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PUBLISHED WEEKLY

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CIRCULATION STATEMENT

During 1909 *we printed and circulated* 534,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for September, 1910, *was* 39,500 *copies.*

October 1..... 12,500

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Contents

Calamine at Leadville

Leadville is perhaps the most wonderful mining camp that this country has known. Worked originally for the placer gold in California gulch, the "heavy rock" found in the sluice boxes led after many years to the discovery of the bonanzas of lead-carbonate ore which revived the fallen fortunes of old Oro and made the newly christened Leadville the cynosure of mining interest. After the carbonate ores were nearly exhausted mining continued into the sulphides, as was to be expected, and then to the surprise of many the sulphides in some places were found to become cupriferous with depth, and Leadville became a copper producer of considerable importance. About the time when the camp was thought to be on its last legs a remarkable gold mine, the Little Jonny, was discovered, and after that Leadville obtained a new era of prosperity as a shipper of zinc blende. Leadville has been one of the few mining districts in the United States that has produced bismuth ore, and we believe there have been some other odds and ends. Indeed a rather large quantity of manganese ore has been shipped for the purpose of steel production. Thus we find this famous old mining district noteworthy at successive periods as a producer of placer gold, silver and lead, copper, zinc and iron.

Latterly the zinc-ore production of Leadville has dwindled materially, and most everyone has thought that the end of Leadville was finally in sight. But now comes the story, at first regarded as a vagary of distorted imagination, that in some of the oldest mines of Carbonate hill, a pristine center of silver-lead production, what has heretofore—during 30 years—been regarded as worthless country rock is in fact rich calamine ore, of which large bodies exist. This news is now so well verified, that we are bound to accept it, maintaining some reservation merely as to the extent and grade of the deposits, which probably have not yet by any means been determined. We are bound to marvel also that the existence of such deposits has remained unknown throughout the searching geological, mineralogical and mining examinations to which these mines have been subjected.

However, if these new bodies of zinc ore prove to be as large and as rich as it is thought they will be, their discovery will be of importance, not only in rejuvenating the waning mining industry of Leadville, but also in supplying our zinc smelters with a much needed addition to their resources of raw material.

The Prospect for Copper

The prospect for copper, still shrouded in uncertainty, will perhaps become clear during the next three months. After the curtailment of production was inaugurated early in August, manufacturers were at first skeptical, which opinion was strengthened after the appearance of the August refinery statistics, it being thoughtlessly neglected that those could not by any possibility reflect a curtailment begun only in August. Since the reports of August production have been coming forward from the smelters, it has become realized that curtailment this time is a

real thing, but it has been asked "What gain is there going to be from a curtailment of 10 or 15 per cent. if consumption is also falling off about 10 or 15 per cent.?" The answer is, no gain, but it is questionable whether consumption is in reality falling off materially. Upon this the statistics of the next three months will throw the necessary light.

Reports from manufacturers indicate a general continuance of good business. In spite of some pessimistic talk there does not appear to be any serious recession. On the other hand, an extremely encouraging factor is the report that several important railway systems are going to do considerable electrification in the near future. It is said that the Great Northern has decided to electrify 57 miles of track on both sides of the Cascade tunnel; that the New York Central is to electrify its line between Syracuse and Geneva, N. Y., a distance of 54 miles; that the Boston & Maine is to electrify its line through the Hoosac tunnel; that the New Haven will electrify its main line between Boston and Providence; and that the Lackawanna is to electrify a part of its line in order to utilize power developed cheaply from the combustion of culm in its coal territory. These projects may prove to be the beginning of a new use for copper wire that has long been expected.

The Mexican Centennial

Dies y Seis de Septiembre, Mexico's Fourth of July, this year has had the added importance of being the nation's centenary, and the occasion has been duly and properly recognized by a month's celebration in the Capital and in other parts of the Republic. The advanced and satisfactory state of the mining industry in Mexico, as partly but sufficiently demonstrated in the articles in this issue of the JOURNAL, is in itself a practical and striking testimony to Mexico's industrial and commercial progress and a measure of the effective government which the country now enjoys. The present epoch in Mexican mining practically coincides with the period of the direction of Mexican political affairs by President Diaz, and indeed it is to his far-sighted public policies that the great advance in the industry in the last quarter of a century is due. Mexico has vast natural resources, including great mineral wealth. The realization of this latent wealth has been directly due to the influence of a stable and liberal government, and no line of advance in Mexico is more a measure and monument of this than is the mining industry.

A Contrast in Coal Rates

Two recent railroad reports, both made by companies which are large coal carriers, shows a sharp contrast in rates received on that class of business. The first is that of the Lehigh Valley Railroad Company, the traffic concerned being chiefly anthracite. In the fiscal year ended June 30, 1910, coal constituted 51.6 per cent. of the tonnage carried by the road and the average rate received was 0.73c. per ton-mile, which was 0.09c. higher than the general freight average. About 18 per cent. of the tonnage was bituminous coal received from other lines, on which rates are usually lower than on anthracite. Allowing for this, the rate on the anthracite moved was about 0.85c. per ton-mile.

The Norfolk & Western, on the other hand carries exclusively bituminous coal, on which it has a long haul in both directions. About one-third of its coal comes to tidewater, and a little over one-half is carried to the West and Northwest. Its coal and coke tonnage last year was 72.4 per cent. of the total freight, and the average rate earned was 0.263c. per ton-mile. As this included the general freight also, on which rates are usually slightly higher, the average on coal was undoubtedly only a very little over 0.25c. per ton-mile. On the coal delivered at tidewater, the average haul was about 375 miles, or nearly three times as long as the tidewater haul on the Lehigh Valley.

