

ENGINEERING AND MINING JOURNAL

October 1, 1921



Entrance to the Mackay School of Mines, Reno, Nevada

Mine Sampling Methods at Tyrone, N. M.

By Barclay G. Anderson

The Callville Wash Colemanite Deposit

By Hoyt S. Gale

Petroleum Possibilities of Guatemala

By Arthur H. Redfield

Considerable activity is reported in the gold district of Southwestern Oregon, and several deals have been negotiated. One of the most recent is the transfer of the Sylvanite group, near Gold Hill, described in the Mining News in this issue, to the newly organized Oregon Pittsburgh Mining Co., of Pittsburgh, Pa.

The Third Annual Western Convention of the Canadian Institute of Mining and Metallurgy was held at Edmonton, Alberta, Sept. 14-16. Technical sessions included papers and discussions on the Western Canada coal and oil fields and mining legislation. A brief report of the meeting is given on page 546 of this issue.



Give the Belt a Chance

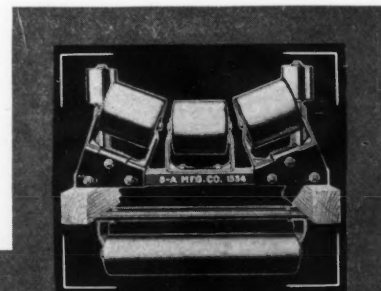
Good conveyor belts can render satisfactory service only when they are operated in conjunction with machinery which is correctly designed and well built.

Belt which carry loads over the smooth, easy turning Unit Ball bearing carriers are economically handling tremendous tonnages.

Have an S-A Engineer give more detailed information concerning the desirability of using Unit Carriers.

Stephens-Adamson Mfg. Co.

Aurora, Illinois



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

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries

METALS

NON-METALS

PETROLEUM

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

Volume 112

New York, October 1, 1921

Number 14

The Unemployed

THE UNEMPLOYMENT CONFERENCE over which Mr. Hoover is to preside in Washington does not at first strike one as likely to have any more tangible outcome than the industrial conferences already staged in the capital. Can any amount of conference make a wider market for copper or shirts, and is it within the bounds of possibility for the producer of copper or shirts to employ men if he cannot sell the product? What practical cure can be devised for the lack of purchasing power of sick and prostrate Europe, which is the main element at the bottom of our semi-paralysis of production?

Yet there are many curious problems which may be investigated in this connection, and even a little daylight let into them may help, even if a very little. The first thing will be to get away from the sob stuff—not to try to arrange a sort of paternalistic federal employment bureau, and find “jobs for the jobless.” It can’t be done: and if it could, the Government owes no man a job unless it needs him—that is to say, unless the taxpayers need him as an investment profitable to them.

Conditions, practice, and theory, as regards employment, are at present diversified and chaotic. Business is depressed; many men and women have been laid off from their war-time and post-war employment. Costs of living are on the decrease; the price of commodities in many lines has come down. It seems impossible, for example, that the price of copper—or leather—or rubber—should go lower. With the slacking or cessation of many industries, with the complete shutting off of wages, the purchasing power of the country has greatly diminished, while that of Europe shows only a shadow of its pre-war vigor. For purchasing power to be renewed, one thing is essential—rock-bottom prices to attract the needy but purse-limited buyer of America or Europe. But the buyer purchases the manufactured commodity, not the raw material; and into the cost of the manufactured commodity enters as the principal item the cost of manufacture—to wit, the price of the human energy involved. Railroad freight furnishes an example. Railroad freight and passenger rates are still soaring in war-time skies. The result is that short-haul freight is handled by motor truck, and the passenger patronage is shrunk by the many who stay at home. The cause of the unreasonably high railroad rates, and the abnormally low railroad business: high wages, secured and maintained by the unions. The result of this is a shortage of the amount of railroad employees, of the employees of car and locomotive works and steel mills, which depend on the railroads; of the iron foundries and iron mines which depend on the car and locomotive works. Thus many men are thrown out of a job; but the few that stay in manage to maintain the approved and agreed wage scale.

In the city of Washington, where the conference is

to be held, carpenters, plasterers, and paperhangers get eight dollars a day, and plumbers nine dollars, having recently secured a raise of fifty cents. There is very little building going on in Washington. People who not build—cannot afford to build—at these wages. The housing situation is accordingly as bad as it was three years ago. The result is that many people who would at once be employed on extensive building operations, if the cost were reasonable enough to justify the sensible investor, are out of a job—looking to the Government for a job—but the few that are employed are able to maintain or even increase their wages. Who is keeping the unemployed out of a job in these typical cases: the Government, the investor, or the unions? Let the unions ponder the problem, and let the unemployed ponder it, and the conferees under Mr. Hoover. All workers should get the highest possible wage—only let them ponder how the average wage of all shall be the highest possible.

In the Government service the same conditions do not obtain. Recently a drastic cut in the wages of navy yard employees has been made—governmental economy; good political stuff. In one instance that came under our observation a man employed as a mechanic, having a wife and six small children, had his pay cut to sixteen dollars a week. Figure it out for yourself. The conference will not be enthusiastic about soliciting this kind of jobs from the Government.

Well then, should we not have an evening up of these chaotic conditions, some democratic sharing? And is not this one way to approach the problem? This is a matter which concerns the mining industry. For example, the breaking of the housing deadlock is far more important to the zinc industry than a tariff on zinc.

It is of no use to build a dam across a dry valley.

Echoes

A SHORT TIME AGO it was announced that some wizard in the Middle West had waved his wand and rediscovered the process for tempering copper said to have been lost by the ancients. Thereupon the gallery applauded. A process as nifty as this was not to be left lying around where Minerals Separation, for instance, might grab it and make another monopoly out of it, so Judge Gary nearly stubbed his toe in his eagerness to buy it for the Steel Corporation—or so the papers said—the price set by the wizard being a small sum like a million dollars or so with a 2c. royalty. The gallery applauded again. But of course, some fool reporter had to go and ask Judge Gary if he had spent all this money in this fashion, and His Honor denied it. But the gallery is still applauding. It has the habit, as one notices at the movies; and it is a habit that is hard to break. Day after day one newspaper after another throughout the country is reprinting this lie about tempering copper, and the work of educating the masses continues.

It is easily seen why stringent laws covering libel and slander have been drawn. Once uttered or printed, words cannot be checked, but take wings and fly to the furthest parts of the earth. A false report may endure as long as the page on which it is printed lasts or a tongue that can utter it lives. Many are reading the story of how the ancients' secret has been rediscovered, and, being interested, are repeating it to others. Few, however, have seen Judge Gary's denial, for this is prosaic and unsensational, and is retained in the memory with difficulty, if indeed it is noted at all.

This is but a single instance of a common occurrence. One who watches the out-of-town newspapers is familiar with the way in which a canard goes its way, continuing its course for weeks and even months after it has been supposedly laid to rest. The eagerness of the papers to make a "scoop" is primarily responsible.

Absentee Capitalism

GOOD MORNING! Have you heard that absentee capitalism is the big new political issue? Ask the Miami, Ariz., *Silver Belt*. It knows. Under the heading "The People Lose Control" a writer says:

"Foreign labor [in Arizona] without votes, was used to displace American workers who would not vote in the interests of the Absentee Capitalists. Deportations were resorted to in different camps and planned for some of the others. The laws of the state and nation were openly flaunted. The Governor was snubbed, and the representatives of the President of the United States were treated as interlopers, and some of them were outrageously insulted."

Evidently the writer has the Bisbee deportations in mind, forgetful of the fact that all the indictments were quashed. But he gives us an idea. It is that all the stockholders of the various copper companies in Arizona should at once move to the camps in which their money has been invested and take up their residence there. What a development of Arizona there would be! Globe-Miami and other camps would at once become large cities, and the *Silver Belt* a larger and better (though the last-named virtue is hardly possible) newspaper. Of course it would take a lot of money to provide food, lodging, and other things for all these people, but they, being capitalists, would never mind the expense. The curse of absenteeism would then be removed.

The Role of Sampling in Mine Operation

IN THIS ISSUE we present an article on mine sampling methods at Tyrone, N. M., which details the work conducted by the Phelps Dodge Corporation. To the best of our recollection, the system, with fewer modifications as to book work, tickets, and tagging, originated at the Clifton-Morenci branch of this same company, and was used with considerable success, a remarkably close check being obtained on the mine sampling and actual mill runs. One point which is not brought out in the article, with reference to groove or channel sampling, is the necessity of close measurement, particularly where the higher-grade streaks or small veins were cut, and it was essential that foot-assays be computed and that these be properly figured in with the regular interval samples. Another point not mentioned is the great value of recording observations that may be useful to the geological department, such as faults, occurrences of rock, and other conditions that will be of service in the mapping of the orebody.

In addition to furnishing data to the mine foreman and to the geological department, a further use for such a sampling system is found in the calculation of tonnages in certain blocks, the uniformity of the orebodies in the Tyrone and Morenci districts being particularly adaptable to this method of estimation. The same is true, to a certain extent, of the iron-ore deposits of the Mesabi Range and other regions where fairly large areas can be blocked out and the contents, together with the assay values, calculated to within a close figure of the actual volume and mineral content.

We understand that the Committee on Mining Methods of the Institute, under the chairmanship of John E. Hodge, is now considering a complete symposium and study of the various methods in use in all of the mining districts. With all of its ramifications, such an undertaking is necessarily a large one, for there is already a mass of published data which must be collected, tabulated, and properly interpolated. Following that, it will be necessary to collect considerable additional information, and this, too, must be so prepared that it will not only constitute a permanent record but be in a form that will be available for such use as mining engineers choose to make of it.

The mine operator of today has a number of methods to select from, and usually chooses that which is best suited to his particular problem. In some instances a careful consideration is not given to all the factors involved, and the result is not only wasteful from a monetary standpoint but a distinct loss to the profession; for mining, like every other undertaking, is a jealous master and takes pride in a well and carefully worked out plan which gives a maximum result. Then, too, the day is past when a complete gutting of an orebody to the detriment of subsequent extraction of lower-grade material is the fashionable procedure.

The consideration of estimation, extraction, and costs in mining is of the utmost importance, and it is most essential that a standardization, as near as is possible, of the several contributing factors be effected. Necessarily, these will vary with the different districts and, to a considerable extent, in the same district, but the plan now proposed by the committee is certainly commendable and invites the support and interest of every mining man.

Following exploration by drilling, test pitting, or shaft sinking and drifting, or a combination of all three, together with the application of such geological features as are available, will come the selection of the mining method, which may or may not be permanent, depending on the conditions encountered. In any case, one of the governing factors which is continually essential throughout the operation of the mine, and from the very beginning, is sampling. The subject in itself forms the very groundwork of mining, and upon the methods adopted in all branches of mine development depends the success or failure of the enterprise.

The paper by Mr. Anderson, therefore, may be regarded as an added contribution to the subject which forms such an important part of the general topic we have mentioned in the foregoing paragraphs. Costs have not been included, and necessarily they will influence the extent to which this system or any other can be carried out. But we hope from time to time to present such figures; for after all, the cost must keep within its fair proportion of the ultimate expense, and knowledge of the methods that accomplish this purpose is quite as important as the "knowing how."

WHAT OTHERS THINK

Asbestos Mining in the Black Lake Area

It is with great interest that I read the article on asbestos mining in the Black Lake area, in your Sept. 3 issue. Without entering into a discussion of the geological portion, which is accurate enough to all intents and purposes, thanks possibly to the "scattered reports and articles that have been published concerning the asbestos and chrome-bearing rocks of Quebec," some of which seem to have come into your correspondent's possession, I, however, do wish to take exception to the last portion of the article.

Being with a competitive firm, I hold no brief for the defense of the Black Lake Asbestos & Chrome Mines, nor are the methods of this mine anywhere as near as primitive in execution as your correspondent endeavors to make out. Most of the statements made are misleading. One portion of this article, however, contains a slur on the asbestos-mining industry as a whole, and that is that portion of it dealing with the labor conditions and the management of the various properties.

One does not conceive that this paper could have been written in good faith with the object of giving the outside world a true insight into working conditions in this district. It sounds more like a disgruntled employee, relieved of his job, endeavoring to get back at his late employers; or of a college student publishing his summer thesis.

No doubt the methods at one or two of the mines may seem antiquated to the uninitiated, but when the history of the camp is studied it will be found that they are not so antiquated as they may seem. For one thing, asbestos is not like a high-grade metallic ore, which can be mined by the usual method of shaft sinking, drifting, and stoping. The serpentine occurs in large bodies, necessitating the quarrying of the rock on a large scale. One of the pits in this district is now at a depth of 340 ft., with a superficial area of 900 ft. square. Owing to the depth of overburden, which amounts in places to over forty feet (none of which must get into the mill, as it discolors the fiber), it has been found more economical to continue sinking on the full area of stripped surface until the maximum depth of open cut has been reached compatible with safety. With those mines which have a property of sufficient size and quality to enable them to carry on their operations over a wider area, steam shovels and cranes are in operation for handling the rock, and the loaded cars run up inclines to the surface and thence to the mill. In one or two mines where the surface area owned is small, modern underground methods are also being followed with success.

With a few exceptions the mines are privately owned and developed by private capital. Until a few years ago, the asbestos industry was in its infancy, and fiber could be marketed only in the crude form. It is barely in its teens even now. As more and more uses were found for our product, the demand increased, and the mines and mining methods were developed as fast as possible. Now nearly every mine has an extensive and up-to-date program of development, which is being

proceeded with as quickly as circumstances will permit.

With regard to the South African engineer who was through here and whom your correspondent refers to facetiously, it is significant to note that we have received visits of a number of South Africans interested in the asbestos industry, who have come to study our methods of milling, one of whom, especially, brought on a small shipment of the South African fiber-bearing rock to be tried out by our methods.

The statement regarding the French Canadians is so erroneous as to be ridiculous, were it not for the bad impression that it is liable to create upon those who have had no experience with them. They are a very intelligent, hard-working, God-fearing people, cleanly in their persons and in their homes. Satisfied with little, fond of their religion and churches, hospitable to a fault, sociable, they are far and away the best labor to be found anywhere; witness the number of industries sponsored by outside capital that have been established in the Province of Quebec to exploit it. Their homes are extremely well kept. Being fundamentally devoted to their families, they have an interesting and amusing social life. Even a colony of only a few families will supply a surprising number of small entertainments and amusements.

A glance at statistics will show that the percentage of crime is the lowest in America. The statement that they are not capable of rising above the mucker stage (locally) is amply refuted by going into figures. Ninety-eight per cent of the superintendents, mill foremen, millwrights, drill runners, blacksmiths, machinists, and craftsmen are French Canadians, and nearly 60 per cent of the office staffs.

On the other hand, there are few of the Czechs, Russians, and Austrians who are not muckers, and these were only imported at a time when labor was scarce, and they are gradually being displaced. This latter movement was precipitated by their lawlessness, the culminating event being the holding up of the paymaster of the Black Lake Asbestos & Chrome Mines while he was proceeding up the self-same hill mentioned by your correspondent, by two of these gentry, who, disregarding the usual sportsmanlike stand-and-deliver challenge, began shooting as soon as they stepped out of the bush. Much to their disgust, the paymaster could shoot also, and did. One of the two got a bullet in the brain, and the other scuttled away, being captured later. Your correspondent will doubtless remember the occurrence.

It is to be regretted that a publication of the world-wide standing of the *Engineering and Mining Journal* should see fit to publish a paper, whatever its geological features may be, which contains a groundless, hopelessly inaccurate charge of inefficiency and waste against men who have devoted their lives to the development of this industry, especially when this charge has been laid by a man who has come into the district recently and has had only slight experience since that time in one small portion of it. C. C. LINDSAY.

Thetford Mines, Quebec, Canada.

The Callville Wash Colemanite Deposit

A Recent Borax Mineral Discovery in Nevada Which Bids Fair To Rival Other Existing Deposits of Colemanite—Large Mineral Reserves Indicated—Geological Investigation Points to Close Association With Local Sedimentary Rock Deposition

BY HOYT S. GALE

Written for *Engineering and Mining Journal*

THE DEPOSIT OF COLEMANITE in the Callville Wash, Clark County, Nev., recently acquired by the F. M. Smith interests, was discovered in the latter part of January, 1921, by two prospectors, F. M. Lovell and George D. Hartman, who were then engaged in a systematic search for this mineral. Their exploration had been instigated by the finding, a few months earlier, of a district carrying a considerable number of smaller veins of colemanite in the White Basin, about fourteen miles northeast of the Callville discovery. Both districts are in the southern and eastern foothills of the Muddy Mountain Range, on tributaries

northeasterly from Las Vegas, fourteen miles to a fork leaving the main road toward the south by way of the so-called gypsum cave and Las Vegas Wash to Colorado River. At the mouth of Las Vegas Wash the present road follows near and north of the Colorado, up a valley about six miles to the mouth of Callville Wash, a locality known as Old Callville. Thence the route follows directly up the channel of Callville Wash to the deposit. The total distance by this road is about forty-two miles. A shorter and better route is in process of construction.

The deposit lies about six miles due south of Muddy Peak, the main summit of the Muddy Range. It is approximately twenty-eight miles in a course due easterly from Las Vegas. According to recent surveys the outcrop of the bed lies in sections 11 and 14, T.20 S., R.65 E., Nevada, as shown by the traverse map of the deposit, which is based on a rough field survey which I made some time ago. Preliminary surveys for a branch line from the Salt Lake R.R. at the station called Dike show a satisfactory route and grade about twenty-two miles off the main line. This is also one of the three routes that have been surveyed to reach and supply the Boulder Canyon reclamation project dam site, and a fair likelihood exists that the railroad will be built independently of the colemanite interest.

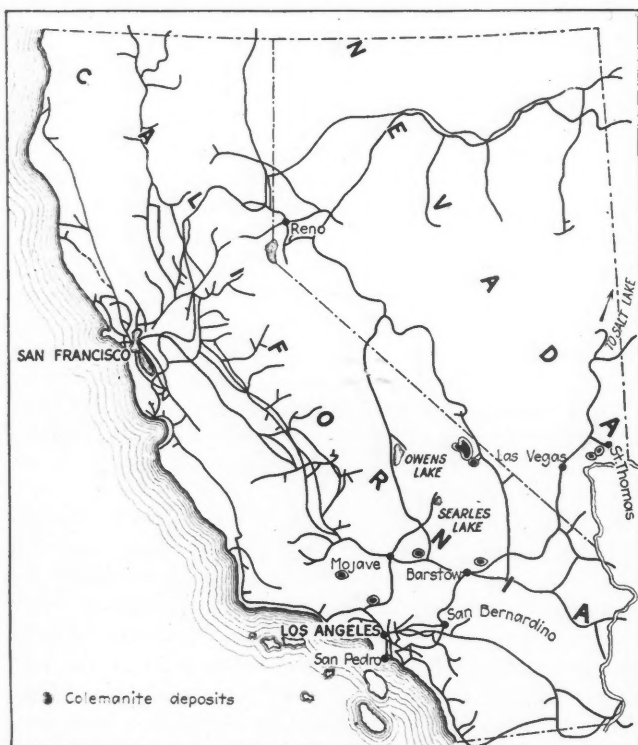
COLEMANITE OCCURS IN A LARGE LENTICULAR BED

The accompanying outcrop traverse map shows the trend of the outcrop, pitch, and general character of the associated formations. The shaded portions refer to estimates concerning probable extension of the bed underground as discussed in a subsequent paragraph.

The colemanite in the Callville deposit is a single large lenticular bed which at this place occurs as a regularly stratified member of the Tertiary succession. It is included with a series of interbedded fresh-water limestones and sandy and shaly beds that are composed chiefly of gray or light-colored volcanic ash or pumice, the beds being of varying degrees of coarseness or comminution. The entire stratigraphic section clearly represents a period of widespread volcanic activity, of lavas of comparatively acidic type, the ash or pumice from which was distributed over the region, forming sedimentary beds mixed with chemically precipitated calcium carbonate.

The evidence seems conclusive that the colemanite itself, and probably much of the associated travertine-like limestone, are the product of ancient spring deposition, formed at the time the inclosing beds were laid down. The mass as a whole seems to be a large lenticular body, such as might reasonably be assumed to have been spread out below the center of spring vents, the waters of which probably came up laden with lime and borate constituents to a degree that was supersaturated at surface temperatures and pressure.

The colemanite bed was undoubtedly deposited during



MAP SHOWING LOCATION OF COLEMANITE DEPOSITS IN NEVADA AND CALIFORNIA

of the Colorado River. The entire district, including both areas of the recent discoveries, lies about half way between the towns of Las Vegas and St. Thomas, and all the localities referred to are in Clark County, the southernmost part of Nevada. These discoveries are also notable in that they constitute the first record of occurrence of commercial deposits of the mineral colemanite outside the State of California, not only in the United States but apparently in the whole world.

The accompanying general index map shows the relative situation of the Nevada deposits with reference to the railroad systems and also with reference to the older developed colemanite districts in California.

At present, the route of access to the Callville deposit is from Las Vegas, a division point on the Salt Lake R.R., by way of the "Arrowhead" automobile road

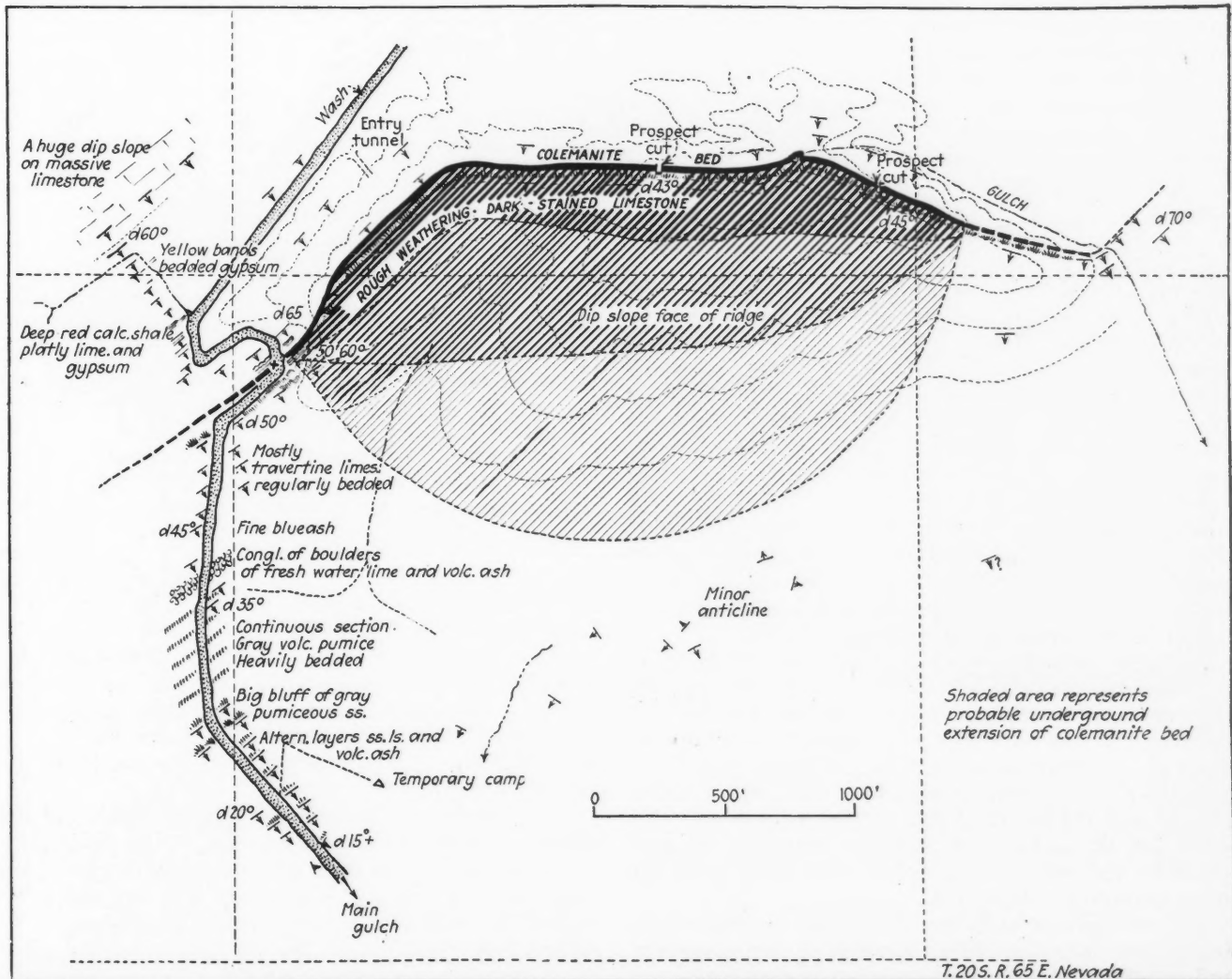
that particular stage of Tertiary time in which the enclosing ash and limy beds were also laid down. It is possible that some of the original mineral may have been ulexite, as the colemanite occurs partly as nodular masses within the bed, and included in shaly bands or beds, but the present mineral of the deposit seems to be almost entirely colemanite. A detail sketch of the colemanite bed, more or less idealized, is shown to represent the appearance of the colemanite in the deposit.

OUTCROP IS EXPOSED ABOUT 3,000 FEET

The structure and stratigraphic section which is given in the diagram on p. 526 is from the data recorded on the traverse plat, the vertical and horizontal scale being equal, indicated by dotted lines in the top sketch. The section thus represents a vertical cut extending northwest from a point near the temporary camp, the profile of the topography being to some degree idealized. The strata described are as exposed along the main gulch (which has been named Lovell Wash, a branch of Callville Wash). The stratigraphic thickness is undoubtedly about correct, but the individual members of the section differ in character from place to place, so that these units probably are not duplicated exactly, or even approximately, far from the section where the measurements are taken. The section serves to show the general character of the beds in which the colemanite occurs.

Specifically described, the colemanite bed, as represented in the outcrop, is shown in natural exposure over a distance of about 3,000 ft. This mineral is included within a softer more shaly part of the section, with massive limestone members above and below, so that the details of the bed are not clearly revealed in the outcrop. However, at the time of my last visit, two prospect cuts had been driven in on the outcrop at points about 800 ft. apart, and these showed practically identical sections. It is from one of these cuts that the structure diagrams were made. These sections showed a measurement of about eighteen feet, taken at right angles to the dip of the bed, which included the most massive layers of the colemanite. Distinct layers of scattered nodules occurred in the shale above this section.

