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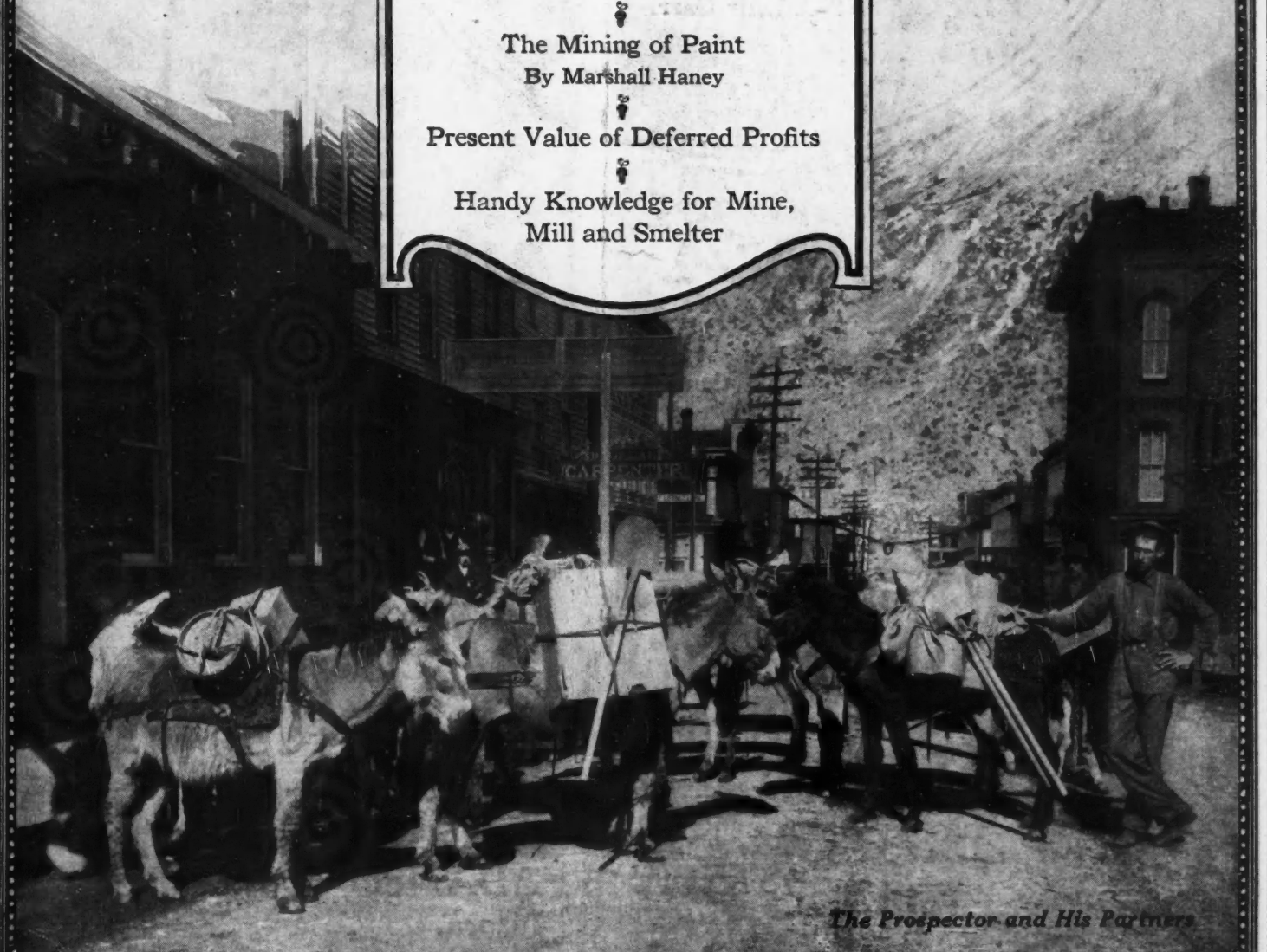
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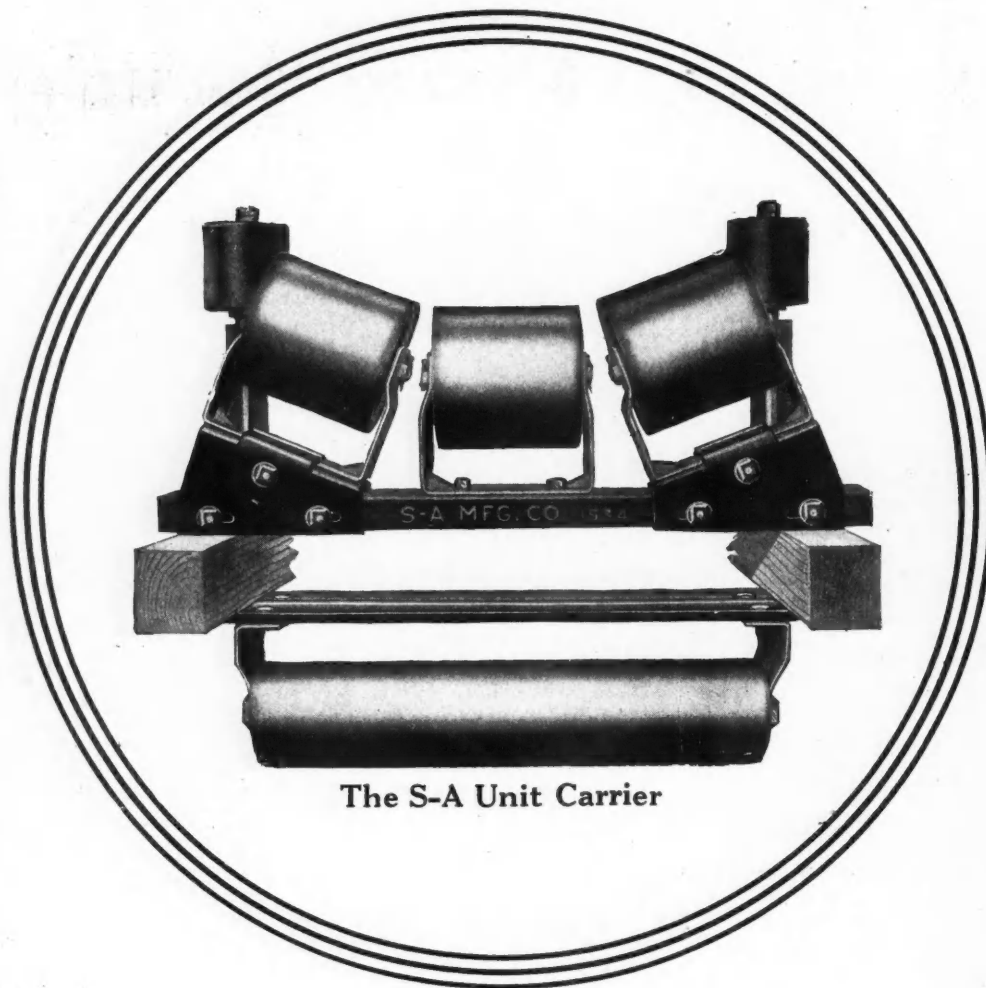
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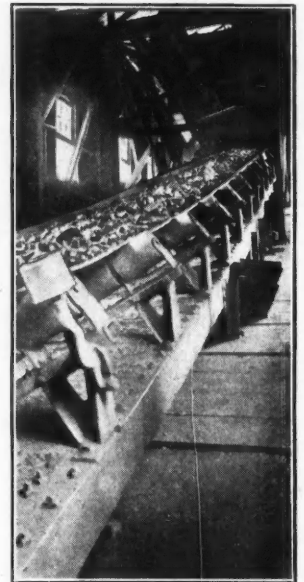


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Volume 110

New York, October 30, 1920

Number 18

Copper and Cotton

THE spectacular slump in the price of copper during the last few weeks illustrates the close relation of the mining industry to other great industries, and its dependence upon general economic conditions. The copper slump was another of those almost perpendicular crashes which have taken place in quick succession—in cotton, sugar, wheat, and corn. It is like a row of dominoes: it is altogether a fine point as to which falls first, but that they fall in the end is inevitable. Some of the industries affected have taken the slump as an unexpected shock, with surprise and indignation. The cotton growers, for example, visited Washington and interviewed Secretary Houston, demanding that the Government "do something" to hold up the price of cotton. Similarly, the wheat growers charge somewhere conspiracy which has resulted in lowering the price of wheat below what is claimed to be the cost of growing; and they also demand that the Government "do something." But neither these plaintive cries for help nor the violence of the night riders of the South will have any effect on the great economic laws which are moving in the direction that has been foretold by every economist and financier since the war—and is as clear and as unavoidable as the law of gravity. As schoolboys we know that

"What goes up must come down
On the head or on the ground."

The blind ones are getting this drop "on the head"; but in these days of enlightenment it is probable that the majority of business has sidestepped it, and is letting it fall "on the ground."

There will doubtless be no pilgrimage to Washington of copper miners, beseeching the Government to "do something" to boost the price of copper. They have not had their fair share of the fat profits which the growers of cotton and wheat have had in the aftermath of fever-prosperity which succeeded the armistice, and against which it was understood that the temperature of the patient would fall below normal before health would supervene; but they are not likely to charge conspiracy, being, we believe, somewhat wiser, as a class, as to what is transpiring in the world than the planter of cotton or of corn.

This general process of deflation, of returning to normal values, of which these sudden slumps are symptoms, is what the common citizen has been praying for to come soon. As miners and otherwise just plain citizens, we have heard with secret joy (although not indecorously exhibited) of the cuts in the price of cotton, wheat, automobiles, and the rest. We see relief from the strain of exorbitant prices, and hope for the teacher, the Government employee, and all the group submerged by that H. C. L., which, if continued, would go far toward extinguishing culture and education, in the wild stampede for "grub." It depends, of course, upon

whose ox is gored. We do not welcome it in copper or in zinc. But if we have to be operated on with the rest, the sooner it is over and we begin to be convalescent, the better: so bring on the anæsthetic!

We hope that in copper the operation is over. Certainly copper is selling at less than it costs to produce, a situation which can hardly be long drawn out. We hope—and believe—that we have touched bottom; but we have no precedent to guide us in hazarding a confident prediction, because the governing factors are such as have never before existed in the history of the world.

Choosing a Director for the Bureau of Mines

UNDER the above head *Chemical & Metallurgical Engineering* discusses in a leading editorial the problem of the forthcoming choice of the Bureau of Mines director. We quote from this editorial as follows:

"All will agree that the greatest care should be exercised in making the choice. The position calls for certain qualifications that are quite obvious. Primarily, we suggest that it seems appropriate that the director of the Bureau of Mines should be a mining engineer—one experienced in the theory and practice of mining, skilled in administration and organization, sympathetic with the related subjects of chemistry and metallurgy and having a broad view of the mining industry and its relation to the welfare of the country. In addition to these qualifications the incumbent should be in a position to make that sacrifice which a Government salary entails, and yet he must not be so secure in his independence as to have lost ambition and initiative."

Cheapening the Mining Engineer

THOUGH the training of disabled ex-service men by the Government is a praiseworthy action, such training for the higher professions should be conducted with due regard to the established educational standards. We are not sure that this is being done. We recently had a visit from a fine young chap, who was suffering from disability from wounds received while with a machine gun battalion in France. He had been offered by the Federal Board for Vocational Education the chance of being educated to a profession by means of a two-year course of instruction, and was hesitating between a course in oil engineering and one in salesmanship. It transpired that he had not had any education beyond the grade schools. Under the circumstances, we were unable to encourage him to go in for oil engineering (a large part of which is, or should be, geology), as it is impossible to turn out a competent mining or oil engineer or geologist from an unprepared youth in that period; and we advised him that, being imperfectly prepared, he would be at a disadvantage compared with

thoroughly trained men. Therefore, we counseled the choice of the salesmanship course.

Our Washington news chronicles the fact that free courses in mining engineering are being given to disabled ex-service men in thirty-seven schools in the United States. The range of schools is not reassuring. Can one enumerate thirty-seven American schools capable of turning out competent mining engineers? We make this query not as a denial, but asking for further information. We do know that in several schools mining engineering and mining geology have been compressed into one summer course. The desire to enlighten the people at large, along the University extension idea, has triumphed over the laudable caution and standards of the educator, and a flood of men have been loosed on the investing public who, with a little of that knowledge which is the most dangerous thing in the world, have masqueraded as engineers or geologists.

We call on the universities and higher schools to look to their principles and ideals. It is a matter of congratulation that the American Institute of Mining and Metallurgical Engineers has in the last few years established proper standards for membership; and the newly organized Society of Economic Geologists will do the same for the science of geological engineering.

Vacations for Wage Earners

MORE and more is the social condition of the working man being improved. Neither is this altogether a result of the labor shortage, as some scoffers have inferred, for the movement is one which has been going on for some years. On the other hand, it is not pure philanthropy, for contentment and happiness are recognized to result in more efficient performance of duty, and a reduction of the labor turnover redounds to the profit of the employer. In the mining industry, particularly, conditions are vastly better than a few years ago. One reason, it must be admitted, is that conditions, at least in some camps, were too unspeakable to continue, and another is that things had to be made more attractive than in similar employment in urban communities in order to hold men in out-of-the-way places.

A recent step in the right direction has been the granting of vacations with pay to those who work by the hour or day as well as to those who work on salary. So far we have heard of no mining companies taking this step, although it is likely that some have done so. The plan has recently been adopted by the Western Electric Co., as mentioned in our Sept. 11 issue. Other companies which have instituted a similar system are the Chain Belt Co., of Milwaukee; the Willys Overland Co., the Utica Drop Forge Co., the Studebaker Co., and the Ritter Dental Mfg. Co., of Rochester. In the case of the Western Electric Co. it is said that heretofore factory workers have not received paid vacations because of the fact that they received pay on an hourly basis, with extra rewards for overtime, whereas the salaried men got no rewards for overtime. In most cases, this would not be true, for the average overtime of the salaried worker is balanced by absence and tardiness for which no deduction is made.

Granting a paid vacation of two weeks of the year to wage earners who have worked steadily will help to eradicate class distinction and will tend to remove the idea that they do not belong to the privileged class. It will also in many cases make for greater efficiency.

A man or a woman who has worked hard for a year needs a rest without the thought that it is costing him or her money in addition to what is spent. The plan will work best among the steady men, generally Americans, who will use the time to visit the home folks, to lay in a supply of wood, or to go on a hunting or fishing trip.

The Vagaries of Orebodies

WE HAVE HEARD of certain Utopias where successful mines are situated within the proximity of prosperous farms, where attractive topography is combined with agreeable climatic conditions, and other equally desirable surroundings furnish the mine manager with an abundance of the needs and pleasures of life. But such enviable combinations are few and far between, and fortunate indeed is he who can include mine, farm, and game preserve in the domain over which he rules.

We recall a visit some years ago to a section of one of the Western mining districts. The trip was made by buckboard, ten miles across the sagebrush, with the sun particularly active, and the dust shrouding the wagon in dense clouds. After an hour's going the foothills were reached, and the upward climb along the sides of the mountains offered a grateful relief from the monotony of the sage flat. Here was an ever-changing vista; the wooded slopes presented a pleasing picture, and the small valley-like depressions were covered with an abundance of vegetation.

The first stop was made at a small spring, which bubbled from the rock clear as crystal. In the party was an Eastern capitalist. This was his first visit to the West, and, although familiar with the financial features of mines and mining, his knowledge of "ground" required upholstering. After taking in his surroundings his first exclamation was, "What an elegant place for a mine!" Subsequently successful mining was done in that section, but several miles from the "elegant" location and in a country almost devoid of vegetation.

Ore deposits in their occurrence are no respecters of persons. They are where they are, and those seeking them for exploitation should be prepared to supply any deficiencies which might be needed to secure a product suitable for treatment. Whether those deficiencies be water, fuel, labor, or other requisites, the economical procuring of them forms a part of the engineer's task in opening and operating the mine.

Prospecting, although somewhat lax during the last few years, still continues in many corners of the globe, and is followed by exploration, and, if circumstances warrant, by development. That climatic conditions are severe and that other handicaps are present do not prevent the constant search for orebodies or the procuring of metals. This has been true and will remain so.

In the article "Desert Prospecting," which appears in this issue, Mr. Leroy A. Palmer points out many of the conditions that may be expected by those engaging in that branch of investigative work. There are undoubtedly drawbacks that discourage prospecting in the "desert provinces," although several decided advantages, such as the lack of vegetation and soil covering, are favorable factors in these localities. Neither the prospector nor the mining engineer can have everything.

One Reason Mining Languishes in Colorado

IT IS A FACT that mining is not as prosperous as it once was in Colorado. This is due to the exhaustion of some mines, the pressure of economic conditions, the relatively few discoveries in recent years, and the fact that mining activity seems to be recurrent in irregular cycles. In the aggregate, the amount of mining that goes along in a steady stream unnoticed is relatively large. The newly discovered district is the center of attraction; the steadily producing mine is apt to be overlooked. The backbone of the industry is, however, these steadily producing mines.

To maintain the volume of mining, new mines must necessarily be developed and brought to production to take the place of those which are approaching exhaustion. Fresh capital and intelligent and honest promotion are important factors in bringing prospects through the various stages to the producing mine. Nothing can do so much in giving a state or a mining locality a bad reputation as unwise or dishonest promotion. Legitimate enterprises suffer. Capital is made more difficult to secure, and the whole industry must endure the consequences, both directly and indirectly. A particularly vicious example of questionable promotion practices has come to our attention in a four-page advertisement of the Redcliff Mining & Milling Co., appearing in the Sept. 25, 1920, issue of the *Daily Mining and Financial Record*, of Denver. We quote two brief extracts:

Your Fortune is in Reading this Advertisement.

The biggest proposition ever offered to Womankind and Mankind in the History of the mining World.

Stock is \$1 per share and never again will you have the opportunity of buying it for any less after this association is completed. Your fortune is before you; your brains and your judgment is your action. The time is now—today—this minute. Be sure you read every word.

Whatever of merit there may be in this particular offering, it is our opinion, after reading the whole advertisement, that no intelligent human being would care to put his money into it. The extravagance of the claims, the inconsistencies of statement, the unrestrained use of ink and type are an insult to the community in which such an advertisement is circulated and a reflection upon the industry of a state which has occupied a unique position in the mining industry. It is time for those who have the interests of Colorado at heart to put the stamp of disapproval upon such practices. The publication of such matter constitutes one of the reasons why mining languishes in Colorado.

We note that there appears in the advertisement an extracted report written by Forbes Rickard under date of April 5, 1911, on the property in question. In the advertisement the report is erroneously signed Robert Rickard, instead of the correct signature, Forbes Rickard. We have ascertained that Mr. Rickard visited the property on his own behalf and out of kindness gave one of the interested parties, a miner, a copy of his report. It was used without his permission in the advertisement; nor did he give the parties permission to use his name as a reference, which is done in the latter part of the advertisement.

The report in question is conservative and in refreshing contrast to the rest of the advertisement. Written over nine years ago, it undoubtedly gave a fair estimate of the possibilities of the property in question, as they existed at that time, but its author could not

foresee present economic conditions. Nevertheless, it serves as a warning to the person who has the patience to wade through the advertisement. Mr. Rickard is an innocent party to the whole affair, being drawn into it without his knowledge or consent.

The Divining Rod Again

THIS is the busy season for the bandit gold and the divining rod business in the Middle West. According to the *New York Sun*, a Kansas City dispatch reports great activity "near Indian Springs," in Kansas, the home of grasshoppers, cyclones, and W. J. Bryan. It seems that

"Fifty years ago a robber band fled thither from a daring, Wyandotte County robbery and buried its glittering pelf."

Pretty good as a starter to one of our bedtime story series:

Act 2 The Wiggler

Upon the scene there arrives one Bartels, with two others, in possession of a magic divining rod, a "gold indicator," which, however, appeared to the profane eyes of Miller, the owner of the farm whereon the treasure was located, as simply "the butt end of a buggy whip with a wire spring on the end." More necromancy. "It was explained that if the spring wiggled while the instrument was held over any spot it was useless to dig there, for no gold would be found; if it didn't wiggle, that was the place to delve for wealth. Therefore, the only requirement for finding gold apparently was an iron nerve and a steady hand on the part of the prospector.

"Taken to the top of a hill the spring wiggled frantically. In the ravine below, it refused to "indicate." The three men began to dig strenuously. At four feet they found an Indian arrow head. The dirt fairly flew. And then at sixteen feet they found—the skeleton of a horse."

That was all. The amateur miners did not get deeper. Like the green Leadville miner, their "hole had come to a point," and the limit of depth possible to engineering skill had been reached. "It was Saturday night, time was up, and the expedition returned disconsolate." What magic inhibition prevented them from working after this Saturday night, the story does not say; doubtless they were poor spirits who had to return to their ghostly vigils when the clock struck twelve. The terms of the contract which they had made with the owner refers to this mystery, among other interesting clauses:

"For the digging rights, \$25. Only one hole to be dug. One-half the treasure to go to Mrs. Miller. *No fair digging after Saturday.* Oil, gas, coal, or lead found incidentally to be Mrs. Miller's."

Oh, the rare optimism of this "incidentally"! Would that we were boys again, or owned a divining rod, \$25, and three free days, and could dig for bandit gold, and, "incidentally," oil, gas, coal, and lead—yes, and diamonds and pearls. We should have put these into the contract.

This divining-rod business should be organized. A \$25,000,000 corporation would not be too much, even though a start can be made with \$25 and a buggy whip. We look to see the scattered industry united and properly equipped.

Desert Prospecting

Conditions Characteristic of the Arid Regions—Topographic Features Frequently Deceptive—Principles To Be Observed in Investigations of Dry Placers—The Occurrence of Water

By LEROY A. PALMER

Written for *Engineering and Mining Journal*

IN A RECENT ISSUE of *Engineering and Mining Journal*¹ I gave a description of an outfit which I had used with success for desert travel and made suggestions as to conduct in camp and on the trail. Those whose work is of such a nature that they are interested in an article of the kind mentioned may also find interest in a brief discussion of various geologic and topographic conditions which are characteristic in a large degree of the arid regions. The features which I purpose to discuss are not limited strictly to "the land of little rain," but I have found them best developed under its influences, so that they may fairly be considered to be characteristic of it.

DISINTEGRATION THROUGH TEMPERATURE CHANGES

In the disintegration of the rocks of the desert provinces, physical agencies play a more active part than chemical, and attention has been directed to the lack of moisture, both as precipitation and in the air, the principal chemical reagent in the alteration of rock. A very important feature in disintegration, however, is the action of heat and cold.

As is well known, there is a considerable difference in temperature between day and night in the American desert. Desert nights are proverbially cool, and when one gets away from the valleys and into the mountains there are very few, even of those following the scorching days of summer, in which a blanket does not form a useful part of the bed clothing.

This diurnal range in temperature is fairly uniform throughout the year, the difference between night and day in winter being much the same as in summer. It is by no means unusual for the desert dweller to break the ice in the bucket to get water to wash on a winter's morning, shed his coat for greater comfort before noon, only to button it about him the more closely before the sun has dropped out of sight in the evening.

Because of the light soil cover, or the entire lack thereof, the rocks are more directly affected by temperature fluctuations than they would be if heavily mantled with soil and protected by forest growth. Rocks are poor conductors of heat, a fact which makes itself apparent to anyone who goes underground. Poor conductors expand and contract readily under the influence of heat and cold. A classic demonstration of this principle is the comparison between silver and mercury. The conductivity of mercury is 1.3 in a scale in which silver is standard at 100. The coefficient of cubic expansion of mercury is 0.0001001 to 0.0000318 for silver, or in the ratio of 3.15 to 1. In accordance with this principle, the alternate heating and cooling to which the rocks are subjected by the daily changes in temperature is accompanied by a considerable expansion and contraction. Though this action often results in a considerable "shelling off" of thin outer layers, it is natural that the heaving which accompanies such expanding and shrinking should take

place along the joint and bedding planes, as being the lines of least resistance, thus tending to open them still wider. Such moisture as is precipitated on the rocks largely follows these openings, and in winter the frost working into them causes a heaving and a splitting along fairly regular lines. Some of the results of this action will be discussed later.

EROSION BY THE ELEMENTS ACTIVE

Ordinarily disintegration and erosion are so closely associated that it is natural to think of one as essentially accompanied by the other, but in the desert they do not always work in conjunction with each other. In the later consideration of alluvial aprons we shall note that the disintegration of the rocks of mountains is frequently accompanied by the building up of their

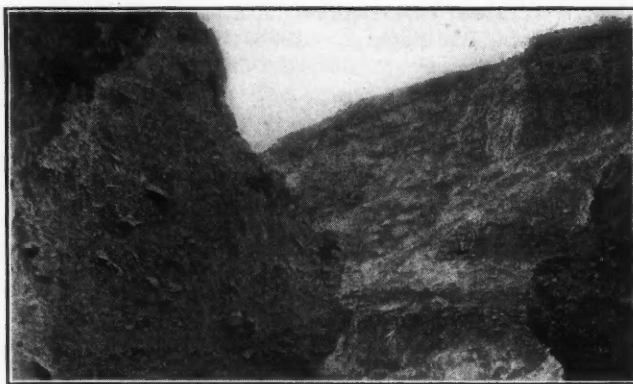


FIG. 1. CANYON IN ALLUVIAL APRON

slopes instead of their denudation by the activities of erosive agencies, so that from the standpoint of volume there is little change in the mountain mass.

Water as an agent of erosion is active in the desert, as is evidenced by many a deep canyon with steep cut, almost perpendicular sides. This erosion is not the result of a slow wearing down of a perennial stream, but is rather the action of intermittent rushing torrents. The mean annual rainfall is low, but the higher slopes receive a considerable precipitation, one year with another, and this precipitation is likely to be concentrated in a few heavy storms instead of scattered through the year or through a long rainy season.

It is frequently the case in a mountain watershed that some one canyon or valley, often the trunk channel, has tributary to it a catchment area far out of proportion to its normal carrying capacity. The steep canyon sides, bare rocks, and exceedingly limited vegetation tend to a high percentage of run-off within a short time, so that when these torrential rains come, the precipitation over a large watershed is rapidly concentrated in a narrow canyon or small valley, and a raging torrent is formed where a few hours before was parched sand and blistering boulders.

A person who has not seen one of these desert floods can hardly conceive of their treachery and tremendous

¹Jan. 31, 1920.

force. It would almost seem that a jealous Providence sends them on occasions to warn Man of his insignificance and the instability of his works. As a tenderfoot I worked on the construction of the Los Angeles & Salt Lake R.R. while it was being built across the Nevada desert, and I could not understand the necessity of putting in bridges 200 ft. and more in length opposite insignificant looking side canyons whose channels did not give the appearance of ever having carried more than sufficient water to wet one's feet. I saw that same railroad after a flood—eighty miles of it wiped out of

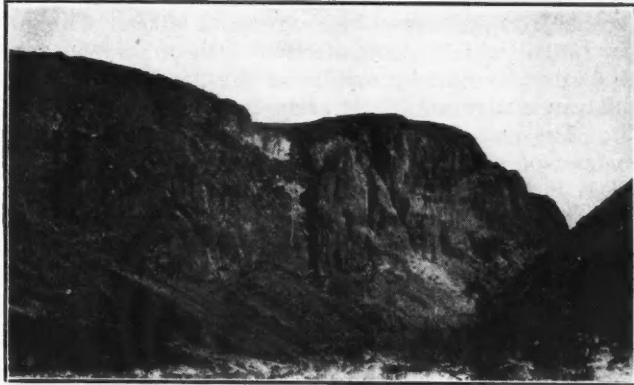


FIG. 2. PSEUDO-FAULT

existence, ninety-pound steel twisted into loops, a whole freight train swept off the track and slammed against the side of a mountain—Man's deepest thought and highest skill set at naught by Nature's forces.

Wind is an active erosive agent in the desert. The arid regions are generally windy throughout the year. Were it not for the winds of summer they would scarcely be habitable during that season, and the winds of winter and spring are frequently of great severity, there being little in the way of trees or other vegetation to act as a protection for the surface. When the wind becomes violent it sweeps up quantities of sand and fine gravel and drives then with it in the terrific sandstorms for which the desert is noted and whose violence can scarcely be exaggerated.

These sand- and gravel-carrying winds exert an active erosive force, which is frequently manifested in the weird and picturesque forms into which the rocks are carved. The Old Woman Mountains, in the eastern part of the Mohave Desert, in California, get their name from one of these odd shapes, which resembles a woman carrying a child in her arms. The entire range presents a skyline of serrated peaks and castellated crags as a result of this æolian action.

ALLUVIAL APRONS HAVE APPEARANCE OF CONGLOMERATES

Among the most prominent features of desert geology, notable topographic features as well, are the alluvial aprons or outwash slopes of the mountains. These outwash slopes are found in a greater or less degree of development bordering practically all of the wider valleys. They extend from the low part of the valley in a uniform slope onto the flanks of the mountains which border it, and sometimes actually reach to the summits of the outlying peaks. Their composition exhibits the sorting of water and wind, the higher parts of the slope being composed of coarse rock fragments which grow finer as one descends, so that the foot of the slope in the low part of the valley is fine sand.

In a region of heavy rainfall, as the rocks disintegrate a considerable portion of the soil so formed is immediately washed from the slopes by the rains, finds its way into the watercourses and finally carried into the larger streams and removed from the region.

In the desert the result is different. As I have indicated, under conditions of aridity physical forces play a more active part in the disintegration of rocks than chemical forces, with the result that the pieces into which the rock is broken are coarser. Then there is not the rainfall to remove the broken pieces with the same rapidity as elsewhere. Hence they accumulate about the slopes, filling first the shallow gullies of moderate grade and then the steeper ones, continuing in this way and drifting with the high winds characteristic of the desert until they have built up a slope that is comparatively uniform.

The sand and gravel of these alluvial aprons assume a compact structure so as to make, or at least approach, a conglomerate. This is particularly so if calcium carbonate or some other cementing material is available in the rocks of the upper slopes, so that it may be taken into solution and form a binder for the unconsolidated material through which it percolates. In such cases the canyon streams, debouching from their narrower confines into the broader valleys, trench deeply into these outwash slopes, which stand well in their consolidated state, and the result is a canyon-like watercourse, frequently very narrow, with high, steep-cut walls, as shown in Fig. 1.

DECEPTIVE TOPOGRAPHY

In the discussion of the subject of disintegration it has been stated that, under certain conditions, rocks have a tendency to rupture along joint or bedding planes instead of yielding to a slow breaking down into soil. This leads to the development of topographic features which may readily receive an erroneous geologic interpretation if conclusions be drawn on casual

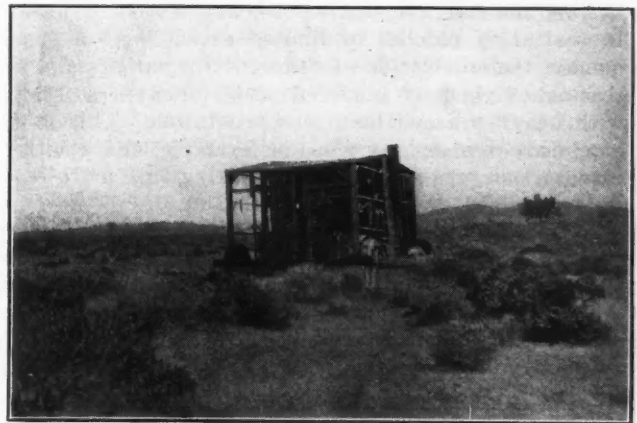


FIG. 3. DRY WASHING MILL, GRANITE MOUNTAINS

observation. Chief among these I would class certain forms which might be mistaken for faults and others which might appear to be the result of glacial action. These will be considered briefly, although the subject is one which is of interest from the academic rather than the economic standpoint.

The pseudo-faults, if I may be permitted to coin such a word, appear as bold escarpments which are the result of the action of such disintegrating forces as those mentioned, acting along joint or shrinkage planes so as to split the rocks along lines approximately vertical.

This is particularly noticeable in the cases of some lava flows coming under my observation which have assumed a columnar structure on cooling. These columns have been split off, whole ones at a time, by frost working along the planes of cooling, so that an abrupt cliff which might readily be mistaken for a fault scarp remains.

Another occurrence, which is of even less importance from the economic standpoint, is a form of topography which bears every resemblance to that resulting from glacial action. I have never found evidence of real glaciation in the desert, but in the Mohave Desert I have seen such topographic manifestations of nearly all of these phenomena as might well be called "text-book illustrations." But, like the escarpments, whose appearance is likely to convey an incorrect impression of faulting, these evidences of glaciation will not stand up under critical scanning.