In other words the Lehigh Valley road received—accepting its general average on all coal—$1.13 per ton for carrying coal 154 miles, while the Norfolk & Western got $1.01 for carrying the same quantity 375 miles. Some allowance, of course, is to be made for the higher proportion of terminal charges on the shorter haul, but this would be sufficient to account for only a very small part of the great difference shown. The bituminous coal is carried almost three miles for what is costs to move a ton of anthracite one mile. The bituminous-coal road, however, manages to make a profit on its low rates and to pay dividends on its stock.

The explanation of the great disparity in rates is not new. The anthracite road hauls a coal for which there is a steady demand and on which there is practically no price competition. Moreover, it really owns most of the coal it carries, and the rates fixed are in effect a matter of bookkeeping as between the railroad company and its controlled coal company. The bituminous coal, on the other hand, is sold in close competition with that from other large producing regions, and must be delivered either at tidewater or in the West at low rates, if it is to find a market at all. The fact remains that the contrast in rates is the sharpest to be found in all of our railroad economy.

The German iron trade is still in deep water, owing to the uncertainty with regard to the future of two of the syndicates which have influenced the trade so largely in recent years. The reorganization of the pig-iron syndicate is complete in form, but it does not yet include furnaces enough to enable it to control the trade. The Luxemburg-Lorraine producers have so far declined to join the new organization, and there are several large companies also which have also refused to come in; while the merchant furnaces of the important Siegerland district have taken no part. The steel syndicate is showing some signs of early disruption, and there are reports of serious dissensions in its management. The trade has been so largely controlled by the great syndicates that anything affecting them cannot fail to be a cause of uneasiness.

A newspaper despatch says that in retaliation for the American tariff on zinc ore the Mexican Government has increased railway rates on the lines running into Texas, so that zinc ore can no longer be shipped into the United States at a profit. It is hard to see where the retaliation comes in. The tariff was put on zinc ore at the behest of some mining interests in order to keep it out. It has developed, however, that under certain market conditions Mexican ore can still come in. If the Mexican government can close this loophole, some of our own mining interests will be pleased. It would seem better for the Mexican Government to extend all possible assistance to the operators of zinc mines in that country.

Calamine at Leadville

E. W. Keith, of the Empire Zinc Company, who has recently examined the new discovery of calamine ore at Leadville, is authority for the following:

"We started at No. 2 level, 800 ft., of the Wolftone and went through the old Maid of Erin drift running toward the Big Chief, and after going several hundred feet had to stop, as the drift was closed. The orebody along this entire distance is 20 ft. wide, and there is no telling how much further it goes beyond the point where the drift is closed. From there we went toward the old Maid of Erin shaft and found the conditions exactly the same with the same character of ore, the two points forming two corners of a triangle. The same conditions were found at the Wolftone at the second level. The orebodies of silicate that I saw in the three properties run from the parting quartzite to the upper contact, a distance of fully 400 ft., with an average value of 47½ per cent. zinc.

"We then went to the Waterloo shaft and here the conditions changed as the horizon is different on account of the shaft being only 600 ft. deep, and the stratum of ore was found at the 400-ft. level, but I found the silicate in place the same as in the other properties, and I have no doubt it will carry itself to the bedding plane 600 ft. away under the water level. At one place I could not prove the thickness of the vein satisfactorily, but in other places it was from 10 to 15 ft. thick, with neither top nor bottom in sight. In the Waterloo it carries clear up to the white porphyry, and the grade will give results of from 25 to 50 per cent. and when broken in large quantities will average from 30 to 35 per cent. All of the orebodies seen are of good character and free from impurities, notably free from lead.

Calamine Accompanied by Carbonate.

"The material apparently is not confined to any one contact, but as in the case of the Maid of Erin shoot, it is found on both sides of the parting quartzite, and in one case seemingly on the footwall of a large lead sulphide stope. As I have stated the shoot in the Waterloo shows clear up to the white porphyry, in some instances, irregularly, but I am convinced it will be found in two contacts below the shaft both above the parting quartzite. In the Big Chief the vein is well defined and it is probably a continuation of the showing in the Maid of Erin and Adams, although from 70 to 80 ft. higher. I am firmly convinced that the purest ore will be found near the replacement of the white limestone, instead of in the blue. The character of the ore is not a clean silicate, but is a carbonate and silicate combined and I should judge that 10 cu.ft. of it will make a ton."

Annual Report of Montana-Tonopah

At the annual meeting of the Montana-Tonopah Mining Company held in Salt Lake City, Sept. 13, reports on operations for the fiscal year ended Aug. 31, 1910, were submitted by Superintendent E. A. Collins, and Secretary-Treasurer W. B. Alexander.

A summary of the year's work as compared with that of the preceeding year is given in the accompanying table.

Mining Operations

During 1908-09 nearly 8000 tons of custom ore were milled, resulting in lower receipts per ton, in spite of the fact that the grade of ore milled was a trifle better than for the last year. The cost of mining was reduced from $3.47 per ton, for 1908-09. to $3.414, for 1909-10, while development charges show an increase from $1.645 to $1.814, due to a much larger footage in new ground.

SUMMARY OF YEAR'S WORK.

	1909–1910.	Per Ton.	1908–1909.	Per Ton.
Tons milled	50,245	.....	49,450	.....
Tons mined	50,245	.....	41,692	.....
Gross value per ton	$15.22	.....	$14.21	.....
Total receipts	$650,405.11	$12.94	$574,865.30	$13.78
Total expenditures	$515,689.71	10.26	$446,901.99	10.72
Total profits	$134,715.40	2.68	$127,963.31	3.06
Development footage	10,681 ft.	.....	8,015 ft.	.....