The mineral colemanite occurs within this main bed both as compact, massive layers, composed of essentially pure mineral, and as nodular layered masses interbedded with shaly material. As shown in the two prospect cuts mentioned, the more massive colemanite seems to be included in the upper ten feet of the main bed, the lower eight feet containing more shale, which grades to pinkish or reddish color at the base. A sample was cut by the writer, intended to be an average directly across the upper ten feet of the main bed, in the easternmost of the two prospects, as indicated in the cross-section diagram. This is, of course, not a conclusive test of the average quality of even this part of the deposit, because



PACED TRAVERSE OF CALLVILLE WASH COLEMANITE OUTCROP

it is a single sample cut in only one place. It is, however, a fair indication of what the bed may be expected to run. Analysis of this sample has been made by the firm of Curtis & Tompkins, analytical chemists, San Francisco, with the following results:

ANALYSIS OF AVERAGE SAMPLE FROM CALLVILLE WASH COLEMANITE DEPOSIT

Chemical Determinations	Per Cent	Computed Equivalents (Approximate)	Per Cent
B ₂ O ₃	23.18	Ca ₂ B ₆ O ₁₁ (anhyd.)	35.56 (colemanite)
SiO ₂	14.55	CaSO ₄ (anhyd.)...	2.21 (gypsum)
Fe and Al.....	11.60 (as Al ₂ O ₃)	CaCO ₃ ,MgCO ₃ ...	32.07 (dolomite)
CaO.....	21.97	Fe ₂ O ₃ ,Al ₂ O ₃ ,SiO ₂ ...	30.16 (pumice)
MgO.....	9.42		
Na and K.....	trace	Total.....	100.00
SO ₃	1.30		
Cl.....	None		
CO ₂	13.97		
H ₂ O and under.....	4.01		
Total.....	100.00		

Thus it may be seen that this part of the bed carries about one-third pure colemanite, about one-third dolomite, and one-third volcanic ash, with a small proportion of gypsum. Interpreting this, it should be remembered that the sample included everything crossed in the section, with no selection at all. This result shows a satisfactory grade of minable ore, part high grade and part for concentrating.

As previously stated, the main colemanite bed seems to be, as a whole, of lenticular form, in that the colemanite itself pinches or disappears in extension either way along the outcrop of the horizon beyond the 3,000-ft. length. Natural exposures are not sufficient to show whether the colemanite itself actually thins off gradually toward the edges, or whether the bed ends abruptly. Observation on the outcrop, and the correspondence in the two cuts already discussed, seem to indicate that the bed maintains nearly its full dimensions throughout most of its exposed length, but the evidence on this point in the present undeveloped condition of the deposit is admittedly rather weak.

LARGE MINERAL RESERVES ARE INDICATED

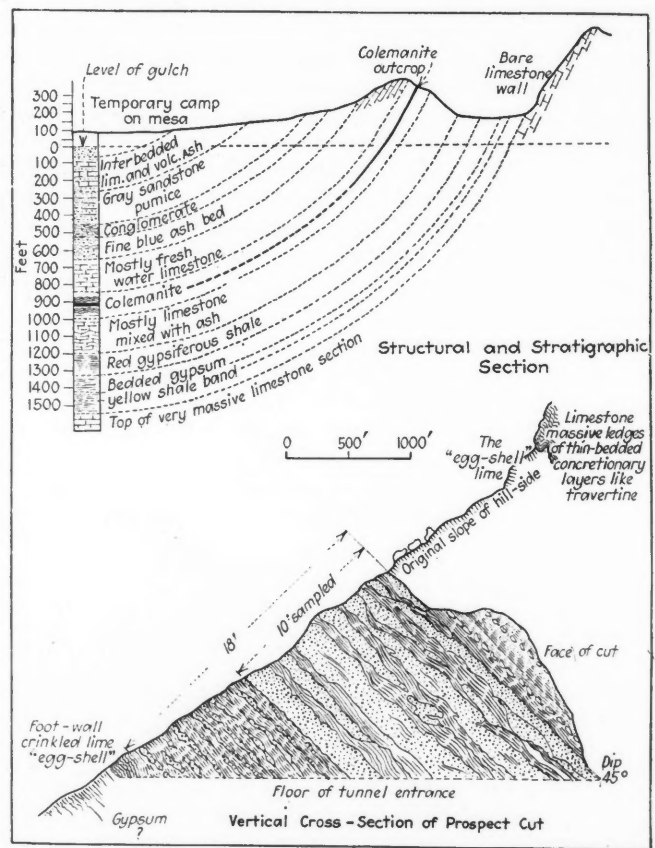
The bed dips toward the south, with a turn toward the southeast at the western end of the outcrop, the angle of the dip ranging from about 45 deg. to, say, 50 or 60 deg. at either end. This dip carries the horizon beneath the limestone "cuesta" or "hog back" in which it is found, and out toward the open valley to the south of this ridge. Estimates of the distance to which the colemanite may be expected to extend underground are based, first, on the postulate that the bed is a remaining portion or segment of the original lens-shaped mass deposited, a part having been cut away with uplift and erosion of the inclosing sediments, and, second, on the assumption that, with an outcrop of such size and regularity, a segment of considerable size of the original lens may reasonably be expected still to exist.

The chance seems small that almost the whole of an original lens has been removed by erosion and only the narrow edge remains, and from the general attitude and curvature of the outcrop one is inclined rather to assume the contrary to be the fact. It seems reasonable to assume as a probability that a segment with a radius at least half the length of the exposed outcrop may still exist, but the tonnage computations on which the first purchase and sale of the property were based were far more conservative than this.

On the traverse map are shown, by shading, three hypotheses as to the likely extension of the colemanite bed underground. The first and narrower strip assumes that the colemanite extends and may be mined out as

far down as the level of the crossing in the main (Lovell) gulch. This should give an average breadth of workable bed, down the dip, of about 200 ft., for the outcrop length of about 3,000 ft. Estimating on a minable thickness of the colemanite of only ten feet, as sampled, these dimensions show a volume of 6,000,000 cu.ft. of crude ore reserve, above the level stated. Assuming 15 cu.ft. to the ton, this shows 400,000 short tons of crude ore. This will probably average better than 20 per cent anhydrous boric acid (B₂O₃), equivalent to 8,000,000 units A.B.A. (anhydrous boric acid) as expressed in commercial terminology.

The quantity assumptions involved in the foregoing calculations are so conservative that a diagrammatic representation has also been given of what would be implied in the assumption that the segment of the lenticular mass still remaining may be that part south of the



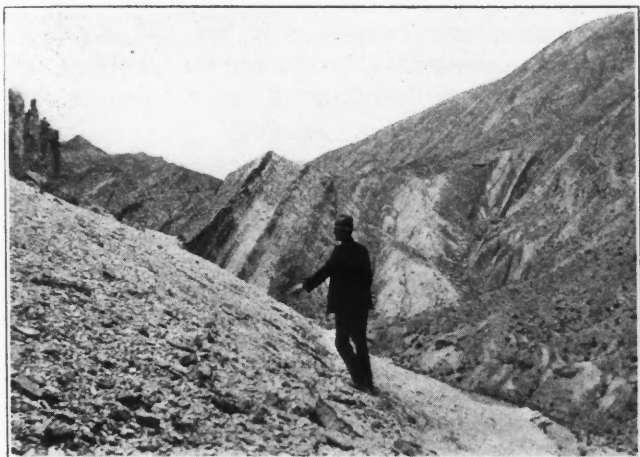
STRUCTURAL AND STRATIGRAPHIC SECTION, VERTICAL CROSS-SECTION OF PROSPECT CUT

outcrop circumscribed by an arc having as radius half the length of the recognized outcrop. The area of this is represented by the entire shaded area on the plat. Without allowing for change in the dip of the beds, this is readily seen to be at least five times the first estimate given. A reasonable minimum expectation of extent is represented as just about one-half of the larger estimate, which is thus at least two and one-half times the first figures given.

As shown by the traverse, the exposed outcrop of the colemanite extends from its crossing of the main gulch (Lovell Wash) on the west, around the north face of the "hog back" or "cuesta" ridge, over a divide and down toward the east into another and smaller wash. The same horizon that carries the colemanite may be readily traced far in extension of the mineral itself both ways from the recognized outcrop, but the colemanite is

not conspicuous on the surface beyond the extent already discussed, and the possible greater lateral extension of the bed must be revealed by future exploration of the area.

The original showing of the colemanite on the surface consisted of bunched masses of the radially fibrous crystalline colemanite, which, being more or less decomposed by the action of the weather, commonly assumes a crumbly granulated condition that is not at once readily distinguishable from gypsum, until one has become fa-



F. M. LOVELL, DISCOVERER, POINTING TO BED. VIEW LOOKING SOUTHWEST ALONG OUTCROP

miliar with this phase of the mineral. The gritty crunching sound when the colemanite is scraped with a prospecting hammer, and the radial, finely bladed crystals usually serve to identify the borate mineral. The analysis quoted shows that there is actually very little of the mineral gypsum included with the main deposit of colemanite.

STRIKING REGULARITY OF COLEMANITE BED

The structure or general attitude of the strata, including the colemanite, is very regular. The valley south of the ridge containing the colemanite is a broad canoe-shaped synclinal fold, with axis extending from east to west. One or two minor wrinkles in the strata probably affect the colemanite, but certainly cannot cause serious inconvenience in following the bed in mining, as the offset is not great. On the whole, the colemanite bed is most exceptionally regular and continuous, as compared with all other occurrences of this mineral with which I am familiar, and it is believed that this factor alone is a strong point in favor of the efficient and economical working of this deposit.

The accompanying photographs show, one looking one way and one the other, along the outcrop, the appearance of the beds including the colemanite, and, in the foreground, the talus or debris slope covering the actual outcrop.

The colemanite is found as a part of the Tertiary series in southern Nevada, and the beds that include this mineral are probably essentially the same age as the beds that contain the colemanite in the other districts in southern California. Prospecting interest, which has been roused to feverish intensity by the recent discoveries and prompt sale of the properties, is being conducted with a clear recognition and practical application of the principles of the stratigraphic association of the colemanite in the series, by which an attempt is made to trace the beds already found into further ex-

tension, and to identify in other localities the same formations in the hope of finding other deposits.

VARIATION IN TERTIARY SECTION MARKED

The Tertiary section is extremely variable in detail from place to place, but there is a fair correspondence of the principal units throughout the Muddy Mountain region, if not farther than this. The variability of the Tertiary section is in general as marked as an extreme of independability as is, on the other hand, the wonderful correspondence and uniformity of the units of the older Paleozoic section not only throughout this same region but reaching from here throughout the whole southwestern United States.

During Tertiary time the conditions of sedimentation were local, and so subject to many local changes, such as nearness to volcanic centers, or areas of upthrust Paleozoic masses, from which the sources of their sedimentary deposition were derived. Doubtless a great part of Tertiary deposition consisted of materials distributed over land surfaces by the agency of surface waters, probably mainly storm waters acting at periodic intervals, just as such materials are being distributed today. Tertiary topography also doubtless resembled that of the present time, being made up of structural mountain ranges and intervening isolated basins, some of which contained lakes. Although conditions of Tertiary sedimentation may have closely resembled those of the present in the desert areas of the country, those older deposits have in general been involved in strong mountain-building movements, so that these beds are now usually folded and faulted into great complexity.

The base of the Tertiary sedimentary section, as recognized in the Muddy Mountain region, is a great outwash deposit, made up chiefly of boulders of the dark blue to blackish limestones, which are clearly derived from adjacent upthrust masses of the older Paleozoic limestone formations. This formation has been called



OUTCROP AND CAPPING OF CRINKLED "EGG-SHELL" LIME LOOKING EAST

the Overton conglomerate by Prof. Chester R. Longwell¹ in his geological study of the Muddy Mountain region, this name being given because this formation is extensively developed near the town of Overton, in the Muddy River Valley.

The Overton conglomerate clearly marks the begin-

¹Longwell, Chester R., "Geology of the Muddy Mountains, Nevada," with a section on the Grand Wash Cliffs in Western Arizona, *American Journal of Science*, Vol. L, January, 1921, pp. 39-62.

ning of a period of redistribution of materials following one of the major mountain-building upheavals, such as brought the Paleozoic limestones up in great fault blocks, with which the region abounds. The summit of the Muddy Peak is itself an example of this. The conglomerate is a great alluvial fan, or wash-debris deposit, spread from these uplifts, which are so clearly the source of its materials. It thus marks an unconformity in the stratigraphic section and is the beginning of a new cycle of deposition. Buried at the base of the Tertiary section its pebbles and boulders have become firmly cemented with a calcareous travertine-like cement. This alluvial fan deposit naturally varies greatly in thickness, ranging, according to Professor Longwell, from several thousand feet near Overton to a thin but fairly persistent layer in other places. So far as I have observed, the Overton conglomerate lies directly over the conspicuous red cross-bedded Jurassic sandstone that is so well represented in the big ledges of the "Valley of Fire" west of St. Thomas. This seems to indicate that the major mountain-building movements of this region started in the Miocene Tertiary, giving the first records of Tertiary deposition for the particular region under discussion.

Next succeeding the Overton conglomerate, and probably resulting from a direct continuation of the same period of sedimentation, is noted a considerable section of finer deposits. These consist of reddish and then white-weathering shaly beds, which are largely fine volcanic ash or pumice, and in parts contain much calcium carbonate. The ash generally shows distinct little hexagonal crystals of biotite mica, when examined closely, and is also made up of a considerable proportion of clear sand-like grains assumed from the cleavage to be glassy feldspar. Some of the ash is in the form of gray sandstone-like beds. The section contains none of the original flow beds, but the lava is supposed to be of acidic type—perhaps rhyolitic or andesitic.

LIMESTONE ASSOCIATED WITH VOLCANIC ASH

Above this section of shaly tuff or ash is a section of calcareous beds that are essentially limestone. These are exposed in rough-weathering, dark-stained, massive beds which make some of the prominent escarpment bluffs and ridges of the region. In composition, these limestones are made up of travertine-like lime of irregular texture, frequently filled with markings or traces of crystalline calcite that might be taken for imperfectly preserved fossil markings. The limestone is interbedded with a great quantity of volcanic ash, and much of the limestone itself looks as if it contained a considerable percentage of ashy or pumiceous material as part constituent.

Some of the interbedded ashy layers are vivid green, but generally gray or dull greenish. The record is clearly one of chemical precipitation of the travertine-like lime during a period of intense volcanic activity in the vicinity, near enough to receive the ash and dust of eruption, but not the lava. This massive limestone section is at least 600 or 800 ft. in stratigraphic thickness, and overlies 300 or 400 ft. of the finer ashy shale beneath it, these thicknesses being approximate estimates which were made in the vicinity of the colemanite districts.

The colemanite bed or beds occur in the upper part of the massive limestone section already described—at least this position is obvious in the section exposed at the Callville deposit. The greater part of the massive lime-

stone section lies below the large colemanite bed in the Callville Wash, forming the bare, rocky, dip-slope walls to the north and northwest of the outcrop of the bed. However, a portion of the massive, ridge-forming members also lies above the colemanite, the latter forming the "hog back" or "cuesta" ridge that stands above the colemanite outcrop, and forms the "hanging wall" of the "vein." The details of this part of the section are given in the diagrammatic structure and stratigraphic section. The limestone associated with the colemanite is referred to as "fresh-water" limestone. Its character is significant of the origin of the deposit as a whole, including the mineral colemanite and the associated beds, and which is described in detail in the following paragraph.

"EGG-SHELL LIME" A DISTINGUISHING FEATURE OF DEPOSIT

Some of the beds most characteristically associated with the colemanite, at once recognized as markers by the prospectors, are thin-layered concretionary deposits of lime that occur above and at places within and below the borate mineral. These concretionary deposits have been variously referred to as "the egg-shell lime," "goose-egg," and the "crinkled lime." In the White Basin district these take the form of rounded white balls, made up of onion-skin-like layers of calcium carbonate, generally found scattered along the weathered outcrop of the colemanite bed, or in extension of the horizon that carries the colemanite. These markers are not certain signs of the presence of the colemanite, but are an excellent prospecting indication. At the deposit in the Callville Wash, this concretionary deposit takes the form of layers, having a concretionary or botryoidal upper surface, a most characteristic example such as has been used in the textbooks on geology to illustrate forms of spring deposits. In cross-section the lime is seen to be made up of egg-shell thin layers, often in curiously contorted or crinkled form, from which the names cited have been derived. No better evidence of the spring-water origin of this particular part of the deposit is needed.

A great and rather irregular ledge of the crinkled lime overlies the Callville colemanite bed, forming the "hanging wall" of the deposit. Viewed from a distance this irregular ledge is somewhat in contrast with the more regularly bedded limestones and shales above and below. The thickest and most irregular part of the crinkled lime ledge seems to be co-extensive with the main part of the colemanite bed also. Thus its origin is undoubtedly closely linked with the origin also of the colemanite.

SEDIMENTS PARTLY DEPOSITED IN SHALLOW WATER

The stratigraphic section above the massive limestones described in the foregoing paragraphs, and above the colemanite, grades into a series of reddish and red-brown, sandy, pumiceous, and shaly beds, which include much gypsum. Some of the beds just above the colemanite-bearing series are characterized by an abundance of cherty or chalcedonic silica, a part of the silica being in bright colors. Some of these beds also contain excellent examples of ripple-marking, showing that, in part at least, they were laid down in shallow water. More study is needed to clear up a more complete understanding of the details of this section.

Another and distinct series of sands and clays, in places carrying large deposits of common salt and gyp-

siferous shale, succeeds the older Tertiary section already described. To this belong the large masses of rock salt exposed along the Virgin River below St. Thomas. These later beds are in general distinctly less deformed than the colemanite-bearing series, and so far as now known no colemanite has been found in the younger group. These younger beds contain in many places interflow bands and intrusions of basaltic lava. This series occupies large areas in the vicinity of the colemanite districts, and as its beds rather closely resemble those with which the colemanite is found, it is important that the distinction between the two groups should be as closely drawn as is possible.

DEPOSIT RESEMBLES REMAINS OF AN EXTINCT THERMAL SPRING

It is important to determine, as closely as may be practicable, the nature and origin of the colemanite bed for the bearing that this may have on the expected extension and continuity in depth of the deposit, if for no other reasons. It has been stated that the deposit as a whole has a distinct resemblance to a large spring deposit, possibly a thermal spring, as this may more readily be assumed to have provided waters carrying lime and boric acid in larger proportions than ordinary spring waters. The mass as a whole seems to be a large, roughly lenticular body such as would probably have been spread out below a center of spring vents, possibly at the edge of a shallow lake. The most convincing evidence of the spring-water origin of the deposits is the travertine-like lime or dolomite with concretionary and botryoidal forms, that occurs above, within, and below the main colemanite bed.

Observation at the deposit, as it is intended to show in the diagrammatic illustrations given with this account, is believed to clearly indicate the original interbedded character of the borate mineral or minerals of this deposit. The mineral colemanite now occurs in layers, mostly distinctly interbedded with shaly or calcareous beds, so interfingering with the original stratification that it seems that the mineral could scarcely have been introduced long after the deposits had begun to consolidate. The colemanite itself is, however, irregularly bedded or layered, or crystallized in bunched masses along defined layers in the beds, and it is not improbable that the mineral may have grown in place in the shaly beds while the latter still formed loose surface deposits, because this is known to be a habit of borate minerals as they are forming today; witness, ulexite in the sands and muds about the margins of present intermittent or *playa* lakes, particularly below places where hot springs enter the deposits.

ORIGINAL BORATE MINERAL UNDETERMINED

It seems certain that in some deposits ulexite has altered to colemanite in place, in buried deposits, but it is equally indisputable that under certain conditions colemanite alters to ulexite, where exposed to surface weathering, and it cannot now be stated what may have been the original borate mineral that formed the Callville deposit. The borate present appears now to be entirely colemanite, the isolated nodules at the top of the deposit having been determined to be a radially fibrous aggregate of that mineral.

Possibly none of the bedded ulexite deposits in this country have been so extensive and at the same time so largely composed of the borate mineral through so great

a thickness as the original extent of the Callville deposit, but many such deposits of even far greater magnitude than any known in this country exist in the *salar*s of the South American Andes, and if these beds had been buried and consolidated and then become accessible for mining they would have produced deposits comparable in general aspect to that found in the Callville Wash.

NO CONSPICUOUS CROSS-VEINING NOTED

Comparatively little secondary recrystallization of the colemanite is to be noted in the Callville deposit, to the extent that would have caused this mineral to migrate into cross-fracture or secondary structure openings, such as has occurred so extensively in most of the other known occurrences of colemanite. So far as observed, the mineral follows the bedding of the inclosing sediments closely, and with the limited opportunity for observation of these details of the deposit now available, no conspicuous cross-veining has been recorded. Observation of the larger masses of colemanite in the older known California districts has so frequently shown the colemanite massed along fissure or fracture zones, in apparently secondary veins, that it has been difficult to determine just what had been the original form of the deposits. The newly discovered deposits in Nevada seem to present a clearer example.

In substance, the foregoing evidence is believed to indicate that the Callville colemanite will prove most unusually dependable as an orebody for mining, and because of its continuity on the outcrop, and as this outcrop has no essential relation to the original form of the deposit, the orebody may reasonably be expected to show like continuity in depth.

NEW DEPOSIT A RIVAL OF OTHERS

It should be made clear that the present account is not a complete or final report on the Callville Wash colemanite deposit. I am, however, confident that it embodies most of the essential facts of geological nature from which the character, dependability, and probable extension of the orebody are to be judged, in so far as such facts are available in the present stage of development. Additional evidence will, of course, be revealed as the underground work progresses, but it is unlikely that these will essentially alter the general conclusions now reached, as the record appears to be clear and satisfactory as far as it now goes.

At the present this deposit in the Callville Wash is the only one in the United States among those containing the larger commercial bodies of colemanite that is outside the properties under the control of Borax Consolidated, Ltd., of London, and its subsidiaries known as the Pacific Coast Borax Co. and the United States Borax Co. The half dozen districts in which commercial deposits of colemanite are known to exist, in this country, are shown by the index map. Each of these districts has had a complex history, and four of them—namely, the Furnace Creek-Death Valley district, the old Borate district, in the Calico Mountains; the Ventura County deposits, and the mine at Lang, in Los Angeles County—have yielded large commercial production of this mineral.

Colemanite still stands as the principal source of borax and boric acid in this country, its only competitor at the present time being the product manufactured from the brine of Searles Lake. Among the colemanite districts the largest, from the point of view of total reserves actually in sight, is undoubtedly the Furnace

Creek field, when considered as a whole, but this is probably the only district that should be placed ahead of the Callville district in importance today.

The old Borate district in the Calico Mountains is considered essentially worked out; the Ventura County field doubtless contains some good colemanite, but is remote from transportation facilities and the best of the ore seems to have been removed; the Lang mine yields a low-grade ore, which was a single lenticular body of mixed shale and colemanite, and has been admittedly on the verge of exhaustion for some time. The field discovered in 1913 near Kramer, Cal., has not been developed except in an explorational way, but the evidence does not seem to indicate that it ranks with the larger more massive form of deposits of the mineral colemanite.

FURNACE CREEK BORAX MINES HAVE MANY DIFFICULTIES

The big deposits in the Furnace Creek district are undoubtedly the peer of any of the colemanite properties as yet opened in this country, from point of view of the total reserves of ore actually in sight. However, there are several factors that stand strongly to the disadvantage of this district as an economical producer. So far as I have been able to ascertain, the cleanest and best colemanite in the Furnace Creek district was that contained in the old Lila C. vein—not strictly on Furnace Creek, but belonging with that group of deposits; but the Lila C. bed or vein is now considered essentially worked out.

The other Furnace Creek properties that have been more recently the principal source of supply for manufacture of borax and boric acid in the country are, so far as I have been able to ascertain, great mixed-up masses of gangue and ore, which was mined at first in large open cuts and later by tunneling and crosscutting underground. The average product obtained in this way is reported to be comparatively low grade, which is the material treated in the big concentrating plant at Death Valley Junction. The difficulty of transportation from this district is well known, and the cost of maintenance for the two railroad systems, namely, the Tonopah and Tidewater, and the Death Valley R. R., is chiefly a direct charge against the operation of these properties.

I recently made a general survey in this district, and though free access to the working properties is usually denied to persons not officially connected with the operating company, the general facts concerning the deposits are readily determined. All of the deposits are professedly very irregular and broken, the colemanite appearing in large bunches or masses at one point and cutting off abruptly at another, so that a continuous and regular form of working cannot be practical. Some of the big open cuts make a wonderful showing, but the way in which the deposits are worked indicates that such bunchy masses are not continuous far in this district, and present mining problems that will be solved with difficulty.

CALLVILLE WASH DEPOSIT IN A CLASS BY ITSELF

I have made careful study in all of the known colemanite districts, and in most districts I made detailed surveys in a general study of the deposits themselves. The evidence at hand indicates that in most of these deposits the colemanite is largely in a secondarily recrystallized condition, and that its present distribution is largely influenced by this metamorphism. A common

association of the large bunchy vein deposits close below or near to thick interflow and intrusive volcanics suggests that the recrystallization may have been effected by hot waters accompanying the volcanics, and the ore concentration produced along fissure zones, or in such situations as ore concentration of this type is usually produced.

Judging from the evidence available on the Callville colemanite deposit, the thickness and extent, considered in connection with the evident uniformity and regularity of structure, which is believed to be dependent on the lack of secondary alteration of the deposit as a whole, seems to place this deposit in a class quite by itself. It thus has a number of important and obvious advantages from the point of view of efficient and economic recovery as compared with the other older known deposits of this mineral that are not so favorably circumstanced.

British Columbia Limonite Deposits of Minor Importance

In a recent report of J. D. MacKenzie, of the Canadian Geological Survey, on the limonite deposits of the Taseko Valley, B. C., Mr. MacKenzie confirms the findings of J. F. Crossland, who in 1920 conducted an exploratory party into the district on behalf of the provincial government. It was found that the deposits were not of sufficient importance to warrant development. The total tonnage is placed by Mr. MacKenzie at 669,350.

There are several deposits of varying quantity. They consist of brown limonite of varying shape, size and thickness, built up of thin layers of brown, cellular, and generally loose textured limonite, lying parallel to the surface of the ground on which they rest. The limonite, when dug, forms a large percentage of fines, most of it breaking into pieces of less than half an inch and much of it breaking into the fineness of sand. The iron is derived from finely divided pyrite, which impregnates greatly silicified and sericitized tuffs on the Taseko formation. The iron sulphate solutions formed by the oxidation and leaching of this pyrite trickle down the mountain slopes and deposit at the first favorable location, building up in the course of that process a bed of limonite.

Field observation was sufficient to determine that replacement of organic matter, which played such a large part in the deposition of the Zymoetz limonite (northern British Columbia), is here of negligible importance, and no certain instance of it was observed. The occurrence of considerable quantities of wood in the form of branches and twigs in certain zones often deep in the limonite, and quite unaltered except for a blackening of the outer layers, may be accepted as conclusive evidence that the iron solutions that are present are not of a nature to replace vegetable matter with limonite.

The report, which is of considerable length, is illustrated with maps and diagrams. Mr. MacKenzie also contributes to the geological survey publication, covering 1920, an article entitled "A Reconnaissance Between Taseko Lake and the Fraser River." On that trip the remains of an old volcano were encountered near the head of Relay Creek, which is in the Lillooet district, and further exploration of the character of the formation of the surrounding country disclosed traces of volcanic origin.