ECONOMIC FEATURES

Nearly all of the minerals that are found anywhere occur in the desert, but it is a region in which prospecting has been far more limited than in the better-watered localities. The reason for this is obvious. It is human nature to follow the line of least resistance, and where one man has the hardihood to face the desert a dozen men choose a country in which conditions are not so rigorous.

Certain minerals, notably of the salines, are characteristic of the arid regions and are found in but few other places in this country, but their origin and occurrence form by far too broad a subject to come within the scope of this article. A consideration of some of the desert forms of deposits common to other localities as well should be of interest.

DESERT PROSPECTING HAS NUMEROUS ADVANTAGES

As has been indicated, prospecting in the desert is simplified by the fact that dense vegetation is wholly lacking and soil covering is not heavy, occurring usually in scattering patches of limited extent. As a consequence, the correlation of different formations and the tracing of veins is rendered easier than in a locality with heavy soil and luxurious vegetation. This is exemplified in many ways. For example, the relations between outcrops and prospect workings are more readily recognized.

Float does not migrate to the extent that it does in a country in which the mountainsides are traversed by numerous streams and rivulets, which may assist in carrying a piece a long distance from the point where it was broken. Consequently, outcrops may be sought generally within a reasonable distance of float, and topography forms a fairly reliable guide as to the relative positions of the two.

DRY PLACERS REQUIRE SPECIAL CONSIDERATION

One of the interesting forms of desert deposits is the dry placer, so called because it occurs under conditions that require working by some means other than the application of water in one of the methods usually prescribed for placer mining. These deposits are usually found under the same topographic conditions as placers in other localities, occurring in a gulch or canyon where the gold has been carried after erosion from veins or stringers on a mountainside and within the catchment area. I have found them, however, in quite unlooked-for places, one such occurrence being

near Williams Well about twenty miles northerly from Barstow, Cal.

This deposit is in a flat of very gentle topography, so gentle, in fact, that in some places it is difficult to tell just where the low places are. The region is underlain by an intrusive granitic rock, and, being nearly flat, has accumulated a considerable covering of soil, especially in the gulches or such depressions as formerly existed, so that these have been filled to such an extent that it is not always easy to distinguish them from the points that were higher originally. The intrusive is traversed by quartz veins carrying considerable iron and associated with basic dikes. The gold is rough, which, in connection with the topography, indicates its near-by origin, as the flat is in reality a plateau, and drainage is away from it rather than to it. The gold has accumulated in the shallow depressions, and some pieces of fair size were found. It lies close to the surface and is associated with float hematite, which impregnates the soil, the size of hematite pieces being some criterion of the size and amount of gold found. An interesting feature that I noted in examining this deposit was that the gold was almost invariably discovered where a small yellow flower grew.

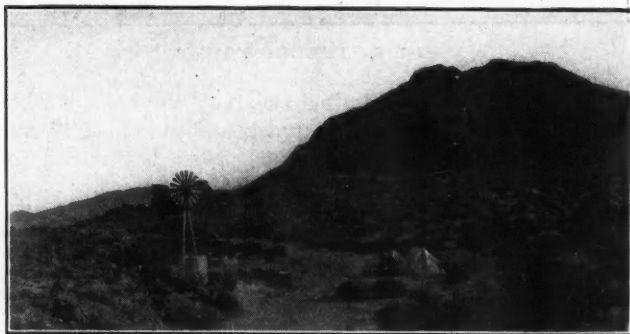


FIG. 4. COLTON WELL, PROVIDENCE MOUNTAINS

Of course the explanation is simple enough. The liberation of the gold from its inclosing matrix is accompanied by the disintegration of one of the associated rocks or minerals, which weathered to a soil favorable to the growth of this particular flower. In this case the mineral was probably the hematite, as it was found closely associated with both the gold and the flower.

Some time ago an attempt was made to work a wide shallow gulch on a large scale with the dry washing mill shown in Fig. 3, but the project failed for the same reason that many another mining venture has gone wrong. The promoters neglected to explore their ground carefully beforehand, and soon exhausted that portion that was amenable to handling by the process installed. As the illustration shows, the mill was on wheels, or rather rollers, so that it could be kept close to the excavating, performed with plow and scraper. It was moved by winding a cable from a deadman to a winch in the mill. This process of handling and treating returned a good profit during the limited time that it was in use.

The usual and generally accepted rule that placers grow richer as bedrock is approached does not necessarily hold true in the desert. It can readily be seen that the natural result for a deposit in the bed of a running stream in which the gravel is permeated with water and subjected to its continuous action would be that the gold, being heavier than the gravel, sinks and tends to concentrate on the bedrock, but this is not

the case with desert deposits. Such water action as they receive is intermittent and frequently in the form of sudden floods, which rise quickly and subside before the water really has time to sink through the stream gravels to bedrock. Consequently, its influence extends only to shallow depth, and the richest placer may be found within a few feet or even a few inches of the surface, whereas the bedrock is practically barren. This is particularly the case with deposits such as that found at Williams Well, where concentration does not occur in well-defined stream channels but in depressions in a comparatively level surface and near the lode in which the gold originated. In desert deposits, and notably those of the kind just mentioned, enrichment is not so much the result of the concentration of the valuable portion as of the removal of the valueless. To borrow a comparison from the gravity concentration of ores, I may liken the concentration of the gold in the bed of a running stream to that which takes place in a jig in which the heavy mineral settles against the action of a current of water, whereas the shallow desert placer is comparable to the vanner, in which the heavy mineral clings against a current that washes the lighter away.

WATER SCARCE BUT USUALLY AVAILABLE

Water is by no means as scarce in the desert as popular conception assumes. There are occasional springs and tanks—both open and "stand" tanks—so that one who knows the country need not, as a rule, go very many miles for an amount sufficient for the needs of a prospecting party.

Water from underground sources is frequently available without much work. One who is simply passing through a country on a prospecting trip will not find it advisable to stop in one locality such time as might be necessary to develop a supply, but if he is establishing a small camp for prospecting development he can frequently satisfy his needs without going a great distance or expending too much labor. In most such cases location and development of water are not so much a matter of technical skill as applied common sense. As water locators, some desert animals, coyotes especially, are far ahead of the witch with the forked stick. I have seen more than one water hole developed where a coyote had shown the way. Seepages along joint planes or fractures frequently are followed with good results, or fracture zones may be found productive even if no water appears on the surface. Fig. 4 is a well used to water several hundred head of cattle and was made by sinking about fifteen feet on a fractured zone in granodiorite and then crosscutting a few feet to expose the zone to its full width.

Alluvial basins and canyon bottoms usually hold water in considerable quantity, and where they are crossed by ribs of rock the water is forced toward the surface. Under these conditions digging will usually develop water at no great depth, but care should be taken to locate the well such a distance above the barrier that rock will not be struck within the influence of evaporation from the soil, which is somewhere about eight to ten feet under average conditions. If this is not done, the result will be a dry hole, but if the limit of evaporation is passed with the hole still in alluvium, and within the influence of the rock barrier, a supply should be found at reasonable depth, the amount varying, of course, with the geological and other conditions affecting the location of the hole.

Importance of Rhodesian Chromite

For some years previous to the war, Rhodesia was the chief producer of chromite, though its output was almost equalled by New Caledonia, according to *The Ironmonger*, the combined yield of these two countries amounting to nearly 90 per cent of the world's production. During 1918, however, the Rhodesian output declined, owing principally to lack of ocean freight facilities and to competitive production in the United States, Canada, and India. Thus the total shipments in 1918 were only 37,875 tons, as against 59,321 tons in 1917 and 87,406 tons in 1916.

The total output of chromium ore in southern Rhodesia up to and including 1918 amounted to 581,558 short tons, valued at £1,718,241. This total value exceeds that of any other mineral produced in southern Rhodesia except gold. Chromite occurs at many localities in Rhodesia. Of these the best known are those of Selukwe, Makico, and Lomagundi, but productive mining has hitherto been confined to the Selukwe property, which has been worked since 1905. The deposits at Selukwe consist of numerous lenticular masses of chromium ore in a matrix of talc-schist and serpentine. The ore is won very cheaply by open-cut mining, and the cost of production is merely nominal, amounting only to a few shillings per ton. The ore as marketed contains from 42 to 51 per cent of chromic oxide, 8 to 15 per cent of magnesia, and 14½ to 16½ per cent of alumina. The best ore contains on the average about 50 per cent of chromic oxide. The material is sent by rail to Beira and shipped to Europe as crude ore. Shipment was suspended for a time after the outbreak of the war in August, 1914, but was resumed in December, and the output for 1914 showed a substantial reduction compared with 1913. The output rose again in 1915, 1916, and 1917, despite the fact that exportation was hindered by lack of shipping facilities.

The price per short ton realized for the ore during 1917 was £4 9s. 7d., an increase of 14s. 7d. per ton compared with the price during 1916. This increase in value stimulated prospecting, which resulted in the discovery of a large deposit in the Lomagundi district. Lack of shipping facilities, however, caused a serious fall in production during 1918, and the output for that year was confined entirely to the Selukwe mines.

Sand-Lime Brick Production Increased in 1919

The sand-lime brick produced in the United States in 1919, according to an estimate made by the U. S. Geological Survey, amounted to 145,000,000 brick, valued at \$1,725,000, an increase of 47,000,000 brick and of \$841,000 over 1918. The maximum output of sand-lime brick—227,344,000 brick—was made in 1916, but the maximum value was that of 1919.

The output of common brick was 142,755,000, valued at \$1,688,000, an increase of 45,937,000 brick and of \$822,000 compared with 1918. The rest of the output was face brick, which showed an increase of 664,000 brick and of \$19,000 compared with 1918. The average price of common brick per thousand in 1919 was \$11.82, compared with \$8.94 in 1918, \$7.54 in 1917, and \$6.43 in 1916. The average price of face brick in 1919 per thousand was \$16.48, compared with \$11.35 in 1918, \$9.36 in 1917, and \$9.64 in 1916.

Present Value of Deferred Profits

In Which the Mining Engineer's Spouse Confounds the Stock Salesman and Points Out a Few Neglected But Important Considerations in the Sale of Mining Stock

BY MRS. ERNEST LEE WAITE*

Written for *Engineering and Mining Journal*

THE wife of a mining engineer is, *ex-officio*, a potential authority on deferred profits. Furthermore, present value is to her a matter more vital and urgent than it can possibly be to any other class of mining investor. Therefore no apology or further explanation is necessary for what may seem to be an intrusion upon a special field of technical finance or financial technicality.

Suppose that a representative of a reputable broker calls and submits an offer of shares of the "Pasado Mañana Silver Mines, Ltd." He is well trained in his business, and presents a masterly argument to show how this British corporation is controlled and managed by technical experts; and that the profits from treating the present ore reserves will produce dividends equivalent to 10 per cent per annum on the investment for fifteen years and an additional amount to provide a sinking fund, which, reinvested at 4 per cent, will replace the original investment at the end of the fifteen years.

"That sounds interesting," says Mrs. Engineer; "in effect, you offer me an extra profit of 6 per cent per annum for the entire period of fifteen years, above the conservative rate of 4 per cent per annum. But if I leave all my money in a savings bank or in good bonds, I can get 4 per cent interest and compound it semi-annually. Do you mean that if I buy these shares I can save the same amount of money and also have the extra 6 per cent per annum as pin money during the entire fifteen years?"

"Practically so," replies the salesman, who feels that the signing on the dotted line is but a matter of moments. "It is like this: It will take five years to equip the property with hoisting machinery and treatment plant. After that period of deferment the life of the present ore reserves is calculated as exactly ten years, during which time uniform dividends will be distributed at the end of each half year. As a matter of convenience the issue of Class A preference shares, with a par value of £10 each, has been determined as with a total par value exactly equal to the calculated total net profit available from the present ore reserves. During the ten years dividends are to be distributed, to the holders of this first issue of preference shares, at the rate of 10s. per share at the end of each second quarter. Putting this in terms of American money, for each dollar of nominal capital there will be distributed twenty payments of what you Yankees would call a 'jitney' each, eh? Quite so. Now, to determine the present value, at which figure we offer you the shares on account of your husband's profession, we employ the formula given on page 46 of this excellent book."

"Oh, I see," murmurs the proposed investor; "I am quite familiar with that volume. It is excellent, as you

say, in many ways. I often use it in calculating values when my husband and I are preparing his report. That is what we call the 'selling formula.' But when we are working things out in the interest of a possible buyer, we arrive at a present value by another route. In that case, it is desirable to allow compounding at the full remunerative rate during the deferred period. In fact, not only desirable but almost imperative; since the risk feature of the investment is compounded during the time that the mine is earning nothing. In ante-bellum days such a point might have been debatable; but now, with the disorganization of all the elements of costs and realization, the seller of a mine is indeed lucky to cash in at a present value calculated by almost any formula."

"But, madam, consider the speculative value of increased reserves that may be developed during both the deferred and the calculated operating period."

"That is a factor which I have not overlooked," is the calm response. "Such speculative value is one of the major elements that influence trading in mining shares. It is almost invariably discounted and re-discounted. In a private transaction in shares such as you offer, it might be called a trade discount to the profession; and therefore it has no place in the calculation of the price at which the shares are to be offered. Coming back to your formula: If we substitute the known interest and time factors as you have stated them, we have, for the present value of the £1 per year,

$$P = \frac{\left(1 + \frac{.04}{2}\right)^{10 \times 2} - 1}{.04} \div \left(1 + .10 - \frac{\left(1 + \frac{.04}{2}\right)^{(10+5) \times 2} - 1}{.04}\right)$$

"The solving of this equation, to learn the supposed value of each £10 share, is a mere detail for some intelligent hireling. But the essence of it all is that the formula is devised to give the maximum plausible valuation. It is plausible when examined in a superficial way, but upon close analysis its falsity may be demonstrated. For instance, when the deferred period is taken as zero, the numerator and the denominator show common terms which may be factored so as to produce an equation identical with that of formula 9a on page 37 of this same excellent book; giving us

$$P = \frac{1}{\frac{.04}{\left(1 + \frac{.04}{2}\right)^{10 \times 2} - 1} + .10}$$

as the value, at the beginning of the operating period, of the ten-year annuity of £1 per annum in semiannual instalments of 10s. each. I should like to ask you whether this will give the correct value per share at the date when the mine begins its era of actual earning."

The salesman notes the algebraic simplicity and feels

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†Address guaranteed—to be fictitious.—EDITOR.

"The Valuation of Mineral Property," by T. A. O'Donahue; published by Crosby, Lockwood & Son, London, 1910.

that it is safe to reply affirmatively. Upon consulting a table of annuities he states that the value, presumably computed by an identical formula, would be £7 1s. 8d.; equivalent to \$34.47½ at normal exchange. He also states that the present value, at the beginning of the deferred period, as calculated by the formula first given, works out as £4 16s. 1d., or £4.805, and equivalent to \$23.38 at normal exchange; being less than half of the par value of £10, or \$48.66½ at normal exchange.

"That is extremely enlightening," remarks the modern Portia, "but in getting your £4.805 you shed what you British might call the 'bloody insurance' on the accumulated interest credit during the deferred period. Following the same principle as shown on page 45 of this really useful book, we get these items that I am jotting down:

Principal	£4.805
Interest at the rate of 10 per cent on £4.805 equals £0.4805, and £0.4805 per annum for five years, compounded semiannually at 4 per cent per annum amounts to.....	2.631
The amount of the principal at the end of the deferred period is therefore.....	£7.436

You see, it is very simple for me to figure this out; as I use the factor 10.94972 for ten semiannual periods at 2 per cent, as given in the handy interest table on page 70 of the same book, multiplying it by £0.240½ as the interest credit for six months. I say interest *credit* because it is not interest actually paid out, but merely a promise. If the original invested capital requires the remunerative rate of interest in the way of additional profit bargained for as insurance on account of the element of risk, as explained on page 7 of the book, then is it fair to evade the maintenance of insurance on the accumulated interest credit? I say it is not. Just see the difference between the valuation with a deferred period of zero and the calculated amount of the principal at the end of a deferred period of five years. As the deferred period is increased, so the discrepancy becomes greater."

"Ah, yes, madam," replies the expert, "but that is readily explained by the fact that in each case the unit of original capital, upon which the remunerative rate is applied, is a different amount."

"Quite true," assents the other, "that is where part of the deception comes in. To correct it, for each class and kind of mining investment there would have to be a special sliding scale of remunerative rates, applying a different one for each variation in the deferred period. Further, the *actual* remunerative rate on the equity of accumulated principal keeps dwindling lower and lower as the operating period approaches.

"When you offer me an investment on the basis of netting me an extra 6 per cent per annum over and above what I can accumulate at a conservative 4 per cent rate, you certainly rouse my gambling spirit. Now, anybody with a gambler's instinct also has a desire to spend money. I *do* want the extra 6 per cent, but I want to spend it as I go. I should have to sell a little of the stock from time to time, or else put it up as collateral and pay current loan rates and submit to ordinary bank discount or worse. Am I right?"

"Bless my soul, my dear madam," is the earnest response; "I should advise you, by no means dispose of the shares at any early date. This is a most extraordinary mine, and it will be an easy matter to find parties who will accept the shares as security. In fact, our house will introduce you to a private banker who is most accommodating. Let me see, did you say 100 or 200 shares?"

"Ha! Ha! Mr. Broker-man, I did not say any amount; but here is what I am willing to do: I know all about your mine, as my husband tried to option it several years ago. We are quite satisfied as to the ore reserves, but the profit will of course depend upon future conditions in the Republic of Tortillas. The remunerative rate of 10 per cent and the sinking fund rate of 4 per cent are about right as dating from the end of the deferred period; but an accumulative rate of only 4 per cent during the deferred period is entirely out of harmony with banking customs for borrowers. You go back to your office and figure out the compound bank discount operation to show the proceeds of £7 1s. 8d. times 200, discounted semiannually for five years at the average bank rate during the past five years. Multiply your answer by the current sterling exchange rate to get the price in dollars. I will then fill out my check for that amount and instruct my bankers to deliver it to you in exchange for a certificate for 200 shares of the Pasado Mañana Silver Mines, Ltd. Good afternoon."

New Designations of Bureau of Mines Stations

The Bureau of Mines has renamed its mining experiment stations, designating them by their line of work or with reference to the district in which located. Hereafter the stations will be designated as follows:

Name	Location	Work
Petroleum	Bartlesville, Okla.	Oil.
Pacific	Berkeley, Cal.	Chemicals; magnesite; miscellaneous.
Ceramic	Columbus, Ohio	Ceramics.
Alaska	Fairbanks, Alaska	Development of resources of Alaska.
North Central	Minneapolis, Minn.	Utilization of low-grade iron ores.
Pittsburgh	Pittsburgh, Pa.	Mining, largely coal; electro-metallurgy.
Rare and Precious Metals	Reno, Nev.	Rare and precious metals.
Northwestern	Seattle, Wash.	Ceramics; coal washing; electro-metallurgy.
Inter-Mountain	Salt Lake City, Utah	Low-grade lead and zinc ores.
Southwestern	Tucson, Ariz.	Low-grade copper ores.
Central District	Urbana, Ill.	Coal.
Southern	Birmingham, Ala.	Iron and steel; coal; coke; byproducts; non-metallics.
Mississippi Valley	St. Louis, Mo.	Lead and zinc.

German Iron Mines in France Sold

The iron mines near Villerupt, in the north of the Briey basin, which belonged to the Rheinische Stahlwerke and the Krupp Works, have been bought through the intermediary of the Société Métallurgique de la Loire by the Steinfort Steelworks of Luxemburg, according to the *Mining Journal*. The Steinfort Steelworks, formerly the property of the German firm of Felten & Guillaume, passed into the hands of the Société Métallurgique de la Loire some months ago. They have five blast furnaces, one open-hearth furnace, and electric steel works, and a steel and rolling mill, as well as a foundry, are to be built. A company has been formed with a capital of eight million francs for the exploitation of the iron mines, whose annual output before the war was from 600,000 to 700,000 tons.

The Mining and Metallurgical Industry of Norway

Brief Review of Resources and Past and Present Production — Iron Still the Most Important Metal, With Copper and Molybdenum of Secondary Interest — Development Dependent Upon Increased Application of Electric Power

BY MATTHEW R. BLISH

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Written for *Engineering and Mining Journal*

THREE distinct ore fields occur in Norway. One is in the southern part of the country, containing copper, iron, nickel, silver, zinc, and molybdenum. This field is an extension of the great ore belt of central Sweden, and, although much smaller in extent, contains somewhat the same character of ores. The second field is in the central northern part of the country around Trondhjem, and contains iron pyrites, copper, chrome, and zinc. The third large field is in the Far North, and here are found iron and copper. Table I shows the production of the various ores from 1896 to 1917. Limestone, upon which the electrochemical industry is based, is found in five different places, namely the Christiania field, the Bergen tract, the coast district in Romsdal amt, the Trondhjem field, and the deposits in Nordlands amt. Besides these, granite, labradorite, soapstone, slate, apatite, and feldspar occur.

SEVERAL MINES HUNDREDS OF YEARS OLD

Some of the mines of Norway have been worked for many generations. Probably the first attempt to extract minerals from the ground was made at the old iron mines in the southern part of the country, about the middle of the sixteenth century, at which time the production of charcoal iron began. Next in age come the silver mines at Kongsberg, which were opened in 1623 during the reign of King Christian IV. At one time these silver deposits were among the richest in Europe. The copper mine at Roros has been in uninterrupted operation since 1646, or about 275 years. Before the world's large mining centers came to be of such great importance, and our present rapid transportation, these mines were of far greater value to the economic life of Norway than they are at present.

The production of iron pyrites held first place for many years, and in fact it was not until 1915 that it was surpassed by iron ore. The ores in the southern and northern iron fields are of quite different characteristics, and each must be considered by itself. The southern ores contain about 54 per cent of iron, are non-magnetic, necessitating hand picking, and some deposits show a large content of titanium, which renders the ore unfit for reduction to iron. The phosphorus and sulphur content are low. These ore have been used for centuries by the old Norwegian iron works, which began at the end of the sixteenth century to smelt down the ore by the use of charcoal.

The production of pig iron continued intermittently through the years which followed, reaching a high point of 9,900 tons per year in 1845. About this time the lumber trade became a competitor of the iron works for the products of the forests, and the use of charcoal for smelting became too costly to allow the Norwegian pig iron to compete with the iron which was now beginning to be produced in other countries by the use of coke. The production of pig iron fell to 1,000 tons in 1880, and

continuing this descent reached the figure of 400 tons in 1905, produced by only one plant near Tvestrand, whereas at the end of the eighteenth century there were no less than eighteen companies with twenty-two furnaces.

TABLE I. TABLE OF MINING OPERATIONS

	Average Yearly Production in Metric Tons				
	Silver Ore	Copper Ore	Nickel Ore	Iron Ore	Zinc Ore
1896.....	527	29,910	.....	2,000	.....
1901-05.....	868	38,134	4,512	51,452	948
1906-10.....	2,170	36,940	8,492	102,311	1,869
1912.....	4,027	60,018	30,697	408,092	40
1913.....	5,411	70,349	49,990	544,686	897
1914.....	7,372	57,951	48,529	652,273	243
1915.....	8,431	56,097	77,018	714,917	1,829
1916.....	7,515	28,670	79,903	417,899	1,017
1917.....	7,147	39,298	69,639	302,739	269

Average Yearly Production Value in 1,000 Krone

	Silver and Silver Ore	Copper Ore	Nickel Ore	Iron Ore	Zinc Ore	Other Ores
1896.....	400	1,136	.....	14	.....	101
1901-05.....	474	1,777	89	356	12	104
1906-10.....	517	1,897	127	1,045	45	87
1912.....	665	2,584	305	5,400	1	59 (a)
1913.....	630	2,844	497	7,350	19	37
1914.....	910	2,697	487	8,460	5	140
1915.....	1,040	7,844	1,010	11,800	64	1,142 (a)
1916.....	620	3,280	310	9,390	33	2,170 (b)
1917.....	980	4,905	2,250	8,380	10	4,971 (c)

(a) Of which 1,040 was molybdenite. (b) Of which 1,550 was molybdenite. (c) Of which 4,125 was molybdenite.

The total production up to 1905 was about 1½ million tons. During the next five-year period the production of pig iron dropped off to almost nothing, averaging only fifty tons per year from 1906 to 1910. The years 1911 and 1912 saw some improvement, the production in the latter year being 300 tons. When, in 1913, the first electric furnace for smelting ore was put into operation, the production of pig iron by charcoal alone fell to practically nothing, and at present amounts to only a few tons per year.

TABLE II. ELECTRIC PIG-IRON PRODUCTION

Years.....	1913	1914	1915	1916	1917
Tons.....	346	6,909	8,742	6,233	6,295

Production of electric pig iron from 1913 to 1917 may be seen in Table II. So far all electric iron has been produced from southern ores, but the electric smelting of northern ores is a possibility of the near future, if the plans of certain Christiania business men and engineers materialize.

NORTHERN IRON DEPOSITS ONLY RECENTLY DEVELOPED

Whether or not the existence of iron in northern Norway was known prior to 1900, it was not until 1911 that the large deposits were opened. These ores are magnetic, contain only about 37 per cent of iron, and are higher in phosphorus and sulphur than the southern ores. On account of the low iron content, the practice of concentrating the ore is common, and it is also exported in the form of briquets. By far the largest part of Norway's iron wealth lies in the north. It has been estimated by Professor Vogt, of the Trondhjem

Technical High School, that the total iron-ore deposits amount to 150 to 175 million tons, containing about 100 million tons of iron. The Sydvaranger Iron Ore Co., whose mines are in Finmarken, near the Finnish border, contributed 600,000 of a total export of 715,000 tons in 1915, which was the record year in iron-ore production.

Although the exports of ore since 1911, when Sydvaranger began to produce, have been many times greater than before, the first ore was shipped abroad from the southern mines in the early 60's. The ratio of the ore exported to the ore mined has fluctuated greatly through the years, principally on account of a variation in the demand from foreign countries. These ratios are also an indication of the manner in which the iron and steel industry, owing to a lack of coal, has failed to take advantage of the iron resources which have been available. During the 60's about 30 per cent of the ore mined was exported; during the 70's about 50 per cent; during the 80's about 80 per cent; during the 90's about 30 per cent, during the period 1901 to 1905 about 94 per cent, and from 1906 to 1913 about 96 per cent. Exports from 1912 to 1919 inclusive are shown in Table III. Exports for 1920 are running at a rate of about 120,000 tons.

TABLE III. EXPORTS OF IRON ORE AND BRIQUETS, TONS

	1912	1913	1914	1915	1916	1917	1918	1919
Iron ore..	230,123	373,071	311,443	164,506	187,805	150,960	61,443	25,680
Iron-ore briquets.	174,867	195,692	156,352	261,386	216,896	46,875	35,253	7,567

APPLICATION OF WATER POWER NECESSARY

England and Germany have always bought most of Norway's iron ore. There is no indication that Norway's iron and steel industry will develop to any great extent until some substitute has been found for coke in the smelting process, or, in other words, until the almost unlimited waterpower of the country has been made available for this work. Sweden has carried this process to a much higher degree, but attempts to smelt Norwegian ore have so far not been attended with great success. As mentioned previously, a plan is now under way for the establishment of a company to reduce the ore from one of the Northern mines by an electric process. Its projectors are waiting, before proceeding, to get the backing of the Storting to a guarantee for a loan. At present the high price of coal and labor has caused the shut-down of most of the iron mines and smelters. No pig iron has been exported since October of last year.

COPPER INDUSTRY SUFFERING FROM HIGH COSTS

The most important copper-bearing ore is chalcocopyrite, containing, in one mine in the southern district, 24.5 per cent copper, but averaging for the entire country only about 5 per cent. Iron pyrites, which is mined principally for its sulphur content, contains about 1½ per cent copper. Some copper has also been extracted by a nickel-refining company from nickel ore. These three ores constitute the only sources of copper in Norway. Practically no copper ore is exported as such, and there are no imports of copper ore. Up to the present only a small percentage of this ore is smelted electrically, practically all being reduced by the use of coke. One company, the Sulitjelma Mine, is experimenting now on an electrical method.

As shown in Table V, the exports of copper fell off during the war, beginning with 1916, and in 1919 amounted to only 394 metric tons. The reason for this

decrease in the last year is, of course, the slump in the copper market. Copper cannot be produced here with the high coal and labor costs and sold on the present market.

TABLE IV. YEARLY AVERAGES OF COPPER PRODUCTION AND CONSUMPTION

Yearly Average in	Copper Production, Consumption	
	Tons	Tons
1891 = 1895.....	792	1,200
1896 = 1900.....	1,100	1,328
1901 = 1905.....	1,260	1,365
1906 = 1910.....	1,610	1,700
1911 = 1915.....	2,420	4,420

Table IV gives the production and consumption of copper for several years before the war. Production kept pace with consumption fairly well up to 1911. During the period 1911 to 1915, while production fell short of consumption by 2,000 tons, the exports averaged for this period about 2,100 tons. In other words, the copper production was sold to Sweden, Germany, and England, to be converted into finished copper and brass goods, and reimported into Norway. The demand for copper wire and other copper articles has increased about 3½ times over that before the war, and this demand has been covered in considerable part from the United States. The imports of copper and copper wares in 1913 amounted to about 2,000 tons, and in 1919 to about 7,000 tons. At present nearly all of the copper mines are closed down, and the electrical industry is buying its copper from foreign countries in a finished state ready for use.

The nickel-refining industry obtains practically all of its nickel ore from deposits in the southern field. At present the nickel ore is concentrated by three mining companies, and sold to the Christiansands Nickel Refining Works for refining into metallic nickel. Before the war some nickel-copper ore was imported also. None of the nickel ore is exported as such.

TABLE V. EXPORTS OF METALS FROM NORWAY

	1912	1913	1914	1915	1916	1917	1918	1919
Nickel.....	385	594	696	761	723	442	60	...
Copper.....	1,551	2,644	2,558	2,691	1,430	1,900	1,254	394
Zinc (a).....	8,914	10,538	16,517	22,617	28,150	18,395	3,390	3,950
Lead (b).....	118	30	200	...	86	70	5	115
Aluminum (c).....	1,140	2,177	2,942	2,883	4,488	7,601	6,835	3,120
Ferrosilicon.....	6,022	6,323	6,144	9,308	25,256	29,450	16,861	2,458
Ferrochrome (d).....	...	...	2,796	...	2,875	3,550	(e)	(e)

(a) Refined mostly from foreign spelter. (b) Contains also old scrap lead. (c) Refined entirely from foreign ore. (d) Produced partly from foreign ore. (e) Figures unavailable.

Refining is carried on by an electrolytic process, invented and developed by the company's chief engineer, Victor Hybinette. The nickel content of the ore is 1 to 2 per cent. Table V shows the exports of nickel from 1912 to 1919. During the war a considerable part of these exports went to Germany. In 1918 the company suffered a loss from fire at its plant, and, owing to readjustments and the drop in the nickel market at the close of the war, no exports were made during 1919. Refining, however, is now proceeding satisfactorily, although no export has been made in 1920. No nickel is imported as such, but certain nickel wares come from abroad, principally from Sweden, Germany, and the United States. Owing to the comparatively small nickel deposits in Norway, it is doubtful whether export to the United States can ever profitably be carried on.

The zinc deposits in Norway are very small and are confined to the fields in the neighborhood of Christiania, Bergen, and in the Trondhjem amt. The average pre-war production of zinc ore was only about 1,000 tons, containing approximately 30 per cent zinc, and many of the mines have been unproductive for the last five years.

A small amount of lead is found in certain of these ores. Practically no zinc ore is exported.

Table V shows that there was exported from Norway in war years a considerable quantity of refined zinc, which was, however, refined almost entirely from foreign spelter, mainly from Germany. The pre-war imports of spelter amounted to from 12,000 to 15,000 tons per year. Practically all of the zinc refined from this spelter was exported again, for the home consumption of zinc is small, probably not over 500 tons annually, which is used for galvanizing nails and similar purposes. Since the war most of the spelter has come from Australia. In 1919 the import amounted to 31,000 tons, and although the export of refined zinc did not show an increase in keeping with this large import, this may be explained by the fact that almost no spelter came into the country during 1918. Volatilization of the spelter by electric heating is the process of refining.

Practically the only interest which the Norwegian zinc industry has for the United States is the possibility of sending spelter or zinc ore to Norway for electrolytic refining, and the sale of the finished product on the European market. Although this is looking into the future, it may be considered as a possibility.

As previously stated, the silver deposits in Norway were at one time among the richest in Europe. During many years' operation they have been worked out to such an extent that the government is considering the introduction of a small proportion of nickel into its coins to conserve the remaining silver. This mining industry, of course, has no interest for the United States, except that it may be necessary for Norway to import some silver in years to come.

Previous to the war the ferro-alloy industry consisted of the production of ferrosilicon, which was being made in 1909 by three companies. This alloy is produced from quartz, and scrap iron or iron ore. It is the most widely used of all ferro-alloys at the present time, and as quartz is found in many places and in great abundance in Norway, it is natural that this alloy should be most extensively manufactured.