Regarding underground development Superintendent Collins says: "During the year a total of 10,681 ft. of new work was added. No new veins, or bonanzas, were discovered, but a large amount of productive work was done on the Triangle and Martha veins, which resulted in the development of a considerable tonnage of good milling ore. Both veins have been developed extensively down to the 4th, or 615-ft. level. Below this level a winze exposes fairly good ore for a depth of 60 ft., below which the vein is apparently faulted. A drift is now being driven from the 765-ft. level to get under this winze, and connections will then be made with a raise. This important work will give us good air, and demonstrate whether this vein reaches the 5th, or 765-ft. level."

Mill Operations

The 40-stamp mill effected an average extraction of 90.8 per cent. of the gross value as compared with barely 90 the preceding year. Shipments of concentrates and bullion during the year were as follows: 1076.6 tons of concentrates, gross value per ton, $253.52; 39,981 lb. of bullion, average fineness gold 11.6, silver 890.6. The cost of milling for the year figured at $3.734, which figure was high on account of excessive repair costs during the first half-year. For the six months, February to July, inclusive, the average cost of milling was reduced to $3.37 per ton treated. This large reduction of costs was largely effected through the efficiency of the mill force, of which B. A. Bosqui is superintendent.

Financial Statement

The general summary of expenditures for the year ended Aug. 31, 1910, shows that direct expenses totaled $495,187 and indirect $20,502; grand total, $515,689. Figured on a cost-per-ton basis the expenditures were: Mining, $3.414; development, $1.814; general expense, including salaries, $0.543; shipping and selling, $0.054; general maintenance $0.296; milling, $3.734. The direct charge to ore milled was thus $9.855 per ton, to which must be added $0.408 for indirect costs, bringing total cost to $10.263.

The receipts for the year were: Concentrates, $236,964; bullion, $402,010; balance, bills collectible and supplies from previous year, $87,209; and receipts from other sources, $60,636. On Aug. 31, 1910, there were on hand supplies valued at $32,931 and a balance of $177,702; the balance on hand Aug. 31, 1909, was only $37,410.

Meeting of Tariff Board

Washington Correspondence

At a meeting of the Tariff Board, in Washington Sept. 25, a conference was held with members of the executive committee of the Association of Chemical Manufacturers of the United States. The intention of the board was to adjust and alter the chemical cost sheet so as to adapt it to the various lines of work in which it is to be used.

It was, however, demonstrated that the association had no control over its members and it is doubtful if accurate cost data will be secured.

E. Gybbon Spilsbury, mining engineer, of New York, has been retained by the board to study metal schedules, particularly those of lead and zinc. The condensed results of four years' investigation by the Bureau of Corporations will be utilized for the iron and steel inquiry.

One of the interesting features promised for the Ozark Interstate Exposition, to be held Oct. 8 to 17, at Joplin, Mo., is a "double-jack" drilling contest.

DETAILS of PRACTICAL MINING

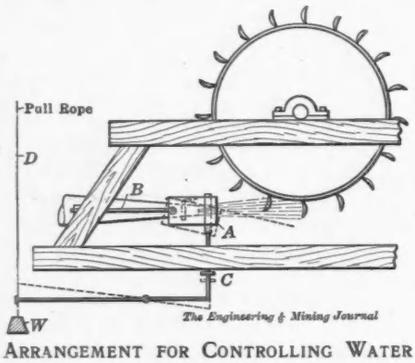
Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

Control for Water Wheel

By R. A. Linton*

A device shown by the accompanying sketch permits turning off the power from a waterwheel almost instantly without causing the excessive strain in the pipe line such as results when the valve controlling the water for the wheel is rapidly closed. It often happens that when something breaks or goes wrong, even after closing the control valve as rapidly as possible, much damage would have been avoided if a quicker means of shutting off the power had been available.

The device merely consists of a pipe *A*, about 6 in. in diameter and 8 in. long, placed over and concentric with the nozzle of the waterwheel, and arranged in such a way that the stream passes through it without interference, except



Arrangement for Controlling Water Wheel

when the rope *D* is pulled. The deflecting nozzle is supported by bolts *B* connected with the framework of the waterwheel. A stop *C* is fastened to the rod that controls the deflector so as to hold the deflector from cutting the stream of water while the wheel is in operation.

Tonopah Slime Treatment

In the Desert mill of the Tonopah Mining Company, at Millers, Nev., the slime treatment costs 30c. per ton more than that of the sands. Ore is crushed in a 4-lb. cyanide solution which is brought up to 6 lb. in the final treatment. The sand treatment requires 14 days. Slimes are agitated 70 hours, material being in the plant about 4 days. The water consumption is 120 gal. per ton of ore treated.

*General manager, Gualcala Mines Company, Tuquerres, Colombia, S. A.

Recovering the Date by a Surveyor's Transit

By A. W. Warwick*

Of all the vexations experienced by the explorer or engineer working in isolated places, there is none more serious than the loss of the civil date. Sickness, or forgetting to tally off a day, is apt to cause confusion as to the date, which is serious when using the ephemeris or nautical almanac for determination of the meridian. It is interesting to note that Harry Whitney when left alone in the Arctic for a year gained 13 days in his reckoning. One of the most damning points against Doctor Cook was that on his return to civilization he had entirely lost his reckoning and it is obvious that under such circumstances his calculations of latitude were valueless.

Losing the Date

A spell of sickness, while alone among Indians in Mexico, caused me to be uncertain as to the date to within four or five days. It became necessary to determine the true meridian on the sun for the purpose of making a survey. An Indian runner was despatched with a note to a distant town asking for the civil date of the day on which the runner commenced his return trip. The Indian, however, on his return met a party of Indian friends with a barrel of liquor, and when he finally showed up he had no idea as to how many days he had been on the road. The note he handed in with the date of his leaving the town was, therefore, useless.