Mine Sampling Methods at Tyrone, N. M.

Highly Specialized Routine Work on a Large Disseminated Copper Deposit, Showing Many Forms Used and Records Kept—Plan of Testing Enables Close Supervision To Be Made Over the Grade of Ore That Is Mined and Progress of Development

BY BARCLAY G. ANDERSON
Written for *Engineering and Mining Journal*

THE MINES at Tyrone, N. M., of the Phelps Dodge Corporation are of the disseminated copper type, and sampling is a necessary part of the daily routine. The methods used in taking the samples and in keeping the records in usable form are therefore of

B M 4088	
PICK SAMPLE	
DATE	5/1/21
DIVISION	1
BLOCK	A
WORKING	4D91
FOOTAGE	27
MEASURED FROM	Sta 510
SAMPLER	Doc
PER CENT CU	
PER CENT OXIDE	

FIG. 1. IDENTIFICATION TICKET FOR A PICK SAMPLE

B M 4069	
CHANNEL SAMPLE	
DATE	5/1/21
DIVISION	1
BLOCK	A
WORKING	4D92
DESCRIPTION	#1-Left 90-95' horiz.
MEASURED FROM	Sta. 500
SAMPLER	Doc
PER CENT CU	
PER CENT OXIDE	
SERIAL	C-3998
.....	
SERIAL	C-3998
DATE	

FIG. 3. CHANNEL SAMPLE TICKET

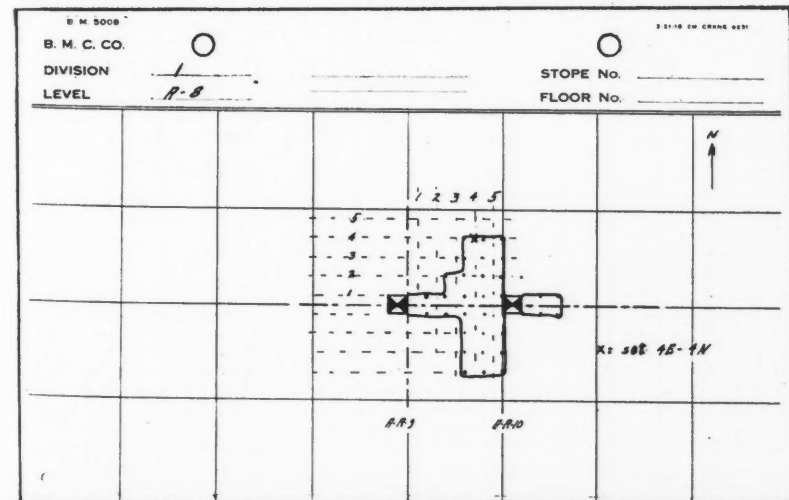


FIG. 2. SKETCH MAP INDICATING POSITION OF SAMPLES

interest. The daily output of the mine is 2,000 tons. The sampling force consists of the head sampler, division sample bosses, channel boss, pick and channel samplers, and office clerk.

The pick samples are taken with a geological pick

and ring bag. Each drift and raise that is being advanced is visited daily and a sample taken at the face. If a strong slip or vein is exposed it is sampled separately. It is planned to substitute a large grab sample for the pick sample now taken.

The kind and number of stope samples vary with the stoping method. In the top-slice stopes, samples are taken in each set advanced on both sides and face. When "runs" through the mat occur, a grab sample of the run is taken. In the rooms of the shrinkage stopes, the back is sampled with a "stoper" drill, holes being put in at the intersection of five-foot squares. The sides are sampled with a pick. Grab samples are taken daily in the drawing-off chutes of the shrinkage and caving stopes.

CHANNEL REPORT						
DIV. 1		DATE 5/1/21	NAME Doc			
BLOCK	WORKING	DESCRIPTION OF SAMPLE	MEASURE FROM	SERIAL NUMBER	TOTAL % CU.	OXIDE % CU.
A	ADJZ	4' Left. 98-95 h	5th 500	C-3998	2.36	0.10
"	"	4' Right. 98-95 h	"	C-3999	1.95	0.11
"	"	2' Left. 95-100 h	"	C-3990	2.00	0.13
"	"	2' Right. 95-100 h	"	C-3991	2.20	0.16

FIG. 4. DAILY CHANNEL REPORT, ORIGINAL AND DUPLICATE

To systematize the work of the pick sampler and to aid in checking up his work, a route book is made out for each run on the first of the month. An ordinary time book is used for this purpose. Each working place on the run is listed, and the sampler writes in his measuring point, usually a survey plug or drift intersection. When a sample is taken he puts down the footage opposite the proper working place and date. The division sample foreman, by frequently inspecting the books of his crew, is quickly able to check up their runs and see if any working places are being neglected and to direct where back sampling is to be done.

Fig. 1 is the identification ticket put in each pick sample. In the top-slice stopes, the samplers carry sketch maps, made on cross-section paper, to indicate the position of the samples and to record assays. On these maps they sketch in each day the outline of the slice, and indicate locations of the samples with a dot. The sets are referred to by a system of coordinates, starting from the initial raise in the slice. Fig. 2 illustrates such a map.

The assay office makes returns twice a day, giving the description of the sample and the percentage of copper. The clerk in the office lists the returns on linen tags (2 in. x 3 in.) for posting underground. The date, description and footage are written in pencil and the assay is indicated in colored crayon, red being used for waste and blue for ore. These tags are taken into the mine and posted by the samplers at working places. The returns from the stope samples are tacked up in the sets in which they were taken, and the drift and raise samples near the proper face. Stope maps are posted daily in the office and are ready for the sampler in the morning.

An eight-hour composite sample is obtained of ore mined or drawn from each stope. These samples are taken with a split fork by the trammer or brakeman, one forkful being taken from each car. The distance between the prongs of the fork, or the width of opening, is varied according to the amount of fines in the ore. The composite boxes are placed at the collecting pockets.

A novel scheme for indicating the

stopes from which the ore comes is used in one of the divisions of the mine. On the main drawing-off level ore is collected from several stopes by a storage-battery locomotive. The ore is hauled to the main pockets, and here composite samples are taken. Each stope number is given a certain color, and bundles of sticks, 12 in. long and pointed, are painted to correspond with these colors. At each chute front is a box of sticks of the proper color. As the chute-puller fills a car he takes a stick from the box and puts it in the car. When the train reaches the pockets each car of ore is identified, for the purpose of taking a composite, by the colored stick. At the end of the shift the composite man counts the sticks and obtains a tally by stopes for the shift's run. The assay returns for both day and night shift are posted at the points where the samples are collected.

When the pick samples for a drift or raise show better than 1.25 per cent copper, groove or channel samples are cut. The groove is four inches wide and one inch deep; and gives about a fifty pound sample for a five-foot cut. Five feet is the usual sample interval, and the cuts are made horizontal, vertical or inclined, depending upon the structure exposed. Both sides of a drift are sampled, and two or more walls of a raise. A continuous cut is taken in a raise parallel to its axis. In cribbed raises the samples are cut after each round.

It is important that channel samples be accurately located and marked at the time that they are taken and in such a manner that they can be correctly plotted on permanent assay maps. The system used at this mine has given satisfactory results. The drift or raise is

BLOCK A		1921	
DATE			DATE
1			1
2			2
3			3
4			4
5			5
6			6
7			7
8			8
9			9
10			10
11			11
12			12
13			13
14			14
15			15
16			16
17			17
18			18
19			19
20			20
21			21
22			22
23			23
24			24
25			25
26			26
27			27
28			28
29			29
30			30
31			31

FIG. 5. DAILY PROGRESS SHEET

COMPOSITE SHEET 1921
May

STOPE No. 1		DAY						NIGHT			AVERAGE		
DIV. No.	DATE	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS
1	23	1.50		3.54		2.15		1.90		2.71		2.26	
2													
1st PERIOD AVE		2.20	1460	3.220	2.02	1.990	3.810	2.12	2.850	6.030			
2nd PERIOD AVE													
3rd PERIOD AVE													
MONTHLY AVE													

FIG. 6. STOPE SHEET FOR MINE AND DIVISION

measured by the channel boss with a steel tape, starting from a survey plug or other definitely located point. Five-foot intervals are marked off on the sides with red paint and numbered consecutively 1, 2, 3, and so on, starting from the initial cut. The channel boss next makes a sketch of the working place, 30 ft. to 1 in., locating the cuts and giving them their proper number. Samples are cut with a moil and single-jack and cuttings caught on a tarp. After the sample is cut, it is sacked up and left in the drift at the point where it was taken. Before the end of the shift the channel boss visits the gangs and puts in identification tickets; and the samples are then taken out. These tickets (Fig. 3) are perforated, as a duplicate of the pulp is saved and the lower part of the original ticket put with it.

Experiments are now being carried on in cutting channel samples with a small air hammer. The results to date indicate that a satisfactory sample can be obtained in this way at half the cost of hand-cut samples.

A daily channel report (Fig. 4) is made out in duplicate by the foreman, who keeps one copy. The other goes to the office. When the work in a drift or raise is completed, he turns in his sketch map and report. This report gives a complete list of the samples taken in that working place.

The assay office makes a daily report of channel determinations to several offices, giving the serial number of the sample, description, and percentage of copper. With the report sent to the sample office, tickets are included, and the clerk in the office checks the description on the report with the original ticket. The assays are now written in on the channel report and sketch map. These form the completed record of the work done in that particular place, and are sent to the geological office, where the results are posted on assay maps. Such a system reduces the chance of error; the sample office always knows when the assays for a place are all reported, and the final plotting is made easier.

Pick sample returns are posted on the daily progress sheet (Fig. 5), and at the end of the month are sent to

COMPOSITE SHEET 19

DATE	1		2		3		4		5		6		7		8		9		10		11		12		
	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS	
23	1.50		3.54		2.15		1.90		2.71		2.26														
1st PERIOD AVE		2.20	1460	3.220	2.02	1.990	3.810	2.12	2.850	6.030															
2nd PERIOD AVE																									
3rd PERIOD AVE																									
MONTHLY AVE																									

FIG. 7. STOPE SHEET FOR MINE AND DIVISION

DIVISION No	STOPE No		EST. TONNAGE		EST. GRADE		MIN. GRADE	
	1	2	%Cu	TONS	%Cu	TONS	%Cu	TONS
	1	2	2.25 %	1500	2.50 %	3000	2.00 %	2.25 %
DATE	1	2	3	4	5	6	7	8
1	2.36	1.50	2.26	2.80				
10	2.10	1460	2.12	2.850				
1st PERIOD AVE	2.20	1460	2.12	2.850				
2nd PERIOD AVE								
3rd PERIOD AVE								
MONTHLY AVE								

TOTAL STOPES	DEVELOPMENT					GRAND TOTAL	MILL HEAD
%Cu	TONS	%Cu	TONS	%Cu	TONS	%Cu	TONS
2000	2.25 %						
2.00	1	3	5	AVE.			
2.05	1750	2.60	1100			2.05	2050
2.10	1700						
150	4000	2.00	2000	2.00	4000	2.00	4000

FIG. 8. STOPE COMPOSITE SUMMARY FOR SUPERINTENDENT

the geological office for plotting. Composite samples from the stopes are entered on individual stope sheets as shown in Figs. 6 and 7. The results are combined to give the daily division assays and the daily mine assays. Taken over a period of several days or a week, the latter agrees very closely with the mill-head assay.

The large stope composite summary (Fig. 8) is kept in the superintendent's office.

Graphical assay charts were devised for use at the mine office. They have proved useful for quick reference, for they show at a glance all the information that the mine foreman wants to know. The pick and channel

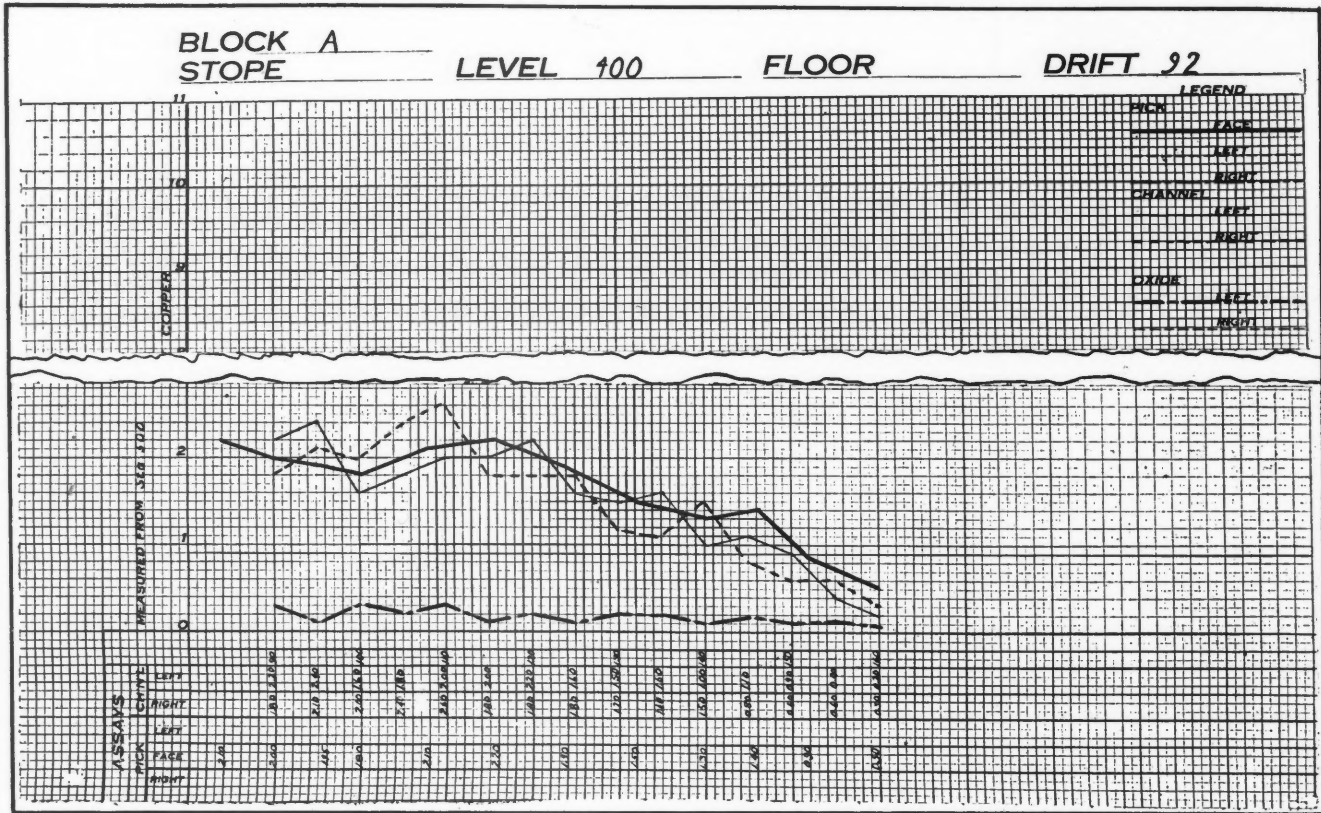


FIG. 9. COMPARATIVE SAMPLE RECORD

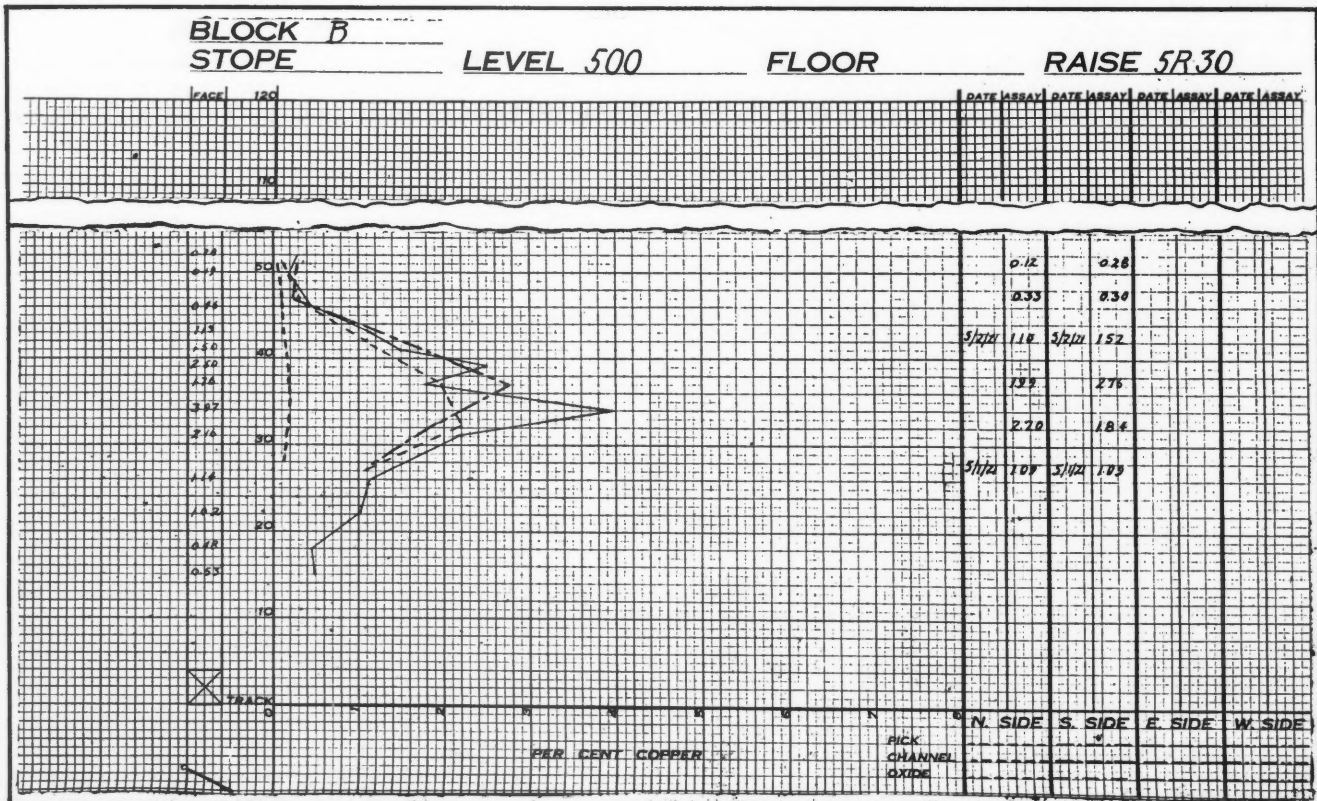


FIG. 10. COMPARATIVE SAMPLE RECORD

samples can all be plotted on one sheet without confusion. The graph shows whether the ore is continuous or spotty, and it also shows the footage of ore. It is sometimes necessary to sample a place more than once, and these two records can be plotted on the same sheet and easily compared (Figs. 9 and 10).

All the assay data are plotted on a set of sectionalized mine maps made on tracing cloth (50 ft. to 1 in.). These maps are made in duplicate, and on one set are plotted pick samples and on the other channel samples. The results of raise sampling are kept in a loose-leaf book, and plotted to a scale of 30 ft. to 1 in.

What Happens Under a Pressure of 300,000 Lb. per Sq. In.

Recent authoritative experiments with pressures as high as 20,000 atmospheres, or 300,000 lb. per sq. in., are discussed by P. W. Bridgman in the *Compressed Air Magazine* for September, 1921. Heretofore the maximum pressures which had been employed in scientific experimenting were about 3,000 atmospheres, and it was only by developing a special kind of packing and a method of measuring the high pressures that this work was made possible.

As Mr. Bridgman says, the wildest and most contradictory stories are in circulation as to the effects produced by tremendous pressures, such as exist at the bottom of the ocean. On the one hand sometimes the statement is made that water is forced bodily through the pores of steel vessels, and on the other hand that water is so powerfully compressed that it becomes even denser than iron, so that all the iron ships that have foundered float around forever at the level where the density of water has become equal to that of iron. Both of these statements are of course, utterly absurd; iron ships do not sink to the bottom, and if an iron bottle leaks it is because the joints were not tight. However, although one may be scornful of the pressure which Nature gives in the oceans of this globe, one must bow down when the billions of atmospheres in some of the stars are considered.

Engineering theories of the strength of vessels were found of no value at high pressures. A cylinder will stand much more pressure than would be expected and will stretch a great deal more than the ordinary tensile strength test would suggest. When it does break, the crack starts on the outside.

Among other things which these tests proved was that there is no truth in the superstition that metals become permeable to liquids under very high pressures, unless, of course, there is a flaw in the metal. The same is not true for gases, however. Hydrogen compressed under a pressure of 10,000 atmospheres will eat its way through a massive steel container and blow out, and if the experiment is repeated often enough will eventually make a crack that can be seen with the unaided eye. Mercury behaves much like hydrogen; it can be forced through massive steel walls by about 6,000 atmospheres. The action of hydrogen is doubtless due to the extreme smallness of the atom; the action of mercury is probably somewhat like it, assisted by an amalgamation with the iron.

Liquids are usually thought of as nearly incompressible, but water may be compressed to 20 per cent less than its normal volume by 12,000 atmospheres, and

alcohol to 27 per cent. The compression of a liquid cannot be carried indefinitely, because when the pressure is pushed high enough the liquid will freeze, no matter how hot it is. Machine oil, used for transmitting these high pressures, was found to freeze solid at room temperatures at 4,000 atmospheres, so kerosene or gasoline had to be used.

Before these experiments were made it was not known whether a liquid could be forced to freeze by pressure alone. There were various theories. One was that there is a critical point between liquid and solid just as there is between liquid and vapor. Another was that there is a temperature beyond which no amount of pressure can force a liquid to freeze. The experiments should be interesting for the geologist in considering the probable state of matter in the interior of the earth.

Even water can be forced to freeze in this way. This is not what might be expected, for when pressure is first applied to water the effect is to make it freeze at a lower instead of a higher temperature. Every one knows that the reason a skate slips on ice is because the solid ice is melted by the pressure of the runners. But if the pressure on ice is raised to about 2,000 atmospheres, something suddenly happens; the slack between the molecules is squeezed out, and the ice collapses 18 per cent in volume, assuming a different appearance with new physical properties. For instance, it will sink instead of float in water. If the pressure is raised further, more slack is presently squeezed out and still another kind of ice appears. The process may be once more repeated at still higher pressures, but then apparently remains constant. Water at 180 deg. F. may be forced to freeze to this kind of ice by the application of about 20,000 atmospheres. The instant the pressure is released, of course, it melts back into ordinary water.

Other substances, such as camphor, show the same phenomena of different physical properties at different compressions. Phosphorus, under 12,000 atmospheres and at 200 deg. C., assumes a black form like graphite in appearance which has lost its combustibility, has become a conductor of electricity, and is 50 per cent more dense than the familiar yellow phosphorus. This transformation, unlike that of ice, is permanent, and the new modification does not go back to its original form when the pressure is released.

Another very striking change produced by high pressures is in the viscosity of liquids or soft solids. Ordinary lubricating oil becomes twenty-five or thirty times "stiffer" under a pressure of only a thousand atmospheres or so. Under 12,000 atmospheres ordinary paraffine wax becomes so hard that it can deform steel, and soft rubber becomes harder than mild steel, so that a steel disk may be squeezed in ridges into the cracks of a soft rubber washer, as into a die. This knowledge should also interest the geologist.

In addition to these effects, there are many others of equal importance in theoretical physics, but perhaps less spectacular. For instance, the electrical properties of metals can be profoundly altered by high pressures; it is possible to make a metal like sodium or potassium conduct electricity five or ten times as well as under ordinary circumstances. In fact, the change produced by pressure in the electrical resistance of a metal, in manganin particularly, was found to be a convenient gage for the measurement of the pressures employed in these tests.

BY THE WAY

The Folly of Poverty

We were walking through Wall Street recently, as is our custom, not at all experiencing any discomfort from our propinquity to the great forces about us. This fact made us ponder, especially when we recalled that it is said that a current of a million volts transmitted near by will make one's hair stand on end if one is up in the air or otherwise insulated from the earth. It seemed strange, as we stopped and lit a seventy-five cent cigar with a dollar bill, that any one could be so foolish or so stupid as to be other than rich. It was so easy, and everybody was doing it. And when we got back to the office and saw the latest mail we were even more convinced.

First, a broker's letter said: "The B— & M— mill is almost completed. Ore in abundance lies waiting for it to start. The mill should earn from \$2,000,000 to \$2,500,000 annually. *It is rumored that when the mill has been running a short time, a dividend will be declared.*"—Here, it is apparent, a fortune is to be had for the taking.

The next was an inquiry as to where an "instrument" could be obtained for "locating or finding gold or silver hidden in the earth if brought anywhere near it." Some day perhaps, we shall get out an attractive line of these ourselves. They would sell like hot cakes.

Then came a news clipping that told of a discovery at Franklin, N. H., where a farmer has started to "tear a portion of his land to pieces" upon receiving a letter from the "Assay Office in Washington in which occurs the statement '\$9 worth of gold and \$2 worth of silver per 1,100 lb. of ore.'" According to the clipping, experts say that this percentage is decidedly high and predict that this area may prove a second Klondike.—Yes, indeed, and the Homestake is working only \$4 ore. This man is on the road to fortune, we hope.

The next was a booklet entitled "Opportunity—A Digest of the Possibilities of the Royalty and Operating Trust," from a "securities" company in Denver. The "Trust" has 1,780 acres of gold placer ground in Colorado, it is stated. The lowest estimate of "competent" engineers is 50,000,000 cu.yd. averaging 50c. per yd. The earnings are expected to be 8½ per cent per month on the entire capitalization. It is intimated that the return will be \$2,547 per every \$1 of capital. Another attractive feature is that there will be no delaying of dividends. This, indeed, is an opportunity for "red-blooded Americans" as the prospectus states.

Under this was one of the "Potash Fortune Opportunity Blanks" of the S. E. J. Cox Co., of Houston, Tex. Apparently one is supposed to fill out and return it with \$25 or \$150 in payment for a "unit" in the Potash Lease Syndicate. We were a little dubious about this potash business, for we recalled that the U. S. Geological Survey has sent out a warning against promotions of stock based on potash deposits in west Texas, saying that the deposits have not yet proved of commercial value. Against this, Mr. Cox's company advertises that "West Texas potash beds are of world's economic supremacy answer to Germany's proud boast." But although there may be no money in this for the investors, there certainly must be for the promoters.

There were more interesting things of the like in this mail and at the bottom of the heap was the latest issue of *World's Work*. On opening this the first advertisement that caught our eye was that of "M— Patent Automatic Water and Oil Finders" made in Liverpool. These sell for £50 to £375, depending on how much you have, and cheap at twice the price.

We were much impressed by the great number of opportunities to get rich thus indicated to us, and as we climbed into our Rolls-Royce to go home we were still marveling why some, a few, remain poor.

A Revival

According to the *New York Tribune*, "the advance . . . yesterday in the quotation for foreign silver caused a speculative revival of interest in the shares of those mining companies which produce silver. One of these was Homestake Mining. . . . Dome Mines and Alaska Juneau were also higher." Personally we do not think all the attention should be paid to silver stocks, with all the decreased costs of gold mining. Such representative gold producers as Nipissing, Federal Mining & Smelting, and Kerr Lake merit attention.