Next in importance and in quantity of manufacture is ferrochrome. The chrome deposits in Norway are found in the Trondhjem and Nordlands amts. Up to 1916, when 2,757 tons of chrome ore was mined, the production was small. In 1917 a total of 3,975 tons was taken from the earth. These ores contain from 14 to 38 per cent chrome oxide. The native ores were not, however, used to a great extent in Norway for the production of ferrochrome while it was possible to secure the rich African chrome ores. This was impossible during the latter part of the war, but now these ores are being used almost entirely.

Another important ferro-alloy is ferromolybdenum. The molybdenum occurrences in Norway are claimed to be among the most important in Europe, but so far they have been worked to only a small extent. They contain about 80 per cent molybdenite. Ferromolybdenum was used during the war by Germany, but has not so far been used extensively by England and the United States, where ferrotungsten is preferred. The invention of Dr. Arnold, of England, has caused considerable stir here, with the hope that his method of steel manufacture by the use of ferromolybdenum may prove so successful that the mining of molybdenum and the production of the ferro-alloy will be stimulated thereby. It will be years before this hope is realized, and in the meantime the use of ferromolybdenum is not extensive.

Other metals are found in Norway, such as wolfram and titanium, and at the beginning of the war, when the demand for ferro-alloys began to assume enormous proportions, experiments were conducted for the production of such ferro-alloys as ferromanganese, ferromangan silicon, ferronickel, ferrotitanium, and ferro-wolfram. With the exception of ferronickel, a small amount of which was exported in 1913, statistics do not show exports of these other alloys. It is now planned to make ferromanganese from ores imported from the Caucasus. The ferro-alloy industry, under the stimulus of war demands, grew considerably, but it still depended mainly on ferrosilicon for its chief support. In 1917, the year of greatest export, the value of this alloy sold abroad was \$4,250,000. Experts have stated that success in the ferro-alloy industry lies in the ability to adapt the production to suit the demands and the markets. The industry is based entirely upon the use of electric current, but a small amount of coal or coke for reduction purposes must always be used, and this must come from abroad.

Ferrochrome and ferrosilicon are the only two alloys exported at present, and they are going mainly to England. The United States has no inducement to buy Norwegian alloys now, because they can be obtained at home more cheaply. There is also a duty of 15 per cent on the import of such materials into the United States, and, in addition, the ferro-alloy industry, which was built up during the war, will probably be maintained for a few years at least, even though the production is expensive.

Copper Industry of Japan

Copper deposits are found over a large part of central Japan. The ores, which occur in Tertiary volcanics, consist of chalcopyrite and pyrite running 2½ to 3½ per cent copper, and are commonly concentrated before smelting. The gangue is usually quartzose. Lenticular deposits of cupriferous pyrite in Paleozoic schists and sediments occur on the west and the south side of Japan. These mines yield smelting ore carrying about 3½ to 4 per cent, but contain little silica. Pyritic smelting is extensively practiced. Over one-half the copper production comes from four chief mines: Ashio and Kosaka, of the Tertiary type; and Hitachi and Beshi, of the Paleozoic schist type.

The state reserves to itself the right of original ownership in all ores, including copper. The right to work them is granted to individuals or companies of Japanese nationality. Copper mining, smelting, and refining companies seem to be entirely Japanese in ownership and policy. The number of mines is considerable, but their ownership is concentrated in a few hands, and the smelting and refining industry is still more concentrated. Japanese producers sell their own copper, all foreign selling agencies being strictly Japanese. The mines in Japan are not generally worked as joint-stock enterprises, but are mostly family properties inherited by the present owners.

Because of labor conditions, abundant fuel near the mines, and free water transportation, Japanese copper production has increased rapidly in recent years. High prices and the adoption of modern methods of mining and smelting have been important contributing factors.¹

¹F. W. Paine in "Political Commercial Geology," McGraw-Hill Book Co., 1920.

The Mining of Paint

The Yellow Ocher Deposits of the Cartersville District, Georgia, Constitute an Important Source of the Pigment Necessary in Its Manufacture

BY MARSHALL HANEY

Written for *Engineering and Mining Journal*

IN 1877 E. H. Woodward opened the first ocher mine near the town of Cartersville, Ga., the ore being hauled in wagons to this point, where it was prepared for market. A. P. Silva opened a mine in the same locality in 1878. In the process of drying the ocher he used a crude brick furnace about thirty feet long and

the east. The separation line of these two groups of formations marks the position of the Cartersville fault, the most important structural feature of the region.

This district is a portion of the southern Appalachian region partly in the Appalachian Mountains and Piedmont Plateau provinces and partly in the valley province. The region has been subjected to intensive compression in a northwest-southeast direction. The formations (Paleozoic) to the west have been folded and faulted and those to the east have been mashed and squeezed. Another result is shown in the upward and westward thrust of the older rocks to the east on the younger rocks of the west, producing the Cartersville fault. At many points the rocks have been greatly altered by chemical and physical action.

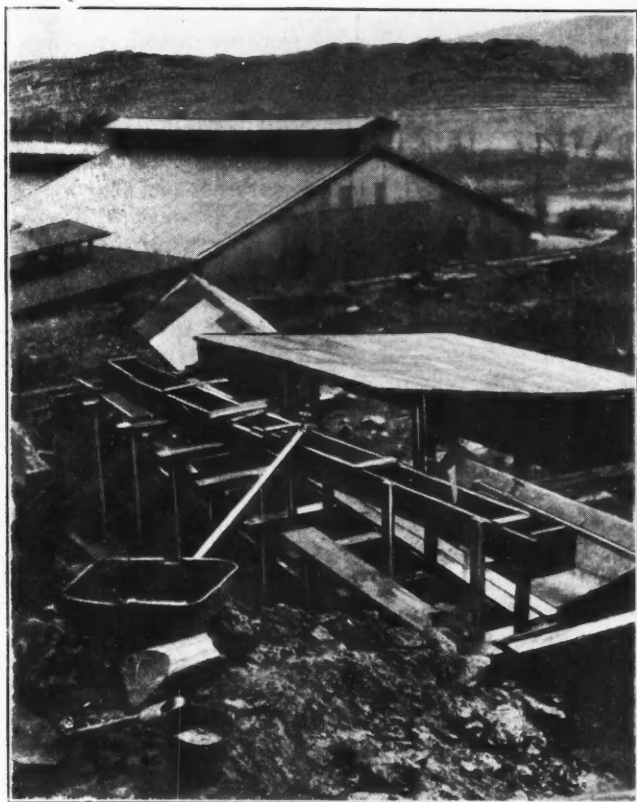
OCHER OCCURS IN SHATTERED QUARTZITE

The most important formation is the Weisner quartzite, which shows evidence of great compression over the district, and this produced conditions favorable for the deposition of ocher. The ocher is confined entirely to the Weisner (Cambrian) quartzite and occurs in a continuous belt from near Emerson to Rowland Springs, a distance of nine miles. It is found in the shattered zone of the quartzite. No clue to the vertical extension of the ore is furnished by any of the extensive workings in the district, although it is generally believed that the ocher occurs at considerable depth.

There is little difference in the appearance of the ore in this district excepting for a slight variation in color. This varies from a dark to a light bright yellow, and is caused by the clay admixture with the ocher, which in turn depends on the character of the rock which the ocher replaces. The colors of ochers generally depend upon chemical composition. Prospectors are guided in locating the ore by fragments and masses of quartzite impregnated with ocher and of a yellow color, and in many places there is little or no showing at the surface and its presence is indicated by natural or artificial cuts and openings. An important surface indication which aids in tracing the ocher deposit is the presence of barite, which occurs in many places in the residual decay covering the quartzite.

The ocher deposits form along irregular branching veins which cut the rock in many directions, and at irregular intervals the veins narrow and widen and thin and thicken. For this reason the workings are very irregular, and in some places the chambers are ten or twelve feet in diameter and connected by an irregular narrow passage with another chamber of varying dimensions. Where the ocher bodies are inclosed by quartzite it is frequently necessary to blast, although this is not required where the ore is inclosed in clays.

The pure portion of the ocher bodies is soft and is easily mined with pick and shovel. Much of the mining is open-cut where the overburden is too thin for underground work. On the developed properties the method of mining consists of adits driven into the ridge, with shorter drifts and tunnels worked from the main ones



OCHER WASHER IN THE CARTERSVILLE DISTRICT

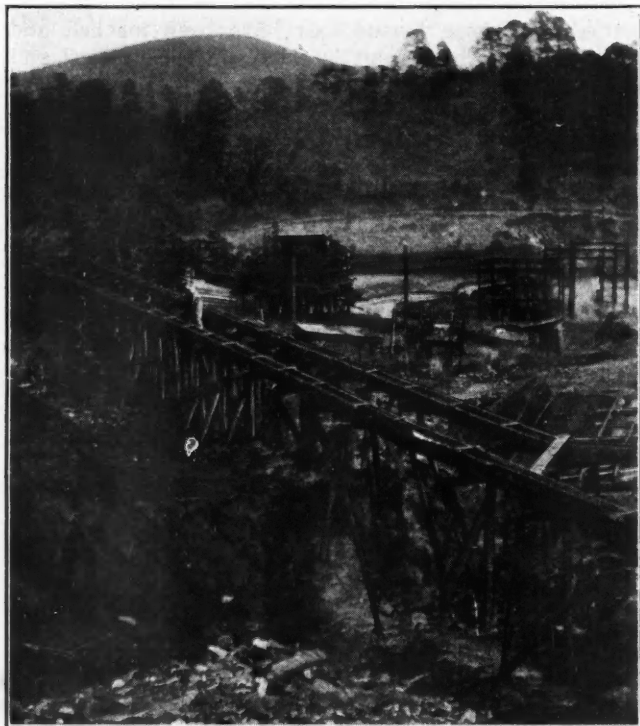
four feet wide, with a sheet-iron bottom and a fire box near one end, and this crude device gave good satisfaction. The hauling of the crude ore to Cartersville for preparation was continued for many years. Messrs. Earle and Oram started the first systematic mining and preparation of the ore in 1891, using modern machinery. During the period between 1891 and 1900 many mines were opened and in operation, and the output for 1900 was valued at \$73,000.

LOCATION OF THE CARTERSVILLE DISTRICT

The Cartersville district, which has produced a large proportion of the ocher mined in the United States, derives its name from the town of Cartersville, the county seat of Bartow County, and is about fifty miles northwest of Atlanta, Ga. The ore-bearing area includes about seventy square miles in the southeastern portion of Bartow County. This region is equally divided between the Paleozoic formation on the west and the older crystalline and metamorphic rocks of the Piedmont Plateau and Appalachian Mountains on

at suitable points. By so doing a number of levels, one above the other, have been worked. Timber is necessary to prevent caving, and the workings are extensive enough to use electric lights and tramways. The tram cars are hauled by mules or by means of cables.

The principal impurities of ocher are clay, sand, and manganese dioxide. The preparation for the market consists of washing, drying, pulverizing, and packing. After the ore has been mined it is carried on a tramway from the mines to a washer similar in construction to the washers used for washing manganese and brown iron ores. The fine portions of the ore remain suspended in the water covering the revolving shaft of the washer and are floated out by the water escaping through the openings near the top of the washer into a flume, which empties into a series of vats a short dis-



FLUMES FOR CONVEYING ORE FROM WASHER TO DRYING VATS

tance away, where the ocher settles. Most of the water is removed by decantation and the rest by evaporation.

Most of the treating plants handle from twenty-five to thirty tons per day. The vats are arranged in series and steam pipes are run at close intervals along the sides and bottom for steam heating. By this method only one or two days are required to dry the ore completely. The rack, air, and sun method requires about eighteen days to complete the drying. After the ore is dried it is pulverized and packed in barrels or bags of uniform size for shipment.

Activities of Ontario's Cobalt-Nickel Refineries

From Jan. 1 to July 1, 1920, according to the Ontario Department of Mines, 1,445 tons of ore, 581 tons of concentrates, and 1,185 tons of residues were treated in the southern Ontario refineries at Thorold, Deloro, and Welland, for a recovery of 1,477,490 oz. of silver, in

addition to arsenic, metallic nickel, metallic cobalt, and compounds of these last-mentioned metals. The companies operating were the Coniagas Reduction Co., the Deloro Smelting & Refining Co., and Metals Chemical, Ltd., respectively. The last mentioned operated for the first three months of the year only, after which the plant was taken over by Ontario Smelters & Refiners, Ltd. Alterations in plant and process were made, which prevented production during the second quarter of the year. This new company also owns the plant at Chip-pawa formerly operated by the Standard Smelting & Refining Co. Copper sulphate was recovered from residues by one of the companies. It should be pointed out that the output of metallic nickel and nickel oxide from silver ores is small compared with that from nickel-copper refining. Only 203,713 lb. of metallic nickel and 15,384 lb. of oxide were marketed.

Talc Mining in South Africa

The mining of talc in South Africa appears to be a development of the war period, according to Trade Commissioner R. A. Lundquist, as little appears to have been done in this field prior to 1913. Even then early mining was for gold, with talc as a byproduct. The production for the past few years is as follows: 1913, 1 ton; 1915, 44 tons; 1916, 132 tons; 1917, 785 tons; 1918, 670 tons; and 1919, 757 tons. In addition to the above raw talc production, the mines themselves have turned out a considerable amount of manufactured talc goods, totaling 412 tons in 1917.

The more important districts in which talc is found are the Barberton district, the Krugersdorp district of the Transvaal, in Zululand, and in southern Rhodesia. The more important of the above is the Barberton district, though it is said that fine foliated talc is found in southern Rhodesia. The area over which talc is known in the Barberton district is about ten miles long and averages about a mile in width, and the deposit occurs in the form of nearly vertical bands up to fifteen feet in thickness. It is said that the talc reserves in the Barberton district are enormous and if properly developed should yield a large tonnage available for export.

At present there are only three producing talc mines in the Union. These are the Verdite mine, Jamestown, Barberton, Transvaal; the Scotia talc mines, Joe's Luck, Barberton, Transvaal; and the mines of R. R. Berrett, Greytown, Natal. The first two mines are the principal producers, and operate in the district between Jamestown and the Sheba Valley.

The Verdite mine and the Scotia talc mines each have a plant capable of dealing with 200 tons per month, though it is understood that recently the latter mine has developed its plant capacity to a point where it can turn out as much as 1,000 tons per month.

The talc is locally prepared according to the French system, using a disintegrator of the "cyclone" type, with a fan separator.

The local demand for talc is not great, and both the Verdite mine and the Scotia talc mines have large surplus outputs available for export. For crushed massive talc the present quotation is £6 5s. per ton of 2,000 lb., f.o.b. Delagoa Bay, for orders of not less than 200 tons. For uncrushed blue massive bulk talc the price quoted is £3 5s. per ton, f.o.b. Delagoa Bay, for orders of not less than 200 tons.

Not So Very Long Ago

Extracts From Early Mining Promotion "Literature" Often Have Familiar Sound—Shepherd Discovering Bonanza by Well-Known Camp-Fire Process—Rocky Mountains And High Altitudes Best Places for Ore Deposits

BY KIRBY THOMAS

Written for *Engineering and Mining Journal*

AN EARLY DAY keeper of the records who was attached to the Astor Library, now merged with the great New York Public Library, has left some interesting monuments to his zeal for history and to his industry. These are to be found in the form of a series of bulky indexed volumes which include many documents of human and business interest, together with a large number of mining reports and prospectuses of mining companies, which were thrust upon the dear public of a generation or more ago—even as today. These records are even now frequently consulted for the historical information that they suggest and for definite data otherwise difficult to obtain. In the light they throw on the different standards and ideas which have developed with the closer identification of engineering with mining they make curious reading. There is, however, a familiar note in some of the promotion reports, as will be observed from the extracts that follow.

This reservoir of the early history of mining, with its recital of names famous in the beginning of the industry but now almost forgotten, and its stories of hopes, which were mostly deferred, as we now know, seems worthy of being tapped for the interest, instruction, and amusement of the present-day seekers after the "golden fleece." Perhaps those so inclined may draw some self-comforting moral from these personal documents of those who have gone before, not so very long ago.

THE OLD FORMULA

Extracts and excerpts from these records are here given, with some necessarily brief comments and elucidations:

A pamphlet, apparently published about 1858, relates the story of the Mina de Tajo, a Mexican undertaking. On the front page is a quotation in large type from an alleged, but not specified, Spanish record, which declares that the mine "*es muy rica, riquísima—abandonada por las aguas*" (very rich, very very rich—abandoned on account of the water). Following this is the serious relation of an incident, familiar to those who read much about mines and mining. A lost shepherd built a fire to keep off the mountain chill, and in the morning found in the ashes buttons of silver melted out of the hearth-stones, which, in this case, as in others which have gone before and followed after, were rich and docile silver ore. This incident is supposed to have happened about 1727.

Anthropologists may consider this recital a plagiarism of their musty notes of the early beginnings of happenings to the human race, and on the other hand some modern engineers, who have made bold to embody variations of this incident in their reports, may not admit priority. The herder made an open cut on the hillside, near the place where the ore came from; hence

the name Tajo, meaning, in Spanish, a cut or trench. The history of the mine, supported by official records and human testimony, is consecutively detailed down to 1850, when, according to the record, one Boniface Rojas, "a noted scoundrel," got control of the mine and looted the rich ore reserves, which fact, perhaps a new idea at the time, is given as a good and sufficient reason why the company which inspired the prospectus was able to secure the property so advantageously. Ward's "History of Mexico" is quoted in substantiation, and, of course, also Alexander Humboldt.

The ore is reported to have had a value of from \$56 to \$1,500 a ton. On the expected basis of an output of "630 cargass" yearly, a profit of \$914,000 annually was promised. One H. J. Van Ripper, "citizen of the United States and eighteen months resident of Rosario, and engineer of the mine," made formal affidavit that "the width and power of the vein in no place, to my knowledge, has been discovered." The principal backer of this undertaking seems to have been one Don Jose Gordon, whose name suggests hybridization. Presumably the mine referred to is the same as the Tajo mine of later-day fame, as it is described as being seventy miles from Mazatlan.

BEST SILVER MINES FOUND IN HIGH ALTITUDES

In 1865 J. P. Whitney, of Boston, issued a pamphlet entitled "The Silver Mining Regions of Colorado." In his opening paragraph he justifies himself by declaring that he has "the authority of the most eminent geologists and metallurgists for the assertion that the Rocky Mountains are the legitimate localities for true gold- and silver-bearing ores." Further, he says that there is "undisputed proof of the volcanic origin of the ores" and also that "true plutonic ores are in such profusion and in such inexhaustible quantity as to almost challenge one's belief." Continuing—"main lodes have been vomited forth from the mysterious depths of the earth, etc. . . . The mines are identical with those of Mexico, of which they are a continuance. . . . It is a well known and established fact that the best silver mines are invariably found in high altitudes."

In conclusion, the author asserts that he met a soldier near the mine, who had "a two-pound nugget of silver cut with difficulty from a ledge." He describes the first ingot of silver ever produced in Colorado. It was from the smelter of Lyon & Johnson and was made Aug. 26, 1865, from "Clear Creek district ores." Explaining the state of the metallurgical art of the day, he discusses the "Lyon smelting process," the "Crosby & Thompson method of desulphurization" the "Behr & Keith process" and the "Mason process." It is interesting to note that none of these names are today current in metallurgical circles.

Whitney's pamphlet ends with a very cheering picture concerning the attractiveness of investments in mining,

a sentiment which is not entirely foreign to the modern promotion literature.

The author of the prospectus of the DeLery Gold Mining Co., issued in 1866, was either an amateur or was over-conscientious. The opening paragraphs of this appeal set forth that "the business of mining the precious metals is confessedly one of great risks. All prudent men regard its allurements with suspicion. None but the bold will fearlessly venture money in a direct search for gold and silver. The history of Mexico and the Pacific Coast furnishes abundant proof that these apprehensions are well founded." After these alarms the writer proceeds to offer the "guaranteed stock" of the company, "capital \$1,000,000, guaranteed stock \$500,000."

It would be interesting to know how the stock was "guaranteed," but this information was not vouchsafed. The company was founded to operate the gold placers in the Seigneurie Rigaud Vaudreuil, on the Chaudiere River, in Quebec. It is blandly asserted that "merely initial exploration has revealed some forty miles of gold-bearing quartz ledges." Surely this fact should have been sufficient without the "guarantee." The company's office was at 72 Cedar St., New York.

ORES OF COLORADO AND MEXICO IDENTICAL

The Mineral Point Tunnel Co., 1878, seems to have been a sort of grandparent for the large progeny of similar undertakings which later disturbed the majestic scenery of the San Juan Mountains of Colorado. The sponsors "propose to call attention of the investors to only such facts as upon more extensive examination can be fully and satisfactorily maintained." Following this very reasonable premise is a quotation from "the great French mining engineer, Simoreis," to the effect that "the silver mines of Colorado give undisputed evidence of great natural wealth. The ores are true silver ores and the mines are identical with those of Mexico, of which they are a continuation."

This same convenient authority declares that "it is a well-known fact that the best silver mines are invariably found in high altitudes." Continuing, he says: "This property is located in the backbone of the silver-mining district, and it is the focal point at which centers and crosses great mother veins." The company had a capital of \$1,000,000. The shares, par value \$25, were offered at only \$10.

Several pages are given to testimonials as to the character and ability of F. J. Pratt, who is apparently the chief figure in this early incident. The proposition is unqualifiedly endorsed by several governors, by half a dozen postmasters, by three mineral surveyors, and, of course, "an old and experienced miner" is quoted, and also "a prominent law firm from Lake City." E. Steinbach, "Dep. U. S. Min. Sur. and Mem. Amer. Inst. Min. Eng.," makes a fairly good report on the property, but spoils its verisimilitude by a fantastic map and section which shows all of the veins "focalizing" on the tunnel courses.

The "Corinna Silver Mining Co." of Bangor, Me., apologetically announced in 1880 that it "had not intended to issue any prospectus until the property had been thoroughly examined and reported upon by a mining expert." The company's property, it is interesting to know, was at Corinna, in Maine, and it was discovered by one Abel Adams, "who had some experience in California mining." The "main" shaft, 60 ft. deep, and two

other shafts, 12 and 14 ft. deep respectively, are reported to have shown "rich antimonial silver ore, which resembles closely Nevada ores." It is stated that "in the vicinity of the vein are large quantities of gossan and melted rock, which are said to be an unfailing indication of a large body of ore below."

In a pamphlet, dated 1877, Ross Conway Stone makes a defence of the mining industry in this hardy fashion: "Gold and silver mining have stood the test of these disjointed times, and despite commercial crises continue to increase in strength. . . . It is fashionable to call gold and silver mining a gamble and ephemeral—the rule is to the contrary." He advises the "East" to secure "its own mines instead of stocks, manipulated by San Francisco magnates." These sentiments are reminiscent of the panic of '73 and recall the reputed methods of the Comstock financial operators of the time. Mr. Stone has not neglected to include a familiar list of "dividend" mines and of "bonanza" properties.

MANY ENDORSEMENTS FOR RED ELEPHANT

The Red Elephant Mines Co., 1864, had the distinction of endorsement in reports made by "Prof. Rossiter W. Raymond, Prof. E. E. Berthoud, General Francis L. Vinton, E. Le Neve Foster, M. E., and W. A. Campbell, Esq." The company had a capital of \$5,000,000, shares \$10 par, office 30 Broad St., New York. Harvey Durand was president. In the prospectus it is claimed that the company owned the four most developed mines of the Clear Creek district, Colorado, namely the Free American, White, White Extension, and Boulder. It is also claimed that the average content of the ore was from 140 to 175 oz. of silver; further, that "there is every certainty of the orebodies not only going to depth but steadily improving with depth in quantity and quality"—a fine figment not yet extinct in mining literature. Mr. Foster says: "The proposition is one of the best in Clear Creek, and can be recommended to parties desiring to invest in mining operations."

Dr. Rossiter Raymond is quoted as follows: "The opinion I formed was highly favorable to the property. It has persistent fissures, carrying extensive shoots of exceptionally rich ore." It is to be noted that Dr. Raymond in this early day stood by his guns, so to speak, with reference to the spelling of "ore shoot"—possibly his genius may have originated the nice distinction between "shoot" and "chute."

The prospectus contains telegraphic reports (some enterprise at the time) from Charles S. Richardson and J. Alden Smith, both state geologists, strongly endorsing the property. The latter says: "The property is capable of producing from \$50,000 to \$75,000 per month, and of increased production when more ground is opened up." With such indorsements and reports a modern Boston promoter would certainly be able to bring about a serious stringency in the money market. The prospectus is further adorned by some lithographed pictures of scenery and maps in block colors.

The Sir Roderick Dhu Gold Mining Co., in the Black Hills, had some good neighbors, a fact which was not overlooked in the printed report of the superintendent, F. A. Babcock, made to John McGuinness, Esq., president, New York, in 1879. It is noted that the Homestake property was selling on the market on the basis of \$4,000,000, and the Deadwood and the Father De Smet for more than \$2,000,000 each. "Why should these be more valuable than the Sir Roderick Dhu, which has

abundance of ore and the requisite mill facilities for manipulating it?" Superintendent Babcock naively asks. He quotes Louis Janin's classic report on the Homestake as an inferential endorsement of his own mine. He estimates \$6 ore and mining and milling costs of \$2.35 a ton, and promises monthly earnings of \$19,500, or 23 per cent annually on the capital of \$2,000,000, "providing the company has sufficient working capital." He asserts that the mine is "capable of magnificent development." He points out the moral of the Comstock operations as an example of the fallacy of not developing mines ahead of the immediate requirement.

A BIRD'S EYE VIEW OF THE BLACK HILLS

The "Bird's Eye View of the Black Hills Gold Mining," edited by Harry L. Norton, and published in 1879, by the New York Mining Exchange, 60 Broadway, records that there were 5,000 mining locations in the Black Hills and fifty-two stamp mills (1,720 stamps). The stamps were from 550 to 800 lb. each. The output for 1878 is given as \$6,000,000, and the total investment in mining is \$2,500,000.

The Black Hills Placer Mining Co., 37 Wall St., New York, Major General Alexander Shaler, president, published "for private distribution," in 1879, a report by Marcus Walker, indorsed by John Rigby, "M. E.," in which a monthly profit of \$100,000 is estimated, which was certainly modest, considering that the property was claimed to have "2,300,000,000 cu.yd., which by estimate will net more than \$1 a yard."

The endorsers of the Columbia Silver Mining Co., 10 Pine St., New York, said to be mining at Austin, Nev., were certainly as eminent as one might desire. Professor Silliman, of Yale College, is quoted under date of 1866 as saying that these mines carry "the richest and best silver ore known." Professor Fisher, of Yale, is given as authority for the assertion that "these mines are far richer and more extensive than those of Mexico, or any others yet developed." Bishop Simpson, of the Methodist Church, is responsible for the statement that these mines "are richer the more they are worked, and no one has been able to estimate their depth or extent." The company had a capital of \$3,000,000, shares par \$100.

Rossiter W. Raymond was secretary and Chauncey M. Depew was president of the MacDonald Silver Mining Co., which in 1866 published a report by Aldeberg & Raymond, mining engineers, on the company's property in Lander County, Nev.

A prospectus of the Bassick mine, in Colorado, published in 1879, contains very complete reports by Henry Cummings, who was later famous in connection with the Hornsilver mine, in Utah, and by James D. Hague, "M.E.," and Professor John S. Newberry. Mr. Cummings congratulates the new owners of the Bassick, Messrs. Frank G. Brown, of New York, and Dennis Ryan, of Frisco, Utah, and ingenuously says, "You should be emulated in your method of employing the most skillful, experienced and reliable expert to examine the mines you purchase. . . . If all persons desirous of purchasing mines would pursue a like method and also adopt your policy of paying for a mine 50 per cent of the estimated value of the ore reserves that can be actually measured mining would be unattended by the hazard generally attributed to it."

It is to be hoped that the policy which Mr. Cummings approved will not be taken too seriously by the capitalists of today, otherwise mines are likely to go without

buyers for some time. Mr. Cummings makes very scant observations on the nature and origin of the unusual ore occurrence at this mine, simply suggesting that the boulders fell into the chimney and stating that they were coated by solutions from below "which were so hot as to char remnants of wood found with the ore." He declares that "the character of the orebody is without parallel, and it is the largest telluride mine yet discovered." He estimates the ore reserve as 2,000,000 tons, value \$58.40 a ton. Shipment to Denver cost \$20 a ton freight, and 10 per cent of the gold and 15 per cent of the silver were deducted by the ore buyer for losses in treatment.

Mr. Cummings also figures in a very interesting publication made by the Hornsilver mine at Frisco, Utah, in 1879. In Mr. Cummings' report the public is assured that the "ore is associated with trachyte of volcanic origin." The ore reserves are calculated in detail, the results showing 527,000 tons, containing an average of 71.52 oz. of silver and 42.26 per cent lead. The net value of the reserve claimed is \$27,976,552. The company had a capital of \$10,000,000, in shares of \$25 each. A separate report made in 1878 by William E. Hooker estimates the grade of the ore at \$34.46 and the net ore reserve at \$17,955,000. The prospectus includes some remarkable plates and drawings, made by the late Leo Rosenberg, of New York.

ALASKA GOLD'S OPERATIONS

A publication more recent than the preceding, yet old enough to give some interesting cost data for comparison, is that of the Alaska Gold Mining Co., for 1897. The property had in operation 120 stamps (1,020 lb. each). The crushing result was 3.75 tons in twenty-four hours for each stamp. The costs per ton were: Milling, \$0.3217; mining, \$0.9532; chlorination, \$0.2106; total, including general and overhead, \$1.5602. The yield per ton was \$2.1242. The total ore mined for the year was 158,000 tons.

The report notes that labor was plentiful. The roll included 105 whites and 33 Indians. The wage scale was as follows: Miners, \$2.50 per day, labor, \$2 per day, drillers, \$2.50 per day, with bonus, including in each case board and lodging. The mill men were paid \$90 a month and the hoisters and concentrators \$65 to \$75 a month, also with board and lodging. The Indians were paid \$2 a day and "no board."

The international aspect of this company is indicated on the title page, which designates as the company's bankers "The Bank of California, San Francisco; Messrs. William Rothchild & Sons, London; London agents, the Exploration Co., Ltd.; Paris agents, Compagnie Française de Mines d'Or et d'Exploration." Honorable William Alvord was president and Captain Thomas Mein, consulting engineer.

These are a few selections from the archives. They may carry interesting recollections to some of the readers of *Engineering and Mining Journal* and afford a crude standard by which to measure the progress in the profession of mining engineering, and perhaps some philosophical minds may be able to deduce from these data whether or not the human race is progressing.

Selenium is recovered as a byproduct in the electrolytic copper refineries operated by the Raritan Copper Works, United States Metals Refining Co., Nichols Copper Co., and American Smelting and Refining Co. Practically none is imported.

Mining Engineers of Note

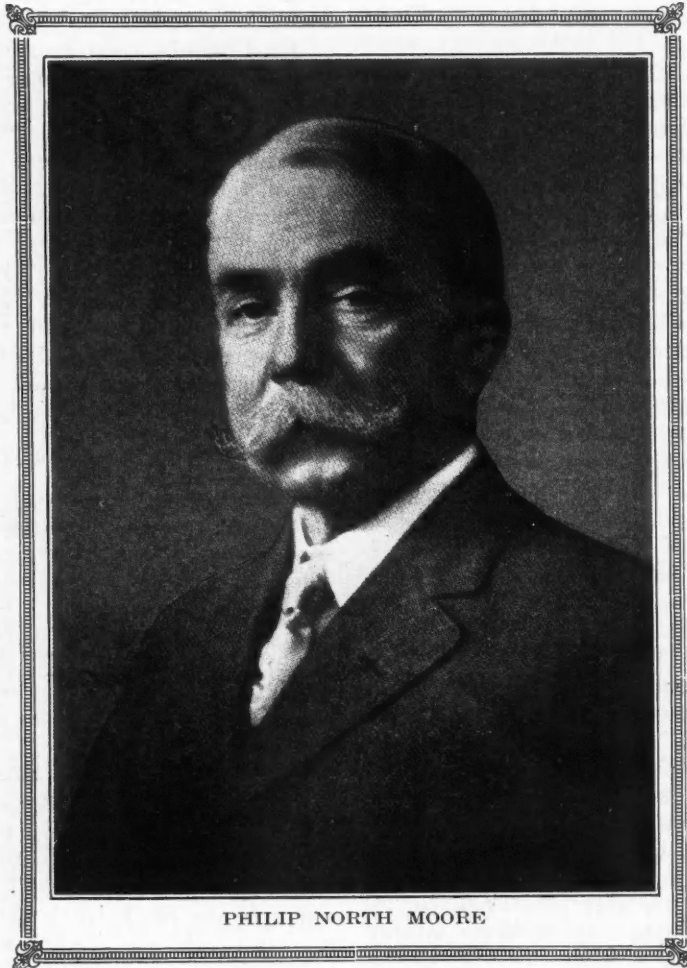
Philip North Moore

PHILIP NORTH MOORE carries his seventy-one years lightly, and younger men may well envy his buoyancy of spirit, his pleasantness of manner, and his keen enjoyment of his work. Graduating from the Columbia School of Mines in 1872, Mr. Moore spent the five years following on the state geological surveys of Michigan, Missouri, and Kentucky. He then entered into consulting practice in Leadville, Col., and later became treasurer and managing director of the Slate Creek Iron Co., in Kentucky. Since that time he has maintained his headquarters in St. Louis. Successively, he has been manager of the Courey Placer Mining Co. and the German Bar Mining Co., of Virginia City, Mont.; president of the Rose Run Iron Co., Kentucky; president of the Tecumseh Iron Co., Alabama, and of the Admiralty Zinc Co., of Oklahoma. From 1917 to 1919 he was a member of the Engineering Council, and from 1918 to 1919 a member of the engineering division of the National Research Council. Mr. Moore's standard in life has been to build a character rather than prominence, on quality rather than quantity.