Determination of the Sun's Declination

Under these conditions a little reflection showed that if the sun's declination could be determined with the transit, comparison with an ephemeris would give the correct civil date. The meridian altitude of the sun can be calculated from the formula,

$$Alt. = 90\ deg.\ lat. \pm dec.$$

By determining the meridian altitude of the sun and knowing the latitude of the place, this equation can be solved for the declination. The latitude was determined by a Polaris method devised by me in which the date was unnecessary. A meridian line was laid out at the same time. When the sun crossed this meridian its altitude was determined in the ordinary way. The equation given was then easily solved and by comparing the result with the ephemeris, the date was determined beyond any question of doubt. The following is the calculation made:

Latitude of place N. 26 deg. 4 min.
Longitude, approximately 108 deg. W.

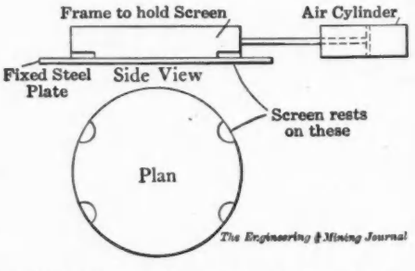
	Deg.	Min.	Sec.
Meridian altitude of sun.....	47	51	00
Latitude	26	04	00
	73	55	00
	90	00	00
Approximate declination of sun	16	05	00
Ephemeris gave declination of sun Tuesday, Feb. 5, 1907, as	16	10	41
Correction for 7.2 hr. west 45 sec. × 7.2 equals.....		55	24
Correct declination at longitude 108 deg. west...	16	05	17

The date of observation was, therefore, Tuesday, Feb. 5, 1907. This method illustrates what a really wonderful instrument the transit is and how many problems can be solved by it with a little ingenuity.

*Mining engineer, McPhee building, Denver, Colo.

Sampling Screen Driven by Compressed Air

Several interesting labor-saving devices are used in the fine-grinding room of the sampling works of the Cananea Consolidated Copper Company. One of these is an air-actuated sampling screen. It consists of an ordinary screen held in a light steel frame, attached to the piston of a small air hammer.

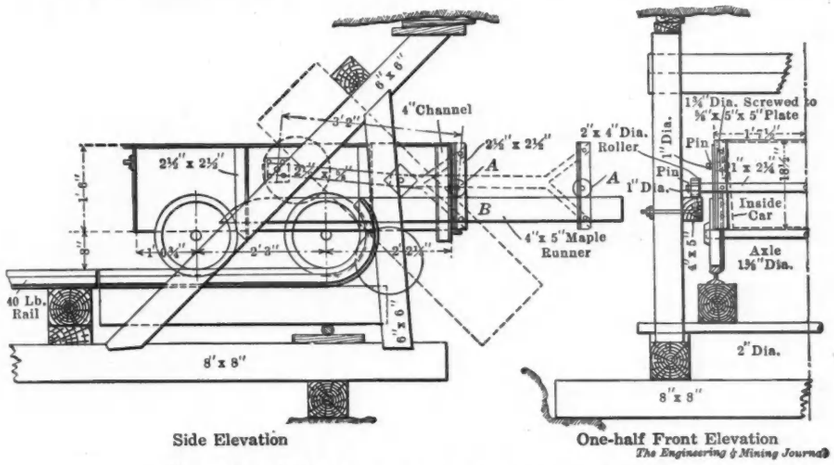


Sampling Screen Driven By Compressed Air

The usual 80-mesh screen with the sample in it is placed in the frame. The attendant turns on the air and merely holds his hand on the screen, steadying it in its back and forth motion. The stroke is about 1½ in. and the compressed air is taken from a main at about 80 lb. pressure. With this device it is possible to screen from 50 to 60 samples per hour while formerly a Mexican screened only from 20 to 25 per hour.

Tram Car with Automatic Door

A tram car with an automatically opening and closing door has been constructed under the direction of A. J. Cummings, superintendent of the Cheever Iron Ore Company, operating near Mineville, N. Y. Previous to the use of a car rigged with a door in this manner, a door was used which required the tram man to open it before entering the tipple. If the door would not open, as was often the case, the loaded car had such momentum that it would enter the tipple and turn to the dumping angle, thus making it difficult to open the door. Trips were attached to the tipple to open the door, but nothing could be rigged conveniently to close the doors mechanically. Open-end cars, designed by Koppel, were used, but these required extra care in loading large lumps of ore at the open end to prevent the fine ore from rolling out on the tram tracks. It was necessary to have the car fitted with a door in order to load to full capacity.



TRAM CAR EQUIPPED WITH AUTOMATIC END DOOR

REGULAR CARS RIGGED WITH AUTOMATICALLY OPERATED DOORS

The Koppel cars were then rigged with the automatically operated doors and these have been entirely satisfactory. Iron plates are tapped and riveted near the top and center of the sides of the car and to these lugs are screwed. Two arms of flat iron are attached to the lugs and extend out to the front end where they are split and riveted to the door. On the horizontal center line of the door a strip of flat iron is riveted and the ends are swedged to 1-in. diameter to receive the rollers *A*. The door is kept in position by resting on two supports formed by splitting the flange of the channels at the end of the car and bending them to the proper angle. As the car enters the tipple and dumps, the rollers carrying the door are guided in a horizontal course by riding on 4x5-in. maple pieces *B*, bolted to each side of the tipple frame.