The Greasy Palm

"Thee don't 'ear so much these days abaout 'igh-gradin', m'son," said Cap'n Dick. "Coorse naow h'it doesn't take so much to make a bloody mine, with this 'ere flotation an' h'all tha h'other schemes for h'extrac-tin' tha pay dirt from tha low-grade h'ores. But, an', dam-me, t'weren't so long h'ago h'at that, there used to be some gert tales goin' 'tha raoun's abaout 'igh-gradin'. I mind one I 'eard baout Jan Walters w'en they struck tha fir'st body o' 'igh grade at tha Dividend mine. 'Billy,' sez 'ee to tha foreman, 'mind thee don't let h'any o' that h'ore stick to thy fingers w'en thee gaws h'off shif tonight.' 'Dam-me, Jan,' sez Billy, 'don't thee be tellin' me that. I remember thee back in tha h'old days in Grass Valley w'en thee wuz packin' a gert piece o' waste to keep in practus.'"

The Development of an Idea

That disseminator of jazz, the fixture without which no home is complete, namely the phonograph, now has a rival, or perhaps we had better say a counterpart so far as general appearance and certain effects go. We read of a "Heatrola—the parlor pipeless furnace," which, according to the description, "looks like a phonograph and works like a furnace." After all, there is something to a name, as evidenced by the adoption of the last two syllables from the trade name of a well-known sound reproducer. We confess to a feeling of spiritual warmth when listening to some famous aria rendered to us by one of the renowned musical artists through the medium of the domestic music box. The temperature of our physical being rises noticeably when we gallantly, and more or less gracefully, attempt the modern dance steps to the strains from the rifled disk. But this recent addition to the household miscellany produces heat without exertion or spiritual exhilaration. The development of an idea, of course. Applying, similarly, the same line of reasoning to other articles of furniture and their reincarnation in our own field, we have the coffee grinder as the forerunner of certain types of crushing machinery, the primitive self-rocking cradle represented in our concentrating tables of today, and so on. And who will deny that the proverbial grease in the boarding-house coffee was the progenitor of the flotation idea?

CONSULTATION

Ganister, Its Production and Uses

"What is ganister? Does it occur in natural form ready for use in this country, or are the supplies limited to the artificial combination? Where and how much is produced in the United States?"

Ganister is defined by the U. S. Geological Survey as a highly refractory siliceous sedimentary rock used for furnace linings; by Raymond, as a mixture of ground quartz and fire clay used in lining Bessemer converters. The term has a loose application and can refer to either the raw product as it is quarried or mined, or to the finished refractory brick made from the raw material ready for the furnace. It is more generally used to designate the raw material. Sandstone (quartzite), in its use as ganister, a refractory material for making silica brick, ferrosilicon, or converter linings, took its place during the war as an important stone product, according to the U. S. Geological Survey. The Survey also states that the requisite qualities for ganister are a content of 98 per cent silica and not more than $1\frac{1}{2}$ per cent of alumina, and that the material should be of such a nature as to be crushed into fine angular fragments. The U. S. Bureau of Standards recommends a content of approximately 97 per cent silica and not much over 0.4 per cent alkalis. Loose sand and sandstones reduced to the original rounded grains on crushing yield a weaker brick.

The ganister sold in the United States in 1918, the last year for which figures are available, was 1,297,874 tons, compared with 573,304 tons for 1915, indicating the great increase in production that occurred during the war. According to uses, the 1918 production was distributed as follows: 1,003,060 tons for use as silica brick, 215,164 tons as furnace and converter lining, and 79,650 tons in the manufacture of ferrosilicon. By far the largest proportion of ganister enters into the manufacture of silica brick.

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

One-half the ganister used in the United States is derived from the Tuscarora or Medina formation from Blair and Huntingdon counties, Pa. This formation consists of two distinct divisions underlain by the Juniata or Oneida formation. The ganister floes, as they are called, or fragments of ganister lying on steep hillsides, are formed by the unequal weathering of the components of the white and red formations of the Medina and Oneida sandstones. These floes, talus slopes, furnish the material used in the manufacture of silica brick, although the ganister may also be quarried from the solid formation. The white formation contains over 99 per cent silica and the red about 97.8 per cent.

If by "artificial" ganister is meant the silica brick

which is almost wholly manufactured from ground ganister, or quartzite, then supplies may be considered to be used to the extent of over 80 per cent in the production of prepared silica refractories. Ganister resources are large, and the supply is not "limited" by artificial combination. Silica brick, being of a uniform quality and uniform size, possesses at least two advantages over the direct use of the raw material as it comes from the quarries. For a technological discussion of the manufacture of silica brick and the factors affecting their quality and methods of testing the finished ware and raw materials, the reader is referred to Technologic Paper No. 116 of the Bureau of Standards, "Silica Refractories," by Donald W. Ross. This paper also contains detailed information about the geology and occurrence of the Pennsylvania ganister.

Current-Driven Water Motors

"May I ask through the columns of *Engineering and Mining Journal* regarding the experiences of other engineers with current-driven water motors? It is not unlikely that the conditions I am meeting in this part of the world have been experienced and dealt with by others under similar circumstances elsewhere.

"I need a moderate power for trying out tests with light-weight machinery in processing material in the field. Here in Brazil there is rarely any dry fuel for steam purposes, but the rivers are large streams, and always bank full. As a class they are swift-moving, and are the usual routes of travel to new projects, whether mining, timber, or agricultural. We are not in a mountainous country, so the rivers are fairly free from rapids. The logical method is to take power from the surface of the streams. It is noticeable that our literature is almost silent on approved settings of current-driven motors mounted on scows or rafts. What have your readers to report regarding developments to meet the needs of the pioneer engineer on powerful watercourses such as these?"

"WILLIAM G. MERRITT.

"American Chamber of Commerce,
Pernambuco, Brazil."

In Bulletin 127, published by the U. S. Bureau of Mines, Washington, D. C., "Gold Dredging in the United States," by Charles Janin, opposite page seven, is given a photograph of a current-wheel dredge in operation in New Zealand, in 1882, for the recovery of gold from river gravel. Side paddle wheels were placed on the pontoon or body of the dredge, and were driven by the current of the river and used to elevate the dredging buckets. No details of paddle construction are given, but the arrangement was considered a success and at one time more than twelve dredges of this type were operating on the river.

The advantages were the small cost of the machinery and the elimination of fuel. Possibly an arrangement similar to this one would be suitable for the generation of power under the conditions which our inquirer outlines. If the power is to be used directly, tests would have to be made on the raft carrying the paddle wheels. Perhaps some of our readers have had experience with crude water-power mechanisms which would help our inquirer.

HANDY KNOWLEDGE

A Review of Drilling—Part V*

BY GEORGE J. YOUNG

Western Editor, *Engineering and Mining Journal*

SELECTED BIBLIOGRAPHY ON ROCK DRILLING

DRILL STEEL

- "Heat Treatment of Rock Drill Steel," G. H. Gilman; A. I. M. E., February, 1921.
- "What Is the Ideal Drill Steel," *Eng. and Min. Journ.*, Vol. 111, p. 668.
- "Rock Drill Steels Too Short for Use Reclaimed by Welding," *Electrical World*, Vol. 77, p. 942.
- "Application of Magnetic Analysis to Rock Drills," C. W. Burrows, A. I. M. E., February, 1921.
- "Investigation of Fatigue of Metals Under Stress," H. F. Moore; A. I. M. E., February, 1921.
- "Analysis of Some Drill-Steel Tests," F. B. Foley; A. I. M. B., February, 1921.
- "Breakage and Heat Treatment of Rock-Drill Steel," B. F. Tillson; February, 1921.
- "Handling and Treatment of Rock-Drill Steel at Copper Range Mines," T. T. Mercer and A. C. Paulson; A. I. M. E., August, 1920.
- "Rock-Drill Steel," N. B. Hoffman; *Chem. & Met. Eng.*, April 27, 1921, p. 751.

*Continued from Sept. 17 issue.

"Drill Steel From Hollow Ingots," By P. A. E. Armstrong, *Chem. & Met. Eng.*, June 1, 1921, p. 960.

DRILL BITS

- "Drill Bits and Drill Steel for Metal Mining," G. H. Gilman, *Eng. and Min. Journ.*, May 12, 1917, p. 823.
- "Comparative Tests of Hammer Drill Bits," C. R. Forbes and J. C. Barton; A. I. M. E., 1917.
- "Relative Merits of Carr and Cross Bits," By Driller; *Eng. and Min. Journ.*, Jan. 2, 1918, p. 185.
- "The Blow of the Drill Bit, Sharp or Dull," Frank Richards; *Eng. and Min. Journ.*, April 26, 1919, p. 735.

DRILL-SHARPENING OPERATIONS

- "Shanking Drill Steel," C. C. Phelps; *Eng. and Min. Journ.*, Aug. 26, 1916, p. 389.
- "Operating a Steel-Sharpener Shop," J. E. O'Rourke, *Eng. and Min. Journ.*, Feb. 10, 1917, p. 263.
- "Drill-Sharpener Methods at the United Verde, Jerome, Ariz.," Frank Richards; *Eng. and Min. Journ.*, Feb. 17, 1917, p. 313.
- "Ideal Shop for Sharpening Drill Steel," G. H. Gilman; *Eng. and Min. Journ.*, Oct. 6, 1917, p. 585.

DRILLING MACHINES

- "Testing and Application of Hammer Drill," B. F. Tillson; *Eng. and Min. Journ.*, April 7, 1917, p. 582.

ROTATING HAND DRILLS

Type Symbol	Length, Inches	Cylinder Diameter, Inches	Stroke, Inches	Size Air Hcse, Inches	Size Water Hose, Inches	Steel Used, Inches	Size Steel Strand, Inches	Net Weight, Lb.	Depth Hole, Feet
Ingersoll-Rand Co.									
BAR-33	15½	2	1½	¾	1	hex.	x 3½	21½	3-6
BRR-13	17½	2	1½	¾	1	hex.	x 3½	35	8-10
BCR-430	20	2	2	¾	1	hex.	x 3½	45	10-12
BCRW-430	20	2	2	¾	1	hex.	x 3	46	10-12
DCR-13	21½	2	2½	¾	1	hex.	x 3½	55	12-14
DCRW-13	21½	2	2½	¾	1	hex.	x 3½	55	12-14
DDR-13	25	2	3	¾	1	hex.	x 4½	70	12-25
DDRW-13	25	2	3	¾	1	hex.	x 4½	70	12-25
Sullivan Machinery Co.									
DP-33, solid or hollow piston	21½	2½	3	¾	1	hex.	x 3½	38	5
DP-33 air tube rotator	21½	2½	3	¾	1	hex.	x 3½	38	12
DP-33 water tube rotator	21½	2½	3	¾	1	hex.	x 3½	40	12
DR-37 auger drill	19	2	2½	¾	1	hex.	x 3½	35½	8
DP-32 light rotator	17½	2	3	¾	1	hex.	x 3½	29	4
DB-13	16½	1½	1½	¾	1	hex.	x 3	14	.....
DC-15	19½	1½	2½	¾	1	hex.	x 3	25	.....
DC-19	21½	1½	2½	¾	1	hex.	x 3½	44	.....
DB-21	27	2	3½	¾	1	hex.	None	62	.....
Cochise Machine Co.									
Valve rock hammer	...	2½	2½	¾	1	hex. hollow	.....	42	.....
Chicago Pneumatic Tool Co.									
Hammer-86	19	2½	3½	¾	1	hex.	Shank	48	10
Hammer-86W	19	2½	3½	¾	1	hex.	Shank	48	10
Cleveland Rock Drill Co.									
33SD dry	20	2½	2½	¾	1	hex.	Shank	40½	.....
33SW wet	24	2½	2½	¾	1	hex.	Shank	43½	.....
33TD dry	20½	2½	2½	¾	1	hex.	No shank	40½	.....
33TW wet	24½	2½	2½	¾	1	hex.	No shank	43½	.....
Denver Rock Drill Mfg. Co.									
Waugh							Collared Shank 3½		
90	20	2½	1½	¾	1	hex.	.....	35	.....
93	21½	2½	1½	¾	1	hex.	.....	39	.....
95	20	2½	1½	¾	1	hex.	.....	37	.....
Model 50	26	2½	3½	¾	1	hex.	.....	47	.....
Model 50	26	2½	3½	¾	1	hex.	.....	47	.....
McKiernan-Terry Drill Co.									
F-2	21½	2½	2½	¾	1	hex.	S. ½ x 3½	37	.....

DIMENSIONS AND WEIGHT OF STOPERS

Type	Weight, Lb.	Piston Diameter, Inches	Stroke, Inches	Length Extended, Inches	Closed, Inches	Remarks
Denver Rock Drill Mfg. Co.						
Waugh 16 V	80	2½	3½	76	54	Valveless, dry, hand rotated
Waugh rotator	105	3	2½	79	55½	Valveless, dry, automatic rotation
Ingersoll-Rand Co.						
No. 11-CC	81	1½-2½	3	74½	52½	C C W, made with water tube
No. 21-CC	90	1½-2½	4	77½	55½	..
Sullivan Machinery Co.						
DT-42 dry	94	2½	3½	79½	61½	Automatic rotation
DT-42 wet	97	2½	3½	79½	61½	Automatic rotation
DT-44 dry	63	2½	3½	65	47	Hand rotated
DT-44 wet	66	2½	3½	65	47	Hand rotated
Cochise Machine Co.						
Cochise No. 3	73	2½	3½	..	..	Hand rotated
Cleveland Rock Drill Co.						
2 S	80	2	3½	76	52	Hand rotated, dry
4 S	100	2½	3½	78	54	Hand rotated, dry

- "Progress in Manufacture of Stopping Drill," *Eng. and Min. Journ.*, May 31, 1919, p. 964.
- "Development of the Rock Drill in America," C. A. Hirschberg; *Eng. and Min. Journ.*, Oct. 25, 1919, p. 677.
- "Jackhammer Type Drills in Witwatersrand Mines," E. M. Weston; *Eng. and Min. Journ.*, Feb. 7, 1920, p. 395.
- "Piston Drills for Use With Hollow Steel," E. M. Weston; *Eng. and Min. Journ.*, Feb. 21, 1920, p. 485.
- "Care of Rock Drills," H. R. Drullard; A. I. M. E., August, 1920.

MINING PRACTICE

- "Tests of Rock Drills at North Star Mine, Cal.," R. H. Bradford and W. Hague; *Transactions*, A. I. M. E., Vol. 49, p. 346.
- "Zinc Mining at Franklin, N. J.," C. M. Haight and B. F. Tillson; A. I. M. E., 1917.
- "Standardization of Mining Methods," C. A. Mitke; *Eng. and Min. Journ.*, Nov. 16, 1918, p. 857; Dec. 21, 1918, p. 1071.
- "Standardized Crosscut Rounds," H. Drullard; *Eng. and Min. Journ.*, Jan. 3, 1920, p. 27.

(Concluded)

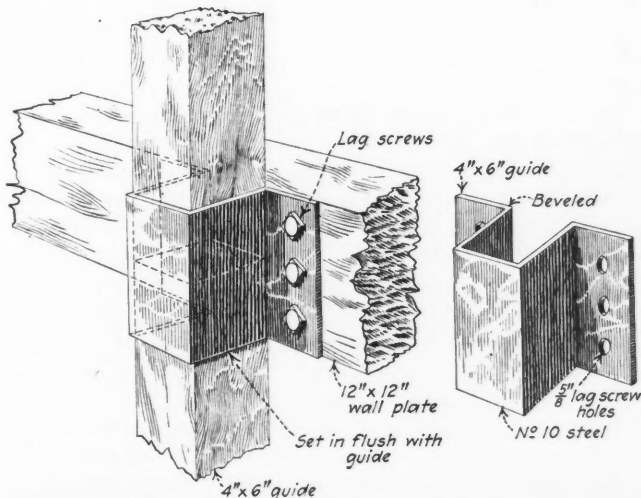
Device for Indicating Hoisting Level

At several California mines an electrical device for indicating hoisting level to the engineer is in use. The arrangement consists of a number of bell pushes placed in a convenient position near the shaft collar and wired to an annunciator placed conveniently near to the hoist engineer. Each push button connects with a drop number in the annunciator box. On operating the button for the desired level a small bell is sounded and the number drops within the glass covered case of the annunciator.

Reinforcing Shaft Guides

Written for *Engineering and Mining Journal*

Where two shaft guides meet upon an end plate or divider, the ends of the guides which abut become worn and more or less battered, and may even split. Usually they are fastened by a single countersunk lagscrew, one near each abutting end. The tightening up of these lagscrews also tends to wear out the ends. To avoid replacing the entire guide and also to protect the guide joint from the hammering action of skips and cages, Andrew Riley, master mechanic of the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Cal., is using a steel form, made from No. 10 sheet steel, as shown in the figure. The ends of the guides on the three rub-



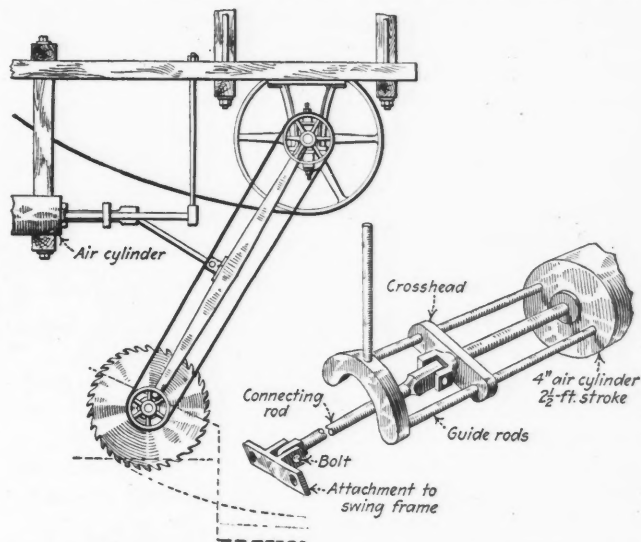
STEEL FORM USED TO PROTECT ENDS OF SHAFT GUIDES

bing sides are cut down a sufficient amount to allow the steel form to make a flush joint. The edges of the steel form are beveled to prevent any part interfering with the skip runners. The form is fastened to the wall plate by lagscrews as shown.

Swing Saw

Written for *Engineering and Mining Journal*

The swing saw is generally used in mine timber-framing shops. It has been standardized by different manufacturers, and, outside of refinements in bearings and hanger, does not admit of much improvement. In most of the swing saws on the market, provision is made for advancing the saw into its cut by means of a hand wheel operating a gear wheel which meshes with



AIR CYLINDER DEVICE USED FOR ADVANCING SWING SAW INTO ITS CUT

a rack attached to a short timber, one end of which is attached to the swinging frame. Handles are attached to the rim of the hand wheel to facilitate its use. At the Plymouth Consolidated Gold Mines, Ltd., Plymouth, Cal., Andrew Riley, master mechanic, discarded the arrangement just described and substituted in its place a compressed-air cylinder as shown in the figure. The air cylinder is controlled by a valve placed in a convenient position. It is preferable both mechanically and from the consideration of safety.

When Hebrew Meets Scot

The Jewish representative of a large Eastern firm had completed a sale of mining machinery to the purchasing agent of a mine situated some miles from a city. It had been a hard sale to land, and the salesman was anxious to show his appreciation.

"Just as soon as I reach town," he said, "I am going to send you a fine box of cigars."

"Nay, nay," replied the purchasing agent, "ma company does not allow the receipt of presents by its agents. I canna accept your gift, laddie."

The salesman thought for a moment. "Slip me a nickel," he said, "then you can say you bought the cigars. D'you see? They won't know how much you paid for them. You just buy the box for a nickel."

The Scotchman smiled slowly, and then placed a coin in the salesman's hand. "Mon, you're clever," he said. "Here, take this quarter, and ye can send me five boxes."

THE PETROLEUM INDUSTRY

The Petroleum Possibilities of Guatemala

BY ARTHUR H. REDFIELD*

Written for *Engineering and Mining Journal*

IN THE WORLD-WIDE SEARCH for new oil fields, the Republic of Guatemala, in Central America, has received small share of the attention of the oil seekers. Repeated rumors of oil seepages, many of them, however, unauthenticated, and the undoubted continuance into Guatemala of formations which have proved petroliferous in the Mexican states of Tabasco and Chiapas, have lent color to the supposition that Guatemala contains oil deposits worthy of investigation. The following summary of the geology and petroleum possibilities of Guatemala is based upon the most reliable data available:

LOCATION AND EXTENT OF POSSIBLE OIL LANDS

The part of Guatemala that is of interest as a possible source of petroleum is in general the area of folded Cretaceous and Tertiary sediments in the northern half of the republic. This area includes, in general, portions of the departments of Huehuetenango, El Quiché, Alta Verapaz, El Petén, and Izabal and covers about 17,000 square miles. The portion of this area that presents structures favorable to the accumulation of petroleum in commercial quantities is only a minor fraction of the total. Indeed, the existence of a zone of faulting in central Guatemala would appear to limit the choice largely to the Department of El Petén with an area of 13,200 square miles. No part of Guatemala has yet been proved by the drill.

The Pacific coast of Guatemala is bordered by a sloping plain, ten to twenty-five miles wide, which attains at its inner edge an elevation of 820 ft. This is succeeded by mountain mass, a southeastward continuation of the Sierra Madre of Mexico, whose highest peaks exceed in elevation 11,500 ft. Central Guatemala is occupied by a series of lower ranges, in general not exceeding 8,200 ft. in altitude, composed of folded and steeply dipping sediments. These ranges are separated by low-lying structural valleys, opening generally toward the Gulf of Honduras. Northern Guatemala, comprising principally El Petén, is a flat-lying lowland, broken only by occasional groups of hills. Its altitude nowhere exceeds 1,640 ft., and for the most part is less than 820 ft.

STRATIGRAPHY

The areal geology of Guatemala corresponds roughly to its topography. The narrow coastal plain that borders the Pacific coast is composed of Quaternary sands and gravels. The mountains which form the eastward extension of the Sierra Madre consist of a complex of effusives of various ages and pre-Cambrian crystalline rocks. The central plateau consists of folded Paleozoic and Mesozoic strata. The north-sloping plains

of El Petén are composed of more or less flat-lying sediments, which are chiefly Tertiary.

The pre-Cambrian crystalline schists of Central America have their widest extension in Guatemala. They form a belt in central Guatemala which reaches its greatest breadth at the meridian of Salamá and extends east by northeast beyond Lake Izabal to the Gulf of Honduras. Smaller patches of pre-Cambrian crystalline schists occur in Alta Verapaz, north of Rio Polochic, and in southern Guatemala.

The pre-Cambrian rocks consist in their lower portion of gneiss, which grades into granite; and in their upper portion of mica-schists and slates, with local intercalations of crystalline limestone, at Rabinal and Salamá; actinolite-schists at Morazán, and quartzites, Near Lake Izabal the slates are replaced by sericite-schists.

A series of talc and chlorite-schists, green, brown, violet, or black in color, of undifferentiated Paleozoic age, occurs on the south slope of the Sierra de las Minas and in the upper valley of Rio Chixoy.

Lower Carboniferous or pre-Carboniferous (?) massive limestones and limestone and dolomite breccias with a calcareous cement occur to a thickness of 260 to 330 ft. near Santa Rosa, in Baja Verapaz, and in the Department of Izabal. These were grouped by Dolfus and Montserrat with the overlying Santa Rosa terrane (Carboniferous), but were separated from it by Sapper. In a later work, however, Sapper eliminated the "pre-Carboniferous" limestones as a separate formation.

The Carboniferous proper in central Guatemala consists of two formations. The lower, known as the Santa Rosa terrane, is constituted by 660 to 980 ft. of quartz-conglomerates, brown or red sandstones, shales, and graywackes, grading into one another. The lowest beds are in general coarse grained, whereas the upper members show a finer grain and more clayey constituents. The highest beds, chiefly shales and graywackes, are intercalated with limestones.

Gypsum strata occur by Rio Chixoy and near Santa Magdalena, in El Quiché. Sulphur is found at the former locality, and a saline spring at the latter. Fossils found in the upper horizons of the Santa Rosa terrane fix its age as Upper Mississippian or Lower Pennsylvanian. The upper formation, of Pennsylvanian age, resting unconformably on the Santa Rosa terrane, consists of 1,970 to 2,620 ft. of dark-gray dolomites and limestones which are locally highly bituminous and limestone conglomerates and breccias.

The Carboniferous appears in the hills west of Puerto Barrios in a series of horizontally bedded, metamorphic limestones. A massive bluish metamorphosed limestone of Carboniferous age crops out along the south bank of Rio Polochic, and in a quarry seven miles south of Puerto Barrios.

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

The Triassic is represented by the Todos Santos terrane, composed of shales, coarse, yellow sandstones, marls, and quartz-conglomerates extending from the Mexican State of Chiapas into Huehuetenango. Through the greater part of northern Guatemala, however, the Cretaceous series of limestones and dolomites, with calcareous conglomerates and breccias, rest unconformably on the Carboniferous. The lower and

The Cobán limestones and dolomites in the south of Alta Verapaz are dark gray to black in color, and highly bituminous in composition. A similar series of limestones north of the Chicoj Range are mostly yellowish in color; and the associated conglomerates are in places colored red by iron oxide. The Cobán limestones, which contain no fossils, probably represent the Lower Cretaceous. The presence of *rudistes* in the northern



MAP OF GUATEMALA, CENTRAL AMERICA

middle stages of the Cretaceous are represented in isolated localities and in a small area on the Honduran border in the northeast of the Department of Jutiapa by the Metapán strata, which consist of marls, sandstones, shales, and conglomerates. These strata, however, have their chief extent in western Honduras, and in the northwest of El Salvador. Throughout central Guatemala, however, the Cobán limestones form the lower member of the Cretaceous.

terrane indicates that it corresponds to the Middle Cretaceous of the Mexican Geological Institute or the Upper Comanchean of the U. S. Geological Survey. The Cretaceous of Alta Verapaz has a total thickness of about 2,620 ft.

Tertiary deposits occur in numerous belts, for the most part narrow, in central Guatemala. They are of considerable extent in El Petén, but are totally lacking in southern Guatemala. They are extremely variable

in their petrographic characters, consisting of sandstones and conglomerates in the Motagua Valley, and in Alta Verapaz and El Petén of shales and sandstones, intercalated in some places with limestone beds.

The oldest Tertiary strata in northern Central America, lying conformably on the Cretaceous limestones, are the Sepur strata, which have a considerable extent in Alta Verapaz and southern British Honduras. They consist principally of red or yellow marls and sandstones, alternating here and there with glauconitic limestones and with conglomerates. The Sepur strata are ascribed to the Eocene. Marls, sandstones, and limestones apparently of the same geologic horizon occur near Chemal and Yulcá, in the mountains of western Huehuetenango.