He was wont to observe that he had never reported on a mining property in which he was interested, and never managed a property in which he was not interested. It was the St. Louis conception of his character which led his friends to break away from the "state" ticket of the American Institute of Mining and Metallurgical Engineers, and nominate him as an independent and opposition candidate for the presidency of that body in 1917; and after a warm but good-natured campaign, out of which both sides got a lot of fun, he was elected. His administration was marked by a great deal of achievement and some unconventionality from Mr. Moore, who has a habit of stating the unvarnished truth as he sees it with the minimum of circumlocution, which may on occasion prove temporarily disconcerting. He does not lack the ability to express his thoughts, however, and this ability has been taken advantage of by pulling him forward often as spokesman for the American Institute of Mining Engineers and Engineering Council.

Mr. Moore's present job is as a member of the War Minerals Relief Commission, whose function it is to pass on claims under the War Minerals Relief Act, and allot to successful claimants their share in the \$8,000,000 relief fund appropriated by Congress. There are now

two engineer members of the commission, Mr. Moore and Mr. Pomeroy—the chairman of the commission being "Honest John" Shafroth, former Senator, and Governor of Colorado. It is a job where the engineer's knowledge and judgment is the main consideration, and from the way the work has been carried on we may extend the sobriquet of its chief to the other members, and say "Honest Phil" and "Honest Horace." We do not think any of the most disappointed ones among the claimants who have to be sent away empty handed would file objection to these designations, although some of them might remark that there are times when they are not looking for just that kind of rigid adherence to the rights of the Government and the public welfare. We will not go so far as to say that "Honest Phil" has it in mind that some of that



PHILIP NORTH MOORE

\$8,000,000 may be turned back into the public treasury. This would be a heresy that would be contrary to all instances of the doling out of Government pap. At any rate, the pressure will be to have the decisions of the commission, if negative, or if "Honest John," "Phil," and "Horace" have not seen their way clear to loosen up, contested ad infinitum in the Court of Claims.

We understand the commissioners are not in favor of the Court of Claims: but if they will consult the case of Jarndyce vs. Jarndyce, as recorded by Dickens, they will find the precedent of once a claimant, always a claimant. If it were not for that, one would be tempted to say that the mining industry had been darned lucky to get such understanding and sympathetic (yet conscientious) administrators as the War Minerals Relief Commission; and that anybody who would not abide by their decision was either a poor sport or the hungry attorneys were pulling his leg. It is a fact that a few claimants that were not entitled to anything have slipped in under technicalities, and received awards.

BY THE WAY

Majority Rule

"This moornin'," said Cap'n Dick, "I wuz talkin' to one o' they college chaps 'oo's learnin' practical minin' trammin' gob on tha h'eight 'underd level, an', dam-me, 'e's come forth with tha mos' h'interestin' discussion o' they Rooshian chaps 'oo call theirsels' Bullsheviki. 'Cordin' to w'ot 'e sez, this 'ere name, Bullsheviki, in Rooshian, means majority. Which reminds me o' poor h'ol' Nicky Trebilcock. One evenin', a nummer o' years h'ago, I sat 'longside Nicky at a meetin' to h'arrange for tha Miner's Union picnic. Nicky, 'e wuz 'ard o' 'earin', an' w'en Jim Penglaze h'asked for tha h'opinion o' tha majority as to w'ere tha picnic was to be 'eld, Nicky 'as to turn to me to h'ask w'ot Jimmy 'ad to say. Several h'others then come forth with suggestions for h'approval o' tha majority, an' all this time Nicky wuz cranin' o' 'is nuddick an' 'is 'and be'ind 'is ear. Sam Treloar, chairman 'o tha refreshment committee, h'announced that, majority bein' willin', 'e would 'ave a special keg o' beer for 'Arry Rowe's brass ban'. By this time Nicky 'ad growed h'excited, an' seemed turrible h'upset. Turnin' to me, 'e sez, 'They bloody h'Irish do seem to be 'avin' all tha h'influence raoun' 'ere lately. Never 'ave I 'eard tell o' this chap *Jarrity* afor', but, dam-me, 'e do seem to 'ave tha 'ell o' a lot to say about this 'ere picnic."

Consult a Physician

We love approval, but it does not interest us long; we are too profoundly aware of our excellencies. Adverse criticism, however, interests us at once: there is always the thrill of the anticipation that we may have unconsciously made an error, and a real pleasure in discovering the mistake or in revising mistaken policies or trends. We love and respect our highly critical friends, and they show the most genuine kindness in pointing out where we can improve. Once in awhile, however, we run across a kicker, who takes the trouble to write us or phone us and kick, without being quite sure what he is kicking about—at least without the mental power of getting down to anything specific. For such a case we can only infer domestic unhappiness or a disordered liver; yet we are too delicate to attempt to prescribe individually. Speaking in general and out of a vast experience, we do not know of any universal remedy for the former; for the latter, we recommend turning for relief to a physician, and not an editor.

The Early Miners

"One of the most marked and best characteristics of the old miners was their kindness," runs a passage in Hittel's "History of California." "An affecting incident illustrative of this occurred in 1848. It was at a little camp, the name of which is not given and perhaps is not important. The day was apparently a hot one and not very far advanced toward the cool of the evening, when a youth of sixteen came limping along, footsore, weary, hungry, and penniless. There were at least thirty sturdy and robust miners at work in the ravine; and it may be well believed they were cheerful, probably now and then joined in a chorus

or laughed at a good joke. The lad, as he saw and heard them, sat down upon the bank and watched them in silence—his face telling the sad story of his fortunes. Though he said nothing, he was not unobserved. At length one of the miners, a stalwart fellow, pointing up to the poor boy on the bank, exclaimed to his companions, 'Boys, I'll work an hour for that chap, if you will.' All answered in the affirmative; and picks and shovels were plied with even more activity than before. At the end of an hour a hundred dollars' worth of gold dust was poured into the youth's handkerchief. As this was done, the miners, who had crowded around the grateful boy, made out a list of tools and necessities and said to him, 'You go now and buy these things and come back. We'll have a good claim staked out for you. Then you've got to paddle for yourself.'"

Half and Half

When the railroad was built last fall to the Rosiclare and Fairview mines in the Elizabethtown fluorspar district of Illinois, both the companies wanted the station named after their own town. The railroad company did the best it could to please them and named the station Rosiview. It was located midway between the town and mines.

The Hydro-Electric Baptists

Dr. George Otis Smith, the director of the U. S. Geological Survey, recently addressed the men's society of one of the Presbyterian churches in Washington on the subject of the super-power survey. Dr. Smith is a Baptist. Dr. Charles Wood, the pastor of the church, at the conclusion of Dr. Smith's address, asked how it would be possible to electrify the men's society into greater activity and inquired of Dr. Smith how the Baptists did it. "They use water power," Dr. Smith replied.

Worthy Pupils

The *Denver Post* has a high regard for the Government's oil specialists. This is indicated by the following quotation from a recent issue of that newspaper:

Two thousand members of the Independent Oil Men's Association are in Denver for the twelfth annual convention of that organization. Of those in attendance one thousand nine hundred and sixty-two are millionaires. The other thirty-eight are salaried employees of the Bureau of Mines who showed them where and how to make their millions.

We predict that a good part of these millionaires will forget all about it the very second that the tax collector comes snooping along.

Correspondence Solicited

The Bureau of Mines has received a request for information as to the process of making soap out of soapstone. Since the Bureau has no soapstone specialist at this time, Assistant Director Holbrook suggests that possibly some reader of this page may be able to supply the requested data. The first idea that occurs to us, although we admit that it may not be worth much, is that it would be appropriate, if nothing else, to begin by erecting a washing plant. This may help our readers to set their train of thought in motion. Replies received will be forwarded to Mr. Holbrook or printed on this page, as desired. We hope to get a lot of good suggestions, for it has steadily been getting more difficult to fill up this page ever since the Eighteenth Amendment went into effect.

CONSULTATION

Gold Mining Tax Exemption

"Under the existing revenue laws of the Treasury Department is a gold mine exempt from the excess-profits tax? An explanation of the working of the excess-profits tax as it relates to gold mining will be appreciated."

The Revenue Act of 1918 states in Sec. 304 (C), "In the case of any corporation engaged in the mining of gold, the portion of the net income derived from the mining of gold shall be exempt from the tax imposed by this title (Title III, War Profits and Excess-Profits Tax), and the tax on the remaining portion of the net income shall be the proportion of a tax computed without the benefit of this subdivision which such remaining portion of the net income bears to the entire net income."

The text of the section is sufficiently clear and warrants little additional explanation. The tax on the "remaining portion of the income" is based upon the proportion which the net income derived from other than gold-mining activities bears to the total net income, and as calculated upon the tax which would have been imposed had all profits been obtained from other than an exempted business.

The following illustration, which considers a corporation engaged in the mining of gold and other metals, is a representative instance and brings out the working of the law. It is assumed that a mining company engaged in the production of gold and other metals has a net income of \$300,000, of which \$100,000 is attributable to gold mining, on an invested capital of \$1,000,000. Without going into the details of the derivation, suffice it to say, that the excess-profits tax which this corporation would have to pay if engaged in some other form of activity would amount to \$63,400. However, the \$100,000 income from gold mining entitles the company to a tax exemption on this sum. Hence the excess-profits tax imposed would be computed on the remaining portion of net income, or \$200,000, and the tax thereon would be proportionate to the tax computed on the entire net income without the benefit of exemption. In other words, \$200,000:\$300,000:: x :\$63,400, where x is the tax on the \$200,000 of remaining income and \$63,400 the normal excess-profits tax on a corporation engaged in an enterprise other than gold mining. The tax would therefore be \$42,266.67.

In these trying days for the gold miner it may be "rubbing it in" to discuss such a matter as an excess-profits tax, yet the problem is one in which all metal mines are interested, not only those producing gold principally, but also the ones in which gold production is merely incidental to the recovery of some other metal, such as copper.

Tellurium Production

"Can you tell me how much tellurium was produced in this country during 1919?"

The *Engineering and Mining Journal* has not been able to compile figures on the annual production of tel-

lurium, and it is to be noted that the U. S. Geological Survey has also failed to publish any such information, because only one producer, the Raritan Copper Works, reported production or sales of the metal to the Survey. The demand for tellurium is small.

Optical Fluorite

"Will you kindly inform me what are the specifications of fluorspar for optical uses and give me other information explaining the particular application for this material?"

Optical fluorite is a rare variety of the common mineral fluorspar, which, as its name implies, possesses physical properties which make it particularly desirable for certain kinds of optical work. Such fluorite must be clear, colorless, free from all defects, and contain pieces of suitable material at least one-fourth of an inch in diameter. Common defects found in specimens of optical fluorite consist of internal cracks, cleavage planes, bubbles, and the inclusion of foreign matter, such as particles of dirt or other minerals. By moistening the specimen with kerosene it is possible to detect the presence of faintly developed or incipient cleavage planes that might not otherwise be suspected as being present.

The chief demand for optical fluorite is from telescope and microscope manufacturers, who employ it in the manufacture of special lenses and prisms. The material is cut into the desired form and placed between glass lenses. The fluorite lens has the property of correcting the spherical and chromatic defects of the glass lenses, a characteristic which is due to the low refractive power, single refraction, and weak color dispersion of fluorite. It is reported that these "apochromatic lenses" represent the finest type of microscope objectives made, and that the value of a microscope is greatly increased by the use of such a lens.

According to the U. S. Geological Survey, little optical fluorite is produced in the United States, although certain localities are known to have been productive and have possibilities. In the United States, southern Illinois, in Switzerland, Meiringen, and in Japan, Obira, Bungo, are the world's important producing centers.

It is seldom that pieces of fluorspar are large and clear enough to be of use to the optical industry. Were it more abundant there is little doubt that a greater number of microscopes would be equipped with optical fluorite. Absolutely clear material is of the greatest value, but faint tints of green, yellow, and purple do not render the material useless for this purpose. Prices vary widely according to the particular quality of the specimens offered for sale. From \$1 to \$10 per lb. is usually paid. The U. S. Geological Survey estimates requirements at several hundred pounds of optical fluorite annually.

To those wishing to market this product, it is suggested that they communicate with the U. S. Bureau of Standards at Washington, D. C., or with one of the large optical companies.

HANDY KNOWLEDGE

Bucket-Dumping Device for Use on an Incline

BY J. B. HARPER

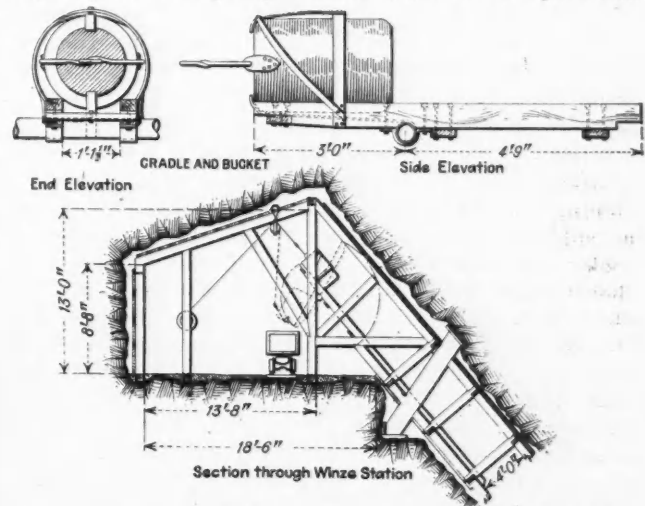
Written for *Engineering and Mining Journal*

A bucket-dumping cradle which was used in sinking a 50-deg. inclined winze on the property of the Jerome Verde Copper Co. and the manner of timbering at the winze station are shown in the accompanying sketch.

The cradle illustrated consists of two parallel 4 x 6-in. timbers spaced the same distance apart as the skids in the incline and fastened tightly to a piece of 4-in. pipe which rotates in hangers above the collar of the incline. A piece of strap iron arched across these timbers and bolted to them, together with hooks at top and bottom, forms a sort of basket into which the bucket is hoisted. The lower hook passes around the 4-in. pipe and is made slightly shorter to take the greater strain. The position of the cradle on the support is such that the

back. As the slack cable is taken up the cradle resumes its normal position and the empty bucket slides back on the skids.

The dimensions of the cradle depend on the size of the bucket to be used. The bucket in the illustration is 2 ft. 9 in. long and 1 ft. 9 in. in diameter, having a capacity of nearly eight cubic feet. It is cylindrical



BUCKET-DUMPING CRADLE FOR USE ON INCLINE

except for the upper and lower edges, which are rounded over on a 3-in. radius to facilitate passage on the skids. This bucket appears to be the maximum size which can be handled by a No. 1-H "Little Tugger" hoist, and was designed for this purpose.

Loose ground made it desirable to cut the winze station as small as possible. The device illustrated requires little headroom. It has been in use for nearly a year, and has proved thoroughly satisfactory.

Determination of Low Percentages Of Lead

Alexander's Method Modified When Lead Is Under 5 Per Cent—Auxiliary Solution of Lead

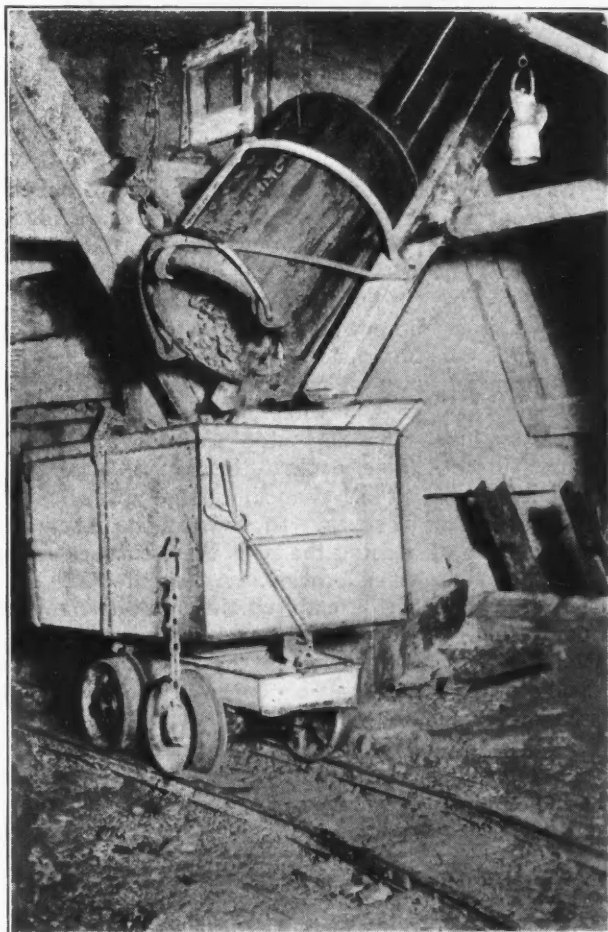
Acetate Employed

BY JOHN H. HASTINGS

Written for *Engineering and Mining Journal*

In using Alexander's methods for the determination of lead, it is somewhat difficult to distinguish an exact end point in titrating when the burette reading is between 10 and 20 c.c., more difficult when between 5 and 10 c.c., and almost impossible under 5 c.c., on account of the slowness of the reaction between the ammonium molybdate and lead solution. Several methods have been proposed as a substitute, but for simplicity and speed none equal the method commonly known as Alexander's.

A modification which I originated and have used for about two years involves the employment of an auxiliary solution of lead acetate, 1 c.c. of which contains 0.005 g. of lead. This solution is added to the lead solution just before titrating to bring the burette reading to 20 c.c. or more. The method is applicable to ores and metal-



EMPTYING THE BUCKET INTO A CAR

lower end is heaviest and rests upon iron stirrups bolted to the end of the skids. These stirrups appear in the photograph, which shows the bucket in the dumping position.

A loaded bucket hoisted to the hooks at the end of the cradle overbalances it, and as the cable is slacked off the bucket tips forward and dumps instead of sliding

lurgical products particularly. Lead may be determined down to 0.1 per cent when 5 g. of material carrying small amounts is taken. It is recommended for use when the lead is under 5 per cent. The method in detail is as follows:

One-half to 5 g. are weighed out into a 250-c.c. Pyrex beaker. If the sample be a sulphide, 10 to 25 c.c. of nitric acid is added; if it be oxidized, 5 to 10 c.c. of hydrochloric acid is used in addition, or else the sample is given a treatment with that amount of hydrochloric acid, with or without the addition of nitric acid after evaporation, depending on whether sulphides are present. If the lead is insoluble the regular treatment with hydrofluoric acid is used.

The lead is separated as a sulphate. The amount of soluble lead sulphate is determined as described in running the standard. This eliminates the necessity of using "lead" acid or alcohol. Any lime present is washed from the lead sulphate.

Fifteen to 20 c.c. of sulphuric acid is added to the solution, which is heated until the sulphuric acid is fuming well, then over a free flame until copious fumes of sulphuric anhydride are evolved. The solution is cooled and diluted with 100 c.c. of cold water. It is then brought to a boil and let stand until all iron sulphate is in solution. After cooling, it is filtered, and the precipitate washed four times with cold water. The precipitate and paper are dropped into a 250-c.c. beaker containing 15 c.c. of a saturated solution of ammonium acetate diluted to 100 c.c., with water. The ammonium acetate is then brought to a boil and boiled a few minutes to dissolve all lead sulphate. Twenty cubic centimeters of the lead acetate solution is then added and the solution titrated hot with a standard solution of ammonium molybdate, using tannic acid solution as an indicator. The end point is a pronounced change to a yellow color. The number of cubic centimeters required in standardizing the lead acetate solution is subtracted from the reading. The per cent of lead is calculated from the remainder.

The various solutions used in the analysis are made up as follows:

The ammonium molybdate solution contains 4.25 g. of the salt per liter of water.

The lead acetate solution contains 9.15 g. of the salt per liter of water, and is cleared by adding a few drops of acetic acid.

The tannic acid solution is a 0.1-per cent solution of tannic acid in water.

The ammonium molybdate solution is standardized by weighing in duplicate 0.1 g. of c.p. sheet lead, which has been thoroughly cleaned, and dissolving in 1 c.c. of nitric acid and 15 c.c. of water and running through as described in the method, except that no lead acetate solution is used.

The lead acetate is standardized by adding 20 c.c. to a 250-c.c. beaker containing 15 c.c. of a saturated solution of ammonium acetate, together with a filter paper and 100 c.c. of boiling water. It is then titrated as described in the method.

The amount of lead taken into solution by the dilute sulphuric acid and wash water is determined as follows: A standard sample of ore running about 5 per cent lead is run according to the method, using a 0.5-g. sample. It is also run using a 2-g. sample, but with no lead acetate solution. The difference in the percentage of lead in the ore shown by the two methods of determination is the amount due to the soluble lead.

This figure must be added to each burette reading on the sample after subtracting the number of cubic centimeters of lead acetate used. The correction amounts to from 0.2 to 0.4 c.c. In the methods of standardizing no other blank needs to be considered.

Practice of Opening Kegs of Black Blasting Powder With Wooden Tools Condemned

BY S. P. HOWELL*

The Bureau of Mines has repeatedly called attention to dangerous practices in the transportation and opening of kegs of black blasting powder. It has not been definitely established just how opening a keg with a wooden maul, wooden sprag, or a wooden mallet causes explosions, as it appears to be difficult to strike a spark with wood against metal, but it may be that in breaking the keg, the sharp points of the sheet iron would be driven inside of the keg; that two or more of these points may have been made; and that in rubbing over one another, these points or the edges of the strips may have caused a spark, or it may be that the strips or points may have been driven forcibly against the side of the keg and produced sparks, or it may be that the wooden tool was covered with a gritty substance, thus facilitating sparking, or it may be—and this has been demonstrated at the Explosives Experiment Station of the Bureau of Mines—that the fine particles of black blasting powder remaining in the angular groove of the chime received the impact from the wooden tool and this ignited the particles.

Evidence shows, however, that the method of opening kegs of black blasting powder with wooden tools by punching a hole through the top of the keg is an unsafe one. The usual 25-lb. black blasting powder kegs are provided with a bunghole and a cap for closing it, and in all cases the powder should be poured from the keg through this bunghole.

The excuses for not doing so are usually that the bunghole is so small (diameter of $1\frac{1}{8}$ in.) that it requires too much time to get the powder out of the keg through this bunghole, or that the bunghole is so far from the chime ($1\frac{1}{2}$ in.) that all of the powder cannot be poured out of the keg. In view of the menace of other methods of opening the kegs, these excuses cannot be given serious consideration. A keg of FFF black blasting powder can be emptied through the bunghole in forty to fifty seconds, leaving less than 100 grams (about $3\frac{1}{2}$ oz.) of explosive in the keg, and it is not difficult to get all but half an ounce of the powder out of the keg by shaking.

The Bureau of Mines therefore recommends that kegs of black blasting powder be not opened with any tool, whether of metal or wood, and that the keg be emptied only through the bunghole provided for the purpose.

Camouflaging a Worn Corrugated Iron Roof

Some old corrugated iron was used in the roof of a new mill in the Joplin district. Although the roof was tight enough for all practical purposes, the effect of the old nail holes was unpleasant. A few hours' work with some J-M elastic roof putty permanently stopped all the holes and gives the effect of a new roof. The same result can be effected by dropping large-headed roofing nails into the holes. Window dressing only, but it gives a visitor a much better opinion of the mill.

*Bureau of Mines, "Monthly Report of Investigations."

THE PETROLEUM INDUSTRY

A Suggested Schedule of Petroleum Priority

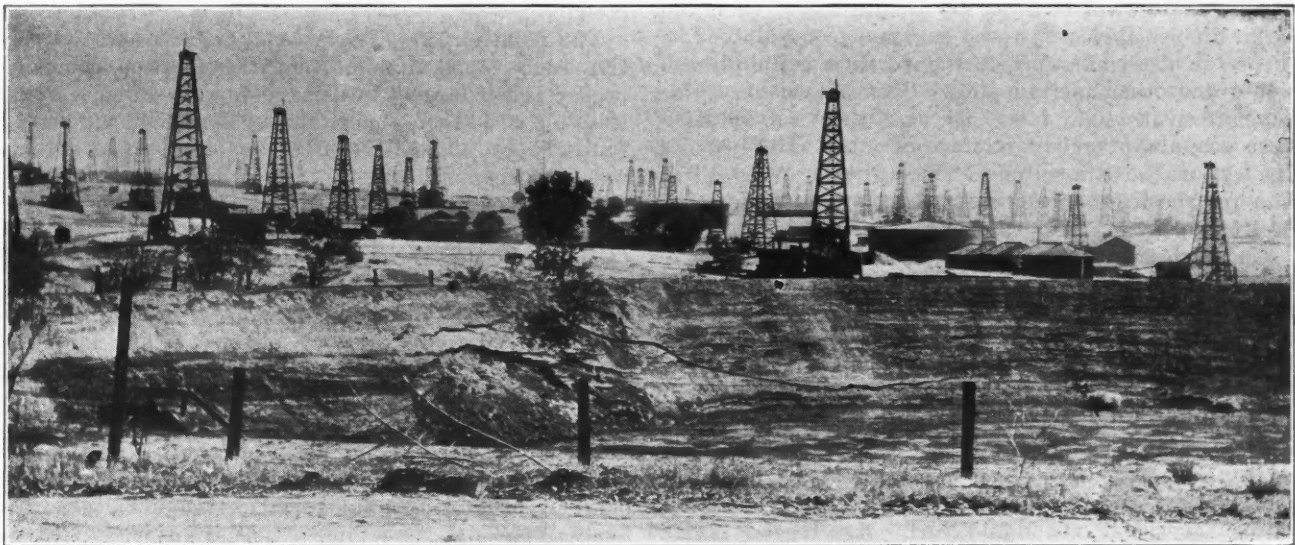
Influence of Price, Application, Demands, and Requirements of Liquid Fuels Are Factors Which Should Determine the Base for a Preferential List—Proposal Represents the Application of New Principle in Natural-Resource Thought

By R. S. MCBRIDE

Written for *Engineering and Mining Journal*

IN A PREVIOUS ARTICLE¹ the importance of thinking nationally of our petroleum problems has been pointed out, and the suggestion made that we must soon consider which of the various applications of petroleum will be given preference in supply. Continuing this discussion, it is desired to give here a suggested priority list. This, it is hoped, will at least serve

another class of priority has been granted by the Interstate Commerce Commission; that is, according to geographical subdivision. This was done that New England and the Northwest would not freeze or be threatened with idle industries during the coming winter season. However, none of these priority systems serves for the present purpose. What is needed is a scale by which



A FULLY DEVELOPED PETROLEUM AREA

Photograph by courtesy of the Bureau of Mines

The wells in this region, at Kern River District, California, are placed from 200 to 300 ft. apart. One of the large open

reservoirs that are utilized for the temporary storage of oil is shown in the immediate foreground of the picture.

as a stimulation of further discussion and for more thought on our basic economic problems of petroleum distribution. It is not expected that it will do much more than this, for the problems treated are still largely unsolved—perhaps, indeed, partly unsolvable, today.

During recent years we have had a variety of bases for determining priorities. Throughout the Great War priority commonly was granted to a specific individual or firm in order that a particular job on hand might be accomplished expeditiously. Then, too, we had priority classes for fuel, in which the character of the institution served or nature of the work to be done by the fuel user determined his position in the list, as, for example, the relatively high placing of public institutions, hospitals and like establishments, the intermediate ranking of public utilities, and the superior ranking of war industries over those termed "non-essential."

More recently, in the case of coal transportation,

we may judge the relative social service performed and thereby establish the economic justification for priority.

It is realized that any effort to this end cannot expect to command general concurrence with every detail; in fact, there will perhaps be as many priority lists established as there are investigators in this field. However, there are certain principles to which practically all agree, and these justify careful consideration, in the hope that at least we may establish some basis to guide the industrial thought for the immediate future.

In the following discussion of such priority it is intended to take rather a middle ground between what can be our every-day practice this year and what might be termed an ideal future practice toward which to work. The suggestions of the following sections are a recommendation toward which it is believed we can immediately turn, with the expectation of realizing the relationships suggested within a few years. Still further development beyond that period will also be needed. However, it is impossible for anyone to say today just

¹"Liquid Fuels—Wanted: a National Policy," *Engineering and Mining Journal*, Oct. 23, 1920.

how each of the several interests which must be regarded as competitive today will develop or to pre-terminate their proper rank for periods of the more distant future. This limited applicability over relatively few years should be carefully borne in mind, to avoid a misunderstanding of the rather high position given to some uses of petroleum that cannot be recognized as worthy of such preference permanently.

THE INFLUENCE OF PRICE IN DETERMINING PRIORITY

In the final analysis, the laws of supply and demand, if unrestricted by artificial legislation, fix petroleum prices properly in reference to trade conditions. He who can still afford to pay the price thus fixed can expect to remain in the market as a successful purchaser. He who can least afford to pay the prices thus established will soonest be eliminated. This, perhaps, is the law of the jungle, but it is almost inevitable that it shall rule. A further consideration of some of the aspects of this principle, however, is worth while.

Liquid fuels are for most uses simply competitors of gas, coal, and electricity as sources of heat, light, and power. So long as liquid fuels afford to the purchaser an attraction superior to these other energy supplies, the purchaser will continue to use the liquid fuel if it be available. Price is, to be sure, only one of the elements in determination of the relative suitability of liquid and other fuel supplies. Convenience of use as compared with solid fuel, ease of storage as compared with gas, and other similar factors enter. However, in the last analysis the purchaser buys the one which gives him for the least expenditure of money and effort the desired operating result.

Under these circumstances, as soon as the petroleum becomes decidedly more expensive per unit of service rendered than coal, let us say for heating, the extensive use of liquid fuel for this purpose will promptly cease. It is likely that price will thus establish a sound basis for determining industrial priority, especially if unaffected by governmental restrictions. Indeed, one might say that such a priority list established by ability to pay the price will ultimately be identical with a list established solely on the basis of the economic justification for use of the liquid fuel. Nevertheless, it is worth while to examine these problems from a broader point of view. To this end, let us consider a dozen of the principal applications of petroleum.

A nearly unanimous opinion probably can be expected with respect to the first on the priority list; a general agreement that lubrication is the most important and most nearly irreplaceable application of all petroleum products. One is justified, therefore, in placing this requirement at the head of an economic priority list.

Next in order, one must probably place either illumination or the special chemical requirements for miscellaneous petroleum fractions. Of these two uses the former draws upon rather a different group of oils than the latter. It, therefore, makes little difference which is placed second and which is third on our list. Kerosene, as an illuminant for districts where city gas, electric current, or acetylene are not available for lighting, certainly serves a fundamental social function that is hard to provide for otherwise. Moreover, this use of kerosene calls for only a part of the illuminating oils which can be manufactured from the available petroleum resources that will be handled if demands in other lines are met. There seems some ground, therefore, for placing illumination as number two in the schedule.

Numerous chemical processes require the use of liquid fuels, but these do not draw very heavily upon our petroleum supplies. To the extent that neither gas nor solid fuel seems quite as well adapted to the processes in question, so far are we justified in giving distinct preference to this requirement.

Within the chemical industry there is also a highly specialized requirement of petroleum fractions or products, which are used not for fuels but rather for other purposes. Ink oils, medicinal oils, petrolatum, paint oils, and similar petroleum products are conspicuous examples. These demands represent applications that certainly justify encouragement. And fortunately this encouragement can be given without any particular burden upon other uses, as the quantities needed are small compared with other requirements.