Unwatering Flooded Mines

BY D. LAMONT*

It often occurs in opening an old mine that a considerable quantity of water has to be removed. I propose to give a few details and hints, gleaned from actual experience as to plant required for this work, its installation and working. I do not propose to deal with elaborate and costly installations, such as have been used in some cases, but confine myself to the style of plant in more common use, and which, in nine cases out of ten, would be used in a medium undertaking by the average engineer with an eye to economy in first cost.

ESTIMATING QUANTITY OF WATER

Before definitely settling on the size and capacity of the pumps required, the size of the shaft and available space must be considered. It is also necessary to ascertain the amount of water the mine is producing, and add a percentage to allow for extra water by seepage from surface during heavy rains or melting snow.

Many mines have an adit level communicating with the shaft as low as the contour of the country will permit. The amount of water flowing from the adit is generally a fair guide to the amount or excess water which the mine is yielding. This may be measured by an ordinary weir.

TYPE OF PUMP

In ordering a pump, a good margin must be allowed on its capacity for the excess water. Of the different types of sinking pumps little need be said, as all have their particular merits, and an engineer or pumpman will generally swear by the particular type of pump with which he has had most experience. I consider it a good policy to give an experienced pumpman his choice of pump.

Most sinking pumps can be driven with either steam or air, or both together, as I have seen done. The steam heats the air, and increases its efficiency considerably. If the distance between the boilers and pump is not too great, the combination of air and steam prevents freezing of the exhaust, which is often a great trouble in pumps using compressed air only. Compressed air is expensive, as it involves the use of steam or other power to work the compressors. The losses in efficiency through friction in pipes, leaks, etc., is also considerable, and although compressed air is a boon in a mine, it is not always convenient in the initial stages of unwatering the mine. Steam power is most favored to begin with, as fuel for boilers is obtainable in most parts of the world.

The boiler ordered, should be a little in excess of the actual horsepower required, and of a type suitable for transport if the mine is situated at a distance from the railway or waterway. The boilers should be placed as near to the shaft as space and solid ground will allow.

REPAIRING SHAFT

If the mine has been shut down for a good many years, it is possible that the shaft timbers have rotted, or fallen in, and it is always safe to begin by putting in a good collar set, well spread, and carrying two or three sets down on hanging bolts. The collar set should be placed a little above the ground level, and the ground sloped outward, to prevent water from entering the shaft.

A temporary headgear should then be erected over the shaft to carry the weight of the pump. A small steam winch should be rigged in line with the pulley for use in lowering and raising men and materials.

A crosshead is useful; the light timber guides of this should be carried down as the work of unwatering proceeds. A signal line should also be fitted in the shaft, and a code of signals arranged. If the sides of the shaft are in good condition it may not be necessary to carry down the timber sets, and, in that case, the only timber required would be the chain-block timbers, and bearers for the pump hangers, and cross timbers to carry the guides for the crosshead. These should be wedged into hitches cut in the wall. Cross timbers should also be placed every 50 ft. or so, to carry the weight of the steam and water pipes. The pipes are supported by clamps. It is a good plan to arrange platforms and ladders in the pumping compartment for executing repairs, and to serve as an exit for the men, in the event of any accident.

PLACING THE PUMPS IN POSITION

A hand crab-winch should be well anchored at the surface. The pump should be hung on this with a flexible

*St. John del Rey Mining Company, Ltd., Morro Velho, Minas Geraes, Brazil.

wire rope passing over the pulley, and lowered through the hoist compartment. When the pump has been lowered into position and hung with a set of chain blocks in the pumping compartment, the rope should be passed over the other pulley and down the pump compartment and secured to the hanger chain by a strong shackle. In this way the pump is always in hand, and, in the event of water rising in the shaft, it is generally possible to lift the pump out of the water.

Sometimes, even in the case of steam pumps, a pump can be made to work under water and clear itself. I recall a case in point where a steam pump was covered with six feet of water. When steam was turned on it started easily, and got the water down to the previous level. This was the Tangye Cameron pump with a capacity of 15,000 gal. per hour working against a head of 400 ft., the exhaust being led to surface. The exhaust is sometimes carried into the water. This arrangement has a tendency to heat the water and any escaping steam makes it uncomfortable for the men. Suction condensers take up too much room under the pump, and interfere with its efficient working. I have always found it the best plan to carry the exhaust to the surface, although it entails a little more work and extra piping.

Sinking pumps are generally fitted with heavy hangers and hooks to take the timbers top and bottom. With heavy heads, however, the vibration of the pump is sometimes so great that it is necessary to supply extra support in the shape of an extra timber from the opposite wall.

Use of Suction Hose

The suction hose is generally a great source of trouble, and it is not always convenient to use an iron-pipe suction, as, in the event of meeting with débris it is essential that a suction can be shifted. Rubber suction hose as supplied by the makers should not be put into a shaft without being protected with tarred rope, or wound with light chain of about 3/16-in. link. If tarred rope is used, the end should be passed through the bight at each turn. It should not be pulled too tight on account of subsequent shrinkage of the rope in the water. Securing the rope at each turn in this way prevents it becoming unwound should it be cut in any part. A foot valve and strainer should be used with a strong rope attached, the end being secured near the pump platform, this greatly facilitates the handling of the suction hose.

Lubrication and Valves

It is always best to lubricate the cylinder and slide valves from the boiler room, or, at any rate, from surface. For this purpose a one-pint sight-feed lubricator should be fitted on the main steam pipe. A ½-in. or a ¾-in. valve should be placed on the lower end of the steam pipe, near the pump, to blow out any water when starting up after a stoppage. A check valve should be placed in the water column immediately above the air vessel, or, failing this, a small pipe connection and valve to empty the column when it is required to open the water end for repairs.