The uppermost Oligocene is represented by the almost horizontally bedded Rio Dulce limestones, which form a flat-topped ridge almost three miles wide at Livingston. Similar limestones, lacking in distinctive fossils, occur on low hills at Jocolo, on the north shore of Lake Izabal, and at Fort San Felipe. It is possible that some of the limestones ascribed by Sapper to the Cretaceous may be of Oligocene age.

Late Tertiary (Miocene and Pliocene) limestones form the bedrock of the greater portion of El Petén. Between the limestones, which in many places abound in seams of chert, beds of yellowish or gray marl, which are locally bituminous, and thick beds of gypsum or alabaster occur.

Slightly consolidated quartz gravels and clays containing fossils of Pliocene or Pleistocene age are found in the lowest of the terraces on which Livingston is built. Fossiliferous white clays containing interbedded black lignite seams and chert pebbles (Pleistocene or possibly Pliocene) underlie the region between Sanhil, in the Sierra de las Minas; the Rio Dulce limestone ridge at Livingston, and Lake Izabal. Lignite beds, 2 to 3 ft. thick, occur between the Rio Dulce and Lake Izabal, and east of the Rio Dulce limestone near Livingston. The series of white clay and lignite beds attains a thickness of a few hundred feet.

Igneous rocks are confined almost entirely to the center and south of the republic. The older intrusive rocks consist of light-colored granites, which grade into diorites and other more basic igneous rocks, largely gneissic in structure. Paleozoic andesites occur in Alta Verapaz, and a broad belt of Paleozoic serpentine occurs north of Lake Izabal and in the upper valley of the Motagua. Mesozoic gabbros and diabases occur in central Alta Verapaz. Younger eruptive rocks, chiefly andesites, trachytes, basalts, and porphyries, form a continuous band across southern Guatemala, and occur as isolated outcrops in southern and central Guatemala. A narrow band of lava and ash deposits from volcanoes whose activity extended into recent times borders the southern slope of the coastal cordillera.

STRUCTURE OF NORTHERN GUATEMALA ROCKS

The Cretaceous and Tertiary sediments of northern Guatemala are folded in a series of anticlines and synclines whose major axes have a general east-west trend. These folds are parallel to those of the Tabasco-Chiapas field of Mexico. The Yucatan tectonic lines trend in the direction of the Isle of Pines; the central Guatemala tectonic lines in the direction of a 3,000 fathom deep in the Caribbean, and those of Honduras in the direction of Jamaica.

Diastrophic movements of considerable magnitude have evidently taken place in Guatemala at four different periods: (1) at or before the close of the pre-Cambrian; (2) at the close of the Paleozoic; (3) during the late Miocene; and (4) in the late Pliocene or early Pleistocene. The Paleozoic movements developed the cordilleran axes, the folding being most in the south. Miocene movements, less intense than the Paleozoic, developed the parallel Caribbean ranges. Evidences of both vertical and tangential movements are found in the Pliocene and Pleistocene sediments from Yucatan southward through Honduras.

As a result of these tectonic movements, there is in central Guatemala a belt of intensely folded strata, which rests against the metamorphic Paleozoic and pre-Cambrian crystalline rocks of the plateau; and to the north a series of diminishing folds, which give way to the comparatively flat-lying strata of Yucatan.

Great longitudinal faults with numerous cross fractures may be traced across central Guatemala. One series of faults separates the Santa Rosa series and the Upper Carboniferous from the Paleozoic serpentines and pre-Cambrian crystalline rocks in Baja Verapaz. The Carboniferous strata on their north are separated from the Triassic and the Cobán limestones by a series of parallel faults. A fault with an east-west strike forms the boundary between the Todos Santos terrane (Triassic) and the Middle Cretaceous limestones and dolomites. Similar faults, striking east and west, occur in the Cretaceous and Tertiary strata of northern Alta Verapaz.

Accordingly, Alta Verapaz consists of a system of folded mountains, whose northern portion is broken by a series of faults, striking east and west. A series of fault blocks descends, step-like, to the plain of El Petén. In southern Petén the folds are flatter and the faults fewer and of less displacement.

The remarkable alignment of the Pleistocene volcanos at the southern edge of the lava plateau is considered by Powers to point to a possible fracture zone on the Pacific side of Guatemala along which a portion of the cordillera has apparently subsided. This conclusion is borne out by the absence of a coastal plain showing uplift, by the uniformly great depths in the Pacific Ocean at no great distance from the shore, and by the remarkable parallelism of the submarine contours to the coast line. The volcanos have evidently been built up at the intersection of cross fractures.

INDICATIONS OF PETROLEUM

The possibilities of finding petroleum in Guatemala in commercial quantities are predicated principally upon the continuation of geologic formations that have been proved to be petroliferous in Tabasco and southern Vera Cruz and have given indications of petroleum in northern Honduras, and on the presence of favorable structures. This assumption is substantiated to a certain extent by the reported occurrence of asphalt seeps in the Valley of Pinula, Department of Jalapa, north-east of Jalapa, in an "island" of Cretaceous rocks.

Highly inflammable bitumen which burns with a bright flame, and emits an odor of kerosene, is said to saturate beds of the Cobán limestone (Lower Cretaceous) in the eastern part of the Department of Alta Verapaz. Arnold reports that the International Railway Co. has prospected petroleum seeps and has obtained from this source lubricants for its own consumption. The location of the seepages is not stated.

Petroleum seeps are reported to occur in El Petén, but these reports have not been authenticated.

It must be recalled that the northern provinces of Guatemala which are considered to offer the greatest probability of finding petroleum form the most sparsely populated, least traveled, and least explored portion of the republic. Moreover, the economic life of Guatemala has been based on agriculture rather than on mining. Consequently, our knowledge of the mineral resources of the republic is less detailed than might otherwise be expected.

No indications of petroleum, asphalt, or other hydrocarbons have been reported in Mexico or Central America in rocks older than the Cretaceous. The Tamasopo limestone which has furnished the phenomenal yields of the Tampico-Tuxpam fields belongs to the Middle Cretaceous, according to the Mexican classification.

The principal oil-bearing formation of the Tehuantepec and Tabasco-Chiapas fields of Mexico is a Cretaceous dolomitic limestone. The reported seepages of asphalt in Guatemala occur in Cretaceous rocks. In the Department of Comayagua, Honduras, a high-grade oil seeps from a bituminous limestone which is considered Cretaceous.

The belt of Cretaceous and younger rocks in Guatemala occurs generally north of latitude 15 deg. 30 min. N. The Cobán limestones crop out in a belt varying from six to twenty-eight miles wide, in the south of Alta Verapaz and Huehuetenango, and through the center of El Quiché, and pass to the north under the Middle Cretaceous limestones. The latter lie in a series of anticlinal and synclinal folds, whose axes strike generally east and west. In the synclinal basins bands of the Sepur strata (Eocene) occur. This area would appear to deserve investigation.

The belt of sedimentary rocks of central Guatemala between latitudes 15 deg. 30 min. N. and 16 deg. N. is, however, not only strongly folded but considerably fractured and faulted.

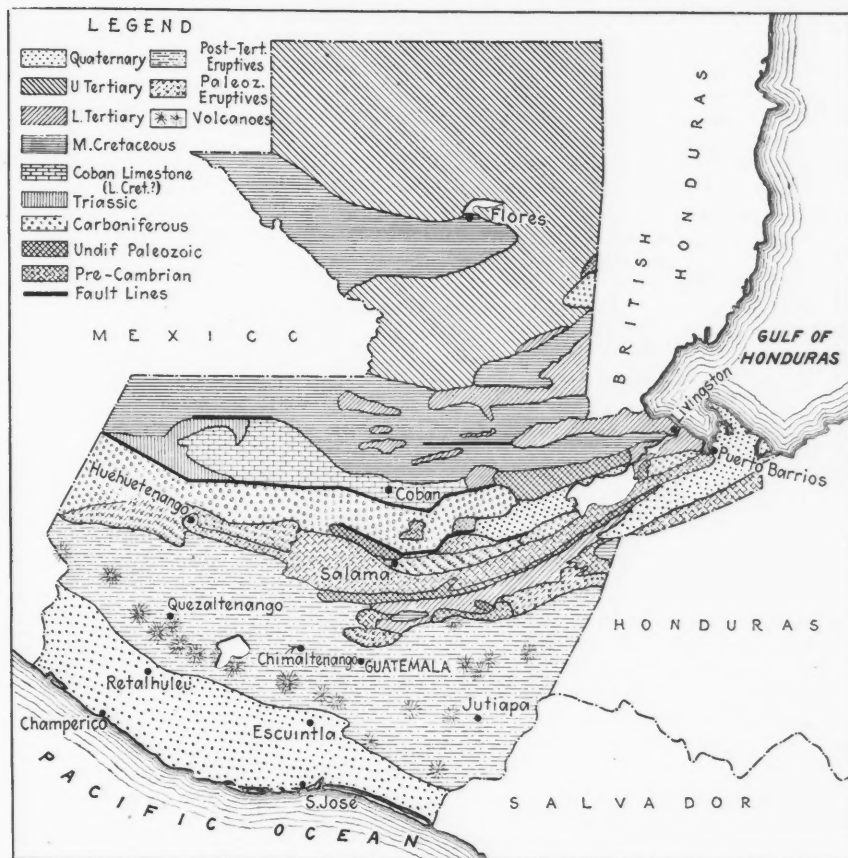
The Cretaceous and Tertiary strata of El Petén, though relatively flat-lying, give evidence of some folding. The relative positions of the Cretaceous and the Tertiary sediments of this department would appear to indicate a series of geosynclinal basins separated by anticlinal ridges in the Cretaceous. This would, however, by no means preclude the possibility of minor anticlinal folds in the geosynclinal basin. Relatively flat folds are reported by Sapper to occur locally.

On the basis of the known data on the stratigraphy and geologic structure of Guatemala, the Department of El Petén offers the most interest to the oil seeker. The Cretaceous, which is the most likely oil horizon of Central America, occurs here apparently under sufficient cover to conserve any hydrocarbons contained in it. The minor folds which occur in the flat geosynclinal structure offer possibilities of oil accumulation. Seepages of petroleum, not, however, authenticated, are said to occur in the department.

It is unfortunate that the part of Guatemala which appears on the face of the known data to present the greatest possibilities of petroleum is the part about which the least detailed information, either geographic or geologic, is available.

PRACTICAL DIFFICULTIES OF OPERATION ARE FORMIDABLE

The Department of El Petén is off the main line of travel, and the region is now accessible only by horse or mule back over rough trails from Cobán, or by crude native *chalanés* (dugouts) up Rio Usmacinta from Frontera, Tabasco. The surface of El Petén is covered by a dense tropical forest, broken only here and there by grassy *sabanas*, or chaparral thickets. These conditions have hindered detailed geologic exploration.



STRATIGRAPHICAL MAP OF GUATEMALA

If oil is discovered in El Petén, the questions of extraction and transportation remain to be solved. Roads in the true sense of the word cannot be said to exist. Considerable clearing of forest will doubtless be necessary before drilling material can be brought in or oil brought out. Equipment of all kinds must be imported. Labor, skilled and unskilled, will have to be brought in, as the population of El Petén, including Indians, does not exceed one per square mile.

By an executive decree dated Dec. 10, 1915, and approved by the National Legislative Assembly April 29, 1916, all deposits of petroleum and other hydrocarbons in Guatemala were declared the property of the national government. These may be acquired or exploited only through a lease, not to exceed ten years in duration, contracted with the Ministry of Public Works. Leases or concessions to explore or develop such deposits are permitted only to native or naturalized citizens of Guatemala. Leases may not be transferred,

except by express authorization of the government, and then a transfer may be authorized only to citizens of Guatemala.

BIBLIOGRAPHY

1. Arnold, Ralph, "Conservation of the Oil and Gas Resources of the Americas." *Proc. 2d Pan-Am. Sci. Cong.*, Vol. 3, p. 223. Washington, 1917.
2. Böse, E., "Reseña acerca de la geología de Chiapas y Tabasco." *Bol. Inst. Geol. de México*, No. 20. Mexico, 1905.
3. Bulletin of Pan-American Union, Vol. 40, p. 695, May, 1915; Vol. 42, p. 144, January, 1916.
4. *Commerce Reports*, Jan. 19, 1916, p. 269; Jan. 25, 1916, p. 337.
5. Dollfus, Auguste, and Montserrat, E. de, "Voyage géologique dans les républiques de Guatémala et de Salvador." Paris, 1868.
6. Exposition Universelle Internationale de 1900 à Paris, Rapports du jury international, Classe 63, "Exploitation des mines et carrières," Vol. 2, pp. 224-230. Paris, 1904.
7. "Fiscalización de depósitos petrolíferos." *El Guatemalteco*, Guatemala, Dec. 20, 1915.
8. "Government To Preserve Control of Petroleum Deposits." *South American Mining Journal*, March 25, 1921.
9. International Bureau of American Republics, Guatemala, Bulletin No. 32, pp. 54-55. Washington, January, 1892.
10. Pector, D., "Les richesses de l'Amérique Centrale," p. 81. Paris, 1908.
11. Powers, Sidney, "Notes on the Geology of Eastern Guatemala and Northwest Spanish Honduras." *Journal of Geology*, Vol. 26, No. 6, pp. 507-523. Chicago, 1918.
12. Redfield, Arthur H., "The Isthmian Oil Fields of Mexico." *Engineering and Mining Journal*, Vol. 111, No. 12, pp. 510-514. New York, March 19, 1921.
13. Sapper, Karl, "Grundzüge der physikalischen Geographie von Guatemala." *Petermanns Geog. Mitteilungen*, Ergänzungsband 24, Heft 113. Gotha, 1894-1895.
14. Sapper, Karl, "Sobre la geografía física y la geología de la península de Yucatán." *Bol. Inst. Geol. de México*, No. 3. Mexico, 1896.
15. "Ueber Gebirgsbau und Boden des nördlichen Mittelamerika." *Petermanns Mitteil.*, Ergänzungsband 27, Heft 127. Gotha, 1899.
16. "Die Alta Verapaz—Ein landeskundliche Skizze mit 5 Karten." *Mitteil. Geogr. Gesell.* Hamburg, Vol. 17, pp. 78-214. Hamburg, 1901.
17. "Ueber Gebirgsbau und Boden des südlichen Mittelamerika." *Petermanns Mitteil.*, Ergänzungsband 32, Heft 151. Gotha, 1906.
18. "Sobre depositos de petróleo." *Diario de Centro-America*, Vol. 34, pp. 1, 12. Guatemala, Feb. 14, 1914.
19. Stephan, Chas. H., "Le Guatémala économique," p. 141. Paris, 1907.
20. Willis, Bailey, "Index to the Stratigraphy of North America." U. S. Geol. Surv. Prof. Paper No. 71, pp. 257, 401, 425-427, 500, 503-504, 579, 585-587, 590, 706, 721-722. Washington, 1912.

Geologic maps of Guatemala are found in the papers by Sapper (13), (15), and (16), and by Willis (20).

Mining Important to Bolivia

Practically 88 per cent of the total exports of Bolivia in 1919 consisted of minerals. This fact is emphasized in a report on Bolivia made by Trade Commissioner W. L. Schurz to the Department of Commerce. In the report he states that the mining industry forms the basis of the economic life of Bolivia to a degree unknown in any other South American republic. In some sections of Bolivia, Mr. Schurz states, oil seepages are so plentiful as to allow the recovery of the crude petroleum with buckets. It long has been used by the natives of eastern Bolivia for local purposes.

Esthonian Oil-Shale Industry To Receive State Aid

BY REUTERS SERVICE

J. Kukk, Minister of Trade and Industry, Esthonia, in a recent speech made in the State Assembly, said in part:

"Esthonia's third important source of natural wealth is oil shale. In Esthonia there is a stretch of land, between Narva and Rakvere (Wesenberg), about eighty versts long and ten wide, the so-called oil-shale field. The deposit contains 40 to 60 per cent of organic substances and about 30 per cent of combustible matter. The university of Tartu and the Petrograd Academy were already investigating the deposits ten years ago. During the war, when the need for fuel was the most burning question, an oil-shale board was established and is still furthering the progress of the industry under government supervision. Great hopes were placed on the industry and large sums were spent by the government in investigations.

"As a state concern, the oil-shale industry has remained a mere shale mining business. Oil shale is mined and the lumps are put into heaps and then carted to cement factories, railway pump houses or wherever there is a demand for it, and the shale is also used on certain locomotives and at the Reval gas factory for fuel.

"The entire oil-shale resources are estimated at a billion and a half tons, and centuries will elapse before they are all consumed. There is no danger in using it in its present state until a definite and practicable method of distillation and recovery is discovered. Last year three million poods of oil shale were mined. This year the output will be increased to five million poods.

"The oil shale contains from 20 to 30 per cent of raw oil, and if we can profitably distill the oil our industrial life will have taken a big step forward. Experimenting with the retort system is taking place now at Kohtla. The results will be reported in the near future, and after passing through the period of experiments we may look forward to the initiation of practical development work.

"Taking into consideration the capital that has been already invested, namely 75,000,000 marks by Esthonia and 2,000,000 roubles by Russia, and what yet remains to be done, we see that experimenting and investigations still require big sums. Together with the establishment of state concerns the government is inviting foreign capital and local business men to invest in the mines. Last year the board introduced a concessions bill, and in conformity with the terms the government has given preliminary permission to companies and individual business men to proceed with the steps that are necessary for the working of the mines.

"In connection with the oil-shale industry there arises the question of transport. If oil-shale distilleries develop into a large profitable industry, whether under state or private ownership, its production will exceed local consumption and we shall have to consider the question of export.

"Now that the government is introducing a bill and asks for 75,000,000 marks to further the oil-shale industry the members should consider the question seriously. The money will be spent building workmen's cottages and constructing new railways along the mine areas."

Technical Papers

Radium—The September issue of *Radium* (Pittsburgh, Pa.; price, 25c.) contains a twenty-two-page article describing the different radium emanations, their effect on normal tissues, and their use in the treatment of disease. Radium emits three kinds of rays—alpha, beta, and gamma—their respective proportions being approximately 10,000:100:1. The alpha rays consist of a stream of particles carrying a positive electrical charge projected with a velocity about one-fifteenth that of light. They can be deflected by intense magnetic or electric fields, and are readily absorbed by thin metal, glass, paper, rubber, or a few centimetres of air. Their therapeutic power is negligible. The beta rays consist of negative electrons projected with velocities of the same order as the velocity of light. They are, in type, identical with the cathode rays developed in a vacuum tube. Their penetration is much greater than the alpha rays, and generally speaking they will pass through 0.2 mm. of aluminum. The gamma rays are very penetrating and cannot be deviated by a magnetic or electric field. Their true nature is still undetermined, but they are analogous in many respects to very penetrating and powerful Roentgen rays.

Mining in Colorado in 1920—The annual report of the Colorado Bureau of Mines for 1920 has been issued, and may be obtained on request to the Bureau of Mines, State Capitol, Denver, Col. The depression in the metal markets of the world caused conditions to be more depressed in this state than at any time since 1893, according to the report, although the amount of zinc, lead, and copper produced was greater than in 1919. Activity was stimulated in the carnotite districts by the increased demand for radium. Tungsten and molybdenum mining was dormant and fluorspar production fell off toward the end of the year. A small amount of mica was mined, and there is a possibility that its production may be increased. Nothing of importance is yet reported from the oil-shale field in the northwestern part of the state, though several large oil companies have acquired land and are experimenting with shale-oil education and refining. The bulletin gives a list of all operating mines by counties, also the situation of the mine, the operator, the post-office address and the character of product.

Mine Ventilation—The ventilation of dead ends in mines is discussed in a three-page article in the September issue of *The Mining Magazine* (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.). The use of canvas tubes and of the Ventwal patent joint is described as being a satisfactory solution of most such mine-ventilation problems.

Concrete Storage Bins—The Portland Cement Association, New York City, has issued a fifteen-page pamphlet describing concrete bins and pits for coal storage, which illustrates many of the various forms used for both open-air and under-water storage. By the use of concrete, danger of fire from external causes is removed and the structure also requires little or no maintenance. A concrete pavement greatly facilitates reclaiming, and prevents the inclusion of dirt in removing the contents of the bin.

Mineral Statistics—The Imperial Mineral Resources Bureau has issued a statistical summary of world production, exports, and imports of the principal metals and minerals from 1913 to date. This bulletin is of the same nature as those of the Metallgesellschaft and the American Bureau of Metal Statistics, reviewed in these columns on July 16, but covers a somewhat more extensive list of minerals. The bulletin contains 114 pages, and may be obtained for 3s. 2d. postpaid from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2.

Peru—A report of the mineral industry in Peru in 1919 is contained in Boletín del Cuerpo de Ingenieros de Minas del Perú, No. 100, obtainable from the Ministerio de Fomento, Lima, Peru.

Canadian Oil Fields—The Department of the Interior, Ottawa, Canada, has recently issued an eight-page pamphlet, "New Oil Fields of Northern Canada," by F. H. Kitto. Data relative to oil regulations, transportation, climate, accommodations, and possible routes of travel to the Mackenzie district are given. A map showing the transportation routes to the region is included. This is the second edition of this pamphlet, and may be obtained on request.

Las Dos Estrellas Gold Mine—In *The Mining Magazine* for August (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) appears a five-page article descriptive of the property of the Dos Estrellas Co. at El Oro, Mexico. The author is T. S. Saunders, who was formerly manager of that property.

Oregon Oil and Gas—A report on "Oil and Gas Possibilities of Eastern Oregon," by John P. Buwalda, has recently been issued by the Oregon Bureau of Mines and Geology (Vol. 3, No. 2). The survey covers about half of the state, the western portion having been investigated and reported upon last year by the bureau in Vol. 3, No. 1 of the "Mineral Resources of Oregon." The report states that eastern Oregon cannot be regarded as impossible territory for oil and gas in commercial quantities, but is rather improbable. The possibility of a commercial gas supply is somewhat better, the Ontario-Vale regions affording the best chances. The likelihood of developing a large output does not seem very good, however.

Petroleum Laws—The U. S. Bureau of Mines, Washington, D. C., has issued Bulletin 206, "Petroleum Laws of All America," by J. W. Thompson, obtainable on request from the Bureau. The main source of this report has been the State Department, which obtained, through its consular service, the laws relating to Mexico, Central and South America, the various states of this country and Canada. The collection includes those laws now in force as far as possible, considering the agencies engaged and the time required for the transmission of mail. The bulletin is somewhat voluminous, containing 645 pages of data covering the subject under discussion.

African Mining Laws—Vol. 1 of the series devoted to the "Mining Law of the British Empire and Foreign Countries" was devoted to Nigeria, and was reviewed in the *Engineering and Mining Journal* of Dec. 25, 1920. Vol. 2 is now available, this being devoted to the mining laws of West Africa. It may be obtained for 15s. 6d. from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2. The third volume, on the Transvaal, is now in preparation.

Tunnel Driving—The Michigan College of Mines *Alumnus* for June, 1921 (Houghton, Mich.), contains an article, "Mohawk and Wolverine Tunnel at Gay, Michigan," by W. R. Bolley, superintendent of the Wolverine Copper Mining Co. at Kearsarge, Mich. The article describes the driving of a tunnel 2,468 ft. into Lake Superior. Costs of the work are included.

Mineral Resources—Recent publications in the Mineral Resources series include "Platinum and Allied Metals in 1920," thirteen pages; "Copper in 1919," seventy-seven pages; "Peat in 1920," three pages; "Abrasive Materials in 1919," six pages; "Fuel Briquets in 1920," three pages; "Graphite in 1920," six pages; "Strontium in 1920," three pages; "Arsenic, Bismuth, Selenium, and Tellurium in 1920," twenty pages; "Fluorspar and Cryolite in 1920," fifteen pages; and "Cement in 1919," seventeen pages.

Limestone—Producers and users of limestone and lime will be interested in the Sept. 10 issue of *Rock Products* (Chicago, Ill.; price, 25c.), which has several articles in this subject. These include "Lime in the Chemical and Allied Industries"; "Needed, Complete and Reliable Analyses of Limestones"; "A New 'Wet' Process of Lime Manufacture"; "Lime in Extraction of Potash from Greensand," and "Lime for Refractory Silica Brick," as well as several others.

Geology and Resources of Trinidad—In *The Mining Magazine* for September (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) H. B. Milner summarizes the present knowledge of the geology of the Island of Trinidad, with special reference to the mode of occurrence and storage of its oil.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Meeting of Canadian Institute in Edmonton, Alberta

Three-Day Sessions Include Discussions of Government Mineral Resources, Mining Laws, and Petroleum Possibilities

SPECIAL CORRESPONDENCE

THE Third Annual Western Convention of the Canadian Institute of Mining and Metallurgy was held Sept. 14-16, at the Macdonald Hotel, Edmonton, Alberta, with an attendance of nearly one hundred members, including several from eastern Canada. O. E. S. Whiteside, of Coleman, Alberta, occupied the chair. Addresses of welcome were delivered by Mayor D. M. Duggan on behalf of the city, and by Premier Greenfield, representing the provincial government of Alberta, who spoke on the research work of the government in connection with the mining industry. Chairman Whiteside in reply said that the Institute would be glad to co-operate in this work with the government.

A paper on "Canada's Coal Problem," by C. V. Corless, president of the Institute, was read by George C. McKenzie. At the afternoon session Dr. Edgar Stanfield read a paper on the air drying of coals, which was followed by an interesting discussion. Dr. K. S. Clark gave an address on bentonite, or soapstone, expressing the opinion that its use might provide a solution of Alberta's road problems. He stated that a number of experiments with the object of utilizing it for road construction were now in progress at the University of Alberta.

President Henry M. Tory of Alberta University spoke on research, contending that the future of the British Empire depended on men of the engineering type. In the years to come the place of the man of science would be greater in the affairs of the world than it had been in the past. A smoker and concert was held in the evening.

On the second day the morning session was devoted to ten-minute talks on the coal field of Alberta. Dr. D. B. Dowling, of Ottawa, who presided, outlining the various formations and the possibilities of the several fields. In the afternoon Prof. Robert C. Wallace, of the University of Manitoba, gave an address on "The Control of the Mineral Resources of the Prairie Provinces," strongly advocating decentralization of control. He referred to the spirit of initiative and resourcefulness in developing their natural domain which had sprung up in Ontario and British Columbia through ownership and administration of their natural wealth, and argued that like results could not be expected in the West until

the power was vested not in far-off Ottawa, but in the provincial governments.

Thomas W. Gibson, Deputy Minister of Mines for Ontario, indorsed many of the suggestions made by Dr. Wallace. He foresaw many difficulties in the way of framing mining laws when the control of mineral resources was transferred to the Western provinces, and suggested that the Institute should draft a model mining law and recommend its adoption by the provincial legislatures before the transfer was made.

Dr. J. A. Allan, of the University of Alberta, thought that the collection of information on natural resources was the duty of the federal rather than the provincial authorities. He said that during the last summer not a single geological party had been centralized in Alberta, whereas no less than seven had been engaged in British Columbia.

