

**NUTS**—Semi-finished, 1/2-in., 2c. each. Discount 70% for 3/4-in. and smaller; 65% for 1-in. and larger. Case hardened, 6c. each, less 50%.

**HOLLOW TILE**—Price per block in carload lots to contractor for hollow building tile.

	New York		Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J. Factory
	Current	Year Ago					
4x12x12	\$0.1162	\$0.1179	\$0.06	\$0.1325	\$0.079	\$0.108	
6x12x12	.1743	.1769	.0825		.107	\$0.2388†	
8x12x12	.2179	.2211	.1125	.25	.146	.2956†	

\* 10x12x12; † 12x12x12.

**MACHINE BOLTS**—1/2x1 1/2-in., per 100, \$1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

**LUMBER**—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, \$2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	\$29.00	\$30.00	\$31.00	\$34.00
3x6 and 8	29.00	30.00	31.00	34.00
4x4-6 and 8	29.00	30.00	31.00	34.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, \$5 additional.

	New York	Chicago
	20 Ft. and Under	20 Ft. and Under
3x4 to 8x8	\$48.00	\$49.00
3x10 to 10x10	52.00	53.00
3x12 to 12x12	56.00	57.00

	8 x 8-In. Pine		x 20 Ft. and Under		20 Ft. x 12-In. Fir*	
	Hemlock	Spruce	Pine	Fir*		
Boston	\$53.00	\$50.00†	\$50.00	\$50.00	\$63.00	\$60.00†
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver		34.75	34.75	34.75		35.75
Minneapolis	42.00	39.75	39.00		44.50	39.75
Kansas City	42.50	31.00			53.50	32.00
Birmingham	32.00				34.00	

\* Douglas fir. † Prime.

**NAILS**—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	\$2.85	2.95	\$3.25	\$4.00	\$4.75	\$3.18
Cut	2.90		5.25	5.00	3.28	5.00

**PORTLAND CEMENT**—Prices to contractors per bbl. in carload lots without bags. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	\$2.50@2.60	\$2.50@2.60	\$2.50@2.60
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.39	2.39	2.39

**LIME**—Warehouse prices:

	Hydrated, per Ton	Lump, per Barrel	280-lb. net
	Finishing	Common	Finishing
New York	\$18.20	\$12.00	\$13.10
San Francisco	22.00		\$2.50@2.75 (180-lb. net) 1.60

**LINSEED OIL**—These prices are per gallon:

	New York	Chicago
	Current	Year Ago
Raw in barrel (5 bbl. lots)	\$1.14	\$0.97

**WHITE AND RED LEAD**—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Current	1 Yr. Ago	Current	1 Yr. Ago
Red	16.25	15.00	17.75	16.50
White	16.25	15.00	16.25	15.00

**HOSE**—Quotations at New York warehouses:

	Fire Protection	50-Ft. Lengths
	Underwriters' 2 1/2-in. coupled, single jacket	56c per ft.
2-in., per ft.	3 ply \$0.33	4 ply \$0.40

Steam—Discounts from List  
First grade... 40% Second grade... 40-5% Third grade... 40-10%

**RUBBER BELTING**—List price 6-in., 6 ply, \$1.83 per lin.ft. for rubber transmission belting.

Best grade	50-5%	Second grade	50-10-5%
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**LEATHER BELTING**—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

	Discount from list
Medium	40-2 1/2%
Heavy	30-5%

**RAWHIDE LACING** { For cut, best grade, 45-50%, 2nd grade, 55%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 45-50%; sides, 41c. per sq.ft.

**PACKING**—Prices per pound:

Rubber and duck for low-pressure steam, 1/2 in.	\$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

**MANILA ROPE**—Per lb., 1/2-in. and larger, 1,200-ft. coils.

Atlanta	\$0.27	New Orleans	\$0.23†
New York	.22	Seattle	.17
Chicago	.21 1/2	San Francisco	.23

**EXPLOSIVES**—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	\$0.27	\$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	.1625	.1925

**FLOTATION OIL**—

Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal.	\$0.32
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**CHEMICALS**—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	\$0.08†
Litharge, f.o.b. New York, kegs, per 100 lb.	16.75
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.18@.22

Mining Stocks

Week Ended March 21, 1925

Table listing mining stocks with columns for Stock, Exch., High, Low, Last, and Last Div. Includes sections for COPPER, NICKEL-COPPER, LEAD, ZINC, SILVER, and GOLD.

Table listing mining stocks with columns for Stock, Exch., High, Low, Last, and Last Div. Includes sections for GOLD AND SILVER, SILVER-LEAD, IRON, VANADIUM, ASBESTOS, SULPHUR, DIAMONDS, PLATINUM, and MINING, SMELTING AND REFINING.

\* Cents per share. † Bid or asked. Q. Quarterly. SA. Semi-annually. M. Monthly. K. Irregular. I. Initial. X. Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend. Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.