All bends or sharp angles should be avoided in the water column. At the top of the shaft or wherever the water is delivered a T should be placed so as to give free exit to the air.

Be Prepared for Emergencies

A spare pump of a similar type should be kept in working order at the surface ready to lower in case of a bad breakdown. Metal valves and seatings are not suitable for gritty water and in the case of rubber-composition valves no time should be lost in turning or changing them if they are in any way leaky. It is bad economy to continue pumping with defective suction or delivery valves. A good stock of these should be kept on hand, and as many spare working parts as possible.

As the water is lowered, the different working levels should be thoroughly explored to see that no bodies of water have been held back by falls of ground or other causes and which would be likely to break away later on and cause damage, besides endangering the lives of the men in the shaft.

Points to be Observed

It is wise to keep under the head specified by the makers and when this limit has been reached the pump should be securely fixed near a level in which a tank should be made either by damming a portion of the level with concrete or by cutting out the floor or side. Another pump should then be installed to continue the work deeper. The steam piping should be large enough to supply the number of pumps considered necessary to unwater the mine, and it is better to put this in at the beginning and save the trouble of changing later on. A book should be kept by the pumpmen in which should be noted: The running time; stoppages; causes; and the depth the water is lowered in each shift.

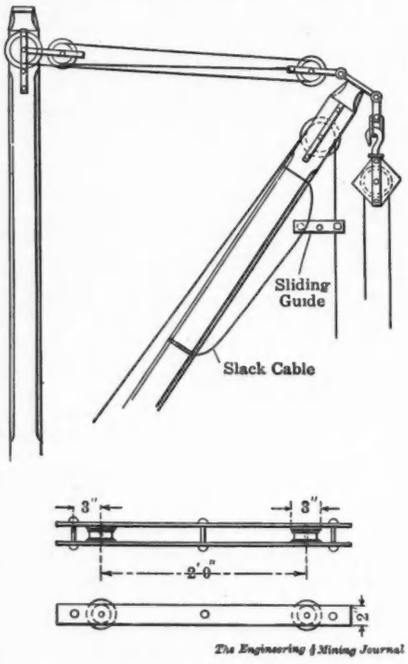
Tapping Old Workings from New Shafts

Another system of unwatering old workings is to sink a shaft in virgin ground to a depth below the level of the bottom of the old workings, and tapping the water by a drill hole which is plugged with a special form of plug and valve. The water is then under control, and can be drained into the sump of the new shaft and pumped to surface. This system requires a large outlay of capital, but, is often advisable, especially in the case of extensive and dangerous workings.

Preventing Twisting and Swinging of Fall Block on a Derrick

A simple method of keeping the fall block on a derrick from twisting is described in *Engineering-Contracting*, Aug. 10, 1910. As shown by the accompanying sketch, one end of a cable with about two feet of slack is fastened as close as possible to the sheave near the top of the boom, and the other end is anchored about 10 to 15 ft. from the base of the boom.

Two flat pieces of iron about ¼x½x24 in. are fastened together with two sheaves between them, one sheave at each end, as shown in the sketch. This is then put on the derrick with the slack cable, the fall line passing between the sheaves. This guide slides up and down on the cables, as the boom is lowered or raised.



Guiding Device for Fall Block

Besides preventing the twisting of the blocks it also serves, to some extent, in preventing the load from swinging.

Saw Sampler for Copper Bars

Copper bars are sampled at Cananea with a series of six parallel saws held in a framework. The bar is inserted and cut halfway through. An electric attachment rings a bell notifying the attendant that the saw should be stopped. The bar is then turned over and cut on the other side halfway between the first cuts. The device saves considerable labor and gives a more accurate sample than the rip saw that was formerly used.

At the Robinson mine, on the Rand, bore holes eight and nine feet long are now used in breaking ore from the wide stopes of the South reef.

Operations at the Mexico Mines of El Oro

The report of the Mexico Mines of El Oro, Ltd., for the fiscal year ended June 30, 1910, details the operations and important developments at this newest of the mines of El Oro district, in the State of Mexico.

During the year the company reports a realized profit £154,990, out of which was paid dividends amounting to £214,391 leaving after all fixed costs were deducted and £8000 written off plant cost, £63,497 balance in the treasury. The total plant expenditure to June 30, 1910, was £103,034, of which £62,179 have been written off and also cost of preliminary development, amounting to £50,963, a total for redemption of capital of £113,142, all out of profits.

Ore Extraction

The quantity of ore broken shows an increase of over 50,000 tons as compared with the preceding year, and the total amounts to 138,266 tons. Of the milling grade ore produced during the year by stoping and development, 135,766 tons were sent to the mill and 2500 tons were placed in reserve on the ore dump. In addition 860 tons of high-grade ore have been mined, 253 tons of which were shipped to the smeltery, and 607 tons were treated at the mine. All of this high-grade ore, with the exception of 45 tons, came from the West Sulphide vein.

The extensive development is set forth in detail. In depth the orebody has been developed by two winzes, one near the South shaft reached the eighth level and showed an average of $47 gold and 40 oz. silver, the other nearly $26 gold and 27 oz. silver at a depth of 30 feet.