Dr. M. Y. Williams, of Vancouver University, in reply to this statement, said that the present condition was due to the resignation of a number of federal geologists, including two who had spent their whole time in Alberta. He thought there could be a satisfactory adjustment between the federal and provincial departments. There was, however, some danger that when the mineral resources were handed over to the prairie provinces, a lessened interest would be taken in these provinces by the Department of Mines.

Dr. John McLeish, of Ottawa, read a paper on "Mineral Industry," showing the necessity for Canada seeking to develop her resources. The country was importing minerals greater in amount than her total mineral production, being dependent on outside services for 50 per cent of the coal supply, and in iron Canada furnished only 5 per cent of her own needs, and in petroleum less than that proportion.

The session closed with a discussion on "Dominion Mining Legislation," led by W. Dixon Craig, N. C. Pitcher, and Dr. J. A. Allan.

In the evening a banquet was held at the Macdonald Hotel, with O. E. S. Whiteside in the chair, the principal speakers being ex-Premier Charles Stewart, Hon. George Hoadley, Mayor Duggan, and A. U. G. Bury.

The third day's proceedings opened with a paper by George Sheppard, geologist for the Imperial Oil Co., on

"Recent Development Work Relating to Petroleum in Western Canada," dealing with operations in the Northern fields, Central Alberta, the Irma district, and southern Saskatchewan. He estimated that by the end of the year, with the results of at least four wells in the Northern field and one at Windy Point nearing completion, there will be a chance to give a fair estimate of the potentialities of this great Northern field. Until the results of the present season's drilling are available it will be impossible to say whether the Norman field will be a commercially practicable development or not.

In summarizing the results of the drilling at Czar, Alberta, he stated that from a commercial point of view they were of no value. Little gas and negligible traces only of oil were observed, and therefore the well was abandoned after all the possible oil horizons had been penetrated at a depth of 3,500 ft. As yet the foothills zone of the Western provinces had proved to be the most satisfactory area for possible oil development, as there the most favorable structures occur for the accumulation of petroleum.

Dr. D. B. Dowling spoke on "The Geological Structure in the Fort Norman District," describing the formations entered by the Mackenzie River at Fort Simpson, and the mountains paralleling the river, which has the Mackenzie range on the west and the Franklin range on the East far below Fort Norman.

Dr. M. Y. Williams gave an account of the field work done by Dr. Hume, Mr. Whittaker, and himself in the Mackenzie River district during the last summer. These explorations were carried on on both sides of the river between the foot of Great Slave Lake and Fort Wrigley, the Horn Trout, Beaver, North Nahanni, Root and Willow rivers being traversed and mapped for a considerable distance.

Mining and Electrical Engineers Hold Joint Meeting

The San Francisco Section of the A. I. M. E. met on Sept. 23 with the local section of the American Institute of Electrical Engineers. The following papers were presented: "Rates of Electricity in Mining Industry," by R. E. Fisher; "How Operations About a Mine or Metallurgical Plant Can Be Scheduled To Fit a Power Contract," by B. B. Beckett; "The Application of Electric Equipment in Connection With Mining and Milling Operations of the Alaska Gastineau Mining Co.," by B. L. Thane, and "Prevention of Electrical Accidents in Metal Mines," by R. L. Eltringham.

MEN YOU SHOULD KNOW ABOUT

Walter X. Osborn has been appointed manager of the Rowley Copper Mines Co. at Gila Bend, Ariz.

R. A. Bryce has been appointed consulting engineer of the Comfort-Kirkland Mining Co., of Ontario.

William Myers has been engaged by the U. S. Bureau of Mines as a member of its non-metals investigating staff.

Harry T. Hamilton, general manager of the Moctezuma Mining Co., recently inspected mines on the Mesabi iron range.

George H. Clark, of Birmingham, Ala., has gone to northeast Texas to report on an oil property for New York interests.

A. W. Newberry has returned to New York from the West, where he examined mining properties in Montana, Idaho and Colorado.

Virgil Kirkham, Idaho State Geologist, was at Hope, Idaho, in September, investigating oil indications near the mouth of the Clark's Fork River.

Frank G. Stevens, consulting engineer, in Canada, of Makeever Brothers, has been placed in charge of the mining and oil operations of that company, with headquarters at Boston.

F. W. Farnsworth, president, and K. F. Williams, vice-president, of the Chippewa Iron Mining Co. were in Duluth, Minn., last week on business relative to the operation of the Armstrong Bay mine.

Frank Ayer, superintendent of mines for Phelps Dodge Corporation at its Pilares Mines, in Sonora, Mexico, is in Jerome, visiting the United Verde and the United Verde Extension copper mines.

R. C. Allen, geologist for Oglebay, Norton & Co., was a recent visitor in the Lake Superior district, where he examined some of the mines of his company, including the Miller mine, at Aurora, Minn.

I. O. Jones, assistant superintendent of furnaces for the Wisconsin Steel Co., Chicago, accompanied by B. W. Batchelder, general superintendent of mines, recently inspected the company's properties on the Mesabi range.

Ernest N. Patty, of the Washington State Geological Survey, has gone to the Washington State College, Pullman, Wash., to take care of the classes of Dr. Shedd, head of the geology department, who is on leave of absence.

Walter J. Eaton, for the last four years with the American Metal Co. interests in Mexico, has resigned as superintendent of the Naica and Santa Eulalia units of the Cia. Minera de Penoles, S. A., to accept the position of mine superintendent at the Smugler-Union, at Telluride, Col.

E. H. Wells, who conducted special geological investigations for the Chino

Copper Co., at Santa Rita, N. M., in 1920 and this year, is the new president of the New Mexico State School of Mines at Socorro. Other newly elected members of the faculty are: W. T. Quayle, mining and metallurgy; J. W. Jourdan, civil engineering; R. E. Bowman, chemistry; W. C. Ramlow, instructor in civil engineering; C. W. Vaupell, geology and mineralogy; and E. C. Studley, who will teach academic subjects and coach the athletic teams.

W. J. Woolsey, Thetford Mines, Quebec, leaves soon for California, where he will build an asbestos mill for the Pacific Asbestos Corporation, in Calaveras County. Mr. Woolsey has been prominently associated with the asbestos and chrome industry for the last five years on the engineering staff of the Asbestos Corporation of Canada,



W. J. WOOLSEY

Ltd., and previously as manager for the Robertson Asbestos Co., Thetford Mines, and traveling salesman for the Johnson Asbestos Co., in the United States and Europe. He is a graduate of the School of Mining, Kingston, Ontario, and after graduation took a post-graduate course in McGill University, Montreal, and in the Mining Academy at Clausthal, Germany. He has contributed several papers on petrography and mining, and is a member of the C. I. M. M. and the A. I. M. E., and has acted as secretary for the Thetford Branch of the C. I. M. M. from its inception.

Mining and metallurgical engineers visiting New York City last week included: W. A. Rukeyser, Montreal, Quebec; S. F. Shaw, Sierra Mojada, Mexico; H. H. Howry, Chicago, Ill.; E. H. Jones, Mountain, Ontario; C. B. Murray, Cleveland, Ohio; F. W. Brooke, Philadelphia, Pa.; H. Kamura, Japan; L. A. Mylius, Urbana, Ill.; E. A. Holbrook, Washington, D. C.; Herbert A.

Tumin, Buffalo, N. Y.; A. E. Dahlke, Portland, Ore.; and O. U. Bradley, Muskogee, Okla.

SOCIETY MEETINGS ANNOUNCED

Utah Metal Mine Operators' Institute will hold meetings at the Salt Lake Commercial Club on Oct. 7 and 8. The institute is under the auspices of the American Mining Congress and the Utah Section of the American Institute of Mining and Metallurgical Engineers. A number of interesting papers will be presented.

American Institute of Mining and Metallurgical Engineers will hold the regular monthly meeting of the New York Section at the Machinery Club, 50 Church St., on Oct. 5, at 8 p. m., following an informal dinner. Brief talks on the subject of "The Problems and Progress of Iron and Steel Metallurgy" will be given by the following: J. Cavalier, professor of metallurgy, University of Toulouse, France; John Vipond Davies, president, United Engineering Society; John A. Matthews, president, Crucible Steel Co. of America; Bradley Stoughton, consulting metallurgist, New York, and William Campbell, professor at Columbia University.

OBITUARY

Alton L. Dickerman, aged seventy-one years, died at his home in Sioux City, Iowa, on Sept. 17.

Thomas J. Chope, of the Anaconda Copper Mining Co., died last week in Butte of peritonitis. He was one of the best-known mining men in the Northwest, and long had been identified with the Anaconda. He was the first appointee of the Anaconda as labor commissioner, an office designed to bring the company into closer touch with its employees, and the success attained by Mr. Chope was marked.

Henry J. Kimman, since 1902 manager of the Cleveland plant of the Chicago Pneumatic Tool Co., died in Cleveland, Ohio, on Sept. 7. He was born in Harlem, Holland, in 1863, and emigrated to America with his parents and settled in Chicago in 1870. In collaboration with his brother, T. P. Kimman, he designed and built the first practical portable piston air drill. Soon after engaging in the manufacture of air drills he joined with E. N. Hurley in forming the Standard Pneumatic Tool Co. in 1898, and he became associated with the Chicago Pneumatic Tool Co. in the consolidation of pneumatic tool interests in 1901, at which time he became manager of the Cleveland plant of the Chicago Pneumatic Tool Co. and remained in active charge of the plant until his death.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

From the Birmingham district of Alabama it is reported that the iron-making industry is beginning to show signs of definite improvement. Here and there the unemployment situation seems a little brighter elsewhere, particularly in the Joplin-Miami district, where several properties are resuming. In Butte, Anaconda is said to be easing the situation somewhat by taking on some men. Increasing activity in the gold-mining district of the Black Hills of South Dakota and in southwestern Oregon is reported. Elsewhere, also, this industry appears improving. In view of this, it is interesting to hear from Washington that twenty-two Western Senators are seeking to get speedy action on the McFadden gold bonus bill. Mr. Wooton, our Washington correspondent, also gives in this issue a list of the numerous co-operative agreements just signed by the Bureau of Mines for the current year.

In Mexico, conditions are looking very promising, now that the menace of Article 27 of the Constitution is removed. In this issue much activity is reported in those districts in Sinaloa and Durango tributary to Culiacan. The A. S. & R. Co. is reported to have bought the San Juan de Gracia mine.

Two interesting discoveries of ore are reported this week: one of high-grade iron ore in the Kennedy mine on the Cuyuna Range, greatly adding to the company's reserves, and the other of rich silver ore in the Old Dominion mine, near Colville, Wash., a mine thought to be almost worked out.

Date Set for Butte & Superior Hearing

The hearing on the accounting in the suit of the Minerals Separation company against the Butte & Superior Mining Co. has been set for Oct. 31 at New York, where it will be easier for counsel engaged in the case to assemble than it would be in Butte. Several months ago Federal Judge G. M. Bourquin named Louis P. Donovan, an attorney of Butte, as master in chancery to hear evidence. The hearing will be had on the damages the Butte & Superior must pay for infringement of the flotation patents held by Minerals Separation.

The Sylvanite Gold Mine in Southern Oregon Oregon-Pittsburgh Mining Co. Organized To Work Properties in Gold Hill District Credited With Moderate Production in Past—Proposed To Erect 100-Ton Milling Unit

By A. E. KELLOGG

Written for *Engineering and Mining Journal*

A DEAL that is the forerunner of a general resumption of gold mining in the district of Gold Hill, Ore., was announced recently, whereby a new company organized under the laws of Arizona as the Oregon-Pittsburgh Mining Co. has taken over the Sylvanite group, three miles north of Gold Hill. The history of this group dates back to the early 90's, when Cox and Lyman, two local miners, recovered many thousand dollars in gold only a few feet below the surface on what is now known as the Cox and Lyman vein, a stringer of the main Sylvanite vein. The Sylvanite group also includes the Cheney, the Simmons, as well as several groups held by Ray and Haff, local operators. All these properties were producers before the Cox and Lyman strike. It is safe to say that from the various strikes made by all operators a total of \$150,000 in gold has been taken from the property.

The first attempt to consolidate these properties was made about twelve years ago, when, with the exception of the Ray holdings, they were leased to the Sylvanite Mining Co. This undertaking failed. In 1914, G. L. Haff and H. A. Ray, holding several adjoining properties, leased the Cox and Lyman, Cheney, and the Simmons mine, and undertook to develop the whole group, with fair success.

In March, 1916, tungsten was discovered by the lessees in the Haff tunnel, which they were driving. The tungsten was found with the gold ore in the form of scheelite. It occurs in small stringers with quartz and averages less than 2 per cent tungstic acid. The tungsten resources of the property have not yet been determined.

In 1916, J. G. Davies, of Sacramento, Cal., and local investors bought the Ray and Haff interests. They succeeded in recovering about \$50,000 in the course of development work. This was spent on further development and in building the present ten-stamp mill, used for treating the free-milling ores.

In 1919, Victor W. Brown and associates, of Pittsburgh, Pa., took an option on the property and continued development until recently. Following

this the present company was organized. According to L. H. Van Horn, engineer in charge, a mill of at least 100 tons' capacity is to be erected.

A large area of northwestern California and southwestern Oregon has been designated by the United States Geological Survey as having been an island in the ocean during Cretaceous times. It is termed by Winchell the "great Siskiyou batholith." Most of its mass is granite, or granitic in character, accompanied with other intrusive and igneous rocks, such as diorite, porphyry, and other intrusions of ancient origin. The elevation in places reaches an altitude of 7,000 and 8,000 ft. Observation shows that all of the placer deposits in this section of the country were along the shore line of this old island. Hence, in these mountains judgment dictates that the source of the gold be sought. The searches thus prompted have proved correct, and numerous mineral deposits are found in the seams and fissures of this old island.

Rogue River Valley lies east and northeast of the Siskiyou Mountains, and the more recent Cascade range of mountains lie east of the valley. The placer deposits occur along the shore line of the valley, and are not found on the Cascade side.

The Sylvanite group is located on this "Siskiyou batholith," on its extreme northeastern shore line. It is on the north bank of Rogue River. From this point the main Sylvanite vein extends to the north for a distance and has been definitely located for about three miles.

The main vein of the group is known as the Sylvanite, or "Big" vein. It strikes N. 22 deg. E. and dips 65 deg. E. It has an average width of 40 ft. The hanging wall is a porphyritic slate. The foot wall is lime carrying other material. The vein carries altered argillite and serpentine, which also is characteristic of the country rock. The main contents of the vein are quartz carrying pyrites and what appears to be a shistose material with sulphides. There is much gold, sometimes free-milling, but often in sulphides. The vein also contains large

boulders, carrying some amphibole and often rich in gold. Galena and occasionally copper stains are found. Silver is also present.

A large number of lateral veins, lying approximately east and west, strike toward the "Big" vein and dip north. As these veins approach the "Big" vein, they curve toward it, turning north, and at the junction are always rich in gold. Five or six of these cross veins have been traced to the junction, and in every instance large bodies of high-grade ore have been recovered. The work which has resulted thus has been very irregular and chiefly near the surface. Many shafts have been sunk, of varying depth up to 400 ft. A large number of drifts

formation of the country rock, largely schistose and broken metamorphosed material. This formation carries no value except where this vein is cut. From the Haff tunnel northerly on the "Big" vein a drift has been driven 375 ft., and the vein continues to maintain its width of 40 to 45 ft. The whole mass is highly mineralized and silicified, bearing gold both free and base, together with occasional bunches of high-grade ore.

About 120 ft. in from the portal of the Haff tunnel a crosscut is driven north 108 ft., and at 28 ft. this crosscut intercepted a vein called the Blind vein. A drift on this vein uncovered an important body of high-grade ore. Continuing this drift 82 ft. further uncov-

work in shafts and drifts. Here have been some of the richest developments in the mine, both in free gold and sulphides. The work on this hillside, extending over a period of forty years by various individuals and companies, has been of such erratic and irregular character that it is impossible to give a description as will carry any definite conception of the situation.

After the closing of the Doan tunnel there seems to have been little system in any of these efforts, until the opening of the Haff, and Cox and Lyman tunnels. The operators seemed to be seeking for bunches of free-milling ore, and on striking sulphides quit. Development shows a remarkable system of veins, all more or less rich, with



SYLVANITE PROPERTY, NEAR GOLD HILL, ORE. ROGUE RIVER IN FOREGROUND. VIEW TAKEN FROM MAIN LINE OF SOUTHERN PACIFIC RAILWAY

have been driven on both the "Big" vein and the crosscut veins, generally with promising results.

What is known as the Doan tunnel was driven early in the history of operations on the "Big" vein. This is the lowest tunnel on this vein and was driven 1,330 ft. on the vein, and throughout its length the vein maintained a width of 40 to 45 ft. Many high-grade shoots were found. Suspension of the work permitted caving and rendered further operation difficult. The tunnel was abandoned, but near one end it was tapped by a shaft. Good ore was taken out during this operation, which still remains on the dump.

Work is now progressing through the Haff tunnel, which is a crosscut tapping the "Big" vein at 630 ft. from the portal, and it is 64 ft. above the Doan level and 350 below the surface. This follows the Hammersly vein for about 135 ft. through rather loose mixed

ered the Scheelite vein, so called because at the surface it yielded scheelite ore. At this point, however, it has developed into a well-defined quartz vein carrying high-grade gold ore, with the scheelite but little in evidence.

Further north and 100 ft. higher than the Haff tunnel on the Iron Dike, a tunnel 525 ft. long has been driven on the Cox and Lyman vein. This vein is from 2 to 5 ft. wide and noted for high-grade ore. At the point where the tunnel cuts this vein there is an upraise into the old workings 120 ft. above. About \$40,000 was taken from this upraise.

At the surface along the line of the "Big" vein are many excavations of varying depths, from which a large quantity of ore has been milled, varying from \$12 to \$100 per ton. Up near the "Saddle" at an altitude of 2,650 ft. and about 1,000 ft. above the lower workings, there has been considerable

free gold at or near the surface and great bodies of rich sulphides as depth is reached.

The Oregon-Pittsburgh Mining Co. has a capital stock of \$3,000,000. Its main office is at 307 Bessemer Building, Pittsburgh, Pa. W. H. Stroup is president and I. C. Palmer, secretary-treasurer. The directors are J. C. Rimgler, A. J. Gould, and F. N. Callback, all of Pittsburgh; Samuel Stone, of Portland, Ore.; and Herbert Shear, of Sacramento, Cal.

Arizona Copper Co. Stockholders To Vote on Sale Oct. 3

The plan of the Arizona Copper Co. to sell its holdings to the Phelps Dodge Corporation has been approved by the directors of the former company. It will be voted upon by the stockholders of the Arizona Copper Co. at a meeting to be held on Oct. 3.

Oil Companies in Galicia To Build Power Station

By Cable From Reuters to "Engineering and Mining Journal"

London, Sept. 26 — A message from Warsaw states that a group of petroleum companies in Boryslav, Galicia, has decided to construct a great electric station to provide current for boring and working the pumps and for other operating purposes. The Minister of Commerce has promised to co-operate for the purpose of creating

an electric system for the whole petroleum base.

Americans Get Gold Concession In Far East

By Cable From Reuters to "Engineering and Mining Journal"

Moscow, Sept. 27—The Sovnet government of the Far East has granted a concession to an American financial group to exploit the gold fields in the Amur region, according to an announcement in the *Krasnaia Gazeta*.

Pyrites Found in Czechoslovakia Near Pressburg

By Cable From Reuters to "Engineering and Mining Journal"

London, Sept. 23 — Dispatches from Prague report that extensive deposits of pyrites have been discovered near Pressburg. It is estimated that the annual yield will amount to about 20,000 wagon loads, which would be sufficient to meet the requirements of the various industries established in Czechoslovakia.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Western Senators Seek Action On McFadden Gold Bill

Secretary of Treasury Urged, If Opposed to Measure, To Formulate Substitute To Protect Industry

Twenty-two Western Senators, led by Senator Oddie, of Nevada, have launched an aggressive movement looking to the stimulation of gold mining. They have called upon the Secretary of the Treasury for definite and detailed comment on the McFadden gold bonus bill (H.R. 5025). They hope to be able to influence prompt consideration of that measure. More than \$80,000,000 worth of gold, says Senator Oddie, is being used in the arts and lost from various causes.

The appeal to the Secretary of the Treasury was made in the form of a resolution, as follows:

Resolved, That the undersigned, members of the United States Senate, urge upon the Secretary of the Treasury the significance of his reply to Chairman Fordney in determining the status of the gold-mining industry, which is vitally important to the maintenance of the gold standard and the financial security of the nation; and be it further

Resolved, That if upon the analysis of the Secretary of the Treasury reasons cannot be definitely assigned for opposing the provisions of H.R. 5025 (the McFadden gold bonus bill), the Secretary is requested to indorse the same in order to expedite the action of the House and permit the bill to be considered by the Senate; and be it further

Resolved, That if the Secretary of the Treasury has specific reasons for opposing the provisions of H.R. 5025, he is hereby urgently requested to formulate a proposal for enactment by Congress: first, to protect the gold-mining industry from destruction, which is a serious matter irrespective of the fact that its operation is necessary as the basis of our monetary system; and second, in anticipation of the heavy foreign drain upon our gold reserve, to provide for augmenting said reserve from sources of domestic production and thereby lessen the need for the further and extensive curtailment of credit which otherwise would result.

Bureau of Mines Signs Many Co-operative Agreements

Scope of Research Greatly Widened Despite Small Appropriation

Practically all of the co-operative agreements between the U. S. Bureau of Mines and the outside agencies for the fiscal year ending June 30, 1922, have been signed. Co-operative agreements with the Bureau are made for one year, and are terminated or renewed at the beginning of each new fiscal year. Though the actual cash which in this way is added to the Bureau's appropriations probably will not exceed \$250,000 during the current fiscal year, the scope of the Bureau's research is increased greatly by contributions of supplies, power, technical men, and general expenses which otherwise would have to come from the Bureau's appropriations.

The co-operative agreements of direct interest to the metal-mining industry are as follows:

University of Alabama—To study the problems peculiar to the mineral industry in the Southern States, particularly those problems relating to iron and steel, coal, coke, non-metallic minerals and byproducts.

University of Arizona—To study problems connected with the mining and smelting of low-grade copper ores in the Southwest, particular attention being paid to the sulphur dioxide leaching of low-grade copper ores and the precipitation of copper from sulphate solutions.

University of California—To handle the chemical end of problems sent in by the mining experiment stations at Reno, Seattle, and Salt Lake City.

State of Colorado—To make investigations and disseminate information with regard to the production of oil from oil shales.

Cornell University, the Vanadium Corporation of America, and the Welsbach Company—To study alloys and electric furnaces.

University of Idaho and the Idaho Bureau of Mines—To study and devise new processes for the better recovery of the values from low-grade and complex gold, lead, silver, zinc, and copper ores of Idaho, especially those of the

Cœur d'Alene and Pend' Oreille districts.

University of Illinois and the Illinois Geological Survey—To study mine ventilation and the utilization of Illinois coals for the production of gas.

University of Minnesota—To study the iron ore problems of the United States.

University of Nevada—To study the rare and precious metal problems of the United States.

University of Missouri—To study existing processes and to devise new ones with a view to increasing the recovery of values from lead and zinc ores.

Ohio State University—To increase efficiency in the utilization of mineral substances necessary to the ceramic industry.

University of Utah—To study the volatilization process as applied to the low-grade lead and zinc ores of Utah; the application of the volatilization process to the reduction of lead fumes and to the recovery of silver, lead and copper from low-grade and complex ore, and to study various ore-dressing problems of the West.

University of Washington—To study electrometallurgical problems of the Pacific Northwest, and problems in washing Alaska and Washington coals.

Arizona Copper Co.—To study problems relating to the leaching of partly oxidized copper ores.

Central of Georgia Ry. Co.—To conduct investigations of Georgia kaolins, clays and bauxites.

Morris P. Kirk, Harbor City, Cal.—To study volatilization of silver and lead from ore and the reduction of the volatilized fume into metallic bullion.

Utah Industrial Commission—To investigate sanitation and safety conditions and appliances best adapted to prevent accidents and improve health in mines, mills and smelters.

E. I. du Pont de Nemours & Co.—To study explosives for detonating.

National Safety Council—To conduct technical safety service work.

War Department, Navy Department, and National Research Council—To continue research work on explosives.

The purchases of silver by the Bureau of the Mint during the week ended Sept. 24 totaled 164,436 fine ounces, making the total purchases under the Pittman Act 73,228,866 oz.

Mine Taxation Bill Introduced in Senate

The following provisions of the tax bill introduced in the Senate Sept. 21 by Senator Penrose, of Pennsylvania, chairman of the Senate Finance Committee, are quoted by a bulletin of the American Mining Congress:

"Sec. 204. (a) That as used in this section the term 'net loss' means only net losses resulting from the operation of any trade or business regularly carried on by the taxpayer (including losses sustained from the sale or other disposition of real estate, machinery, and other capital assets, used in the conduct of such trade or business); and when so resulting means the excess of the deductions allowed by section 214 or 234, as the case may be, over the sum of the following: (1) the gross income of the taxpayer for the taxable year, (2) any interest received free from taxation under this title, (3) the amount of deductible losses not sustained in such trade or business, (4) amounts received as dividends and allowed as a deduction under paragraph (6) of subdivision (a) of section 234, and (5) so much of the depletion deduction allowed with respect to any mine, oil or gas well as is based upon discovery value in lieu of cost. Paragraph (b) provides that such a net loss sustained by any taxpayer may be deducted from the net income of the taxpayer for the succeeding taxable year.

"Sec. 211. (b) In the case of the bona fide sale of mines, oil or gas wells, or any interest therein, where the principal value of the property has been demonstrated by prospecting or exploration and discovery work done by the taxpayer, the portion of the tax imposed by this section attributable to such sale shall not exceed, for the calendar year 1921, 20 per centum, and for each calendar year thereafter, 16 per centum, of the selling price of such property or interest.

"Secs. 214 (a) (10) and 234 (a) (9) In the case of mines, oil and gas wells, other natural deposits, and timber, a reasonable allowance for depletion and for depreciation of improvements, according to the peculiar conditions in each case, based upon cost including cost of development not otherwise deducted: Provided, that in the case of such properties acquired prior to March 1, 1913, the fair market value of the property (or the taxpayer's interest therein) on that date shall be taken in lieu of cost up to that date; Provided further, That in the case of mines, oil and gas wells, discovered by the taxpayer, on or after March 1, 1913, and not acquired as the result of purchase of a proven tract or lease, where the fair market value of the property is materially disproportionate to the cost, the depletion allowance shall be based upon the fair market value of the property at the date of discovery, or within thirty days thereafter; And provided

further, That such depletion allowance based on discovery value shall not exceed the net income, computed without allowance for depletion, from the property upon which the discovery is made, except where such net income so computed is less than the depletion allowance based on cost or fair market value as of March 1, 1913; such reasonable allowance in all the above cases to be made under rules and regulations to be prescribed by the commissioner, with the approval of the secretary. In the case of leases the deductions allowed by this paragraph shall be equitably apportioned between the lessor and lessee."