Within the group of chemical applications there is, also, a peculiar class that is rather the result of the existence of products not readily adaptable to other uses. To the extent that these relatively inferior products can be efficiently applied in chemical industry, we should give great encouragement to such use. All of these so-called "chemical" uses are grouped together and placed as third in the economic priority schedule proposed.

The requirements of petroleum fractions for automotive fuels is peculiar in that the fraction commonly needed is not largely in demand for any other purpose. Gasoline is, in fact, almost synonymous with automotive fuel. Practically all gasoline can be given to automotive requirements, and this use placed as number four in a priority list, without giving rise to serious objection.

The only sense in which automotive requirements are in conflict with other demands for petroleum is that fuel-oil fractions are now being used to a considerable extent for the production of gasoline by cracking. In placing automotive requirements as number four, it is not intended to include with them this indirect production of gasoline; this rank of four is confined to the gasoline produced by the older methods of distillation.

It is well known that all the gasoline which can be made by present-day plant practice is quickly absorbed by the markets. The competition or priority with respect to gasoline, if such were undertaken, would, therefore, require a very different type of classification than that which we are now discussing. It would require, in fact, a discrimination between uses of greater and lesser economic justification. In other words, a contrast between essential, desirable, and purely luxury applications. To enter a discussion of that question is, for the present purposes, wholly unnecessary.

After recording the first four entries on a priority list a more difficult problem is met, for at this stage one must decide as between those who require substantially the same fractions of petroleum. There are eight groups of gas-oil and fuel-oil uses that must be so judged and ranked. These applications are: Gas manufacture, gasoline manufacture, internal-combustion (Diesel) engine use, navy fuel, merchant-marine fuel, locomotive fuel, steam power-plant fuel, and fuel for heating plants.

In this group gas manufacture is distinguished from others because it represents a distinct type of fuel-oil application. Other public-utility fuel users would also require special treatment were it not for the fact that their oil requirements fall within the scope of the other groups mentioned. For example, these other public-

utility uses are in Diesel engines, power plant, or heating plant; and for present purposes these need not be distinguished from similar demands by other users.

It is a general principle in our census of manufactures that a measure of industrial development is the increase in value added by manufacture. For this purpose, value of raw materials is compared with value of products and the difference taken by the census as of economic significance. Proceeding upon the same theory here, we can place gas manufacture and gasoline manufacture somewhat ahead of other demands for fuel oil. In these applications the oil is not consumed but rather is converted into a material available for application in a superior class.

If it were possible quickly to substitute coal-gas plants for existing oil-gas and carburetted water-gas installations, there would be no particular need to regard the city gas manufacturer as entitled to serious consideration for high place in a priority list for fuel oils. However, such quick change of gas-making process is not possible. The machinery and materials needed for installation of coal-gas or coke-oven plants cannot be made available for a considerable period. Neither can the funds required for so large a change in investment be secured by utility companies at present. Gas represents an essential of modern city life. For the present and for a considerable number of years to come, therefore, preference must be given to gas manufacture over other fuel-oil requirements *to such extent* as will permit uninterrupted adequate gas supply.

This situation may continue longer than at first seems likely, for natural-gas supplies are now continuously decreasing in quantity, and manufactured gas must inevitably ultimately replace them. Much new construction of coal-gas and coke-oven plants will doubtless, therefore, be directed to extension of gas-making facilities in such districts of the country as were formerly served to a large extent by natural gas. Municipal growth and extension of gas supply into suburban territory also tend to limit gas-works construction to only that which can be regarded as extension of present plants. Thus, for many years to come an important fuel-oil demand for water-gas making must be met.

Gasoline production from fuel-oil fractions, when it can be efficiently practiced, raises the petroleum production from a lesser to a greater usefulness. To the extent that equipment is available for this conversion to gasoline, preference will, doubtless, be given for such use by the petroleum refiners. This will be not only a matter of good business judgment on their part, but also, for the reason cited, an economically justifiable procedure. On the other hand Diesel-engine use is so much more efficient than most gasoline-engine use that there is no ground for encouraging conversion of fuel oil to gasoline for work which the Diesel engine can do. Therefore, as Diesel-engine demand develops, this new factor will enter to offset the present tendency toward cracking to make "gas."

Having disposed of gas making and gasoline manufacture, there remain for consideration only power and fuel uses. Because of the greater efficiency of petroleum use in internal-combustion engines, as contrasted with boilers of any type, we certainly must give preference to this use. As a matter of fact, this, for the immediate present, is not of large commercial significance, because the internal-combustion engine (limiting ourselves here to the non-automotive type) does not demand any large percentage of our fuel-oil supplies.

Nevertheless, with increasing costs of liquid fuels, we may look forward to great increases in this more efficient method of fuel-oil utilization; and as these uses develop we probably shall continue to place them at this point in any priority schedule.

The remaining users of fuel oil burn the oil under a boiler or for direct heating purposes. Of these users the naval requirement unquestionably comes first. Following this, most persons would doubtless agree that the merchant-marine demand should be met before other use can be justified. That this merchant-marine demand is going to increase continuously in the next few years cannot be questioned. Not only are the estimates from our Shipping Board good evidence of this, but also there is extensive development of oil-fired shipping by the British. In fact, the "Olympic" and "Aquitania," two great Cunarders, only recently made their maiden voyages as oil-burning vessels.

After these marine uses, we can probably give the locomotive boiler next position. The large advantage of liquid fuel for such mobile power plants is well recognized. To the extent, therefore, that the locomotive cannot be electrified, we can justify oil burning in preference to the use of oil for stationary power or heating-boiler use. This preference is also supported by the critical state of the transportation demands of the country at the present. It is to be anticipated that this preference for locomotive use will not continue long except in certain limited portions of the country where liquid fuels are much more readily available than solid fuels. Oil for locomotives is rapidly becoming practically prohibitive in cost or wholly unavailable.

As a matter of fact, by the time we reach this stage it makes little difference to whom we give priority; for if the higher classes of use are satisfied, no oil is left to distribute. Nevertheless, one may as well continue to theorize through to the end, and discriminate between the steam-power plant and the heating plant. It appears that the former should be given preference over the latter, for a greater increase in efficiency is doubtless generally obtained in power production through oil firing as compared with solid-fuel firing, than can be found in contrasting liquid-fuel and solid-fuel use for heating purposes. Thus, we would place steam-power-plant use ahead of heating-plant application, the latter being the last of the twelve items in the schedule.

As a result of the discussion, one obtains a priority list for liquid fuels as follows:

Character of Use	Kind of Oil Applied
1. Lubrication	Lubricants (fuel oil)
2. Illumination	Kerosene
3. Chemical byproducts	Miscellaneous
4. Automotive engines	Gasoline
5. Gas manufacture	Fuel oil
6. Gasoline manufacture	Fuel oil
7. Internal-combustion (Diesel) engines	Fuel oil
8. Navy	Fuel oil
9. Merchant marine	Fuel oil
10. Locomotive firing	Fuel oil
11. Steam-power plants	Fuel oil
12. Heating	Fuel oil

It is doubtful if this schedule will meet general acceptance, but it represents the application of a relatively new principle in national-resource thought, and, as such, it should be considered. In any event, whether one agrees with it or not, it represents a starting point for the consideration of a still more important engineering problem, namely: What attention must be given to petroleum substitutes, in order that all these industrial needs for liquid fuels may most effectively be met? This latter question, however, requires separate discussion.

NEWS FROM THE OIL FIELDS

Revision of Standard Petroleum Specifications

BY R. S. MCBRIDE

The conference on the revision of standard specifications for petroleum products held Oct. 18 in Washington was attended by representatives of all the Government departments interested, state oil inspectors, oil producing and refining interests, and automotive interests.

The specifications particularly under consideration were those for gasoline, kerosene, burning oils, fuel oils, and a wide variety of lubricants. In executive session the committee continued consideration of the proposals for the two days following the public conference and it is expected that the revision of the standards will be completed within a short time and revised standards published covering all of these materials. Nominally the specifications which it adopts relate only to Government purchases of petroleum but in practice a number of states are adopting the specifications, particularly those for gasoline.

Four states have already adopted the motor gasoline specifications of this federal committee and others give evidence that they are likely to do so. Some states are writing the specifications into the state law; others simply provide that the latest specification of the committee shall govern, or place the matter in the hands of a commissioner.

The advantage of state regulation in contrast with federal legislation seems to be wholly with the smaller refiners who like to have different standards which will permit disposal of their poorer products in states where less rigid requirements prevail. It was the consensus of opinion that where state laws do specify gasoline standards, the refiners, particularly the larger operators, are very careful as to the quality of material shipped into that state.

Oil-Land Leases in California

To date over 105 applications for the leases to oil lands under the Federal leasing law in California have been made. The total acreage under these applications is 31,840. A total of royalties amounting to over \$6,775,000 has been paid to the Government by California lessees. Of this amount one-fifth, or \$1,355,000, will be turned over to the State of California. At present the Federal Land Office is compiling maps showing unappropriated oil lands in areas of known favorable structure and formation. This information is available at the various offices of the Land Office in San Francisco, Visalia and Los Angeles.

Texas State Institutions Require 80,000 Bbl. of Oil Annually

From Our Special Correspondent

The State Board of Control has awarded contracts for supplying the various state institutions with oil. The Nortex Refining Co., of Eldorado, Kan., will supply the institutions of north Texas, and the Humble Oil & Refining Co. those of south Texas. In all, about 80,000 bbl. will be required for the year.

Stephens County is now the largest oil-producing county in Texas. Many new wells are being brought in, and it is probable that the present production of about 90,000 bbl. daily will be increased. South of Breckenridge, in this county, the I. A. Stocker No. 2 well, after being shot, settled down to a flow of 4,000 bbl. daily; the joint well of the Humble Oil & Refining Co. and the Templeman Oil Corp., in the Breckenridge district, was also shot, and its flow increased to 400 bbl. Other companies that have increased their Stephens County production lately are the Gulf Production Co., Fensland, Magnolium Petroleum, Mid-Kansas and Texas companies. Extensive work is now being pushed in the Eliasville district.

Burkburnett and Electra fields continue to furnish many new producing wells. The most important completion lately is the big gas well of the Camp Oil & Gas Co., south of Burkburnett, in the Texhoma district.

Three Sections Prospecting for Oil in Nevada

From Our Special Correspondent

Drilling for oil continues in three widely-separated areas in Nevada and a derrick is now being erected for active operations in still another. Individuals who are connected with the Red River Lumber Co. have acquired a big acreage near Sulphur, on the Western Pacific R.R., and will sink a test well. The Red River Lumber Co. is working a sulphur deposit near by, although it is said to have no connection with the oil-drilling operations.

The well of the California Excelsior Oil Co., in Fishlake valley, 55 miles from Tonopah, is now down over 400 ft. and making progress at the rate of 25 ft. a day, according to K. Davis, a former Texas operator who is in charge of drilling operations. Mr. Davis states that there is a showing of oil in the well and that he is much encouraged.

The greatest activity is in the Fallon section. Six companies are actually drilling in the field and as permits under the new leasing act are now being received it is expected that still others will soon be busy.

September Oil Production in Wyoming Shows Increase

From Our Special Correspondent

During September forty-four wells were completed in Wyoming, twelve of them dry. The total oil production was 785 bbl. greater per day than during the preceding month. Over 400 wells were being drilled on the first of the month. In the Osage field one dry and five producing wells were completed during the month, the largest number for any field in the state. A recent completion is the V. M. Kirk well, which came in from below 1,500 ft. as a gusher. The Quinn Oil Co. is down over 1,400 ft., and in all about 20 rigs are set up in this field.

Well Near Fort Norman, Can., of Scientific Importance

From Our Special Correspondent

It has been recently announced that drilling operations of the Imperial Oil Co. on the Mackenzie River struck oil on Aug. 25 at a depth of 783 ft. The oil flowed out of a six-inch casing for thirty minutes, when the well was capped and shut in. Any estimate as to the amount of oil this well would produce is only a guess, as there was no receiving tankage available and an accurate test could not be made. The discovery is considered an important strike and scientifically of much value. From a commercial point of view, however, it is not of immediate value as it probably will be years before it can be made available in quantities for the use of the Canadian market on account of its remoteness from any refinery outlet.

Two New Gushers Added to Tampico Field

From Our Special Correspondent

Two more big gushers have been added to the list of Mexico's oil producers. The first was brought in by the Cias del Agwi, and the second by the Huasteca Petroleum Corporation. The Agwi well was brought in at a depth of a little over two thousand feet. The gusher is located on the bank of the Tancochin River on Lot 251, Amatlan. Its estimated flow is in the neighborhood of 30,000 bbl. daily. This company has three other big producers as this same lot. The second well, which was a test in the Zacamixtle country, is one of great importance. Several companies have dotted this territory with well locations, as the geological reports recommended this section highly. When salt water was struck in the International well two weeks ago and several other tests were down over 2,500 ft. things looked doubtful, in fact several of the rigs closed down temporarily.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Chinese Silver Mines of Six Hundred Years Ago Discovered

Much Silver Was Removed—Still More Accessible by Modern Methods—Obstacles to Successful Exploitation

"In the Kaying section of northern Kuantung," writes S. S. Beath, of Kaying Academy, in *Millard's Review of the Far East*, "there are several mines that have long been abandoned. Recently American mining interests have investigated to learn if they still contain ore of sufficient value to warrant further operations by modern methods.

"Geologically speaking, the mines here are in a limestone formation that was probably at one time intruded by molten rock, thus forming the pockets of ore that were mined. Silver and large quantities of galena were thus formed. The latter ore is still to be found near the surface of the earth. There are also large deposits of manganese, but the high cost of shipping has prevented its export.

"One of the most promising sections lay to the northeast of Kaying in a rather sparsely populated valley. A portion of this valley, perhaps a mile square, had been worked over carefully by the ancient miners and not less than a million tons of slag remains as the result of the smelting process. Most if not all the ore smelted was produced in a small contiguous area and treated at small charcoal smelters.

"The underground workings of these mines are well preserved, though they are probably 600 years old. Shafts chiseled out of the solid rock lead down at about 45 deg. to a series of horizontal passages, then a second series to a lower level, and so on, to a considerable depth. The work must have been dangerous and tedious, as these excavations are only large enough to admit one man. It is probable that the ore was carried out in baskets. No trace exists of any pumping system, though it is reasonable to suppose that crude bamboo pumps were employed to keep the water under control. Baskets and bamboo pumps are still used in Nankin.

"The American miners interested in this exploitation originally expected to find silver ore at relatively shallow depth, assuming that the native miners must have been soon hindered by mine water. The surprisingly extensive and deep native workings have led them to conclude that the best solution of their problem involves the exploitation of possible deeper ores by means of modern mining machinery.

"In the process of investigation a stone tablet was discovered in the vicinity that explained the reason for the closing of the mines. This tablet,

dating from a dynasty in power 600 years ago, bears an edict from the magistrate at Kaying forbidding any further working of the mines. The edict responded to a petition by the local clans stating that the operations were interrupting the natural water courses, spoiling the fields, and that the water was being poisoned by the smelting process, resulting in many deaths.

"The same group of engineers are working on perhaps half a dozen other similar projects, many of which are promising. South of here there is an abandoned silver mine of the vein type that is said to be of tremendous size. The work was stopped, according to local tradition, because of 'feng shui' difficulties over a grave belonging to a prominent clan. The ancient miners followed the veins of ore under a large mountain, and when baffled by underground water they dug an immense underground channel that is said to be a considerable feat of engineering. Today local opposition to the 'foreign devils' prevents further exploitation of a most promising mine. Large quantities of unmined ore are almost certainly there. It seems to be the general opinion of these men that the Chinese miners with primitive tools showed great skill in making Mother Earth yield up her treasure.

"Many current reports seem to indicate that China is virgin territory as far as mining is concerned, like Siberia, but in this section at least most of the deposits of common minerals have been discovered and worked. This is true of surface mines, but little is known of the deeply covered mineral resources. The most promise seems to lie in the direction of reopening these ancient mines, and applying modern methods.

Obstacles to Western Development

"There are many difficulties and obstacles to be overcome in this type of work. Official channels are difficult to navigate, and official sanction once secured may fall on deaf ears when one has to deal with local officials and clans. Part of the opposition is due to a conservative attitude toward foreign enterprise, but the greater reason is the so-called 'feng shui' idea, which is well known to all residents in China. This conception, which forbids the disturbance of the vicinity of graves by digging, of course is a great hindrance to mining. There is, doubtless, much unmined silver and other ore in this section, but whether foreign interests will be able to mine it is, at least for the present, rather problematical. If the difficulties were technical, modern methods would make success reasonably certain, but the other difficulties I have mentioned are much harder to deal with successfully."

Prospectors in New Caledonia Propose, but Paris Disposes

A group of prospectors in New Caledonia (French) recently requested the Consul General of that colony to promulgate and enforce a law that should reserve the rights of discovery to the prospector concerned. The Consul General replied, according to *Le Bulletin du Commerce de la Nouvelle-Caledonie*, to the effect that he did not make the laws for France-in-the-Southern-Hemisphere ("la France australe") and that only certain gentlemen living at their antipodes, knowing nothing about Nouvelle-Caledonie and ignoring their existence for the most part, decided all Caledonian questions, and from them there was no appeal. Thus it is that they have inflicted on the mining world a law which both the colony and its prospectors must obey.

"Perhaps," says *Le Bulletin*, "if someone should try to make these gentlemen who manufacture the world's laws listen to reason, rights of discovery would be accorded—but it is doubtful. These mining laws are voted by indigenes or autochthones of Carpentras, Paris, Cognac, or Dragugnan, who do not know what a mine is and do not care. They vote 'for' or 'against' with serene indifference. They will vote a law that ruins a province if the author of the bill is their friend. It is possible that they would adopt a good law for Nouvelle-Caledonie if it were presented by a member of the majority. But that would not be their fault."

Aluminum-Bronze Coinage Chosen by France

In these columns for July 31 it was announced that France had decided to replace or supplement her silver small-change supply with metallic tokens or "counters" issued for the chambers of commerce in denominations of 2 fr., 1 fr., and 0.50 fr. *Journal du Four Electrique et des Industries Electrochimiques* has recently stated that after a number of tests France has decided to use the aluminum-bronze of Henri Ste.-Claire-Deville for these chamber of commerce counters. The greater hardness of this alloy will necessitate special machinery for the minting of this issue. Some years ago it was suggested that the French copper coins be replaced by others struck from this bronze.

Four hundred members of the American Society of Mechanical Engineers have organized a section on Materials Handling. This section will hold special meetings on particular subjects coming within the scope of its field.

MEN YOU SHOULD KNOW ABOUT

F. W. DeWolf, State Geologist of Illinois, was in Washington, D. C., last week.

Harold W. Stotesbury recently examined a mine in Hailey, Idaho, for the Tonopah Mining Co.

Philip S. Smith has returned to Washington after a summer of field work in Alaska for the U. S. Geological Survey.

W. C. Alden has returned to his desk in the U. S. Geological Survey after a study of the glacial deposits and Tertiary bench gravels in Montana.

D. F. Hewett has returned to Washington after examining the Crimora manganese mine, Augusta County, Va., for the U. S. Geological Survey.

L. C. Graton, consulting geologist, of Cambridge, Mass., left for Peru early in October. He expects to be absent from the United States for six months or longer.

Tom Hamilton, mining engineer, expected to leave Bolivia for Buenos Aires, Argentine Republic, on Aug. 17, and hoped to reach the latter city by Sept. 6.

George E. Collins, mining engineer of Denver, Col., was in New York recently on professional business. Mr. Collins expected to leave for Denver on Oct. 23.

E. L. Hawes, mining engineer with the Ingersoll-Rand Co., is going to the Johannesburg office of that company in the Union of South Africa, and not to South America.

George H. Garrey, consulting engineer and geologist of the Tonopah Belmont company, has returned to Tonopah, Nev., after spending several months in the East.

Dr. Willet G. Miller, provincial geologist for Ontario, and Thomas W. Gibson, Deputy Minister of Mines, are making an official visit to the mining districts of northern Ontario.

W. H. Knowles, field representative of American Mining Congress, was in Helena, Mont., early in October, in connection with the organization of a Montana chapter of the congress.

J. D. Millen, recently general manager of Mount Bischoff Tin, Tasmania, is now a senator in the Commonwealth Parliament. He was succeeded as general manager by C. W. Gudgeon.

Carl O. Lindberg, mining engineer, of Los Angeles, Cal., is in New York on his way to Bolivia, sailing early in November. He expects to return to the United States about Jan. 15, 1921.

William J. Loring was in Carson City, Nev., early in October in connection with the suit in the Federal court brought by David Tungsten against the Nevada Humboldt Tungsten Mines Co.

George D. Van Arsdale, consulting chemist to Phelps Dodge Corporation,

will move to Los Angeles, Cal., where he will open an office as consulting engineer in hydrometallurgy, flotation and similar fields.

C. W. Knight, assistant provincial geologist, Ontario Bureau of Mines, is in charge of the geological examination of the Bourkes area along the L. & N. O. Ry. His present address is Bourkes, Ont.

Paul Paine, consulting petroleum engineer, of Tulsa, Okla., and formerly with Gypsy Oil Co., is a special lecturer at Massachusetts Institute of Technology, where he is giving a course on oil and gas production.

Bulkeley Wells, of Denver, and George M. Taylor, of Colorado Springs, Col., have been appointed to the committee of Colorado Metal Mining Association to co-operate with those seeking to readjust relations with the management of Colorado School of Mines.

F. H. Curry, formerly with Inspiration Consolidated Copper Co., Miami, Ariz., sailed from New York City on Oct. 22 for Cape Town, South Africa, on his way to the Belgian Congo, where he will be mill superintendent for L'Union Minière du Haut-Katanga.

Elmer H. Finch and Max W. Ball, geologists formerly with the U. S. Geological Survey and now of the Matador subsidiary of Royal Dutch-Shell Oil Co., recently accompanied president W. Van Der Gracht of Roxanna Oil Co. (Cal.) to the oil fields of Grand County, Utah.

H. A. C. Jenison, of the U. S. Geological Survey, was looking over the Engels, Walker and other mines on the Plumas copper belt of California recently. Mr. Jenison visited the Calaveras Copper, Penn Mining and the Mammoth mines before he returned to Washington, D. C.

Bert W. Dyer, of U. S. Mine Rescue Car No. 5, Butte, Mont., graduate of University of Utah, and Assistant Mine Safety Engineer of Bureau of Mines since 1918, has been appointed Mine Inspector for Alaska. He will have headquarters at Fairbanks on the Tanana, and will work in co-operation with the Alaska Mining Experiment Station.

G. F. Loughlin, geologist in charge of the division of mineral resources, U. S. Geological Survey, was in Butte, Mont., recently on his way to the Pacific coast, and visited the geological department of the Leonard mine. He will visit the Survey offices at Salt Lake City, Denver, and San Francisco, before returning to Washington, D. C.

E. W. Shaw, geologist and mining engineer, formerly with the U. S. Geological Survey, who has been doing geologic mapping with a number of other geologists in Bolivia, was in Charagua on Aug. 16, and expects to return to the United States in December. His address until Oct. 1 was care of Bolivian-Argentine Exploration Corporation, Bartolome Mitre 478, Buenos Aires.

SOCIETY MEETINGS ANNOUNCED

The New York section of The Mining and Metallurgical Society of America met at the Columbia University Club, New York City, on Oct. 27 to hear an address by Van. H. Manning, research director of the American Petroleum Institute, who spoke on "The Petroleum Industry."

The Nevada Chapter of American Association of Engineers, which recently completed its organization, will announce its program at a meeting to be held Nov. 9, at the rooms of the Chamber of Commerce, Reno, Nev. The officers of the chapter are H. M. Loy, president; H. F. Holly, vice-president; L. V. Campbell, secretary.

The meeting of the Columbia Section of A. I. M. E., to be held at Kellogg, Idaho, has been postponed from Oct. 29 and 30 to Nov. 19 and 20. This change has been made in the hope that it will thus become possible for the president, Herbert Hoover, to attend the meeting, as he plans to do. Besides an address by Mr. Hoover, the program will offer papers by Rush J. White and Thomas L. Owens, assistant manager of Federal Mining & Smelting Co. L. W. Armstrong, of Spokane, Wash., is secretary of the section, and Rush J. White is chairman of the local committee of arrangements.

OBITUARY

Gustave de la Marre, chief engineer of Cie. des Mines de Roche-la-Molière & Firminy, and graduate of St.-Etienne in 1894, died in his forty-ninth year on Sept. 30, after a brief illness. M. de la Marre had been with the Firminy mines ever since his graduation, and passed from the rank of mining engineer to chief by successive steps. He had long filled the duties of the last position before being formally installed therein.

G. D. E. Mortimer, mining engineer, and president and general manager of Bolivian Mines Co., Inc., Casilla No. 12, La Paz, Bolivia, died in that city on May 4, last. Mr. Mortimer was a native of Clifton, Ohio, and was educated at the Episcopal Academy of Philadelphia, Pa., and Lehigh University. He showed great ability as a mining engineer, notably as organizer and administrator, being greatly helped by his sunny and lovable disposition. Before going to La Paz Mr. Mortimer had had charge of the Inca Oro at Sorata, Bolivia. Yet earlier he had been in charge of mining properties in California, Arizona, Nevada and Kerr Lake mine, Cobalt, Ontario. Letters may be addressed to his company at 1202 West End Trust Building, Philadelphia, or in care of Rev. S. D. McConnell, Easton, Md.

THE MINING NEWS

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The Utah Consolidated—Utah-Apex Lawsuit

Court Decides in Favor of Utah-Apex Five Out of Six Cases Brought by Utah Consolidated Mining Co. To Stop Former From Mining Ore in Yampa Limestone — Plaintiff Failed To Prove Formation a Broad Lode

BY E. B. JENNINGS

[The decision in the apex litigation between the Utah-Apex Mining Co. and the Utah Consolidated Mining Co., both operating in Bingham Canyon, Utah, was handed down by Judge Tillman H. Johnson, of the U. S. Circuit Court of Appeals, on Oct. 20 after the case had been under advisement by him since Jan. 31 last, when the arguments ended. Judge Johnson decided five of the six cases in favor of Utah-Apex in suits brought by Utah Consolidated to enjoin the Utah-Apex company from mining ore under Utah-Apex territory in the Yampa limestone. The court found against the Utah Consolidated because that company did not show by preponderance of evidence that the Yampa limestone was a broad lode. The decision in the Leadville case, brought by the Utah-Apex, holds that the barren Highland Boy limestone between the Highland Boy orebodies and the Leadville orebody breaks the continuity of the lode and that the Highland Boy limestone cannot be considered the lode.]

In the case brought by the Utah-Apex company holding that the Dana Leadville fissure is the apex by extralateral rights of orebodies being mined by the Highland Boy, the court held that the Utah-Apex did not prove by a preponderance of evidence that the Dana fissure above and the Leadville fissure below were one and the same fissure, and decided this case against the Utah-Apex.—EDITOR.]

THE lawsuits between the Utah Consolidated and Utah-Apex mining companies, which, after pending for nearly two years, finally came to trial in November, 1919, constituted one of the most important litigations in the West. The suits were tried before Judge Tillman H. Johnson, of the U. S. Circuit Court of Appeals, in Salt Lake City. By consent of the two companies the action of the Utah-Apex against the Utah Consolidated, which was known as the Leadville or Highland Boy case, was tried first. This occupied three weeks.

The second suit, known as the Yampa case, occupied a like time. In the Yampa case, the Utah Consolidated

company asked for \$3,000,000 for illegal extraction of ore from the Yampa limestone, which apexed on the Utah Consolidated property. In replying to this action the Utah-Apex Mining Co. filed suit for \$1,750,000 for ore mined from the Dana or Leadville vein. Both suits developed into debates on the question of which was the lode, the flat-dipping limestone beds or the nearly vertical veins which cut them. In the Yampa case, the ore in question had been mined on the Petro vein in or near its intersection with the Yampa limestone. In the Dana suit, the ore mined by the Utah Consolidated was in the Highland Boy limestone at its intersection with the Dana or Leadville vein. The Utah Consolidated company obtained surface rights from the Utah Metal & Tunnel Co. to gain a clear title to the apex rights of the Highland Boy limestone. There was some question as to the exact point of apexing of the Dana vein on the Charles A. Dana claim owned by the Utah-Apex, but this was cleared up by some surface work done by the Utah-Apex to prove this. This left the decision to be based entirely on the opinions of the expert geologists and engineers.

Work was started by both companies almost two years before the suits came to trial. Prominent attorneys and geologists from all over the country were retained by both companies. Among these were Judge Curtiss H. Lindley, of San Francisco; Judge John A. Marshall, of Salt Lake City; Dr. Waldemar Lindgren, Dr. A. C. Lawson, Albert Burch, and O. P. Peterson, who were retained by the Utah-Apex. The Utah Consolidated engaged John Grey, of Spokane, and A. C. Ellis, of Salt Lake City, as attorneys. Horace V. Winchell, former president of the A.I.M.E.; Dr. J. F. Kemp, Dr. C. K. Leith, Reno H. Sales, A. N. Winchell, Perry G. Harrison, and R. N. Hunt represented the geologic staff of the Utah Consolidated.

The models used in court by the Utah Consolidated were made by F. C. Calloway, and consisted of a wire reproduction in miniature of the surface and underground workings of both mines and a block model of the limestone beds

of the Utah Consolidated and Utah-Apex properties. The maps used by the Utah Consolidated were constructed by the company's engineering staff. The Utah-Apex exhibits were nearly duplicates of those shown by the Utah Consolidated, the models having been made by E. C. Uren, of Nevada City, Cal., and the maps made under the direction of Frank Anderson, a mining engineer of Salt Lake City, and S. G. Emidio, of the Utah-Apex. The cost of all the exhibits was about \$100,000.

DANA CASE OPENED

The testimony in the Leadville case was opened by Utah Consolidated, the defendant. R. N. Hunt explained in detail the conditions existing in and near the Leadville vein and the Highland Boy limestone, as shown by the geologic maps. Mr. Hunt did not attempt to elucidate the theory of the mineralization, but confined his testimony to actual conditions that he had observed. The direct and cross examination of Mr. Hunt occupied about three days.

A. N. Winchell described the rocks and ores of the district, of which he had made an exhaustive petrographic study. Mr. Winchell explained in detail the methods used in making a microscopic examination of rocks. He stated that he had found that the ore was to a large extent in the limestone formations and rarely in the interlying quartzites. Mr. Winchell had made a study of nearly eight hundred specimens taken from the formations of the district.

Prof. C. K. Leith described the deposition of ore in the limestone beddings. The presence of ore was due, he said, to several factors, namely, the proximity of the porphyry and the consequent alteration of the limestone, the porphyry dikes in the limestone, and the bending and thickening of the limestone lodes. The fact that a great part of the ore is along and parallel to the bedding showed that this bedding was the distinctive feature of the occurrence of the ore on the Utah Consolidated property. Mr. Leith stated that the fissures and beddings were closely related but that the porphyry intrusions were the mineralizing factors.



1. SURFACE PLANT OF UTAH-APEX MINING CO. AT BINGHAM CANYON, UTAH. 2. UTAH CONSOLIDATED MINING CO.'S SUR-
OUTCROPS OF DANA FISSURE. 5-6. A LINE DRAWN BETWEEN THESE POINTS WILL REPRESENT THE COURSE

Dr. J. F. Kemp discussed the possibility of correlating the Jordan and Commercial limes, which are the principal mineralized portions of the U. S. mine, with the Yampa and Highland Boy lime beds of the Utah Consolidated on the opposite side of the Utah Copper porphyry mass. He showed that this correlation was possible.

Horace V. Winchell explained that the mineralization of the lime beds was due to the solutions from the cooling porphyry masses, but that it was impossible to tell by what definite fissure or crack these solutions came up to the overlying lime beds. In defining a lode, Mr. Winchell said: "A lode or vein is mineralized rock or rocks which contain such indications of valuable minerals as to justify development with the expectation of finding ore. As soon as quartzite over a considerable distance becomes mineralized, then it becomes a lode. Just as soon as either the other rocks can produce and do produce ore, or contain indications which lead the experienced miner or prospector of judgment to develop it in the expectation of finding ore, then it becomes a lode." The Highland Boy and overlying limestones were so mineralized, and were claimed to be lodes.

Reno H. Sales, geologist of the Anaconda Copper Mining Co., defined the conditions in the stopes of the Highland Boy lime and in and near the

Leadville fissure. He described the fissures passing through the stopes in the limestone but did not directly connect these fissures with the mineralization of the Highland Boy limestone. Mr. Sales completed the testimony for the Utah Consolidated in this case.