Shaft Sinking and Development

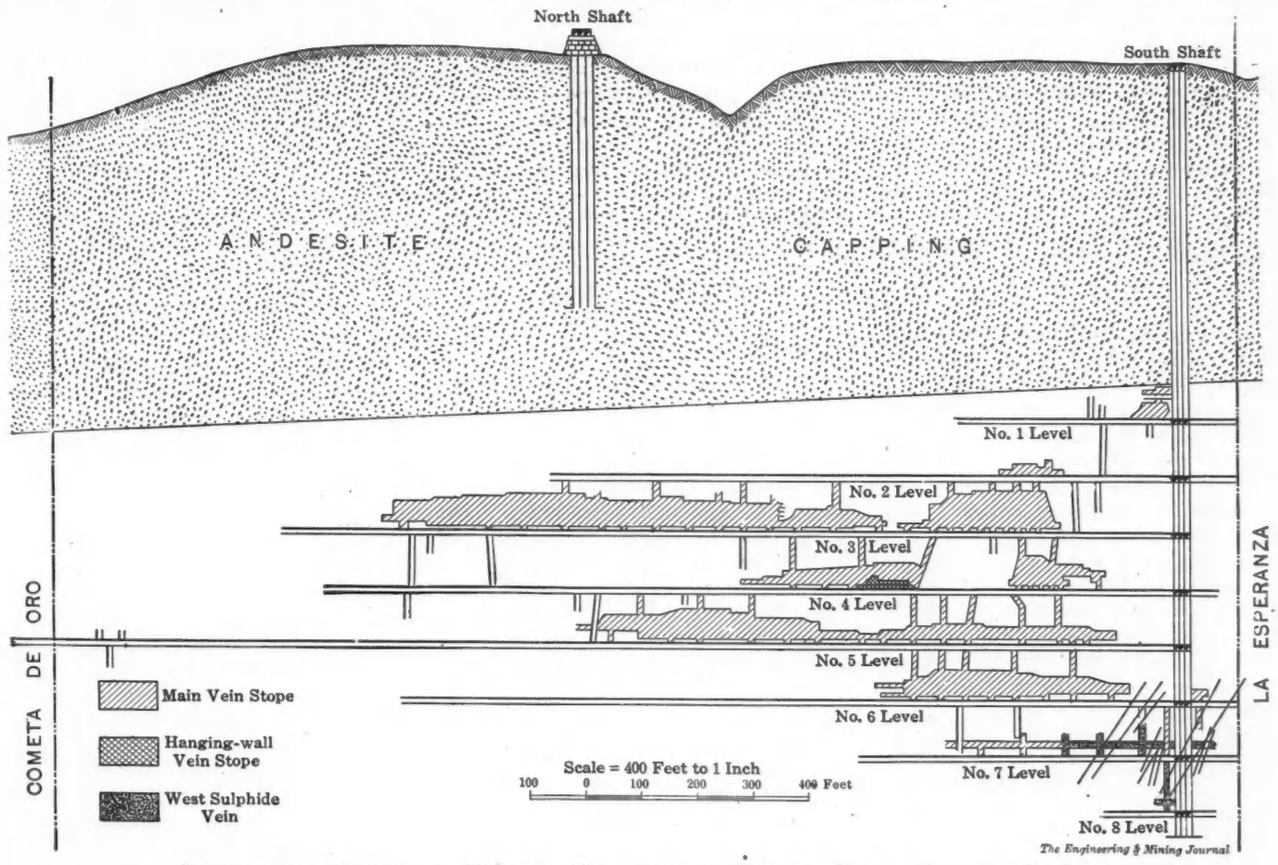
The main or South shaft has been sunk to the eighth level and has a depth of 1350 ft. The Auxiliary shaft has also been carried down to the eighth level. The North ventilating shaft has attained a depth of 500 ft., and will, as soon as connection with the working level is made, greatly improve the ventilation of the mine. Including this shaft sinking, the total of development for the year amounts to 9558 ft., as compared with the corresponding figure of 3791 ft. done during the previous 12 months. Of this footage, 2921 ft. was in ore averaging $24.94 gold, and 18.9 oz. silver.

Ore Reserves

The ore now developed amounts to 283,735 tons, averaging $9.57 gold and 5.9 oz. silver. With regard to the average ore grade, it must be taken into consideration that on the seventh and eighth levels the development on the West Sulphide is relatively much further advanced than on the lower-grade ore of the Main and Footwall veins. For that reason, during the coming year later development on these levels will probably, while adding to the reserves, lower the average ore grade as now expressed.

Milling and Cyaniding

The mill made a remarkably steady run, reaching 97.8 per cent. of the full time. The ore crushed was increased nearly 100 tons per day, as compared with the year before. During the latter part of the year the high-grade sulphide ore, previously shipped to the smeltery, was cyanided separately, with the result of greatly increasing the net profits from this rich ore. By giving it special treatment, average extractions of 97.47 per cent. of gold and 91.37 per cent. of silver were obtained, or a saving of total content amounting to 96.14 per cent. The high-grade ore so treated was 607 tons, yielding bullion to the sum of $60,749, which amount is included in the total production. In addition, 253 tons shipped



Projection on Sections of Main and West Sulphide Veins of Mexico Mines of El Oro

to the smeltery, with gross valuation of $49,693, yielded $40,180 net profit.

The report of General Manager A. F. Main includes the operating details by month. The yearly totals of the mill and cyanide statement are as follows: Tons crushed, 136,372; assay value, gold, $8.31, silver, $3.24; theoretical extraction, gold, 80.20 per cent. silver, 88.37 per cent., total 88.37 per cent.; actual recovery, gold, 90.64 per cent., silver, 82.78 per cent., total, 88.43 per cent. The total realized was: Gold, $1,026,923; silver, $365,413; total, $1,392,336.

The detailed statement of working costs, also by months, show: Tonnage, 136,372 tons; mining cost per ton, $1.62; development, $1.02; milling, 0.23; cyaniding, $1.04; water supply, 0.02; general expense, 0.25; taxes, 0.50; other expenses bring the total cost up to $4.75. In the total costs a reduction of nearly $1 per ton was made over the previous year. All departments contributed toward this reduction, but the greatest cut was in the cost of mining. Development showed a total expenditure of $40,000 more than in the previous year, but there was two and one-half times as much work done.