It is stated unofficially by representatives of the Bureau of Internal Revenue that the above change will not affect mines and that it will be applicable under certain conditions only to oil companies, according to the bulletin of the Mining Congress.

Assessment Work Year Bill Signed

The bill changing the assessment work year so as to coincide with the fiscal year instead of the calendar year was signed on Aug. 24, 1921, and is now Public Law 64. Announcement of this important event was accidentally omitted from the Aug. 27 and succeeding issues.

NEWS BY MINING DISTRICTS

London Letter

Roodepoort United Proposes Copartnership Basis of Operation to Men—White Hope, at Hampton Plains, To Liquidate

BY W. A. DOMAN

London, Sept. 13—An indication of the state of affairs on some of the older low-grade mines of the Rand is to be found in the case of the Roodepoort United. This property has been kept alive for a long time only by the high price obtained for the gold produced. Hopes were entertained that expenses of working would be lowered. Unfortunately, such hopes are unfulfilled; in fact, the tendency seems to be for the level of costs to increase. The mine is one of the General Mining and Finance Corporation group, and, being in the Roodepoort district no high-grade ore is being taken out.

More than a year ago the chairman uttered a note of warning, and indicated that in certain circumstances it would be necessary to cease operations. Later, the serious position was explained to the white miners, who were told that the only hope of keeping the mine going was to retrench 25 per cent of the men, and leave the others to maintain the efficiency at the old rate. Rather than be deprived of employment the men accepted the scheme, and de-

ecided among themselves who should be retrenched. To their credit be it said the experiment has worked remarkably well.

With costs on the up grade, however, and with the price of gold lower, a new situation has arisen. Again the men have been appealed to. It was a question either of shutting down immediately, or of the workers shouldering a greater part of the burden. The proposal is that the mine should be worked on a copartnership basis. The men are to forego half the union rates of pay; next, the interest on the company's debt is to be paid; then the first charge on the proceeds is to make up wages. Any remaining surplus is to be divided between the men and shareholders. There is certainly a spice of speculation in this arrangement, and if it should lead to economy and clean mining there would seem to be a fair prospect for the employees.

The shutting down of the Roodepoort United would, of course, affect more than the mine workers and shareholders. It would create a drainage problem for, say, the Durban Deep, which is an expensive mine to work, the costs being between 33/— and 34/— a ton, an impossible figure without the gold premium. There are no high-grade mines in the Roodepoort district, so that the closing down of the Roode-

poort United would be a serious matter.

It has been evident for several months that numerous mining companies floated to test the new gold field in Western Australia at Hampton Plains were not meeting with the success expected, and some have gone under. The latest, and one of the best known in London, is the White Hope. It had a capital of £80,000 in 10/— shares; a block of them being introduced to the London market at £4. As gold cannot be found in paying quantities, the directors have decided to wind up. The White Hope was a gamble at the outset, but the public have not made the money. Some of them are still wondering why they paid 80/— for 10/—.

Johannesburg Letter

Transvaal's Gold Output for July Shows Increase—Drilling Largest Item of Underground Costs

BY JOHN WATSON

Johannesburg, Aug. 16—The Transvaal's output of gold in July was made known by the Chamber of Mines on Aug. 10. The total for the month was 689,555 oz. of fine gold, having a value of £3,878,747, an increase over June of 11,065 fine ounces and an increase in value of £231,863. The value for July

is taken at £5.625 per fine ounce, whereas in June the value was £5 7s. 6d. per fine ounce. It must be remembered that July had a day more than June. The principal increases were shown by the Crown Mines, with 4,762 oz. increase over June; Government Areas, with 1,645 oz. increase, and East Rand Proprietary Mines, with 1,218 oz. increase.

The native labor report for July shows that the gold mines of the Transvaal employed 166,999 natives, the collieries 14,688, and the diamond mines 1,246. These figures show a total decrease of 1,240 natives, as compared with June.

The South African Institution of Engineers held its monthly meeting on Aug. 10, when the newly elected president, R. C. Atkinson, gave his inaugural address. He is mechanical engineer to the Central Mining & Investment Corporation, known locally as "The Corner House." In his address, Mr. Atkinson dealt with industrial economics, the study of which he commended to the engineers and to the white workers, generally, on the mines and the reef. Among employees here, he said, the questions of more wages, fewer working hours, and holidays were continually to the front. The question of the amount of work done for wages paid or benefits received was not so much in evidence. He hinted at some of the results which were being achieved through the official investigations now being made on behalf of the industry into the actual running of rock drills underground. Drilling has been found, for example, to be the heaviest item of underground costs, averaging no less than 20 per cent of the whole, with shoveling and tramping second, at 15 per cent. These important trials are not yet complete, but the final results are likely to be published within the next twelve months. Alluding to the report of the Low Grade Mines Commission, the president was in favor of the removal of the color bar and declared his conviction that the white man would benefit mainly and ultimately by the adoption of this measure.

AUSTRALIA

Mount Morgan Appeals Against Assessment on Income Tax for Gold Premium

Melbourne, Aug. 22—The net premium earned during the last half year, after making necessary provision for contingencies, was £444,636, which represents £1 per oz. of standard gold (approximately £1 1s. 10d. per oz. fine) produced by members, as shown by mint certificates lodged with the association during the last accounting period. Of that amount £144,523 10s. was distributed as an interim payment on May 30, and the balance will be payable on Aug. 25.

During July, the association sold 89,888 oz. of standard gold (mint par value, £350,000) at an estimated aver-

age net price of £5 1s. 9. per oz., which is equal to £5 11s. per oz. fine. The average gross price quoted in London for the same month was £5 12s. 9d. per oz. fine.

The Mount Morgan Gold Mining Co., Ltd., has lodged an appeal against its assessment by the Queensland Commissioner of Taxes for income tax on gold premium, and the case will soon come before the Queensland court.

CANADA

British Columbia

Bond on Van Roi Property Relinquished—Ottawa Mill Running on Dump Ore

Silverton—Clarence Cunningham has relinquished the bond held by him on the Van Roi property.

Slocan City—The new mill at the Ottawa mine has been running on dump material since completion, with satisfactory results.

Nelson—The California Mining Co., controlling a considerable acreage of gold-bearing claims on Giveout Creek, made a test run of the remodeled Athabasca mill, which it has under lease, about the middle of September. It is believed that the plant will be able to handle about fifty tons per day, but some additional underground work will have to be done in the mine before that tonnage is continuously available.

Trail—Ore received at the Consolidated smelter during the week ended Sept. 14 totaled 5,115 tons. Shippers were as follows:

Name of Mine	Locality	Net Tons
Company Mines		4,981
Knob Hill, Republic		100
Providence, Greenwood		29
C. N. Trevitt, Republic		5

Ontario

Hollinger Increasing Milling Capacity—Ontario Kirkland's Mill Building Completed

Porcupine—The Hollinger is installing rolls at the shaft to follow the primary crushing. This will reduce the size of the material going to the stamps, and will increase their capacity. It is expected that with this additional installation the mill will be able to handle 4,000 tons per day. The company has declared a 1 per cent dividend, payable Oct. 7.

The Marsh mines is installing a mining plant, and will do underground development.

At the annual meeting of the McIntyre held in Toronto recently, the manager stated that, based on the first two months of the year, the present fiscal year would show a record for the company. The main shaft is down 1,750 ft., and a good grade of ore has been proved to persist to this depth.

Cobalt—The Oxford-Cobalt has decided to continue sinking No. 2 shaft.

At the annual meeting of the Temiskaming held recently it was stated that though the mine at Cobalt was nearly

exhausted, the company's holdings in the Blue Diamond coal mine, in Alberta, pointed to a bright future. During July the Blue Diamond made profits of \$14,433; in August they were \$37,474. The present output is 1,100 tons per day, practically all of which is sold to the railway. This output can be substantially increased if the market improves.

The Reliance Lease will soon start shipping ore to the Bailey mill.

The Temiskaming Testing Laboratories, which was taken over in July by the Department of Mines from the T. & N. O. Ry. Commission, is handling a considerable amount of ore, and if this tonnage is maintained there is no reason to fear that this valuable enterprise will be lost to the mining industry of northern Ontario.

The report of the T. & N. O. Ry. Commission for the month ended Aug. 31 shows that only two cars of ore were shipped out of the camp over the railroad. This report, however, gives little information as to the real output of the camp, as the Nipissing and Mining Corporation ship nothing but bullion, and practically all of the O'Brien ore also goes out in the form of bullion. At the present time both the Coniagas and La Rose ore is being treated by the plant of the Mining Corporation, and the resultant product is shipped out in the form of bullion.

At the Frontier mine, in South Lorraine, good ore has been found on the 300 level.

Kirkland Lake—During August the Lake Shore milled 979 tons of ore, and recovered \$42,274, or an average of \$21.36 per ton.

It is reported that a promising surface discovery has been made on the LaBelle lode claims.

The Kirk Gold Mines, Ltd., has increased its capitalization from 2,000,000 shares to 4,000,000 shares of \$1 par.

The Comfort-Kirkland is installing a new compressor, and has started to sink a shaft.

The Sylvanite is sinking a new shaft west of the old one, which was considered to be too small for the scale of operations that has been planned.

The mill building of the Ontario Kirkland is practically finished, and most of the machinery is on the ground. The company believes that it will be able to start producing by Jan. 1.

Teck-Hughes is making an addition to its mill, which will bring the capacity from 100 to 160 or 180 tons per day. The recovery, including New York premium, is in the neighborhood of \$11 per ton, and the costs are approximately \$6. It is understood that there is no possibility of the bond holders taking the property over.

Development work on the Argonaut property continues to be satisfactory. The company's mill was burned down some months ago, and it is not expected that rebuilding will start until winter, when timber can be obtained from the bush.

MEXICO

Sinaloa

San Jose de Gracia Mine Reported Sold to A. S. & R. Co.

Culiacan, Sept. 12—The San Jose de Gracia mine, in the Sinaloa district of the State of Sinaloa, is reported to have been purchased by the American Smelting & Refining Co. for \$150,000. This property has a record of having produced a large amount of gold in the last twenty-five years. It is equipped with a 100-ton stamp mill and cyanide plant. An all-sliming process is used and a good extraction is made. This property was confiscated by the Carranza government in 1914. The government worked the property to full capacity as long as supplies and bonanza ore were in sight. When these began to run low it turned the property back to the owners, Tarriba and Paraza. Undoubtedly the mine was left in bad condition.

Mocorito—The Potrero Mining Co., in the Mocorito district, is working its ten-stamp mill at full capacity. This is a gold property.

The Palmarito Leasing Co., in the same district, is crosscutting from the 100 level of its three-compartment shaft. There is native silver at that depth, and the whole vein is running about 20 oz. silver. This ore carries only about 1 oz. in gold to 5,000 oz. in silver. It is planned to enlarge the mill to 500 tons' daily capacity. With the installation of a new power plant the company will eventually be one of the large silver producers of Mexico.

Badiraguete—The San Luis Gonzaga mine, in the Badiraguete district, which is under option to F. E. Avery and associates, of Columbus, Ohio, is continuing development work on a large scale. The company has developed water power and will soon install compressors and air drills. This property has been a large silver producer, and has large tonnage of milling ore available for treatment by a combination of flotation and cyanidation. E. B. Holt is manager.

Santiago de los Caballeros—The Los Tajos group of mines, in Santiago de los Caballeros, is under option to Eastern people who will soon begin examination, with a view to purchase. This mine was caved by the owner when he was obliged to leave the country on account of the revolution in 1912. It is claimed there is a large tonnage of 50-oz. silver ore, and because of the caving of the openings there is little likelihood of any of the high-grade having been stolen.

Santa Cruz de Ayala—In the district of Santa Cruz de Ayala, Sinaloa, Frank H. Noble and associates have installed a cyanide plant to treat about 7,000 tons of mill tailings. These tailings are residues from concentrates made in years past by the old West Coast Co. A good extraction is obtained by re-grinding and treating everything as slimes.

Early recognition of the Mexican

government is being anticipated by a number of reliable mining companies and individuals, which is evident in the number of new denouncements being made and of the properties being taken under option and actually bought outright by far-sighted investors.

Durango

Rich Ore Opened in San Juan de Mata Mine—Zalate Mine Sold

Copalquin—In the Copalquin district of extreme western Durango the San Juan de Mata mine, which was recently sold by the Rocha company, of Mexico City, to Filer & Innes, of San Francisco, is said to have opened up some wonderfully rich new orebodies. Development work and cleaning out of the old workings has been going on continuously since the option was taken early this year. It is said that the net valuation of the ore developed while cleaning up the workings is many times that of the price of the mine.

Tamazula—The Zalate mine, in the Tamazula district of western Durango, has been sold to Ramon Espinosa. This property has been held for a number of years by the commercial house of Wohler Bartning. The mine is one of the famous *antiguas*, and has produced millions of ounces of silver, mainly by the patio, amalgamation and chloridation processes. The shipping ore carries from 1,500 to 2,000 oz. silver, with a good ratio of gold, per ton. The mine has been abandoned for a number of years, but Mr. Espinosa has installed a boiler and modern pumping plant. This with the hoist installed will permit 40 to 50 tons of ore per day to be handled. Metallurgical experiments are being made to determine the best method of treating the milling ore.

The La Bajada mine, also in the Tamazula district, has recently been examined by the American Smelting & Refining Co., with a view to purchase. This is one of the largest mines in the district and is credited with a big production. The price on this property is not known.

The Providencia and Olvidada mines are under option to an English syndicate. These properties are in the Tamazula district, and are gold-copper producers.

ALABAMA

Iron Making Industry Showing Improvement—Seven Stacks in Blast; Twenty-Six or Twenty-Seven Normally

Birmingham—The general iron-making situation in Alabama may be said to be just beginning to show definite signs of improvement. Progress, however, toward normal will, it is generally conceded, be gradual unless material improvement is noted in present market conditions. There are in the state forty bituminous and coke pig-iron furnaces, which have in the past represented a possible annual output of 4,000,000 tons. Of this number there are twenty-seven stacks in and immediately contiguous to Birmingham. Four char-

coal furnaces have been recently active under favorable conditions, none of them, however, being now in blast.

Of the forty coke furnaces, six or seven are probably permanently shut down, being either too small, or definitely scheduled by reason of location to be torn out and rebuilt under the plan of plant consolidation that is favored at present. Approximately thirty stacks therefore represent the present average maximum of capacity in the state, twenty-six or twenty-seven being the usual fair average of normal operations. The average daily capacity of these stacks is 300 tons, although some of the large and modern stacks of the Tennessee Coal, Iron & Railroad Co. at Ensley have made over 600 tons.

The seven stacks at present in blast probably represent recent increases in excess of approximately 25 per cent of normal output. Of this number, four are of the large modern type, being recently constructed furnaces of the Tennessee Coal, Iron & Railroad Co. at Ensley; two are similar modern furnaces belonging to the Woodward Iron Co. and situated at Woodward; and the seventh stack is the furnace of the Central Iron & Coal Co. at Holt, Ala.

During the period of inaction, relining and general repairing has been going on to some considerable extent, so that the general revival of the iron trade will probably find Alabama furnaces prepared immediately to make if not exceed their average annual output of pig iron.

Resumption of activity in the ore mines has naturally kept pace with furnace requirements.

The only definite announcement of the blowing in of new stacks is made by the Alabama company as to its No. 1 furnace at Gadsden, which is scheduled to resume operations on Oct. 1.

MINNESOTA

Cuyuna Range

New High-Grade Ore Reserves Discovered in Kennedy Mine

Cuyuna—An important new reserve of high-grade iron ore has been discovered in the Kennedy mine, which will give this oldest Cuyuna Range property a much extended life. The new lens was discovered by drifting on the 262 level north from the present workings, and has been subsequently checked up by drilling. The main crosscut passed through 200 ft. of high-grade hematite averaging 60 per cent iron. Assays of 65 per cent iron were not infrequent. The new body will be outlined by raising and developing on higher levels, which have been already mined out in other parts of the property. If the concentration extends along the strike as expected, it is likely that the overburden will be stripped and the deposit mined by steam shovel.

William Harrison, George H. L. Crosby, and G. G. Hartley, of Duluth, are among the fee owners of the Kennedy. It has been operated since 1911 by the Rogers-Brown Ore Co. and has

produced a total of 2,022,275 tons. Captain G. A. Anderson is general superintendent.

The Rogers-Brown Ore Co. will ship a part of its 100,000 ton stockpile at the Kennedy mine, and will also make a small shipment from the Meacham mine stockpile. Both properties have been inactive for several weeks.

Crosby—The Inland Steel Co. took on a night shift of seventy men at its Armour No. 2 mine recently, and will push active mining up to the close of navigation. A demand has been made on the property for a considerable tonnage in excess of its yearly minimum requirements, which had already been mined and shipped.

Ironton—The Hillcrest mine has completed the shipment of 100,000 tons of iron ore and 15,000 tons of manganiferous ores and has suspended active operation for the season. The operators, Coates & Tweed, are planning to sink a new drainage shaft for the open pit and to do some check diamond drilling during the winter.

Daily shipments are being continued from the Mahnomen mine by Clement K. Quinn & Co. with one shovel. The Mahnomen produces both manganiferous and straight iron ore grades.

Trommald—The new washing plant of the Marquette Ore Co., which has been in operation for the past month at its Maroc mine, is reported to be giving excellent results. The Maroc orebody is the first deposit of wash ore to be worked on the lower horizon of the Cuyuna formation, and in consequence the operations at this property are being watched with interest by mining men of the district. Already exploration work is under way to locate extensions of this wash ore along the quartzite base of the formation. R. M. Adams, of the Adbar Development Co., is one of those most actively interested in drilling for wash ore.

Brainerd—A suit filed in the district court here against the Merritt Development Co. by the Dower Lumber Co. and various other lien claimants has been postponed from Sept. 20 to Oct. 1, to allow the defendant company to establish its right to being represented by a receiver. The defendants were the operators of the Merritt mines, at Trommald.

Mesabi Range

Railroad Spur To Be Built to Armstrong Bay Mine

Hibbing—In attempting to prevent serious seepage from Mud Lake to the Sweeney pit, the Oliver company has built several 4 to 6-in. siphons about 2,000 ft. long to lower the lake.

The Laura stockpile is being rapidly loaded, and daily shipments are being made.

Virginia—The ore in stock at the Madrid mine is being shipped steadily.

Nashauk—Additional stripping work has been started at the York mine.

The Patrick and Harrison concentrators, operated by Butler Bros., have increased their operations to double shifts. The Patrick is taking ore from the Patrick and Mace No. 2 mines, and the other is working on Harrison ore.

Ely—The stockpiles at the Oliver company's Pioneer and Zenith mines, are being shipped to Two Harbors. Several other stockpiles in this district have been shipped. Most of the mines have been active part of the time this summer.

A contract has been let for building a four and one-half mile spur from the main line of the Duluth & Iron Range R.R. to the Armstrong Bay mine, of the Chippewa Iron Mining Co. The present plans call for laying the steel early next spring.

Mountain Iron—Operations at the Pitt Iron Mining Co.'s Wacootah mine have been resumed. Daily shipments of ore from the open pit are being made.

MICHIGAN

Gogebic Range

Oliver Company's Mines Working Eight Shifts Per month

Ironwood—Mining operations in this district continue at a low ebb. The mines of the U. S. Steel Corporation (Oliver Iron Mining Co.) are working eight shifts per month, and shipments from stockpiles are being made at a reduced rate. Most of the other large mines are shut down completely or are doing only development work. The Steel & Tube Co. recently started filling a 40,000-ton order from its stockpiles at the Anvil and Newport mines; otherwise there has been no work at these big properties. The Davis mine is shut down except for the work necessary in connection with the building of the electrical pumping plant on the 26th level. The pumps have all been taken underground and are now being erected, as is the electrical apparatus in the mine and on surface.

Menominee Range

Hanna Co. Drilling Judson's Unexplored Lands—Little Ore in Stock in Crystal Falls District

Iron River—The shipment of 50,000 tons of ore has been started from the Tully mine. A steam shovel is doing the loading from stockpile.

Alpha—The E. J. Longyear Co. has two drills at work for the M. A. Hanna Co. on lands owned by the Judson Land Co. When the Hanna interests took over the operation of the Judson mine an agreement was made that the former were to have first opportunity to drill the unexplored lands of the Judson company, with the privilege of leasing. It is known that an iron formation exists on the lands now being drilled, and the chances of finding commercial ore are considered good. The Judson is making regular shipments of ore from stock.

Amasa—The Palms-Book Co. is now putting down the second hole on lands under option near Amasa. A large tract was secured early in the year and is to be thoroughly tested. The first hole was put down 500 ft., the formation being encountered.

Crystal Falls—All ore in stock at the Carpenter is to be shipped. A shovel is now at work. New levels are being opened up underground. It is thought that mining will be resumed in the fall.

Ore was shipped from the Monongahela recently. Some underground work is being carried on at this property. The shaft is being trimmed down, and mining will be resumed when the repair work is completed.

The Balkan and Porter are both making shipments. It looks now as though little ore would be left in stock in the Crystal Falls field by the time navigation closes. This should encourage the operators to carry on mining work throughout the winter.

JOPLIN-MIAMI DISTRICT

Oklahoma-Kansas-Missouri

Labor Situation Fairly Satisfactory—Commerce M. & R. Co. Building New Mill—Several Properties Resume

Joplin—The labor situation is considered fairly satisfactory in the district. Although there is no surplus of helpers, it is felt that even such activity as is at present being enjoyed will give employment to all the miners who have remained in the district, and that there will be no suffering or hardships on account of unemployment during the coming winter. The operators would rather that there should exist a slight shortage in help than that there should be a surplus, as that would almost certainly bring distress to the field during the winter.

In referring to the recent transfer of the High Five mine, at Waco, in *Engineering and Mining Journal* of Sept. 10, p. 434, it was stated erroneously that "it is felt certain the Barnsdall people will not be able to co-operate with the American Zinc, Lead & Smelting Co. for this deeper drainage." This was exactly the opposite of what it was intended to say. That is, the negative should have been omitted. Our apologies are due the companies mentioned.

Picher—Construction of a new concentrator has been begun by the Commerce Mining & Royalty Co. on its lease a short distance north and east of the Vinegar Hill Zinc Co.'s Barr mine, in Kansas, north of Picher, Okla. Preliminary development has disclosed a good-sized orebody, and it is expected the mine will prove fully as good as the Commerce company's Webber mine, a short distance to the west, and the Blue Mound mine, also near by, which has been one of the district's bonanzas.

Baxter Springs—The Chanute Spelter Co. has almost completed construction of its new mill a mile north of its Hartley mill, west of Baxter

Springs, Kan., but it is understood the plant may not be started up before Jan. 1 if ore prices do not improve.

Several mines have started, the betterment in lead ore prices being the excuse. The Underwriters' Land Co. started its No. 2 mine, at St. Louis, Okla., on Sept. 19. The Skelton Zinc & Lead Co.'s No. 7 mill, its largest, and situated at Douthat, Okla., and the Fort Worth mill, at Picher, have been started in the last ten days. It is also understood that the Manhattan mine, owned by the United Zinc Smelting Co., in which Charles M. Schwab is interested, will be placed in operation soon.

ARKANSAS

Silver King Lead & Zinc Co. Operating Sure Pop No. 2

Yellville—The Silver King Lead & Zinc Co., which lately purchased the Sure Pop No. 2 mine, producing zinc carbonate, from W. E. Layton, of Yellville, has started operations on the property. The mine is on Water Creek, in Marion County, and during the period of high prices produced a good tonnage. The new owners have cleaned out the tunnels and overhauled the mill, and have it in operation. They will ship their output from Yellville.

Little Rock—The Arkansas Fuller's Earth Refining Co. is exploiting a deposit comprising about 1,500 acres of fuller's earth lands lying in Saline County, Ark., about twenty-three miles northeast of Hot Springs, Ark.

The deposits run in fissure veins, unlike other deposits in the United States. These veins are from 2 to 4 ft. thick, about one-half mile long, and at least 200 ft. deep, dipping at an angle of about 70 deg. southeast. The estimated tonnage will run around 5,000,000 tons at this depth. The property is opened by vertical shafts and crosscuts. Thus the method of mining fuller's earth in Arkansas differs considerably from the practice in Florida, Georgia, and Texas, where sedimentary deposits may be mined with steam shovels. The expense, however, amounts to about the same with the proper equipment.

SOUTH DAKOTA

Gold Feather Building Mill—Cutting Mining Co. To Resume Work

Deadwood—The Gold Feather Mining Co. has nearly completed excavations for a twenty-stamp mill. The equipment for the first unit of ten stamps is on the ground and this will be installed and in operation before Jan. 1. Amalgamation and concentration by Wilfley tables is the present plan for treatment. A cyanide annex will be added later. The mine, which adjoins the Monarch, is opened to a depth of about 150 ft, and most of the development has been done at this level. The ore occurs in the flat formation. Considerable ore has been shipped from the adjoining property in past years, and much of this was of high grade.

The Cutting Mining Co. has nearly

completed plans for a resumption of work at its property near Lead, and development started on Oct. 1. Work was stopped a year ago when the water could not be handled by the equipment then on hand. New pumps will be placed, and the driving of laterals from the bottom of the 500-ft. shaft will be started.

The Golden Crest Mining Co. is continuing the development of its mine. A crosscut is being driven on the 200 level to tap the orebody. The cyanide plant will not be placed in operation until after Jan. 1.

UTAH

Tintic Standard To Pass Next Dividend To Provide Cash Surplus

Salt Lake City—Lead furnaces operating at Salt Lake Valley plants Sept. 20 were: United States company at Midvale, three lead and one furnace on matte concentration. A. S. & R., at Murray, two lead furnaces. International, at Tooele, closed down.

Pictures of Utah mining camps taken from an airplane will form a part of the state's exhibit at the coming meeting of the American Mining Congress, which will be held in Chicago during the week of Oct. 17 to 22.

Eureka—Shipments from the Tintic district for the week ended Sept. 17 amounted to 158 cars. Shippers were: Tintic Standard, 45 cars; Chief Consolidated, 35; Victoria, 12; Eagle & Blue Bell, 11; Dragon, 8; Centennial-Eureka, 5; Mammoth, 5; Swansea, 5; Bullion Beck, 4; Sunbeam, 3; Gemini, 2; Colorado, 3; Alaska, 2; and Tintic Drain Tunnel, 1.

The directors of the Tintic Standard, with a view to establishing a substantial cash surplus, have decided to pass the coming quarterly dividend. The mine is in excellent condition, producing a large tonnage of both first-class and milling ore, and the new mill is a success.

Park City—Shipments for the week ended Sept. 17 amounted to 3,927,620 lb. Shippers were: Silver King Coalition, 1,427,620 lb.; Judge allied companies, 1,096,930; Ontario, 923,130; and Naildriver, 480,000.