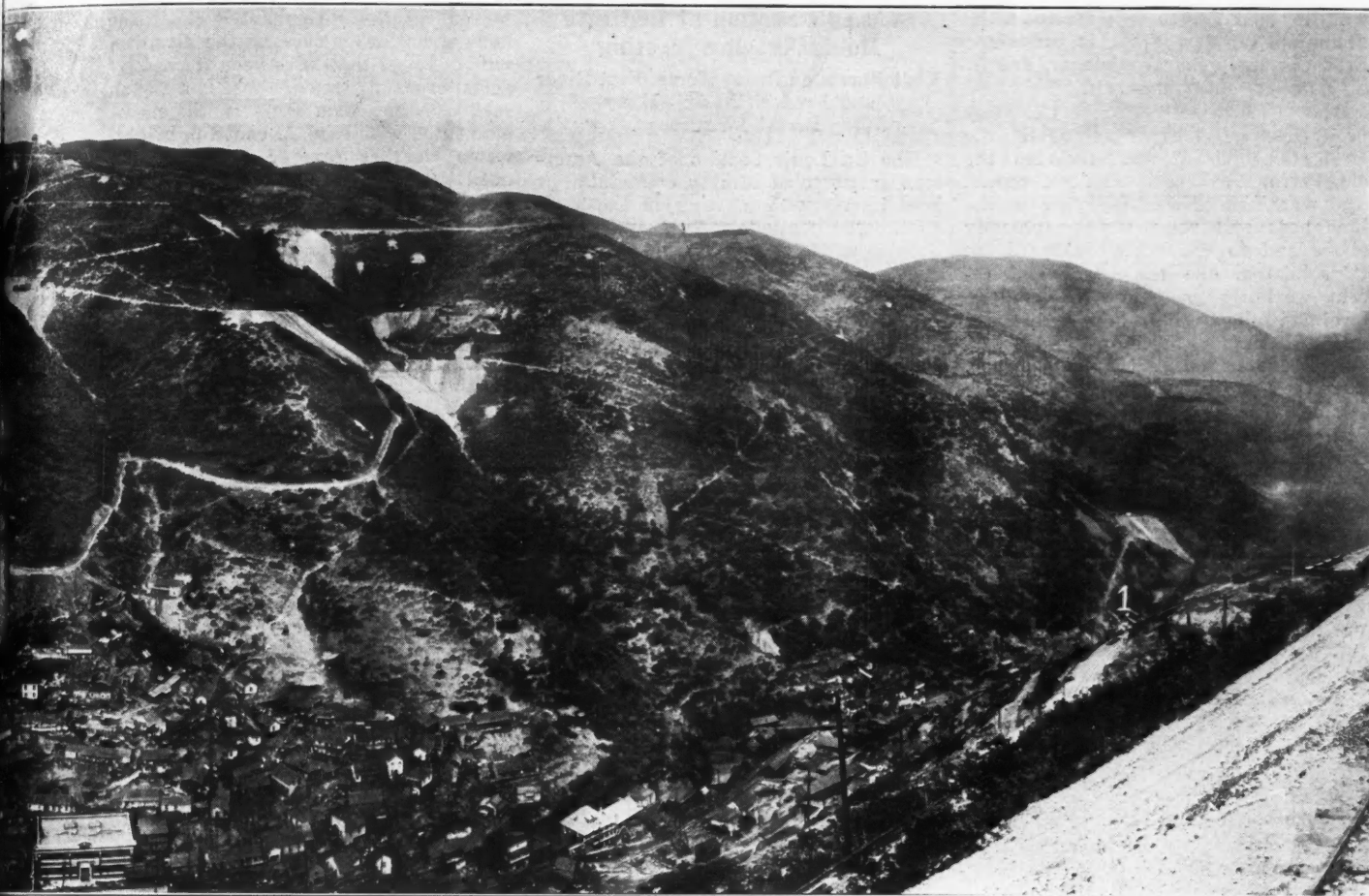
The first witness for the Utah-Apex, Frank Anderson, told of sampling the limestone and adjoining quartzite, the results of the sampling showing that in the places sampled the quartzite disclosed more mineralization than the limestone. In cross examination, Mr. Anderson stated that he had never heard of a broad limestone bed being sampled to prove it a lode.

J. A. Norden, assistant superintendent of the Utah-Apex company, described the upper levels of the Apex mine along the Parnell bedding and the Dana fissure. He stated that the greater part of the ore in these workings had been taken from the quartzite. These workings are several hundred feet above the ore in question in the Highland Boy limestone.

Colonel Ellsworth Dagget, of Salt Lake City, formerly mining engineer at the old Winnamuck mine, recalled that his experience in the early days in Bingham had been that the ore to a large extent was found in the fault fissures. He showed several specimens of ore taken from the mines in Bingham from the fault fissures.

Orrin P. Peterson, geologist for the Utah-Apex company, described the Dana fissure in the upper levels of the Apex mine. He said that the mineralizing solutions from the Dana fissure had gone out for several hundred feet into the limestones and quartzite, but, because the quartzites were more crushed than the limestones, the former were more susceptible to the solutions.

Albert Burch, of Berkeley, Cal., told of making an extensive examination of both mines. In making this examination he found that the country rock consisted of three types, namely limestone, quartzite, and porphyry. Within these three classes of country rock are two types of veins, the broad lode veins and the distinct fissure veins. In the Highland Boy lode the fissures are so close, Mr. Burch said, that it is impossible to distinguish between them. The tongues or dikes of porphyry running off into the country rock were very important in its mineralization and also in limiting the extent of the orebodies in the limestone. In regard to the Dana or Leadville vein, whose principal mineralization is lead ore, this lead ore could not have been deposited from the same vein as was the copper ore in the Highland Boy limestone, but was deposited through the Dana Leadville system of veins. This Dana Leadville vein passes up through the quartzites and limestones above.



FACE PLANT. 3. PLANT OF UTAH METAL & TUNNEL CO. 4. APPROXIMATE LOCATION OF CHARLES A. DANA CLAIM AND OF THE YAMPA LIMESTONE OUTCROP. 7. APPROXIMATE LOCATION OF HIGHLAND BOY LIMESTONE OUTCROP

Dr. A. C. Lawson, of the University of California, in his testimony described the several types of veins, lodes, and orebodies. A simple vein has two distinct and well-defined walls, whereas a lode may be made up of several veins close enough together to be mined at one operation. In correlating the Dana and Leadville fissures, Dr. Lawson showed the similarity of the two fissures, inasmuch as they had the same dip and strike, the same direction of movement, and the same type of mineralization. As there is no complete connection from the surface to the Highland Boy limestone on the Dana fissure, and as it is faulted by the base of the Yampa limestone, it is impossible to make a complete correlation. There was no doubt in Dr. Lawson's mind that the Leadville and the Dana were one and the same fissure.

Dr. Lindgren gave a long introductory talk on the geology of the Bingham district at the beginning of his testimony. He did not consider that the correlation of the Jordan and Commercial limes with the Yampa and Highland Boy had been conclusively proved. Dr. Lindgren limited the Highland Boy lode in the Highland Boy limestone by the foot wall and the Alice W. dike, a small porphyry dike extending along the strike of the bedding. Outside of these limits, the limestone was not mineralized until the

Dana Leadville fissure was reached, this being several hundred feet to the west. He described the Dana Leadville vein and his reasons for considering it the same vein or system of veins from the surface to the 1,800 level of the Apex, which is the lowest level in either mine. He considered the Dana Leadville system to be of later origin than the Highland Boy lime, and thought that the two were in no way related. Dr. Lindgren's testimony ended the expert testimony of the first suit, and the Yampa case followed immediately.

TESTIMONY IN YAMPA CASE HEARD

In the Yampa case it was necessary to introduce a new set of maps and models, which were explained in detail by Perry G. Harrison. In this suit it developed that the Utah-Apex had mined ore on the Petro fissure and the Yampa lime at their intersection. The Petro fissure was followed down from the surface through the Yampa lime and extends below this into the underlying quartzite. There are continuous stopes from above the 1,000-ft. level to the 1,500-ft. level along this fissure and in or near the Yampa lime. As the old Yampa mine, now a part of the Utah Consolidated, is to a great extent inaccessible, it was necessary to rely on old maps and information furnished by former employees of the Yampa.

Most of the ore taken from the Yampa mine and the Utah Consolidated's workings in the same bedding has been copper ore, whereas the ore mined on the Petro fissure in the lime has been lead ore.

Mr. Winchell's testimony for the Utah Consolidated consisted of his description of the Petro fissure from the upper levels to the lowest level of the Apex and its effect on the mineralization of the Yampa lime. In this case both companies used the same witnesses as before, and the testimony was practically the same, being a statement of geologic facts and theory of the mineralization.

A third suit was presented the last day of the trial by the Utah-Apex. This was the Dana extralateral case, which was to cover the extralateral rights of the Charles A. Dana claim. No testimony other than the presentation of a map showing the extralateral rights was given.

The Utah Consolidated is one of the oldest mines in the Bingham district, having been a producer for over twenty years. In size it is the second largest, furnishing employment to about 600 men. The company has extensive holdings in the district, including the old Yampa mine, which was recently purchased from the Tintic Mining & Development Co. Its workings are in a comparatively small area in the High-

land Boy and Yampa limestones. R. H. Channing, of New York, is president; Fred Cowans, general manager, and A. S. Winther, superintendent.

The Utah-Apex Mining Co. was organized a short time after the Utah Consolidated, and includes the old Petro, York, and Phoenix mines. The workings of the Apex are in the lime beds and veins stratigraphically above and to the north of the Utah Consolidated, and the lower and recent workings go below the haulage level and follow the fissures from above into the Yampa limestone and intervening quartzites. Recent work which has been done connecting the two

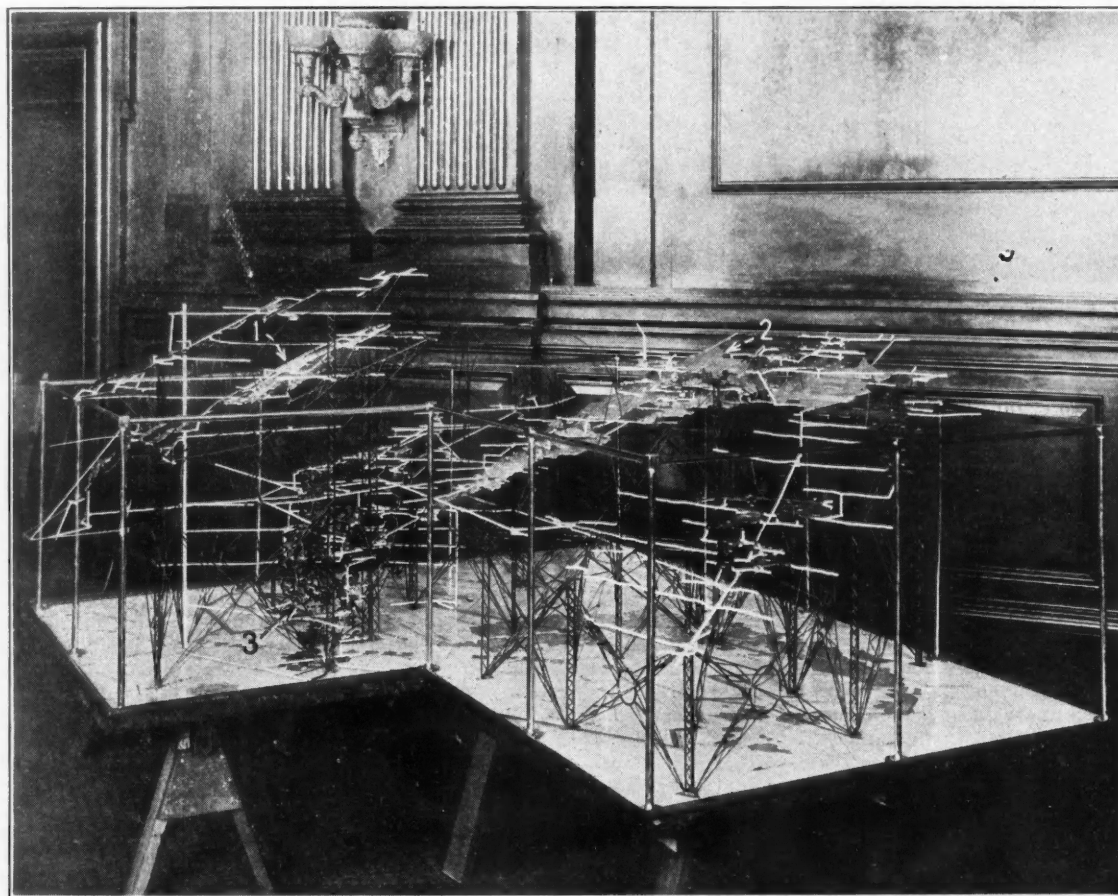
St. Louis Section of Institute Holds Autumn Meeting

Visit Plants at Bonne Terre, Flat River and Fredericktown—Many Social Features

The St. Louis Section of the American Institute of Mining & Metallurgy held its Autumn meeting in the Lead Belt. The party left St. Louis on the evening of Oct. 15 and were entertained that evening at the Bonne Terre Club House with dancing and bridge whist. The morning of the following day was spent in visiting the mines and mills at Bonne Terre and Flat River of the St. Joe, Federal and National companies,

served on the "Elephant-Rocks," the huge granite boulders at the Graniteville quarries that have been formed by aerial erosion. One of these is a 20-ton rocking stone that some of the members tilted with ease. Beautiful, bright, warm weather favored the excursion until the conclusion of the trip to the granite boulders, when as the party was on the eve of breaking up to return home, a violent thunder storm arose that was reminiscent of April, rather than the late fall.

The energetic efforts of the local committee made the event a great success, which was enjoyed by over 200 members and guests, in which the



WIRE MODEL (1 IN. = 50 FT.) EXHIBITED BY UTAH-APEX MINING CO. TO ILLUSTRATE PETRO-YAMPA CASE. MODEL MADE BY E. C. UREN, NEVADA CITY, CALIF.

mines shows the proximity of the workings and difficulty of distinguishing between the property of each. R. E. Haffenreffer, Jr., of Boston, is president, and V. S. Rood is general manager. The Utah-Apex is the largest lead mine in the state, and employs about five hundred men.

Canada Copper's New Concentrator Placed in Operation

The new 2,000-ton concentrator of the Canada Copper Corporation at Allenby, B. C., was finally placed in operation on Oct. 18. The new primary crushing plant is said to be giving excellent service at full rated capacity. No other report of results has been received to date.

with luncheon at Farmington. In the afternoon the entire party went by auto through the picturesque hills of the Ozarks, which were in their beautiful Autumn foliage, to Fredericktown, in Madison County, and inspected the mill and smelting works of the Missouri Cobalt Co., the only plant in Missouri that is producing copper, nickel, cobalt and some lead, the latter as a by-product, although the mine was originally worked for lead alone.

The local committee entertained the members in the evening with another dancing and bridge whist party, followed by refreshments.

The morning of the following day was spent at Iron Mountain, which is being reopened on a small scale, and a very enjoyable picnic luncheon was

local membership was well represented. Those chiefly responsible for the success of the meeting, in which the ladies participated as an innovation, were C. J. Adami, of the St. Joseph Lead Co.; H. G. Washburn, of the Federal Lead Co.; Messrs. Comyns & Thompson, of the National Lead Co., and T. J. Ma-teer, of the Missouri Cobalt Co.

But nine fatal accidents have occurred in Marquette County, Mich., during the last year, according to the report of the mine inspector, James H. Yelland. The fatality rate is 1.88 per 1,000 men employed. During the year 4,799 men were employed on the average in the industry, including quarries. This is the lowest fatality record made in the county.

Claim Increased Freight Rates on Bullion Absorbs Profit

Colorado Operators and Traffic Managers Seek Remedy for Interstate Shippers

During the recent investigations in Colorado into the matter of increased freight rates it developed that the increase on bullion shipped from western smelting points to refining plants on the Atlantic seaboard, places a heavy burden upon the mining industry. While mine operators do not directly pay this freight, the cost of moving the bullion is passed back to them by the smelters in increased charges and deductions. Operators claim that the increase, when apportioned back to each ton of ore produced, often absorbs the profit in mining it.

On Oct. 16, the Colorado Metal Mining Association filed with the Western Trunk Line Committee, an application for a hearing looking to a readjustment of bullion rates in effect between smelting points in Colorado and seaboard refining points. Mining organizations in the various western states were invited to join with the Colorado organization in asking for the hearing, since any readjustment of rates must necessarily include an entire revision of the bullion rates from all western smelting points.

The Colorado organization in support of their petition stated:

"Owing to the increased cost of operation, producers of lead and copper ores, except in the most favorable locations and conditions, have found it no longer profitable to mine them and the output has declined to an alarming degree. Conditions in Colorado are now such that unless relief is granted, the few remaining mines which make an appreciable production of these ores, must cease shipping.

"The following table shows the decline in production since the increased rates became effective early in 1918:

PRODUCTION IN POUNDS FROM COLORADO MINES			
	1917	1918	1919
Lead	69,990,012	65,960,760	35,859,675
Copper	8,122,004	6,122,004	3,310,090

"It now seems probable that the 1920 output will show an even greater decline.

"The falling off in production was due to the increased cost of operation in which transportation charges are a large factor both directly and indirectly. Transportation charges are said to affect the producer not only directly in the movement of ore and bullion, but in still greater measure are reflected back in increased treatment charges, deductions and cost of supplies.

"Prior to the order of the Railroad Administration of May 25, 1918, the bullion rate from Colorado common points to the Atlantic seaboard was \$7.60 per ton. Under Order No. 28 the rate, instead of taking a 25 per cent increase, as in the case of other commodities, was arbitrarily advanced \$6.50 per ton. With the 33½ per cent increase recently ordered, the rate is now, in-

WEEKLY RÉSUMÉ

The long awaited decision in the lawsuit between the Utah Apex and the Utah Consolidated mining companies was rendered on Oct. 20 in favor of Utah Apex. Advices from Wallace, Ida., state that the pending apex litigation between the Federal Mining & Smelting Co. and the Hecla Mining Co. has apparently been settled out of court. In British Columbia, the Canada Copper Corporation finally started its new concentrator at Allenby on Oct. 18. Mine operators of the Cobalt district, Ontario, have adopted a flat wage scale in place of the bonus plan recently in effect. At Bisbee, Ariz., the Phelps Dodge Corporation has laid off part of the force engaged on the Sacramento Hill excavation work owing to the delay experienced in building the new concentrator. In the Grass Valley district, California, the power restrictions hampering the operations of the gold mining companies have been removed.

In Washington, the gold committee of the American Bankers' Association reported unfavorably on the McFadden gold bonus bill at the convention of the Association held during the week. O. C. Ralston, of the Bureau of Mines, who has recently returned from Alaska, states that the erection of a smelter there is not advisable.

cluding war tax \$19.34 per ton, or an increase of 153 per cent over the pre-war rate.

"The first increase, figured on each ton of ore as mined, in many instances entirely absorbed the profit, and a large proportion of the mines were forced to close down. The last increase will still further curtail shipments, and instead of increasing the revenues of the carriers will result in just the opposite effect. The decline of the mining industry in Colorado has greatly reduced the revenues of railroads serving the mining districts and the distressing conditions are rapidly leading to the almost complete depopulation of communities which depend upon the mines."

Federal and Hecla Apparently Settle Apex Dispute

Both Companies Stop Work Intended To Demonstrate Possession of Apex

After a year of intensive preparation for a battle in the courts over apex rights involving the ownership of the bonanza orebody in what is commonly termed the "east" vein of the Hecla mine, the Federal Mining & Smelting Co. and the Hecla Mining Co. have apparently settled their differences out of court. So far as the public is concerned, there had been no intimation that a settlement was pending, and the orders issued by both companies on the same day to discontinue all work that was under way in preparation for the litigation came as a complete surprise. James F. McCarthy, manager of the Hecla, was in New York the day the order was issued, and Frederick Burbridge, manager of the Federal, was in Spokane.

Northwest Convention Date Set

The Northwest Mining Convention will be held in Spokane, Wash., February 28 to March 5, next year, according to a preliminary announcement.

Phelps-Dodge Corp. Cuts Down Sacramento Hill Force

Slow Delivery of Mill Construction Material Delays Completion—Market Conditions Also a Reason

The Copper Queen Branch of the Phelps Dodge Corporation announced on Oct. 16 that a number of men would be laid off from the Sacramento Hill steam shovel work on Nov. 1. The reason given is that owing to delay in receiving materials needed for mill construction the starting of the new concentrator will be delayed approximately six months or until July 1, 1920, so that the company can now lay off one-half of the Sacramento Hill force and be ready for ore production by the time the mill is completed. Present market conditions are also given as a further reason. About 350 men are effected.

Work of removing Sacramento Hill, in Bisbee, Ariz., was begun in April, 1917, with steam shovels, the object being to recover approximately 25,000,000 tons of low-grade copper ore that lay under the flank of the hill. This tonnage includes smelting, concentrating and leaching ore. The peak of the mountain was originally about 300 ft. above the gulch on the upper side. When the work is finished, in place of the hill, there will be two pits, roughly circular in outline, one about 1,500 ft. in diameter and 420 ft. deep and the other about 2,200 by 1,500 by 440 ft. deep. The total amount of material to be moved was about 40,000,000 solid cu.yd. in place, of which by volume slightly less than one-third was ore. It will require in all about sixteen years to complete the work.

To date, about 5,500,000 cu.yd. of material has been moved, which was nearly all waste, and has been hauled away and dumped about two miles from the pit. A concentrator is being built to handle 4,000 tons of ore per day and ore production will begin in 1921.

The hill is being worked off in horizontal benches 60.45 or 30 ft. in height. About sixteen miles of railroad track were required to connect these benches with the waste dumps and the concentrator. The ground is drilled with churn drills and heavy compressed air drills, and blasted with dynamite to break it up and facilitate loading by the shovels. Seven steam shovels are used on the work, all standard machines, weighing about 110 tons, and having 3½-yd. dippers.

Cobalt Operators Drop Bonus for Flat Wage Scale

At a recent meeting of the Cobalt Mine Managers' Association it was decided to drop the bonus plan of wages, under which a bonus was paid depending on the price of silver, and adopt a flat scale. The wages will be unchanged, \$5.25 for miners and others in proportion. Following the drop in the price of silver, wages were retained at the same level as when silver sold for \$1.20 per ounce, and it was felt better to drop the bonus altogether and go on the flat wage basis.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Smelter Unnecessary in Alaska, Says O. C. Ralston

Tonnage Insufficient To Warrant Erection of Plant—Granby Accessible to Southeast Mines

Concentration or hydrometallurgy seems to be the logical recourse in handling the copper ores in Alaska, rather than attempting to smelt these ores within the territory. This is the opinion expressed by Oliver C. Ralston, of the Bureau of Mines, who with Alfred H. Brooks, of the Geological Survey, at the direction of the Secretary of the Interior, collaborated in an investigation of the metallurgical needs of the Alaskan copper ores. "In general, it is hard to see any justification for a smelter," said Mr. Ralston, "to be built by anyone in either the Prince William Sound or southeastern Alaskan districts. The impression seems to have prevailed that a copper smelter was needed in the Territory. Such demand arose for an investigation that a report on the subject was called for."

Mr. Ralston's report will discuss the various types of ore and the methods which seem to him to be best adapted for their treatment. There are several thousand copper prospects in Alaska which are not being worked. There is not enough tonnage available from the so-called independent operations to justify the erection of a smelter. Even if the output of the principal producers were added, the tonnage even then might not be sufficient to justify a smelter of sufficient size to be really economical.

Since the smelter of the Granby Consolidated Mining, Smelting & Power Co. at Anyox, B. C., is fairly accessible to the copper mines in southeastern Alaska, there apparently is no thought of an additional smelter in that region.

Mr. Ralston did not visit Broad Pass. While there are a number of very promising copper prospects in that region, no large amount of shipments can be expected for some time to come.

Cottrell May Continue as Head of Bureau of Mines

The latest development in the discussion of the Bureau of Mines' directorship is the suggestion that in view of the wide differences of opinion as to the type of man who should hold this position, Dr. F. G. Cottrell may withhold his proposed resignation and continue at the head of the bureau for an indefinite period.

At the close of business on Oct. 23, the total purchases of silver which have been made by the Bureau of the Mint under the Pittman Act was 20,091,231 fine ounces.

McFadden Gold Bill Reported On Unfavorably by Committee of American Bankers' Association

Measure Defended by Sponsor on Floor of Recent Convention in Washington—Report Referred to Economic Policy Commission for Further Study

A report unfavorable to the McFadden gold bill was made by the committee on gold of the American Bankers' Association at the convention of that organization in Washington last week. The report was signed by the three members of the committee; namely, George M. Reynolds, president of the Continental and Commercial National Bank, Chicago; A. Barton Hepburn, chairman of the board of the Chase National Bank, New York; and Lawrence E. Sands, president of the First National Bank of Pittsburgh. The report, however, was not adopted by the Association as a whole but was referred to the economic policy commission of the Association for further study. Waldo Newcomer, president of the National Exchange Bank of Baltimore, was chairman of that committee.

Representative McFadden, of Pennsylvania, the chairman of the Banking and Currency Committee of the House of Representatives, not only defended his bill on the floor of the convention to which he was a delegate, but made a detailed reply to the arguments of the committee on gold. Extracts from the report made by the committee on gold follow:

"A large body of other industries, whose costs have risen faster than their prices, have similarly suffered.

"Recognizing that no national emergency exists calling for special treatment of the gold mining industry, it is difficult to make a case for singling out the gold mining industry for special relief from the Government. That it has suffered is unfortunate, but it is one of the costs of the war. It is one among a large class of those which the war has injured.

"Gold mining, however, though suffering under present conditions, enjoys a peculiar advantage which few other industries enjoy. As a consequence of the fact that gold is the standard of value the price of gold in terms of gold money is necessarily fixed. The demand for gold, however, is always unlimited. The gold miner can always sell at a fixed price as much gold as he can possibly produce. He finds his costs rising in periods of boom and prosperity, and he suffers as a consequence. On the other hand, periods of adversity, depression and falling prices bring to the gold miner, as to no one else, increased profits. He has an unlimited market in the worst depression, and the more severe the depression the lower his costs of produc-

tion tend to be. He is at present suffering in an intensified form from the upswing of prices and costs. He has in the past, however, enjoyed periods of prosperity when the rest of the community was suffering, and in the natural course of things he may look forward to the recurrence of similar situations.

"In reality the propaganda in favor of doing something for gold is exactly on a par with the propaganda in favor of doing something for silver, about which we heard so much a generation ago. It has no more stable foundation than did the silver propaganda. There is nothing to justify Government interference in behalf of this industry, or to justify a Government bounty upon the production of virgin gold. Per contra there is very much to be said against such action on the part of the Government.

ARGUMENTS AGAINST BONUS

"We may pass briefly over the difficulties of administration of such an act; the danger that frauds would be practiced upon the Government; the difficulty of distinguishing virgin from old gold melted down. Gold which differs from other gold merely in having a special history. . . . The temptation to manufacture history instead of mining gold would be very great.

"Again, the provisions in the McFadden Bill introducing the index number of commodity prices as a basis for fixing the rate of taxes on gold manufacture and of premium on gold mining constitute an opening wedge for the general introduction of the index number as a standard of value in the United States.

"The greatest objection of all, however, lies in the danger in which this measure would involve the gold standard itself. Nearly all of the European states are on a paper basis. Only a few of the smaller countries of Europe are even approximately maintaining the gold standard. The United States, par excellence, and Japan, as well, stand out conspicuously as nations maintaining the gold standard. All the world believes that our dollars are as good as gold. All the other nations of the world are struggling and hoping to get back to the gold standard. We enjoy a proud preeminence in this respect, and it should be zealously guarded and maintained.

"Offering to pay a premium for the production of gold in this country, in-

stead of strengthening our position would weaken it. . . . Great Britain, with far greater difficulties than we are facing, has resolutely refused to do anything of the sort in reply to the petition of her South African gold miners. . . . Action of the kind proposed by the United States would be a red flag to the commercial world. The passage of the McFadden Bill, instead of strengthening confidence in the position of the United States would weaken it. . . . Increased gold production in a period of low prices and low costs makes it easier for prices to rise again, while diminished gold production in periods of high prices and high costs tends to reduce prices and costs again."

In answering the arguments advanced in the committee report Representative McFadden said:

"Since the consumers of gold in the industrial arts and trades are receiving their metal at the pre-war price no reason can be assigned why they should not pay an increased cost alike with all other industries which have been forced to pay the increased cost for their raw materials.

"As compared to 1914 the purchasing power of the dollar in terms of all commodities in 1919 was 47 cents. The gold producers' ounce in 1914 had a purchasing power of \$20.67, whereas during 1919 the same ounce could purchase in terms of all commodities but \$9.70. Since the price of gold has been

arbitrarily fixed by statute at \$20.67 an ounce the gold producer is in the same position as a person who received the same income in 1919 as in 1914 and finds that a \$2,000 income has shrunk in purchasing power to \$970. This is the principal reason for the decline in the gold production from \$101,000,000 in 1915 to less than \$60,000,000 this year. Were it not for the fact that the Government has arbitrarily fixed the price of gold, in which event the law of supply and demand does not operate, it would not be necessary to consider compensating the gold producer for a part of the decline in the purchasing power of the dollar which has taken place the last four years. The premium to be paid to the gold producer, based upon the new ounce of production, cannot be construed as a bonus or subsidy for the above reason. Most of the wage increases that have been allowed by various industries and the increases in transportation rates, car fares, and for municipal gas and electric services throughout the country have been based upon the increase in commodity prices or the decline in the purchasing power of the dollar. The products of all other industries except that of the gold mining industry have been automatically increased in price during this period, so that the cost of production is fully covered, together with a profit, by which alone future production of such commodities may be assured. . . .

"Particularly in view of the fact that Congress has fixed the price of gold, it seems that Congress has now the power to stimulate the production of gold by creating the machinery whereby the consumer of gold in the industrial arts may pay more nearly the cost of production for his raw material, thereby enabling the producer of new gold to increase his output to meet the industrial requirements of the arts and trades, and protect the monetary gold reserve from further industrial depletion. The Government should legislate to stimulate the domestic gold supply and thus relieve the strain and send into the currents of industry the invigoration of this new gold. . . .

"The Committee's objection to the bill, based upon the possibility of fraud arising from the difficulty of distinguishing between virgin and old gold, is more serious in theory than it will prove in practice. With the co-operation of the Bureau of the Mint, the Bureau of Mines, and the Geological Survey, all of which organizations have field representatives in the gold mining districts, any successful fraud on the Government could only be on a very small and negligible scale. The affidavit of production specified in the bill and the penalty provided insures the Government protection against fraud.

"The British gold producer has been aided by the exchange premium. This bill offers a domestic solution for our own gold problem."

NEWS BY MINING DISTRICTS

Special London Letter

How Shall Government Dispose of Broken Hill Concentrates, If Strike Ends?—Esperanza Disappoints

By W. A. DOMAN

London, Oct. 12—Now that there is a probability of a resumption of mining operations at Broken Hill a question of importance in connection with zinc concentrates arises. Before the war the output of lead and zinc concentrates of the bulk of the Barrier mines was controlled by what was termed the German metal octopus, concerning which much was heard on your side during the war. To provide itself with spelter the British Government was compelled to make ruinous contracts with American firms. Mr. Hughes, the Premier of the Australian Commonwealth, decided to cut the German connection absolutely, and even abrogated contracts. For a long time he endeavored to induce the British Government to support him in his action and met with little success. After considerable correspondence, however, the Australian producers made an arrangement with the Imperial authorities by which the latter determined to thwart any renewal of the Zinc Con-

vention, and to prevent the Germans from again depriving this country of essential metals. A contract was entered into to purchase a moderate supply of zinc concentrates at a high price. Later this was thought to be unworkable, and by a modified agreement the government contracted to purchase a much larger quantity, 300,000 tons per year, at a lower price for ten years after the war. The price has never been divulged and considerable speculation has existed as to what it may be. For the first five years it is to be a flat rate, and for the second period it will be determined by market conditions, with the previous flat rate as a minimum. As the Broken Hill mines have not produced for about seventeen months in consequence of the miners' strike, the Government has not bought any considerable quantity of concentrates. The object of the arrangement was to encourage the smelting of concentrates in this country, and financial assistance was given by the government to at least one important undertaking at Swansea Vale. For various reasons, partly technical and partly labor, no real industry has been established, and the Swansea Vale works have come to a standstill. In

fact it is credibly reported that only one smelting works is now in operation, as the costs are on such a scale as to preclude profitable results being obtained. This is a great blow to certain metal interests in the country who had expected to employ large amounts of capital remuneratively. But quite apart from supplying concentrates to smelters here at reasonable rates the British Government has undertaken to guarantee a certain quantity to French and Belgian smelters, which before the war were largely dependent upon German goodwill, even if they were not in fact dominated by the metal ring. The question now is, how will the British Government dispose of the large tonnage of concentrates which it has contracted to purchase.