MONTANA

Anaconda Adding Men To Ease Unemployment Situation—Anselmo Mining Co. To Deepen Trifle Shaft

Butte—Drifting is under way on the 2,200 level of the Black Rock mine of the Butte & Superior Mining Co. on the recently opened copper ore, and the results attained will govern the program for developing this orebody below the 2,200. From 2 to 3 ft. of ore is showing on the 2,200 level, assaying from 7 to 8 per cent copper and from 8 to 9 oz. silver. The mineralized ground is wider than this, but the rest is lean and is being given no consideration except for the fact that there exists a chance that it may show enrichment either with depth or by drifting.

The deepest level at the Black Rock is the 2,600, and it will be necessary to drive about 800 ft. on this level to reach a point where the copper vein should be found, if it extends downward on what appears to be its present line of projection.

The Anaconda Copper Mining Co. is putting more men to work, but it is explained that this is a measure to help relieve the unemployment situation and does not reflect any improvement in the copper situation. The company is continuing its repair work, particularly at its smelters. The Great Northern Ry. Co. has started repair work on the ore cars employed in transporting ores from Butte to Great Falls. The first shipments on the recently announced 10,000,000-lb. wire order received by Anaconda from the Pacific Gas & Electric Co., of San Francisco, have been made.

The Anselmo Mining Co., back of which are the Beer, Sondheimer interests, will sink its Trifle shaft from the 1,200 to the 1,700 level. This property is on the western edge of the Butte district proper, and is fairly close to the larger producers. Good ore has been found on the 1,200 level. It is in this territory that the Anaconda company, on its 2,800 level of the West Gagnon, has opened a body of copper ore in a vein which nearer the surface shows silver-zinc-lead ore. The change has encouraged the Anaconda to continue its exploratory work. The Beer, Sondheimer and the Anaconda companies are working in conjunction and sharing the territory north and east of the Anselmo's property.

Installation of an electrically operated hoisting plant at the shaft of the West Butte company is well under way. An air compressor is in position.

WASHINGTON

Rich Ore Found at Old Dominion Mine

Colville—W. H. Linney, manager of the company developing the Old Dominion mine, near here, reports an important strike of silver ore assaying as high as 1,140 oz. of silver over a width of 3 ft. This strike has just been made on the 600 level. Twenty years ago the Old Dominion mine was the best known property in Washington, and produced over \$600,000 in high-grade silver ore. During the early history of the mine it was so unfavorably situated that the first ore was brought 100 miles to Spokane on pack horses. Later a railroad was built within twelve miles of the property. This encouraged the erection of a concentrator, and the mine was successfully operated for a number of years.

The ore occurs as replacement chimneys in limestone, and it has been generally supposed that the property was worked out. Two years ago Mr. Linney secured a lease on the property and began new exploration work. He has recently made several shipments of ore, and if the new orebody holds out the mine will again come to the front as a profitable producer.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	12@12.125	26.625	26.875	4.65@4.70	4.45	4.175@4.20
23	12@12.125	26.625	26.875	4.70	4.45	4.20@4.25
24	12@12.125	26.625	26.875	4.70	4.45	4.25
26	12.125	26.625	26.875	4.70	4.45@4.50	4.25@4.30
27	12.125	26.50	26.75	4.70@4.75	4.45@4.50	4.35@4.40
28	12.125@12.25	26.125	26.50	4.70@4.75	4.45@4.50	4.40

*These prices correspond to the following quotations for copper "delivered": Sept. 22, 23 and 24, 12.25@12.375c.; 26, and 27, 12.375c.; 28, 12.375@12.50c.

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

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

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

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
22	67 $\frac{3}{8}$	68 $\frac{1}{2}$	72	156 $\frac{1}{8}$	158 $\frac{1}{8}$	22 $\frac{3}{4}$	22 $\frac{5}{8}$	25 $\frac{1}{4}$	25 $\frac{3}{4}$
23	67 $\frac{3}{4}$	68 $\frac{1}{2}$	72	156 $\frac{1}{8}$	158 $\frac{1}{8}$	22 $\frac{3}{4}$	22 $\frac{5}{8}$	25 $\frac{1}{4}$	25 $\frac{3}{4}$
24	68	68 $\frac{3}{4}$	72 $\frac{1}{2}$	157 $\frac{1}{8}$	159 $\frac{3}{8}$	23 $\frac{1}{4}$	23	25 $\frac{3}{8}$	26 $\frac{1}{4}$
26	68	68 $\frac{3}{4}$	72 $\frac{1}{2}$	157 $\frac{1}{8}$	159 $\frac{3}{8}$	23 $\frac{1}{4}$	22 $\frac{7}{8}$	26	26 $\frac{1}{2}$
27	68	68 $\frac{3}{4}$	72 $\frac{1}{2}$	157 $\frac{1}{8}$	159 $\frac{3}{8}$	23 $\frac{1}{4}$	22 $\frac{7}{8}$	26	26 $\frac{1}{2}$
28	68 $\frac{3}{8}$	69 $\frac{1}{4}$	72 $\frac{1}{2}$	156 $\frac{1}{2}$	158 $\frac{1}{2}$	23	23	26 $\frac{3}{8}$	26 $\frac{3}{4}$

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

Sept.	Sterling Exchange "Checks"	Silver			Sept.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
22	372 $\frac{1}{2}$	99 $\frac{1}{4}$	68 $\frac{5}{8}$	41 $\frac{1}{2}$	26	372	99 $\frac{1}{4}$	68 $\frac{5}{8}$	41 $\frac{1}{2}$
23	373 $\frac{1}{2}$	99 $\frac{1}{4}$	68 $\frac{5}{8}$	41 $\frac{1}{2}$	27	372 $\frac{1}{2}$	99 $\frac{1}{4}$	71 $\frac{1}{8}$	43 $\frac{3}{8}$
24	372 $\frac{1}{2}$	99 $\frac{1}{4}$	68 $\frac{5}{8}$	41 $\frac{1}{2}$	28	372 $\frac{3}{8}$	99 $\frac{1}{4}$	71 $\frac{1}{8}$	43 $\frac{3}{8}$

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

Metal Markets

New York, Sept. 28, 1921

Conditions in the non-ferrous metal market continue to improve. Producers are optimistic and believe that the gradually increasing prices, which are general, are not merely a flurry but will persist. Copper, lead, and zinc are all firm, and producers show no inclination to cut prices to attract business, for they feel that waiting will now redound to their advantage. Silver has advanced rapidly in the last two or three weeks, the jump of 3c. yesterday being startling. A reaction is not unexpected. The tendency is likely to continue upward, and for some of the metals, such as zinc, which has long been de-

pressed, would be particularly well deserved.

Copper

Few of the large producers are selling any copper except through the Copper Export Association, for they are keeping their prices just ahead of an advancing market. Some are willing to sell at 12.50c. delivered, but they may possibly withdraw from the market when business can be booked at this figure. Some of the smaller interests who have been willing to sell in the neighborhood of 12.375c. delivered have done a fair amount of domestic business, and inquiries have been numerous. We believe November copper is now unobtainable under 12.50c. Export demand has been of

fair volume, but Germany continues a poor customer, owing to disturbed financial conditions in that country. France and Japan have taken small lots. The price in general has ranged between 12.50 and 12.75c., c.i.f. European ports.

We believe that copper has taken a definite turn for the better and that the present movement is not a flurry such as occurred in May. (See the curve on page 559). Surplus stocks of refined copper are probably not as great as is generally considered, and stocks of scrap brass have also been depleted to such an extent that prompt supplies are difficult to obtain, and the quality is becoming poorer. Brass makers have contracted for important tonnages of copper in the last week or two; newspaper reports have minimized rather than exaggerated this demand. Too much must not be expected from foreign buyers, however, and a somewhat limited export demand for some time to come is likely. Germany is in no position to take much copper until financial conditions have been straightened out. We expect a gradually increasing price level for copper and believe that consumers will make no mistake in laying in moderate stocks at current levels.

Lead

The American Smelting & Refining Co. again advanced its official contract price on Thursday, Sept. 22, from 4.65 to 4.70c.

Business has been of about the same volume as during the last few weeks. Most of the inquiries are for prompt supplies, and one or two producers are cut of the market. Outside dealers in small lots of spot metal are demanding 5 to 10 points premium. The market in the St. Louis District is comparatively quiet, particularly for chemical and the poorer grades of desilverized. Corroding lead is in more active demand. Producers continue disinclined to quote on later deliveries than November, but in cases where they do, slight premiums are being asked. It is reported that the lead market is firm in Europe. Spanish supplies have been curtailed somewhat by labor troubles.

Zinc

The market has shown an improvement of about one-quarter cent during the week, owing to the greater demand from galvanizers. The Pittsburgh iron and steel industries are reported to be in better condition, and running about 60 per cent of capacity, with comparatively small stocks of zinc on hand. The market is looking stronger than for many weeks, and producers generally are refraining from doing anything which would disturb the upward

trend of prices. It is felt that stocks of zinc are generally in strong hands, and that the market will not collapse as easily as it has in the past, because of the forced disposal of weakly held stocks. High-grade zinc has been sold in larger quantities at unchanged prices—6c. per lb. delivered.

Tin

The tin market has been devoid of interest most of the week, though there was mild activity on one or two days. The price remained at almost a constant figure. Most inquiries are for forward delivery, though there is no great accumulation of spot metal. About 1,500 tons are due in the next few days on two boats, but most of this is already sold. Tin-plate business is gradually improving. Forward deliveries are quoted at the same prices as spot to ¼c. higher. The supplies of 99 per cent grade continue to be largely in the hands of one interest.

Arrivals of tin, in long tons: Sept. 20th, Australia, 10; 22d, London, 275; 26th, London, 25; Straits, 40.

Gold

Gold in London: Sept. 22d, 110s. 11d.; 23d, 110s. 9d.; 26th, 110s. 11d.; 27th, 110s. 11d.; 28th, 110s. 11d.

Foreign Exchange

German marks continue to be the center of interest in the foreign exchange market. On Tuesday, Sept. 27, francs were 7.13c.; lire, 4.13c.; and marks, 0.8125c. New York funds in Montreal, 10¹/₈ per cent premium. Sterling cables continue to be quoted one-half cent higher than the figure given on page 556.

Silver

Buying by China and the Indian bazaars advanced the price of silver on the 27th to a new high level for the year—London quoting 43½d. and New York 71½c. At these rates buyers were satisfied, and silver reacted slightly in consequence. However, with Eastern exchanges firm, the market is likely to fluctuate near present levels, although the speculative nature of operations creates an uncertain tendency.

Mexican Dollars—Sept. 22d, 52½; 23d, 52½; 24th, 52½; 26th, 52½; 27th, 55½; 28th, 55.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 4.60@4.70c.; market dull. W.C.C. brand, 5¼@5½c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, wholesale lots, 6½@7c.

Bismuth—\$1.50@1.55 per lb.

Cadmium—Range \$1@1.10 per lb., in 1,000-lb. lots. Smaller quantities, ½.10@1.25 per lb.

Cobalt—Metal, \$3@3.25 per lb., black oxide, \$2.35 per lb. in bbls.

Iridium—Nominal, \$150@170 per oz.

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

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnage, spot, 35@38c. Market dead.

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

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

Palladium—Nominal, \$55@60 per oz.

Platinum—\$78 per oz. Market firm, but trading light.

Quicksilver—Market weaker at \$40@42 per 75-lb. flask. Largely a jobbing business. San Francisco wires \$43.75. Dull.

Rhodium—\$150 per troy oz.

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

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

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

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr₂O₃, crude, \$20@25 per net ton; ground, \$30; analyzing 45@50 per cent Cr₂O₃, \$25@26; ground, \$28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, \$6.45; Mesabi bessemer, 55 per cent iron, \$6.20; Old Range non-bessemer, 51½ per cent iron, \$5.70; Mesabi non-bessemer, 51½ per cent iron, \$5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, \$4.85; old bed concentrates, 63 per cent, \$5.75; Harmony, cobbled, 63 per cent, \$5.75; new bed low phosphorus, 65 per cent, \$8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO₂) \$50@55 per gross ton, lump; \$70@75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS₂, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

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

Titanium Ores—Ilmenite, 52 per cent TiO₂, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO₂, 12c. per lb. for ore, with concessions on large lots or contracts.

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

Uranium Ore (Carnotite)—Ore containing 1½ per cent U₃O₈ and 5 per cent V₂O₅ sells for \$1.50 per lb. of U₃O₈ and 75c. per lb. of V₂O₅; ore containing 2 per cent U₃O₈ and 5 per cent V₂O₅ sells

for \$2.25 and 75c. per lb., respectively; higher U₃O₈ and V₂O₅ content commands proportionately higher prices.

for \$2.25 and 75c. per lb., respectively; higher U₃O₈ and V₂O₅ content commands proportionately higher prices.

Vanadium Ore—\$1 per lb. of V₂O₅ (guaranteed minimum of 18 per cent V₂O₅), New York. Nominal.

Zircon—Washed, iron free, 3c. per lb.

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

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 24—Zinc blende per ton, high, \$23.50; basis 60 per cent zinc, premium and Prime Western, \$21; fines and slimes, \$19@17; average settling price, all grades of zinc, \$21.48.

Lead, high, \$61.50; basis 80 per cent lead, \$60@61; average settling price, all grades of lead, \$56.53 per ton.

Shipments for the week: Blende, 5,927; lead, 1,303 tons. Value, all ores the week, \$203,050. Shipments for nine months: Blende, 197,740; calamine, 102; lead, 43,900 tons. Value, all ores nine months, \$5,922,410.

Sellers endeavored to maneuver the market up a dollar per ton, but buyers would offer no higher than prices current a week ago, and 6,200 tons sold on \$21 basis for practically all but fines and slimes. Shipments are now about consuming the weekly production.

Platteville, Wis., Sept. 24—No sales of zinc or lead ore. Shipments for the week none. Shipments for the year: Blende, 8,461, lead ore, 1,171 tons. Shipped during the week to separating plants, 665 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, \$1,500@2,000; No. 2, \$850@1,250; spinning fibers, \$350@850; magnesia and compressed sheet fibers, \$225@350; shingle stock, \$95@150; paper stock, \$55@70; cement stock, \$16@27.50; floats, \$8.50@15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium sulphate, \$10@12 per net ton; ground (white) \$23@24 in bags, carload lots; (off-color) \$21@22 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, \$25 per net ton, f.o.b. Atlantic seaports. Western grades are \$24.50. Crude quoted \$7@10 per long ton, f.o.b. Cartersville, Ga.

Bauxite—French bauxite, \$8@10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, \$8@10 per gross ton, f.o.b. shipping points; pulverized and dried, \$12@15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, \$20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5½c. per lb.; in bbls. 5½c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, \$6.50@ \$8.50; washed, \$9@ \$10; powdered, \$13 @ \$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, \$13@ \$20, f.o.b. Virginia points. Imported lump, \$12@ \$20, f.o.b. American ports; powdered, \$25@ \$30, f.o.b., quoted at New York.

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

Feldspar—No. 1 soap grade, \$7@ \$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, \$6@ \$6.50; No. 2, \$5@ \$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, \$26 f.o.b. cars.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$20@ \$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, \$40@ \$55; lump, \$12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF₂, \$30, New Mexico.

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

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3 @4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

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

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, \$1.40@ \$1.75 per net ton; 1½ in., \$1.35@ \$1.70. Prices for other sizes practically the same. Agricultural limestone, \$2.50@ \$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, \$12@ \$15 per ton. High-grade caustic calcined, lump form, \$30@ \$40 per ton. Plastic calcined, \$45@ \$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, \$60.

Dead-Burned—\$33 per net ton, Chewelah, Wash.; \$58@ \$64, Chester, Pa. Austrian grade, \$53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

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

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

¹ Foote Mineral Co., Philadelphia, Pa.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, \$11.65; 75 per cent, \$10.65; 75@ 74 per cent, \$10.15; 70 per cent, \$6.25; 68 per cent, \$5.75; 68@66 per cent, \$5.50.

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

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

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

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

Talc—Paper making, \$11@ \$20 per ton; roofing grades, \$8.50@ \$13; rubber grades, \$11@ \$18; all f.o.b. Vermont. California talc, \$16@ \$35, talcum powder grade. Southern talc, powdered, carload lots, \$7.50@ \$11 per ton; less than carload, \$25, f.o.b. cars. Imported, \$30@ \$40; Canadian, \$18@ \$40 per ton.

Mineral Products

Arsenic—5¾c. per lb.

Sodium Nitrate—\$2.30@ \$2.40 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, \$12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; \$20@ \$22 per ton, New York.

Potassium Sulphate—Powder, domestic, \$1.20 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

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

Ferrocerium—Per lb., \$12@ \$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11½c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, \$60@ \$63, f.o.b. furnace; resale, \$90, delivered; English, \$60@ \$63, c.i.f. Atlantic seaports. Spiegeleisen, 18 @20 per cent, \$25@ \$26, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2.25 per lb. of contained metal, f.o.b. works. Imported material, \$1.70@ \$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, \$38@ \$40; 50 per cent, \$60@ \$65; 75 per cent, \$130@ \$135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

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

Ferrovandium—\$4.25@ \$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19.50c. per lb.; wire, 13.75c.

Lead Sheets—Full lead sheets, 7½c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal—Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ¾ to 3 in., 13.25c.

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

Refractories

Bauxite Brick—56 per cent alumina, \$50 per ton; 76 per cent, \$90@ \$95 f.o.b. works.

Chrome Cement—40@45 per cent Cr₂O₃, \$30@ \$32 per net ton, and \$31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—\$52@ \$55 per net ton.

Fire Brick—First quality, 9-in. shapes, \$35@ \$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, \$30@ \$35.

Magnesite Brick—9-in. straights, \$65 @ \$70 per net ton; 9-in. arches, wedges and keys, \$77; soaps and splits, \$98, f.o.b. works.

Silica Brick—9-in., per 1,000; \$35@ \$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Sept. 27, 1921

The advance of \$5 a ton in sheet prices by the American Sheet & Tin Plate Co. (Steel Corporation), predicted last week, was made effective on Sept. 22, practically all the independents having previously advanced. The new prices are: Blue annealed, 2.50c.; black, 3c.; galvanized 4c.

Bars, shapes and plates have been steady for several weeks at about 1.65c., with slight concessions on large orders, and the price may soon take a turn for the better. The best demand is for the lighter products, and thus ingot production does not increase greatly, being now about 35 per cent of capacity. A rate of between 40 and 50 per cent is likely to obtain in the last quarter of the year.

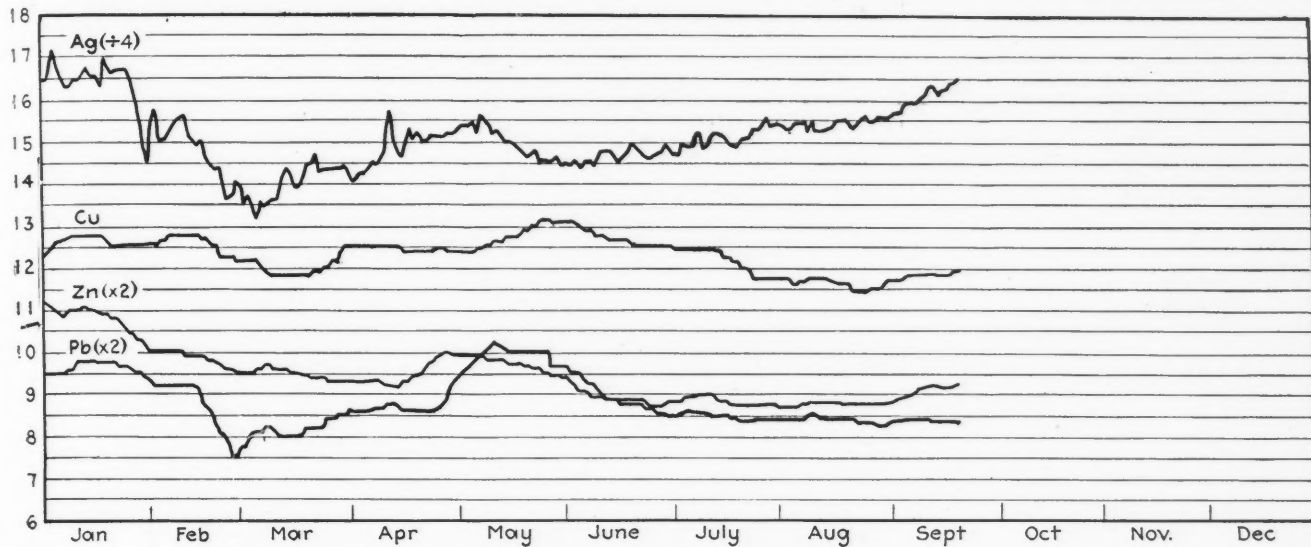
Pig Iron—The market is quiet but firm, and the next buying of any consequence is likely to advance prices a trifle. The market stands at \$20 for bessemer, \$19@ \$20 for basic, and \$21 for foundry, f.o.b. Valley furnaces.

Steel—Billets are nominal at \$30. Several mills have announced an advance in sheet bars from \$30 to \$32.50, and others are expected to follow, this being predicted on the sheet advance.

Coke

Connellsville—Furnace, \$3.25@ \$3.50; foundry, \$4.25@ \$4.50.

1921 Prices of New York Copper, Silver, Lead, and St. Louis Zinc



Ore and Metal Movements for August, 1921

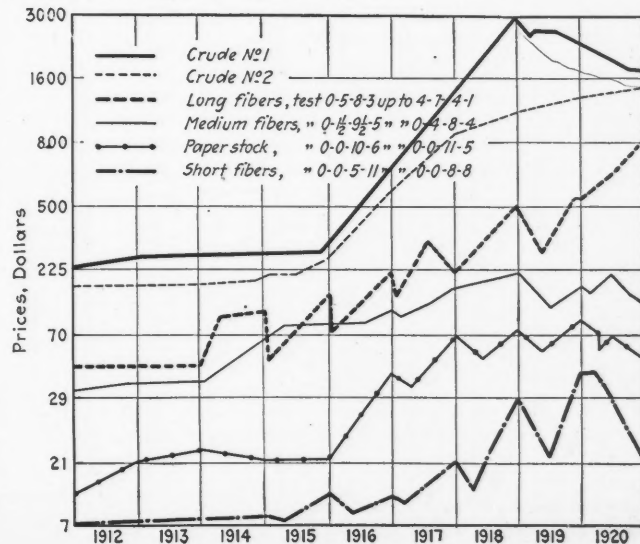
IMPORTS, AUGUST, 1920, AND AUGUST, 1921
In Pounds, Unless Otherwise Stated

	August, 1920	August, 1921
Antimony ore, contents	146,284	2,570,743
Antimony matte, regulus or metal	2,570,743	2,718,285
Brass, fit only for remanufacture	3,866,289	2,563,467
Copper		
Ore, contents	5,752,146	6,834,291
Concentrates, contents	5,287,911	2,300,197
Matte, regulus, contents	130,588	1,753,938
Imported from, in part		
Spain	433,203	457,428
Canada	3,831,447	61,674
Mexico	2,134,787	723,209
Cuba	4,123,917	2,726,241
Chile	203,257	5,828,650
Unrefined, black, blister	17,971,202	12,574,740
Imported from, in part		
United Kingdom	222,516	12,124
Canada	1,844,706	320,486
Mexico	4,905,979	1,604,588
Chile	3,910,073	4,122,415
Refined, in bars and plates	271,916	271,916
Old, for remanufacture	1,894,317	5,662
Composition metal, copper chief value	324,717	385,307
Lead		
Ore, contents	1,500,484	5,151,595
Bullion, contents	5,139,435	7,819,123
Imported from		
Canada	745,597	4,432,747
Mexico	5,873,237	8,301,796
Other countries	21,085	236,175
Pigs, bars and old	7,403,826	3,254,013
Imported from		
Mexico	3,454,259	3,254,013
Germany	445,861	.....
England	3,474,142	.....
Canada	28,900	.....
Jamaica	664	.....
Manganese ore, long tons	99,601	28,939
Imported from, in part		
Cuba, long tons	3,000	.....
Brazil, long tons	88,776	28,939
British India, long tons	4,900	.....
Tungsten ore, long tons	131	286
Pyrites, long tons	48,832	10,892
Imported from, in part		
Spain, long tons	19,201	10,892
Canada, long tons	16,940	.....
Tin ore, long tons	5,385	3,201
Tin bars, blocks and pigs	11,195,937	5,200,504
Imported from, in part		
United Kingdom	2,039,044	2,138,972
Straits Settlements	5,969,928	2,836,434
Hongkong	2,387,847	225,098
Australia	181,440	.....
Zinc		
Ore, contents	2,083,429	26,228
Imported from		
Canada	366,162	.....
Mexico	1,717,267	26,228
Blocks or pigs, and old	1,826	.....
EXPORTS OF COPPER, LEAD, AND ZINC		
Copper		
Unrefined, black, blister	61,437	43,705
Refined, in ingots and bars	39,274,235	41,249,258
Exported to:		
Belgium	2,978,454	1,345,313
France	14,633,149	6,091,452
Germany	4,808,472	16,428,127
Italy	112,285	.....
Netherlands	2,551,411	1,127,258
Spain	.....	471,082
Sweden	2,889,617	560,578

	August, 1920	August, 1921
United Kingdom	6,828,152	1,234,428
Canada	2,961,718	16,715
Japan	.....	7,699,880
Other countries	1,510,977	6,274,452
Composition metal, copper chief value	11,417	4,549
Copper rods	.....	1,136,766
Old and scrap	123,907	.....
Pipes and tubes	653,994	75,602
Plates and sheets	3,901,891	164,406
Wire, except insulated	2,056,285	216,111
Lead		
Pigs and bars		
Produced from domestic ore	187,057	90,804
Produced from foreign ore	509,504	6,086,575
Exported to		
United Kingdom	.....	4,815,967
Canada	16,074	6,013
Brazil	134,400	224,202
China	6,092	.....
Japan	.....	448,000
Other countries	539,995	683,197
Zinc		
Dross	82,100	1,832
Produced from domestic ore	16,268,344	949,712
Produced from foreign ore	196,020	588,002
Exported to, in part		
Canada	.....	260,000
Mexico	28,776	68,653
Japan	.....	1,008,014
United Kingdom	12,579,686	.....
France	2,082,267	.....
In sheets and strips	1,385,433	96,806

Asbestos Price Curves

The following copyrighted curve, published by permission of Asbestos & Mineral Corporation, New York, shows how greatly the various grades of asbestos have fluctuated in price during the war and after.



MINING STOCKS
Week Ended September 24, 1921

Table listing mining stocks under various categories: COPPER, NICKEL-COPPER, LEAD, QUICKSILVER, and ZINC. Columns include Stock name, Exch., High, Low, Last, Last Div., and price.

Table listing mining stocks under various categories: GOLD, SILVER, GOLD AND SILVER, SILVER-LEAD, VANADIUM, and ASBESTOS. Columns include Stock name, Exch., High, Low, Last, Last Div., and price.

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