Esperanza shares after their skyrocketing as a result of the phenomenal gold and silver values in the Descubridora vein at the No. 5 level have received a nasty shock. This rich vein, though no sensible person could have expected it to persist with such high metallic content, has temporarily cut out and the price has tumbled about 20s. per share from the highest touched. As a borehole has proved the existence of the reef about 150 ft. from

the present face there is still the probability of good, profitable values being found again. Shares of neighboring mines, especially the Mexico Mines of El Oro, through which the Descubridora vein is expected to pass, also experienced the effect of the disappointment though the manager of the Mexico Mines announces some very high gold and silver values. But "Hope springs eternal," and in the Asquithian phrase holders of Mexican shares are prepared to "wait and see."

Twelve months ago the Falcon Mines of Rhodesia had a large stock of copper on hand, and also had borrowed something like £144,000 to finance it. Now a rumor is in circulation that the unsold metal has been disposed of and that the indebtedness has been repaid.

Special Australian Letter

Gold Producers' Association Distributes Premium—Broken Hill Prop. Outlines Plans in Report

From Our Special Correspondent

Melbourne, Sept. 20—Broken Hill South Ltd., New South Wales, received £127,733 during the year ended June 30 from realization on the products of former periods, all active operations being in abeyance throughout the year on account of the strike. Sundry revenue items, such as dividend and interest, yielded a further £36,578. Maintenance and cessation expenses totalled £98,645, and after meeting administration and taxation costs, and allowing £19,637 for depreciation, a net profit of £13,599 remained. The surplus of liquid assets, as on June 30, was £488,907, as against £617,149 at the commencement of the term. Ore reserves were estimated at 3,500,000 tons.

The Gold Producers' Association, Ltd., which attends to the marketing of gold for Australian producers, paid premiums totaling £1,365,506 to its shareholders, up to June 30, 1920. The latest distribution, which covered the balance of premiums earned in the first half of 1920, amounted to £300,857, and was divided among the several states as follows: Western Australia \$220,860; Victoria, £45,668; Queensland, £21,913; New South Wales, £7,474; Tasmania, £3,258; South Australia, £1,159; Papua, £523.

Owing to strikes and consequent shortage of coal, the Wallaroo & Moonta company's mines and smelting works were closed down for five out of the twelve months ended June 30, 1919. From Wallaroo mines 64,336 tons of material was mined, the yield therefrom being equal to 2,044 tons refined copper. From Moonta mines the tonnage mined was 8,340 tons, assaying 2.51 per cent copper. The cementation plant at Moonta produced 650 tons of precipitate, containing 71.8 per cent copper. Experiments have proved that Moonta ore can be successfully concentrated by mixing it with Wallaroo vein matter. The smelters treated during the year 21,203 tons of Wallaroo ore, 1,410 tons from Moonta, 684 tons purchased, and 434 tons of precipitate from the cementation works. The total product was 2,302 tons refined copper, and 301

oz. gold. The acid plant was in commission twenty-four weeks, and produced 2,430 tons sulphuric acid. An important change is being made at the smelters, in the erection of a large reverberatory furnace with a hearth area of about 2,000 sq.ft. Pulverized coal will be used for firing, and a pulverizing plant is to be installed, the first consignment of machinery for this having arrived from America. The year's work resulted in a loss of £38,914. Liquid assets at June 30 exceeded liabilities by £267,200.

Extensions of plant at the Newcastle iron and steel works, which it will take two years to complete, and the establishment of new industries are outlined in the annual report of the Broken Hill Proprietary Co., Ltd. One statement of especial importance is that, with the large number of coke ovens in operation, distilling about 270,000 tons of coal a year, it is desirable to save all the by-products, and a fully qualified man has been engaged to take charge of the coke oven department and erect a by-product plant.

CANADA

British Columbia

Dolly Varden Planning for Winter Work

Stewart—The Algonquin Development Co. has decided that further development of the George Group situated on the south side of Bear River shall be postponed to next season.

Good progress has been made in opening up the property of the Indian Mines, Ltd., situated on the west side of Cascade Creek, between the Salmon River glacier and Cascade Creek. Development consists of three open cuts on the outcrops and two tunnels.

Alice Arm—For several weeks there have been about 200 men employed at the Dolly Varden mine. During the summer large shipments of ore have been made, development and construction work also being carried on. It is understood that about 65 men will be kept on the payroll for development during the closed season.

Nelson—Spokane capital, which became interested in the Revenue group, on the South Fork of Kaslo Creek, early in the summer, has carried on extensive surface development with a view to putting the property in shape to be worked underground during the winter. Accommodations for over twenty men have been provided, and if the heavy snowfall does not come too early, and interfere with the getting in of supplies during the late fall, work along the lines originally planned will likely be carried out.

The Cork-Province Mines, Ltd., owning extensive mineral holdings and a mill and camps on the South Fork of Kaslo Creek, has leased the camps and the saw mill to the Howland & Waltz logging syndicate, of Minneapolis. The syndicate will use the camps during a part of the winter, but the lease contains a proviso to the effect that the mining company may resume occupancy upon a month's notice.

Indications are that tonnage handled at Consolidated M. & S. smelter at Trail for 1920 will be well in excess of that handled during 1919. By the middle of October the tonnage for 1920 had already surpassed that of 1919, being 267,768 tons. The tonnage of the Sullivan mine in 1919 was considerably smaller because of labor troubles and strikes. Of the 1920 tonnage, about 155,000 tons came from mines operated by the Consolidated M. & S. Co.

The Keystone Development Co., in which Winnipeg capital is chiefly interested, has maintained development of the Charleston group, near White-water, during the past summer and fall with encouraging results, according to reports, particularly as to work on the Keystone claim. The property carries values in silver-lead, and is located on veins paralleling the White-water lode, which has been one of the best producing areas of the Slocan.

Ontario

Engineer Reports on Associated Gold-fields as Result of Criticism

Gowganda—At the Castle property of the Trethewey mine, the Office vein has been crosscut on the 75-ft. level and shows several inches of high-grade ore.

Cobalt—The Coniagas has stopped the re-treatment of old slimes until next summer. Some minor mechanical troubles developed, and this, coupled with the low price of silver, has caused the management to anticipate suspension of the season's operations by a few weeks.

During September eleven Cobalt companies shipped 1,607 tons of ore and concentrates, of which 93 per cent went to Canadian smelters and 7 per cent to American smelters.

Kirkland Lake—The Kirkland Lake Gold is treating 125 tons a day and expects to bring the mill capacity up to 175 tons. Drifting has been started on the 900-ft. level, the deepest in the camp. Labor shortage is impeding development, as is also the case with the Teck-Hughes, where sufficient men cannot be obtained to put on an extra shift.

The Wright-Hargraves mill is waiting delivery of thirteen motors which will delay the starting of the mill until after Jan. 1. The main vein has been developed for a length of 400 ft. and a width of over 20 ft., on the 400-ft. level. The north vein is 6 ft. wide, and carries good values.

The scarcity of labor and the high cost of materials has caused the Ontario Kirkland to delay work on its mill. It was planned to build the foundation this fall, but this has also been postponed.

The Hunton has decided to increase its capital from \$1,500,000 to \$2,500,000 in order to have sufficient treasury stock to finance development. The main shaft is to be sunk to 400 ft.

It is officially announced that the Kirkland Lake Proprietary (1919, Ltd.) has completed the taking over of the assets of the English Tough Oakes Gold Mines, the old Kirkland Lake Pro-

prietary Co., the English Aladdin Cobalt, and the Sudbury Syndicate. A notice sent out to the stockholders of the Ontario Tough Oakes states that arrangements are now under way for the acquisition by the new company of the assets of the Ontario Tough Oakes, the Burnside and the Syndicate Gold Mines.

A recent report on the Associated Gold Fields of Larder Lake again brings this company into the limelight. The report was the result of action taken by several of the large shareholders who were not satisfied with the statements made by the management. The control of the company is in the hands of Dr. McKay, a dentist, whose knowledge of gold, prior to his connection with this company, appears to have been limited. At the annual meeting, held some time ago, he stated that the ore ran over \$11 a ton, and that the company had reserves aggregating \$159,000,000.

The complete text of the report has not been published. Apparently it accepts the assay results of the company's engineers, and the conclusions are almost entirely based on the results of diamond drilling. It is said that experience has shown that in the gold district of Northern Ontario, diamond drilling is not a safe guide for the estimation of values and that numerous instances could be quoted in support of this, but results at the Dome may be considered as typical. This may be said to be the first engineer's report to have been made on this property, which has succeeded in obtaining so much of the public's money and which has aroused such a storm of criticism.

MEXICO

Boston Syndicate Buys Iron Property in Durango—Explosives Embargo Removed

City of Mexico—The Secretary of finance in a recent interview expressed considerable indignation because a number of banks in the City of Mexico have refused to receive on deposit the new silver coins in quantities beyond twenty pesos, alleging that the coins are under weight and not legal tender. They claim also that the Government has been working overtime in the mint because the exchange of the new silver peso and half dollar for gold coin is "good business." Secretary Alvarado denies that the government is making an excessive issue of silver and says that there is still a great scarcity of change in the interior.

Advices from Durango City state that the large iron property near there, locally known as Cerro del Mercado, has been sold to a Boston syndicate. The Cerro del Mercado, which is almost within the city limits, is a remarkable single deposit. It is 3,600 ft. long and 1,100 ft. wide, covering ninety acres. The hill is 640 ft. high and is estimated to contain above the base 200,000,000 tons of ore of unusual purity, free from sulphur and phosphorus and running about 63 per cent iron. An option was secured by Japanese capitalists some

time ago, but owing to international objections, it was cancelled.

The war department has withdrawn the restrictions regarding the importation of explosives into mining camps, which restrictions together with red tape formed one of the main drawbacks to active mining operations in many parts of the country under the late Carranza regime. General Calles, minister of war, during his recent trip through Chihuahua and Sonora made a careful investigation of complaints regarding these obstacles and upon his return issued an order permitting the free importation of explosives of all kinds. The fact that Mexico is absolutely at peace with herself is best proven by the withdrawal by the government of all the small garrisons which were formerly maintained not only in country villages, but in the principal mining camps, and the lifting of the embargo on explosives.

The fact that Mexico passed the United States, her nearest competitor in silver output in 1919, and resumed her position at the head of the silver producing countries of the world caused the Minister of Commerce and Industry to state that the silver production this year in Mexico would be over \$200,000,000. The minister bases his statements on reports already in for more than half the year and the fact that more mining concerns will open in the next three months than were actually in operation during the past three stormy years. The recent drop of silver again has in nowise affected operations as it is generally assumed that the metal will strike a normal gait above 90c. and remain there.

The finance department is preparing to enforce the provisions of the last presidential decree which requires that all receipts for taxes paid on mining property must be in order by Nov. 1. The government apparently intends to be severe with those who have made no attempt to set themselves straight, either intentionally or from neglect. Companies that have not complied by Nov. 1 will be listed and a complete record turned over to the Department of Commerce and Industry with instructions to cancel the titles at once and to open the properties for re-denouncement.

MICHIGAN

The Copper District Osceola's September Output Drops— Michigan To Suspend—Isle Royale Purchases Tamarack Hoist

Houghton—The production of the old branch of the Osceola Consolidated Mining Co. decreased to 4,700 tons in September. This was owing to the fact that the branch operated but one shift.

The Victoria Copper Mining Co. is producing about 125,000 lb. of copper with 100 men, which is considerably less than half its normal quota. The management is now reaping the advantage of the Taylor hydraulic air compressor which it installed on the west branch of the Ontonagon River

about fifteen years ago. This equipment furnishes all the motive power needed, even in the stamp mill. With coal around \$10 per ton this surely is a distinct advantage.

The Michigan Copper Mining Co. have decided to suspend mining operations temporarily. This decision has been reached because of the high prices of supplies and decreased labor supply. The property is in good condition as regards equipment and copper content of the openings on the Butler lode, which is from 30 to 80 ft. wide. Even with the small labor force Michigan has been producing from 100,000 to 200,000 lb. of copper per month for the last six months.

The Mayflower-Old Colony is passing through some well mineralized ground in the south drift about 200 ft. from the shaft. The indications are that it has passed through the disturbed zone and is about to enter the more regular vein formation.

The auxiliary hoisting engine at the old Tamarack No. 3 shaft has been purchased by the Isle Royale Copper Co. and is being installed at its No. 5 shaft. This is a 32 x 72-in. duplex hoist with an 18-ft. drum built by the Nordberg Manufacturing Co., of Milwaukee.

Gogebic Range

Production Stops at Davis Mine—"G" Pabst Coal Handling Equip- ment Being Installed

Ironwood—The new change house at "A" shaft of the Norrie mine is now in use. It is similar to the one at "E" Aurora, single story, 40 x 138 ft., and of fireproof construction. The coal and ash handling equipment at "G" Pabst power house is being erected. The coal will be loaded by locomotive cranes fitted with grab buckets, which will dump into a large hopper car from which it will be loaded into small cars and hauled to the crushing plant, from which point it will be taken by conveyors to the feed hoppers over the stokers. The ashes will be drawn off into cars, run outside the building, and dumped into a skip, which will hoist them up and dump into a large bin over the railroad tracks. The coal dock has a capacity of 35,000 tons but has not yet been filled. Last week several fires have developed in the coal piles and are causing trouble; even at "A" Aurora where the piles are very small there have been fires.

The Davis mine has temporarily ceased to produce, the small amount of ore which was left on the upper levels having now been worked out, and development work on the bottom levels has not yet reached the ore which is expected to be encountered coming over from the Newport mine as the footwall carries it northward. The fire which occurred in the Davis shaft 18 months ago delayed this development at least six months and brought on the present condition. The work on the pump house on the 26th level is progressing well. A mucking machine is being used to get out the rock.

JOPLIN-MIAMI DISTRICT
Oklahoma-Kansas-Missouri
Lucky O. K. Gives Up Option on Acme Mines

Hockerville, Okla.—The Lucky O. K. Mining Co., after a 30-day investigation, gave up its option on the mines of the Acme Mining Co., southeast of Picher. P. W. George, manager for the Lucky O. K., which is a subsidiary of the Federal Mining & Smelting Co., states, however, that the option was given up more because continued low zinc ore prices and falling lead ore prices do not encourage as much additional operational activity as the taking on of the Acme mines would mean for his company. However, the Lucky O. K. has recently taken an option on the Lucky Jenny and Choctaw Chief mines, which are located in Hockerville, a short distance south of the Farmington mine. The Farmington was taken over by the Lucky O. K. some months ago, and, after a thorough drilling campaign, was opened up and has been made a profitable property. Under its original management it had been considered a failure. The success of the Lucky O. K. management is due to deeper operations. The company has placed a drill right in the middle of the main street in the little town of Hockerville.

A short distance south of the Choctaw Chief mine the Hawkins Mining Co. continues developing its recently discovered lead mine. While slowly sinking its discovery shaft, the company is making an average of about five tons of lead per day, with only two men in the ground and a total force of six men. In the meantime it has been sinking a field shaft about 350 ft. to the north, but the manager is now considering the advisability of sinking still a third shaft in between these two and erecting a concentrator at this shaft. He has a mill at Sunnyside ready for moving. The first 100 tons of lead from his mine he sold at \$115 per ton, and the next 100 at \$100. He declines to sell at the new low prices and will hold for a time at least.

The Right Good Mining Co. is erecting a concentrator on a 40-acre lease of the Kropp land, about one-half a mile south of Hockerville. Drill prospecting is being carried on while the mill is being erected, but there is a shaft into ore at a depth of only 154 ft. W. T. Dunlop, Clay Center, Kan., is manager of the company, which was unsuccessful in developing a good mine in the Lincolnville camp.

Tar River, Okla.—Auburn Mining Co. has purchased the Cliff mill at Joplin, and is moving it to a 40-acre lease southwest of Tar River, where the mine already has been well developed by Douthat Mining Co. The latter company got in litigation and the property was recently sold by order of the court, the Auburn Co. getting it on a bid of \$40,000. The principals of this company include several of those formerly interested in Douthat. Abel Green, formerly manager of the Adams-Hicks, is manager.

Miami, Okla.—Al Standefer has been appointed receiver of the Pottorff-Smith mine, three miles south of Baxter Springs. H. Logan had claimed a one-half undivided interest in the property and protested the appointment of a receiver, and asked for a court order directing partition of the property. This was denied.

Blue Mound, Kan.—The Blue Mound Mining Co. has recently opened up promising lead ground on a lease a quarter of a mile east of its mill and at the foot of the blue mound which marks this entire section. The ore is found almost in solid soapstone, the dirt as it comes from the shaft containing scarcely any grit. For this reason the company is considering the installation of some kind of log washer equipment such as is used in the Batesville, Ark., manganese field for ore cleaning. If this is done it will be an innovation for zinc mining. The Blue Mound Co. has temporarily abandoned development at the shaft it equipped last winter and which is still east of the lead strike, but plans to reopen it when the price of ore becomes more satisfactory.

The Euterpe Mining Co., located in Kansas, northeast of Hockerville, Okla., has started up its new mill and reports exceptionally good dirt. It has had difficulty in getting coal for operations, however.

The Empire Development Co. is temporarily down while it carries on some prospect development work on its lease, just to the northeast of the Euterpe.

Webb City, Mo.—A very fair strike of coal has been made by the Home Coal Co. on the Connor land, south of Carterville, in a district that for a long time was a rich zinc and lead field. The strike was made at a depth of only 17 ft. from the surface, where a vein 7 ft. thick has been proved up. Three skilled coal miners have been engaged to bring the coal to the surface, where it is commanding a price of \$6, undelivered, or \$7 delivered to Carterville and \$7.25 delivered to Webb City. George J. Kusterer, formerly manager of the Onamena Zinc Co., is manager.

MISSOURI

Southeast Missouri Lead District
Lee Mine, Near Vineland, Being Opened
—Beulah Closed Down for Winter—
Shulte Under Option to
Picher Lead

Anaconda—The Picher Lead Co. is developing its recently acquired Fisher mine near Anaconda, in Franklin County, where some small, rich lenses of solid galena were discovered by the former owners. Churn drills have been brought in to test the lower ground and some encouraging lead is said to have been found at about 400 ft. This will be checked up with diamond drills. The rich galena lenses were found at 40 ft., as is customary in this district, or at very shallow depths.

Annapolis—The Annapolis Lead Co. has sunk its shaft over 200 ft. at Annapolis, in Iron County, and expect

to bottom it next month, when the erection of the mill will be started. A large body of disseminated lead ore has been proved up on this property with the diamond drill.

Fredericktown—The Shulte property at Fredericktown, in Madison County, has been taken under option by the Picher Lead Co., which will do further drilling before finishing the shaft started by the late Harry Cantwell. Considerable nickel and cobalt occur, besides lead. The tract is only two miles from the mine of the Missouri Cobalt Co.

Vineland—The old Lee mine, near Vineland, in Jefferson County, is being re-opened by Desoto and Joplin people. This property produced considerable shallow lead from gash and pipe veins many years ago, but has been full of water for over twenty years.

The Sherry Lead Co. is about to start drilling for disseminated lead east of Vineland, near the old Valle mines, where a heavy fault has more or less mineralized the country.

Kelcey—The Beulah mine, at Kelcey, in Franklin County, has closed down for the winter, on account of the pyrite shipments freezing in the cars. This mine has produced considerable pyrite, of the marcasite form, and has recently been put in good shape for a large tonnage that at present is going to the Chicago market. The ore runs from 40 to 44 per cent in sulphur and is very desirable for acid making, as it is free burning. The property is owned by East St. Louis parties.

COLORADO

Valley View L. & M. Co.'s Mill in Operation

Matterhorn—The new 100-ton mill of the Valley View Leasing & Mining Co. is in operation. It is equipped with a gyratory crusher, ball mills, tables and flotation.

Leadville—Work was recently resumed on the Emma and Mabel placer, in the East Tennessee section of the Leadville district, which has been idle since last June on account of surface water which necessitated a close-down. Lessees of the property expect to carry out extensive development work in an attempt to locate the source of free gold which has been found in the placer fields of the East Tennessee section. A shaft 50 ft. deep was sunk through the quartzite on the property a year ago and a 90-ft. drift run through a varied formation. It is expected that but little work will be required to bring the breast of the drift into the contact under the parting quartzite, and it is here, the lessees believe, that the gold veins should be found.

Although the East Tennessee section has never produced any large mines, mining men are of the opinion that it will ultimately prove a good producer. The Jenny June and Lucy L. claims, comprising a portion of the Emma and Mabel placer, have both produced gold ore, which has been taken from small

veins in the lime formation. The free gold found in the placer fields of the district is sharp-edged and shows no signs of being washed for a very great distance. This fact has lead mining men to the conclusion that somewhere in the district the mother lode will be found.

Cripple Creek—An ore shoot opened recently on the 13th level of the Modoc mine is developing into an important deposit. The shoot has been opened for a length of 120 ft. and has an average width of over 30 ft. The ore extends up to the 11th level. About 50 per cent of the stope now being worked is shipping ore. New hoisting equipment is being installed, and development will proceed on the 14th and 15th levels. The new hoist will be operated by a 250-hp. Westinghouse motor, and will be designed to operate two double-deck cages from a depth of 2,000 ft. The new installation will cost about \$25,000.

Idaho Springs—The Little Mattie mine has been taken over by the Commonwealth Silver Mines, Inc., J. F. Cleveland, president, and is being unwatered, preparatory to a campaign of active development work. The mine is opened by about 5 miles of underground workings, including a 900-ft. shaft. Equipment includes a 60-ton concentration and flotation mill.

Alice—The Roosevelt Mining Co. will build a tram about three-quarters of a mile long, from the Reynolds mine to the mill, and install a new air compressor. The 15-stamp mill is being re-modeled.

Breckenridge—During July and August the Wellington Mines Co. operated at a loss, but in September it distributed a dividend of \$100,000. Total dividends to date amount to \$2,050,000. During 1919 the company suffered from unsettled market and labor conditions and high cost of production. However, systematic development work was carried on. New equipment has been installed recently, including a new compressor. The company proposes to resume sinking the old Oro shaft as soon as miners are available. J. W. Oldham is president and R. M. Henderson manager.

NEVADA

Nevada Con.'s Giant Blast Breaks Huge Tonnage—Pioche Shipments Falling

Ely—It is estimated that 200,000 tons of rock were moved when twelve tons of powder, placed in eight holes drilled in the hill in the center of the pit at Copper Flat, where exploded recently. It was one of the biggest blasts ever set off by the Nevada Con. and the location of the holes was carefully planned by engineers of the company. The school at Ruth was adjourned in order that the pupils might witness the sight, but from the spectacular point of view it was somewhat disappointing to those who expected to see the whole hill go up in the air. However, it was entirely satisfactory to the engineers.

Dayton—The big steel dredge of the Gold Canyon Dredging Co., the initial performance of which was witnessed by over 1,200 persons on Sept. 5, is working smoothly and several cleanups have already been made.

Pioche—Mining activity is waning in the Pioche district, owing, it is said, to the apathetic attitude of the officials of the Salt Lake Route towards the effect of the recently increased freight rates. Ore shipments from the district showed an increase over last week's total, but were considerably below the average. The Prince Consolidated produced a larger tonnage but the smaller properties showed a decided decrease. Shipments were: Prince Consolidated, 1,510 tons; Virginia Louise, 515 tons; Bristol Silver Mines, 150 tons; Black Metals, 100 tons; Combined Metals, 55 tons; Currency Lease, 40 tons; and Zero Lease, 40 tons.

CALIFORNIA

Power Restrictions Removed in Grass Valley District—Ruby Copper Installs Mill

Quincy—The Ruby Copper Co., in the Plumas copper belt, has installed a mill and is making an average of 1,000 lb. of concentrates per 10-hour day. The mill at present is losing much of the bullion.

The Reinmiller Copper Co. has practically completed the road from the main Susanville road to the mine and the men will soon be put on mine development. Recently the grading crew opened up a promising blind quartz vein.

Johnsville—The old Plumas-Eureka, which is one of the historic gold mines of Plumas County, is about to be taken over by the Guggenheim interests, according to local reports. The Plumas-Eureka was located in 1850 and has produced several million dollars. The most of the free-milling gold ore averaged between \$6 and \$8 per ton, but occasional bodies of very rich ore were also found. Colonel Proseky, of Reno, at one time owned the property.

Doyle—The Plinco Consolidated group of 23 claims, located about 15 miles east of the Walker mine, has been taken over by John F. Cowan, of Salt Lake City, according to a recent announcement. High-grade copper ore has been opened up on three levels and is said to be 25 ft. wide in some places on the 200-ft. level.

Grass Valley—The Pennsylvania plant of the Empire Mines will be opened as a result of the order issued to remove power restrictions. The effect of the new order will be to make available all power needed to restore the operating schedules of the mines in the Grass Valley district.

ARIZONA

Bisbee—The work of reopening the Irish Mag shaft is practically completed. The work was started in April, 1920, by the Irish Mag Leasing Co. under the management of M. J. Elsing.

This company is operating on a lease of the Irish Mag claim from the Calumet & Arizona Mining Co. Three hundred and sixty feet of the shaft was completely caved.

IDAHO

**Cœur d'Alene District
Big Creek Again Operating After Shutdown**

The Big Creek Mining Company is again in operation after an enforced suspension due to an order from the court forbidding the company to contaminate the water of Big Creek by discharging water from the mill into the stream, this being the source of domestic water supply for the town of Kellogg. The company constructed a flume which diverts the water to a point far removed from the creek. The mill is now running full time on a large accumulation of low grade ore on the dump. Men are being put on in the mine as fast as they can be secured, and in addition to the usual mining operations, a raise will be driven from the lower tunnel to the level 550 ft. above. The management announces that it is expected to be on a dividend paying basis by spring.

Crosscutting from the bottom of the 400-ft. shaft at the Chicago-Boston has advanced about 50 ft. and it is expected that the vein will be reached in about 200 ft. This work is being done by the Interstate-Callahan, which controls the Chicago-Boston.

WASHINGTON

Mining at Republic Suffering Because of Gold Situation

Index—Development during the summer at the Kromona mine in the Sultan Basin district has been encouraging. The copper vein has an extended natural exposure and a crosscut recently completed shows that it maintains its values over a good width. Winter rains and snows have stopped work until next summer. The Florence Rae mine, in the same district, has been bonded by a syndicate which is planning active mining operations.

Republic—Operations in the Republic camp are dormant, more so than for years. This is owing to the present gold situation which will not permit shipment of gold ores of medium grade. The mines of the district are working below the 500-ft. level and increased costs and freight rates are discouraging extensive shipments of ore. The revival of the district appears to be contingent upon the solution of metallurgical problems, the gold ore having so far proved refractory.

The Quilp mine is supplying siliceous ore to the Trail smelter where it is used as a flux. This ore is being drawn from stopes above the 700-ft. level. It is probable that when these stopes are exhausted the Surprise shaft will be sunk 200 ft. further.

The Last Chance and Lone Pine-Surprise properties are involved in apex litigation and neither is producing at present.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper N. Y. net refinery* Electrolytic	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
21	15.10	38.50	39.00@39.50	6.75@7.00	6.60@6.90	7.05
22	15.10	38.00	38.75@39.00	6.75@7.00	6.60@6.80	7.00
23	14.85@15.10	38.50	39.00@39.50	6.75@7.00	6.60@6.75	6.95@7.00
25	14.85	38.75	39.25@39.75	6.75@7.00	6.60@6.80	6.95
26	14.85	39.00	40.50@40.75	6.75@7.00	6.60@6.90	6.95
27	14.85	39.50	40.75@41.00	6.75@7.00	6.60@6.90	6.95

*These prices correspond to the following quotations for copper, "delivered": 15.25, 15.25, 15.00@15.25, 15.00, 15.00, and 15.00c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

slashing prices to make sales without wishing to make the facts known. So far as we know, business at the current level is of small volume, buyers not wishing to carry large stocks on their inventories at the end of the year. Some sales of somewhat larger volume are being booked for January delivery.

Lead

The A. S. & R. official price continues at 7½c., New York, and some producing interests are quoting this price without, however, making any sales. The market is gradually becoming more restricted, and unless it improves, producers are apt to find at the end of next month that some of their November metal is unsold. The number of cancellations and requests for postponed deliveries is increasing. Another striking feature is the fact that consumers are offering spot metal for resale, a particularly depressing influence. At current prices, London lead cannot be laid down here for less than 7¼@7½c., so that trouble from importations is hardly expected.

Chemical lead is scarce and a slight premium is being demanded for this variety in the St. Louis district, where 6.90c. has been asked for the last two or three days. Mexican lead is offered at ½c. under this figure in St. Louis, owing to its having been thrown into that market by a cancelled contract.

Zinc

This metal has exhibited a further gradual decline, and yesterday the 7c. level was passed, sales taking place at 6.95c. Not all producers were willing to sell at this figure but apparently little or no business could be induced at any higher quotation. Consumers are simply not buying. The curtailed production should tend to help the market as it did last summer, and also, with black sheets in better supply, the galvanizing business should improve. Stocks of zinc are, however, larger than producers would like to have them. Metal for forward delivery commands 5 to 10 points premium.

Tin

One producer says the principal feature of the tin market just now is a demand for futures at the prices quoted for spot. There are large supplies of spot Straits now in New York, and consumers are not interested. Recent forced sales caused by buyers of unknown reputation declining to accept deliveries have had a depressing influence. The market is very irregular. Some electrolytic has been moving at around 39c. One consumer was offering electrolytic for resale yesterday at 39½c.

Straits tin for future delivery: Oct. 21st, 40.00 @ 40.75c.; 22d, 39.75 @

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	S.	3 M							
21	91	89½	101	251½	256½	36½	35½	38½	39½
22	8½	88½	100	248	254½	36	35½	39	40
23									
25	91½	90	100	251½	257½	36½	35½	39½	40½
26	8½	88½	100	258½	263½	36½	35½	39½	40½
27	88½	87½	100	261½	265½	36½	35½	39	40

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

Silver and Sterling Exchange

Oct.	Sterling Exchange	Silver			Oct.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
21	343½	99½	81½	53½	25	347	99½	80½	52½
22	343½	99½	80½	52½	26	346½	99½	80½	52½
23	345½	99½	80	52½	27	347	99½	80½	52½

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

Metal Markets

New York, Oct. 27, 1920

Price recessions have continued during the last week but to a diminished degree. Both producers and consumers are beginning to consider that present prices are at or near the bottom and it is unlikely that any further marked declines such as have taken place during the last few weeks will occur. Metal for forward delivery is beginning to command a slight premium as a general rule, for the spot demand is totally lacking. With present general conditions and a declining tendency in price levels, it is, however, almost too much to expect any marked increase in metal prices. The approaching election seems to have been overshadowed by other conditions and

has probably exerted little influence on the market. Those who look for increased buying after Nov. 2 may, therefore, be disappointed.

Copper

The market seems to have reached a stable basis at 15c., delivered, after the recent rapid decline from the 18@19c. level. Large producers are now selling about on a parity with the outside market. Rumors have been circulated about large lots of copper having been sold both at 15c. delivered and slightly under this price, but after careful investigation, both among producers and consumers, we are unable to confirm any of these transactions. There is no doubt that several sales of rather large volume were made on the quiet during the recent recession, producers

40.00c.; 23d, 40.00@40.50c.; 25th, 40.50@41.00c.; 26th, 41.25@41.75c.; 27th, 42.25@42.75c.

Arrivals of tin in long tons: Oct. 20th, Rotterdam, 10; 21st, London, 50.

Silver

From October 21 to 27 the London price has fluctuated between 53½ and 52½ pence. London reports buying for Indian bazaar and China account as responsible for the upward movements; and further sales of melted coin from the Continent and a certain amount of speculative selling are the factors causing the decline.

During this same period the improvement in sterling exchange has been sufficient to increase the London parity by over one cent, but the fall in the London quotation has more than offset this.

The New York price continues to follow closely the London parity, as buying for China account in this market is not strong enough to cause any appreciable advance over the London rate.

Exports of bar silver from San Francisco for the month of September amounted to 5,958,000 ounces, and from New York to England for the period October 1st to 20th to 185,600 ounces.

Mexican Dollars—Oct. 21st, 52; 22d, 61½; 23d, 60½; 25th, 60½; 26th, 60½; 27th, 60½.

Gold

Gold in London on Oct. 21st, 119s. 3d.; 22d, 119s. 6d.; 25th, 118s. 2d.; 26th, 118s. 2d.; 27th, 117s. 9d.

Foreign Exchange

With brighter prospects of settling the labor troubles in England, sterling has tended to strengthen during the last few days. Other exchanges have generally been quiet with narrow movements. On Tuesday, Oct. 26, francs were 6.35c.; lire, 3.74c.; and marks, 1.43c. New York funds in Montreal, 10½ per cent premium.

Other Metals

Aluminum—For 50-ton lots: ingot, 99 per cent and purer, 33.1c.; 98@99 per cent, 32.90c.

Antimony—Spot metal, 6¼@6¾c. per lb. Cookson's "C" grade, 12½@13c. Chinese and Japanese brands, 6¾@6¾c. W. C. C. brand, 8¼c. Chinese needle antimony, lump, firm at 6@6¾c. per lb. Standard powdered needle antimony (200 mesh), 10c. per lb. Market dull.

White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, wholesale lots, 10c.

Bismuth—\$2.55 per lb., 500-lb. lots, and \$2.57 per lb., 100-lb. lots.

Cadmium—Nominal, \$1.40@1.50 per lb. Market steady.

Cobalt—Metal, \$6 per lb.; black oxide, \$4.10 per lb.; sulphate, \$1.60.

Iridium—Nominal, \$400@450 per oz.

Magnesium—Crude, 99 per cent or over pure, \$1.75 per lb. for the metal in 100 lb. lots and over, f.o.b. Niagara Falls.

Molybdenum Metal in rod or wire form, 99.9 per cent pure, \$32@40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

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

Osmium—Open market, \$50@75 per troy oz.

Palladium—\$85 per oz. Dull.

Platinum—Firm at \$95@105 per oz.

Quicksilver—Market quiet; \$60 per 75-lb. flask. San Francisco wires \$62.50@65. Market steady.

Ruthenium—\$200@220 per troy oz.

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

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

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

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr₂O₃ foreign ore with a maximum of 6 per cent silica, 75@85c. per unit, New York. California concentrates, 50 per cent Cr₂O₃ and upward, 70@75c.

Manganese Ore—60@70c. per unit, seaport; chemical ore (MnO₂) \$70@80 per gross ton, lump; \$80@90 per net ton, powdered.

Molybdenum Ore—85 per cent MoS₂, 65@70c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 55@65c. per lb. in ton lots.

Titanium Ore—Ilmenite, 52 per cent TiO₂, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO₂, 15c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO₃ and over, per unit of WO₃, \$6 f.o.b. mines; wolframite, 60 per cent WO₃ and over, per unit of WO₃, \$4.50@5, in New York.

Uranium Ore (Carnotite)—\$2.75@3 per lb. for 96 per cent of the contained oxide (U₃O₈). Ores must contain a minimum of 2 per cent U₃O₈.

Vanadium Ore—\$1.25@1.50 per lb. of V₂O₅ (guaranteed minimum of 11 per cent V₂O₅), New York.

Zircon—Washed, iron free, 5c. per lb.

Zirkite—According to conditions, \$80@90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at \$1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 23—Zinc blende, per ton, high, \$51.10; basis 60 per cent zinc, premium, \$41; Prime Western, settling basis, \$50@40; buying basis, \$40; fines and slimes, \$37.50@35; calamine, 40 per cent zinc, \$35. Average settling prices: Blende, \$45.14; calamine, \$38.48; all zinc ores, \$45.01.

Lead, high, \$111.85; settling basis 80 per cent grades, \$110@65; buying basis, \$65; average settling price, all grades of lead, \$98.69 per ton.

Shipments for the week: Blende, 13,135; calamine, 263; lead, 1,906 tons. Value, all ores the week, \$773,990.

The second mine close-down of the

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

year became effective this week. Sellers claim the production is lessened 90 to 95 per cent and buyers concede a possible 80 per cent. The first week ends with the production restricted approximately as in July. At that time a part of the mines resumed operation the middle of the second week. There is to be another week and possibly will extend over Election Day. The mines operating are generally selling on the market, but ore held by those down is not offered. It is estimated that there is an unsold tonnage of 20,000 to 25,000. The purchase this week was 3,250 tons, approximately the production. Seven regular buyers were out of the market this week. The car situation tightened at the week-end.

Platteville, Wis., Oct. 23—Blende, basis 60 per cent zinc, \$45@45.50 per ton base for high grade. Lead ore, no sales. Reported shipments for the week: Blende, 1,117; sulphur ore, 58 tons. Shipments for the year: Blende, 55,896; calamine, 2,474; lead, 4,398; sulphur ore, 1,342 tons. Shipped during the week to separating plants, 2,308 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, \$2,000@3,000; No. 2, \$1,400@1,700; spinning fibres, \$400@800; magnesia and compressed sheet fibres, \$325@400; shingle stock, \$110@150; paper stock, \$60@75; cement stock, \$17.50@30; floats, \$8.50@15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, \$10@12 per net ton; ground (white) \$24@30 in bags, carload lots; (off-color) \$22@26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, \$23; ground (white), \$45; ground (off color) \$30@32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, \$10 per ton, f.o.b. cars, Missouri; floated, \$28 per ton in bbls.; \$26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@7c.; light, 5@6c.; dense, 4¼@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, \$9@12; washed, \$12@15; powdered, \$18@22; bags extra, per net ton, f.o.b. mines, Georgia; crude, \$8@12; ground, \$15@40, f.o.b. Virginia points. Domestic lump, \$10@20; powdered, \$25@30; imported lump, \$25@35; powdered, \$30@60, f.o.b. New York.

Feldspar—Crude, \$8@14 per gross ton, f.o.b. Maryland and North Carolina points; \$7.50@10, f.o.b. Maine; ground, \$27@30, car lots, f.o.b. Baltimore; ground, \$17@21, f.o.b. North Carolina points; \$17@21 per ton, No. 1 ground, f.o.b. New York State; \$21@23 per ton, ground, f.o.b. Maine. Crude spar very scarce.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$25 per ton, f.o.b.

Illinois mines, and \$27.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, \$60; lump, \$17.50, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for \$20 per ton f.o.b. Madoc; output limited. Canadian price generally \$18 (Canadian currency) per ton, f.o.b. mines; market inactive.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade is practically unobtainable, prices being 7@9c. The higher lubricating grades sell for 11@40c., according to carbon content.

Gravel—No analysis guarantee, f.o.b. Roseview, Ill., \$25 per ton; gravel suitable for acid, chemical or enameling purposes, \$60.

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

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, \$1.60@1.65; 2@8 in., \$1.55@1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, \$1.65@1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined—High-grade caustic calcined, lump form, \$35@40 per ton, carload lots, f.o.b. California points. In Chicago district, \$57.70; Atlantic seaboard, \$61@63.

Dead-Burned—\$32.50 per net ton, Chewelah, Wash.; \$52@58, Chester, Pa. Austrian grade, \$52@55 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica slightly stained, per lb.: No. 6, 50c.; No. 5, \$1.20@1.40; No. 4, \$2@3; No. 3, \$4.25@5; No. 2, \$5.50@7; No. 1, \$8. Clear block: No. 6, 55c.; No. 5, \$2; No. 4, \$3.50; No. 3, \$5, No. 2, \$6.50; No. 1, \$8; A1, \$10; extra large, \$25, all f.o.b. New York; ground, \$150 per ton, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, \$45@50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., \$1.15; 2 x 3 in., \$1.65; 3 x 3 in., \$2.10; 3 x 4 in., \$2.50; 3 x 5 in., \$2.75; 3 x 6 in., \$3.75; ground 165 mesh, \$240 per ton; ground roofing mica, \$60; mica washers, 75c.@2 per lb.; 1½-in. disks, No. 1, \$1.60 per lb.; No. 2, \$1.30. The foregoing domestic prices obtain also in the Chicago district.

Monazite—Minimum of 6 per cent thorium oxide, \$35 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, \$13; 75 per cent, \$11.50; 75@74 per cent, \$11; 70 per cent, \$8.35; 68 per cent, \$7.85; 68@66 per cent, \$7.60. Finely ground Tennessee rock sells for \$8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, \$9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 17c.; Spanish lump, 14@16c.; domestic

fines, f.o.b. mines, Georgia, 12@14c. Market improving.

Quartz—(Acid tower) fist to head, \$10; 1½ to 2 in., \$14; rice, \$17, all net ton, f.o.b. Baltimore; lump, carload lots, \$5@7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, \$4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is \$3 per ton; \$2.50 on annual contracts. Sand at Klondike. Gray Summit and Pacific, all in Missouri, is \$2.50 on contract; some outside sales have been made at \$4. St. Louis, open market, at \$3.50; contract price on large quantities, \$2.50; on small quantities, \$3.

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

Talc—Paper making, \$12@22 per ton; roofing grades, \$9.50@15; rubber grades, \$12@18, all f.o.b. Vermont. California talc, \$20@45, talcum powder grade. Southern talc, powdered, carload lots, \$12@15 per ton; less than carload, \$25, f.o.b. cars; freight to New York \$5.25 per ton, carload lots; less than carload lots, \$9.25. Imported, \$60@70; Canadian, \$20@40 per ton.

Mineral Products

Arsenic—White arsenic, 15½c. per lb.; sulphide, powdered, 20@21c. per lb., f.o.b. works, carload lots.

Nitrate—Soda, \$3.85 per cwt., ex vessel, Atlantic ports. Market quiet.

Potassium Sulphate—Domestic, \$225@250 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocobalt—For 15 to 18 per cent material, \$200@250 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., \$12@15. Foreign conditions as affecting the price of American goods remain unchanged.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 18½@19c. per lb. of chromium contained; 4 to 6 per cent carbon, 19@20c., f.o.b. works.

Ferromanganese—For 76 to 80 per cent, prompt delivery, \$170@175 freight allowed; last half, \$170; English, \$170, c.i.f. Atlantic seaports. Spiegel-eisen, 18@22 per cent, \$82.50@85, f.o.b. furnace.

Ferromolybdenum¹—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2@2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, \$60@65; 50 per cent, \$82.50@85; 75 per cent, \$150@160.

Ferrotungsten¹—Domestic, 70 to 80 per cent W, 80@90c. per lb. of contained tungsten, f.o.b. works. Foreign, 70c.

Ferro-uranium—35 to 50 per cent U, \$7 per lb. of U contained, f.o.b. works.

Ferrovanadium¹—Basis 30 to 40 per cent, \$6.50@8 per lb. of V contained, f.o.b. works.

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

Metal Products

Copper Sheets—Current New York price, 25½c. per lb.; wire, 19c.

Lead Sheets—Full lead sheets, 10½c.; cut lead sheets, 10¾c. in quantity, mill lots.

Nickel Silver—Unchanged at 36½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 23½c.; sheathing, 23½c.; rods, ¾ to 3 in., 20½c.

Zinc Sheets—\$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, \$160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr₂O₃, \$55@60 per net ton, and \$65 in sacks, carload lots, f.o.b. eastern shipping points.

Fire Brick—First quality, 9-in. shapes, \$55@60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, \$45@50.

Magnesite Brick—9-in. straights, \$110 per net ton; 9-in. arches, wedges and keys, \$121; soaps and splits, \$134.

Silica Brick—9-in., per 1,000: Chicago district, \$65@70; Birmingham, Ala., \$56@61; Mount Union, Pa., \$55@60.

Iron Trade Review

Pittsburgh, Oct. 26, 1920

Throughout the steel trade it has been admitted of late that prices of independents will decline to the Steel Corporation level. This leaves two interesting questions, how it will be until the decline is completed, and whether the Corporation prices then will be what they are now. As to the first question, some of the independents have fairly well-filled order books, despite recent cancellations, and are indisposed to reduce their quotations until they have shipped as much as possible on existing contracts.

Pig Iron—On an inquiry for a small lot of foundry iron for Pittsburgh delivery several Valley furnaces showed that they would shade \$45, furnace, but the order went to another district at a lower delivered price. We quote foundry at \$45, Valley, against \$47 formerly quoted. Some in the trade insist that basic iron is quotable at \$40, Valley, on the basis of some small sales, the former quotation having been \$42, and we quote basic at \$40@42. On offerings of bessemer, not taken, we quote that grade at \$47, Valley, instead of \$48.50 formerly quoted. Freight to Pittsburgh is \$1.96.

Semi-finished Steel—No transactions are reported, and we quote the market nominal at \$55@60 for billets and \$65 for sheet bars.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls. hardwood, 6c. per lb., in 250-lb. bbls.

Connellsville—Furnace, \$16.50@17; foundry, \$18.

The Decline in Copper

Cheap Metal Will Cause Decrease in Production and a Natural Readjustment to Existing Economic Conditions—Producers Are in the Same Position as Those in Other Industries—Production Above Pre-war Rate

COPPER has yielded to the long strain under which it has been laboring. Month after month—in fact, ever since last winter's heavy buying—there has been anxious anticipation of a buying movement, which, unfortunately, has not matured. Glancing over the average prices of electrolytic copper for the first nine months of the year, it is surprising to note the small fluctuation in the price of the metal. The lowest average price in June, 18.065c., and the highest in January, 18.918c., show a difference of only .853c. This stability of copper prices emphasizes the comparative dullness of the market for practically the entire period. Contrasted with a similar period of 1919, we have a range from a low in March of 14.856c. to a high in August of 22.319c., indicating by this wide variation the intense speculative trading that occurred last year, when large quantities of American copper were purchased by the Japanese only to ruin the market subsequently in this country.

AVERAGE PRICES NEW YORK ELECTROLYTIC COPPER, 1919-1920

	1919	1920	1919	1920
January.....	(a)	18.918	August.....	22.319 18.346
February.....	16.763	18.539	September.....	21.755 18.144
March.....	14.856	18.331	October.....	21.534
April.....	15.246	18.660	November.....	19.758
May.....	15.864	18.484	December.....	18.295
June.....	17.610	18.065	Year.....	18.691
July.....	21.604	18.576		

(a) No market.

In the middle of September copper was sold at about 18.50c., delivered. The price then gradually declined, but sharply of late, so that copper can now be obtained for 15.00c., delivered—a decline of 3½c. in a little over a month. The copper companies are producing copper to sell, and not to hold, and the consequent lowering of their price to make a market accounts for the sharp decline. The policy of most producers has been to hold their output from the market at the absurdly low prices for the metal, with the thought that not only was there a great and potential demand for copper all over the world but that domestic production was going on at an unprecedented rate and a buying movement would start of its own accord—at any rate, they felt that a further concession in price would not result in increased purchases.

Finally the financial strain of carrying so much unsold copper became acute. Certain producers no longer found themselves able to follow the policy they had mapped out, and gossip had it that they underbid their competitors in order to sell their copper. During the period of market dullness the largest business recorded was by the smaller producers, and always at prices below that of the major operators. This trade inequality has begun to disappear; practically all the large copper interests are participating in the market and are furnishing keen competition to those interests which formerly consummated the greater share of business. As a result, the price of copper reflects the keener competition for trade among the copper sellers.

At 15.00c. copper is decidedly below a pre-war price basis (the average price of New York electrolytic for the years 1906-1913 inclusive was 15.274c.), and is undoubtedly below the cost of production of all but the lowest-cost producers. The cost of producing copper as given by representative copper companies in their annual reports for last year follows:

Utah Copper (open-cut porphyry).....	12.366c
Copper Range (deep lake mine).....	a 15.02
Inspiration (deep mine porphyry).....	a 13.412
Ray Consolidated (deep mine porphyry).....	b 14.94
Nevada Consolidated (porphyry).....	b 16.14
Tennessee Copper (lode).....	c 18.72
Calumet & Hecla (deep lake mine).....	c 19.77
Chino (porphyry).....	b 15.49
Shattuck Arizona (lode).....	22.40
Chile Copper (porphyry).....	18.35

(a) Exclusive of depreciation and depletion charges.
 (b) Exclusive of Federal taxes.
 (c) Exclusive of New York charges

The list is selected from both large and small producers, porphyry and lode copper mines, and although the method of cost accounting in many cases is different, the table furnishes an indication of what 15c. copper means to the industry.

Of course business moves in cycles. There are periods of depressions and periods of prosperity. Losses must be taken with the gains. The copper industry is passing through one of these depressed periods, after having experienced a period of unprecedented prosperity when copper prices ruled abnormally high. That is the one comforting feature of the situation, and were it not for the financial surpluses which most copper companies accumulated during the war, the industry would indeed be in dire straits. But there is a limit to which these financial reservoirs can be drained, and for many months they have been called upon to tide the companies over the present trying period.

If copper cannot be produced at a profit—15c. copper does not represent a profit—mines will shut down. Production is already being curtailed. A preliminary estimate of copper production for September places it at 103,000,000 lb., which is a decided decrease from the preceding month's figure of 116,000,000 lb. and the smallest output of the year. There is one striking feature of the activity of the copper mines during the post-war period: although they have not operated to capacity they have been operating above the pre-war rate of production. The following table is intended to illustrate this point. From 1909 to 1913 smelter production in the United States averaged 1,149,000,000 lb. In 1919 production was about 1,210,000,000, but in 1920 a preliminary estimate, should production continue at the present rate, is 1,350,000,000 lb. This is about 18 per cent above the pre-war average given, and would indicate that there is much room for healthy contraction in the copper supply.

COPPER PRODUCTION AND PRICES, 1906-1920

Year	Smelter Production in Pounds	Average Price Electrolytic N. Y.	Year	Smelter Production in Pounds	Average Price Electrolytic N. Y.
1906	917,000,000	19.277c	1914	1,093,000,000	13.602
1907	879,000,000	20.004	1915	1,424,000,000	17.275
1908	948,000,000	13.208	1916	1,943,000,000	27.202
1909	1,105,000,000	12.982	1917	1,923,000,000	27.180
1910	1,086,000,000	12.738	1918	1,938,000,000	24.628
1911	1,084,000,000	12.376	1919	1,210,000,000	18.691
1912	1,241,000,000	16.341	1920	a 1,350,000,000	.....
1913	1,229,000,000	15.269			

aEstimated

How great a curtailment of production may take place it is hazardous to predict, but that producers are becoming tired of the present state of affairs and are determined to force an issue seems clear. Europe is in no position to purchase the copper it needs under the present foreign-exchange situation, and is content to utilize the large amounts of scrap material still available on the Continent. This attitude alone of our greatest copper customer should be sufficient to compel the industry to contract its output, and, coupled with the smaller domestic demand, would seem to insure it.

Despite the serious predicament of the copper producers, no one doubts for a moment that the industry will emerge successfully from its ordeal, and that after economic laws have again become balanced, a period of unexampled prosperity may confidently be expected. The market is seeking out its bottom with a determination to reach a level from which confidence on the part of the consumer in a stable market will be restored. To do this it is necessary for the market to not only reach the bottom but also to get under it so that prices will be raised or the market supported. This state of affairs is progressing at the present time, and low levels for the year are being recorded.

MINING STOCKS

Week Ended October 23, 1920

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.
COPPER						GOLD					
Adventure	Boston	*60	*60	*60		Alaska Gold	N. Y.	1 1/2	1 1/2	1 1/2	
Almeek	Boston	55 1/2	54 1/2	55	Sept. '20, Q	Alaska Juneau	N. Y.	2	2	2	
Alaska-B.C.	N. Y. Curb.					Carson Hill	N. Y. Curb.			22 1/2	
Allouez	Boston	23 1/2	23 1/2	23 1/2	Mar. '19	Cresson Consol. G.	N. Y. Curb.	1 1/2	1	1 1/2	June '20, Q
Anaconda	N. Y.	50 1/2	49 1/2	50 1/2	Aug. '20, Q	Dome Ex.	Toronto	*40 1/2	*39 1/2	*40	
Ariz. Com'l.	Boston	9	9	9	Oct. '18	Domr Mines	N. Y.	11 1/2	11 1/2	11 1/2	Oct. '20, Q
Big Ledge	N. Y. Curb.		1 1/2	1 1/2		Golden Cycle	Colo. Sprgs.	1		*73	Sept. '20, Q
Bingham Mines	Boston	9 1/2	9 1/2	9 1/2	Sept. '19, Q	Goldfield Con.	N. Y. Curb.	*10	*8 1/2	*9 1/2	Sept. '19
Calumet & Ariz.	Boston	55	2 1/2	54 1/2	Sept. '20, Q	Hedley	Boston			4 1/2	June '19
Calumet & Hecla	Boston	255	24 1/2	249	June '20, Q	Hollinger Con.	Toronto	5.75	5.60	5.60	Oct. '20, BM
Canada Copper	N. Y. Curb.					Homestake	N. Y.	*47 1/2	*45	45	Sept. '19
Centennial	Boston					Kirkland Lake	Toronto			*46	
Cerro de Pasco	N. Y.	39 1/2	37 1/2	39 1/2	Sept. '20, Q	Lake Shore	Toronto	1.05	1.04	1.05	Oct. '20, K
Chief Consol.	Boston Curb	4	3 1/2	3 1/2	Feb. '20, Q	McIntyre-Porcupine	Toronto	2.05	1.99	2.00	Sept. '20, K
Chile Copper	N. Y.	14	13 1/2	14		Porcupine Crown	Toronto	*23	*23	*23	July '17
Chino	N. Y.	25 1/2	24	25 1/2	Sept. '20, Q	Portland	Colo. Sprgs.	1		*60	Oct. '20, Q
Columbus Rexall	Salt Lake	*36	*33	*34		Reorgan. Booth	N. Y. Curb.	5 1/2	4	5	May '19
Con. Ariz.	N. Y. Curb.					Silver Pick	N. Y. Curb.	*6 1/2	*6	*6 1/2	
Con. Copper M.	N. Y. Curb.			61	Dec. '18, Q	Teck Hughes	Toronto			*8 1/2	
Copper Range	Boston	34 1/2	33	34	Sept. '20, Q	Tom Reed	Los Angeles	1.50	1.37 1/2	1.44	Dec. '19
Crystal Copper	Boston Curb	*48	*32	*48		United Eastern	N. Y. Curb.	2 1/2	2	2 1/2	Oct. '20, Q
Davis-Daly	Boston	7 1/2	7	7 1/2	Mar. '20, Q	Windicator Consol.	Colo. Sprgs.	1		*18 1/2	Jan. '20, Q
East Butte	Boston	10 1/2	9 1/2	9 1/2	Dec. '19, A	West Dome Consol.	Toronto			*16 1/2	
First Nat'l.	Boston Curb	*88	*80	*85	Feb. '19, SA	White Caps Min.	N. Y. Curb.	*8 1/2	*7	*7 1/2	
Franklin	Boston			2 1/2		Yukon Gold	Boston Curb	1 1/2	1 1/2	1 1/2	June '18
Gadsden Copper	N. Y. Curb.			*70		SILVER					
Granby Consol.	N. Y.	30	29	29 1/2	May '19, Q	Arizona Silver	Boston Curb	*21	*16	*18	Apr. '20, M
Greene Cananea	N. Y.	27 1/2	27	27	Aug. '20, Q	Beaver Con.	Toronto	*39	*37 1/2	*37 1/2	May '20, K
Hancock	Boston	3	3	3		Coniagas	Toronto	*2.50	*2.40	2.55	Aug. '20, Q
Houghton	Boston Curb			*40		Crown Reserve	Toronto			*27	Jan. '17
Howe Sound	N. Y. Curb.	1 1/2	1 1/2	1 1/2	Oct. '20, Q	Kerr Lake	Boston	3 1/2	3 1/2	3 1/2	Oct. '20, K
Inspiration Con.	N. Y.	44 1/2	42 1/2	43 1/2	Oct. '20, Q	La Rose	Toronto	*31 1/2	*31 1/2	*31 1/2	Apr. '18
Iron Cap	Boston Curb			8 1/2	Sept. '20, K	McKinley-Dar.	Toronto			*50	Oct. '20, Q
Isle Royale	Boston	24	23	23 1/2	Sept. '19, SA	Mining Corp.	Toronto	1.75	1.70	1.74	Sept. '20, Q
Kennecott	N. Y.	22 1/2	22 1/2	22 1/2	Sept. '20, Q	Nipissing	N. Y. Curb.	9	8 1/2	9	Oct. '20, QX
Keweenaw	Boston	1 1/2	1 1/2	1 1/2		Ontario Silver	N. Y. Curb.	5 1/2	5	5	Jan. '19, Q
Lake Copper	Boston			3		Ophir Silver	N. Y. Curb.	1 1/2	1 1/2	1 1/2	Jan. '12
La Salle	Boston	2 1/2	2 1/2	2 1/2		Peterson Lake	Toronto	*11 1/2	*11	*11	Jan. '17
Magma Chief	N. Y. Curb.			*21		Temiskaming	Toronto	*32	*32	*32	Jan. '20, K
Magma Copper	N. Y. Curb.			17	Jan. '19, Q	Trethewey	Toronto	*28	*24 1/2	*27 1/2	Jan. '19
Majestic	Boston Curb	*14	*10	*14		GOLD AND SILVER					
Mason Valley	Boston	2 1/2	1 1/2	1 1/2		Atlanta	N. Y. Curb.	*1 1/2	*1	*1 1/2	
Mass. Con.	Boston	3	3	3	Nov. '17, Q	Barnes-King	Butte	1.11		1.11	Aug. '20, Q
Mayflower-O.C.	Boston	5 1/2	4 1/2	4 1/2		Bost. & Mont.	Boston			*63	
Miami	N. Y.	19	18 1/2	18 1/2	Aug. '20, Q	Cashboy	N. Y. Curb.	*7 1/2	*6	*6	
Michigan	Boston	3 1/2	3 1/2	3 1/2		El Salvador	N. Y. Curb.	1		1	Aug. '18, SA
Mohawk	Boston	5 1/2	5 1/2	5 1/2	Aug. '20, Q	Jim Butler	N. Y. Curb.	*17	*15	*16	Aug. '16
Mother Lode (new)	N. Y. Curb.	5 1/2	5 1/2	5 1/2		Jumbo Extension	N. Y. Curb.	*6 1/2	*5	*6 1/2	June '18, SA
Nevada Con.	N. Y.	11 1/2	10 1/2	11	Sept. '20, Q	Louisiana Con.	N. Y. Curb.			1 1/2	May '10
New Arcadian	Boston			2 1/2		MacNamara M.	N. Y. Curb.			1 1/2	Oct. '20, QX
New Baltic	Boston Curb			3		N.Y. Hond. Rosar	Open Mar.	*12	*11	*12	Oct. '20, Q
New Cornelia	Boston	18 1/2	18	18	Aug. '20	Tonopah-Belmont	N. Y. Curb.	1 1/2	1 1/2	1 1/2	Oct. '20, Q
Nixon Nev.	N. Y. Curb.			*9		Tonopah-Divide	N. Y. Curb.	2	1 1/2	1 1/2	Oct. '20, Q
North Butte	Boston	14	13 1/2	14	Oct. '18, Q	Tonopah Ex.	N. Y. Curb.	1 1/2	1 1/2	1 1/2	Oct. '20, SA
North Lake	Boston			*25		Tonopah Mining	N. Y. Curb.	1 1/2	1 1/2	1 1/2	Oct. '20, SA
Ohio Copper	N. Y. Curb.			1 1/2		West End Con.	N. Y. Curb.	1 1/2	1	1 1/2	Dec. '19, SA
Oribway	Boston	22 1/2	22 1/2	22 1/2	Dec. '18, Q	SILVER-LEAD					
Old Dominion	Boston	23	22 1/2	22 1/2	June '20, Q	Caledonia	N. Y. Curb.	*18	*15	*18	July '20, M
Osceola	Boston	32	31	31	June '20, Q	Consol. M. & S.	Montreal	24	22 1/2	22 1/2	Oct. '20, Q
Phelps Dodge	Open Mar.	*190	*170		Oct. '20, Q	Daly Mining	Salt Lake	2.50	2.45	2.45	July '20, Q
Quincy	Boston	43 1/2	42 1/2	43	Sept. '20, Q	Daly-West	Boston	4 1/2	4 1/2	4 1/2	Oct. '20, Q
Ray Con.	N. Y.	14 1/2	13 1/2	13 1/2	June '20, Q	Eagle & Blue Bell	Boston Curb	2 1/2	2 1/2	2 1/2	Apr. '20, Q
Ray Hercules	Boston Curb			*50		Electric Point	Spokane	*14	*13	*14	May '20, SA
St. Mary's M. L.	Boston	35 1/2	34	34	June '20, K	Fed. M. & S.	N. Y.			13	Jan. '09
Seneca	Boston	17 1/2	14	17 1/2		Fed. M. & S. pf.	N. Y.	31 1/2	31 1/2	31 1/2	Sept. '20, Q
Shannon	Boston	1 1/2	1 1/2	1 1/2	Nov. '17, Q	Florence Silver	Spokane			*25	Apr. '19
Shattuck Ariz.	N. Y.	8	7 1/2	8	Jan. '20, Q	Grand Central	Salt Lake			*37 1/2	June '20, K
South Lake	Boston			2		Iron Blossom	N. Y. Curb.	*28	*25	*25	Apr. '20, Q
South Utah	Boston	*10	*9	*10		Judge M. & S.	Salt Lake			3.97 1/2	Sept. '20, Q
Superior Copper	Boston			4 1/2	Apr. '17	Marsh Mines	N. Y. Curb.	*14	*11	*11	Sept. '19, K
Superior & Boston	Boston	3 1/2	3	3		Prince Consol.	N. Y. Curb.	*31	*14	*14	Nov. '17
Tenn. C. & C.	N. Y.	9 1/2	9 1/2	9 1/2	May '18, I	Rambler-Cariboo	Spokane			*9	Feb. '19
Tuolumne	Boston			*54	May '13	Rex Con.	N. Y. Curb.	*6	*6	*6	Sept. '19, K
United Verde Ex.	Boston Curb	*29 1/2	*29	29	Aug. '20, Q	South Hecla	Salt Lake	*89	*85	*85	Oct. '17
Utah Con.	Boston	6 1/2	5 1/2	5 1/2	Sept. '18	Stand. S. L.	N. Y. Curb.	2 1/2	2 1/2	2 1/2	Oct. '19, K
Utah Copper	N. Y.	58	55 1/2	58	Sept. '20, Q	Tamarack-Custer	Spokane	2.47	2.20	2.20	Dec. '19, K
Utah M. & T.	Boston	1 1/2	1 1/2	1 1/2	Dec. '17	Tintio Standard	Salt Lake	3.05	2.90	2.90	June '20, Q
Victoria	Boston	2 1/2	1 1/2	1 1/2		Wilbert Mining	N. Y. Curb.	*4 1/2	*3 1/2	*4 1/2	Nov. '17
Winona	Boston	*35	*25	*35		NICKEL-COPPER					
Wolverine	Boston	12 1/2	10 1/2	10 1/2	Jan. '20, Q	Internat'l Nickel	N. Y.	18 1/2	17 1/2	17 1/2	Mar. '19
LEAD						Internat'l Nick. pf.	N. Y.	83	83	83	Aug. '20, Q
Hecla	N. Y. Curb.	5	4 1/2	4 1/2	Sept. '20, QX	QUICKSILVER					
St. Joseph Lead	N. Y.	14 1/2	14 1/2	14 1/2	Sept. '20, QX	New Idria	Boston			5	Jan. '19
Stewart	Boston Curb			*13	Dec. '15	TUNGSTEN					
Utah Apex	Boston	4	2 1/2	3 1/2	Nov. '18	Mojave Tungsten	Boston Curb			*10	
ZINC						VANADIUM					
Am. Z. L. & S.	N. Y.	11 1/2	11 1/2	11 1/2	May '17	Vanadium Corp.	N. Y.	65	62 1/2	63 1/2	Oct. '20, Q
Am. Z. L. & S. pf.	N. Y.	45	45	45	Aug. '20, Q	ASBESTOS					
Butte C. & Z.	N. Y.	6 1/2	6 1/2	6 1/2	June 18, I	Asbestos Corp.	Montreal	97	94	94	Oct. '20, Q
Butte & Superior	N. Y.	17	15 1/2	16	Sept. '17	Asbestos Corp. pf.	Montreal	103 1/2	100	100	Oct. '20, Q
Con. Interst. Cal.	N. Y.	9 1/2	8 1/2	8 1/2	June '20, Q	MINING, SMELTING AND REFINING					
New Jersey Z.	N. Y. Curb.	17 1/2	169	169	Aug. '20, Q	Am. S. & R.	N. Y.	59 1/2	58 1/2	58 1/2	Sept. '20, Q
Success	N. Y. Curb.	4 1/2	2 1/2	3	July '16	Am. S. & R. pf.	N. Y.	92 1/2	91 1/2	91 1/2	Sept. '20, Q
Yellow Pine	Los Angeles			*95	June 20, Q	Am. Sm. pf. A.	N. Y.	78	77 1/2	78	Oct. '20, Q
*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, bimonthly. K, Irregular. I, Initial. X, includes extra						U. S. Sm. R. & M.	N. Y.	53	52 1/2	52 1/2	Oct. '20, Q
						U. S. R. & M. pf.	Boston	45	43 1/2	45	Oct. '20, Q