Mexican Geographical and Geodetic Surveys

The Mexican geographical commission has finished the printing of the general map of the republic for 1910 and the wall map of the State of Morelos. The commission has also published six more separate maps of divisions of the general map, to a scale of 1/100,000. It has fixed astronomically the situation of 49 points in the State of Chihuahua, Coahuila, Durango, Oaxaca and Yucatan and has determined the elevation above sea-level of 182 other points and has effected tachymetrical surveys of an aggregate distance of 7700 km. with a view to the formation of new maps of separate portions of our territory.

The geodetic commission has continued its work of triangulation for the survey of an arc of meridian 98 deg. west of Greenwich. It has also completed a project of triangulation along parallel of latitude 25 deg. 30 m. north, between Guanacevi and Monterey, and made observations as to gravity at Zacatlan, Tlaxcala, Chalchicomula and Orizaba, besides doing its indoor work, including all the required calculations.

New Concessions in Mexico

A concession was granted March 19, 1910, for the exploration of the subsoil of the national territory, in Mexico, from a scientific and industrial point of view, by means of deep borings, the concessionaries undertaking to invest in the work the sum of 600,000 pesos.

Another concession was granted on April 20, 1910, for the establishment of zinc smelteries in the Republic and allied industries, such as the production of zinc in pigs and sheets or in the filiform state, etc.

Another concession, issued on March 19, 1910, grants franchises for surveys looking to the discovery of oil in the northern portion of the territory of Lower California.

Franchises were granted for a Japanese exposition in Mexico City in order to familiarize the Mexican people with the manufactures of Japan, which henceforth can be imported direct, owing to the establishment of a line of steamships between Japanese and Mexican ports.

El Chico District, Hidalgo, Mexico

By Luis Pascoe*

The district of Atotonilco el Chico, or El Chico, as it is better known, lies about six miles north of Pachuca, in the State of Hildalgo. It is connected with Pachuca by a mountain-wagon road, built at a cost of $70,000. The district is on the northern slope of the Sierra de Pachuca and has a moist, mild climate, quite different from that of the camp of Pachuca. The elevation of El Chico village is 8012 ft. above sea level and of Pachuca 8030 ft. and the intervening sierra rises to 10,830 feet.

Eruptive Tertiary Rocks Similar to Those of Pachuca

El Chico district is geologically similar to Pachuca and is formed chiefly of eruptive rocks mostly andesite, rhyolite and basalt, in age ranked as name. The veins are found mostly in the andesite area in El Chico as at Pachuca and at Real del Monte.

In the El Chico are two principal parallel veins—the Arevalo and San Pedro, the latter on the south and both dipping to the south. These correspond to the "mother" veins of the Pachuca district, the Viscaina and Tapona. The chief content of all these veins is silver but in El Chico veins more gold is found than in the Pachuca veins. All of the ore may be cyanided with good results as to cost and saving.

El Chico Mines Worked Before Spanish Conquest

The mines of El Chico were undoubtedly worked before the Sanish conquest. Archives in the church at El Chico record the beginning of operations by the Spanish in 1521. In the early part of the last century the German house of Eberfeld operated mines at El Chico and also at Zimapan, Bonanza and Capula. The ore from all these camps was treated at the "Plan Grande" mill at El Chico, the ruins of which can yet be seen about 1000 ft. from the mouth of the modern Nepton tunnel. The patio process was used and power was derived from great overshot water wheels. The Germany company sold its interests to the Revilla family and the mines were again transferred to Thomas Mancera, father of Don Gabriel Mancera, the present owner and the backer of the notable Nepton-tunnel enterprise.

The Arevalo, one of the mines owned by Sr. Mancera, has a record of being continuously worked for over 100 years without a shutdown, and today at a depth of 530 m. shows no signs of exhaustion of the ore in the vein or diminution in its grade.

Among the other principal mines worked in the last half century are the Artejea, Fortuna, San Antonio, El Rico, San Jose, La Laguna, San Raefael, El Torno, Gran Campañia, Marquis Solo, San Isidero, San Nicholas, San Tomas, El Porvenir, San Pascual, Tetitlan and San Marcial. These have yielded a large tonnage of ore and are extensively developed. Ores from these mines kept nine haciendas going and before the modern smelting plants came into the market, the high-grade ore was treated in Indian furnaces called *chacuacos,* of which more than 15 were in operation up to 25 years ago.

Driving Nepton Tunnel to Unwater Arevalo Mine

The most important work being carried on at the present in the district is the Nepton tunnel, started in 1895, by Gabriel Mancera, to develop and unwater the Arevalo mine. It is now 2169 m. long and is being advanced 40 m. per month. It should cut the Arevalo vein within a month and at a depth of 370 m. The plan is to continue it to cut the San Pedro vein about 40 m. south of the Arevalo vein. The tunnel has cut 56 veins in all and has effected the unwatering of all the district north of the Arevalo vein.

The principal interests in the districts today are the Mancera company, controlling the Arevalo mine and the Nepton Milling Company, largely owned by the Ludlow brothers, this company having extensive holdings and also operating under leases the famous Tetitlan mine, owned by Julian Perez Duarte; the Fortuna company, a local organization in bonanza, and the R. H. Lyman company, owning the Aguila de Oro, Las Monjas and Cuahtemoc, in all 134 pertenencias. The Las Monjas claims are on an extension of the San Pedro vein of the Tetitlan and the Cuahtemoc claims cover the Arevalo and San Pedro "mother" veins on the course of the Nepton tunnel.

Plans for the active operation of several other properties in the district are being made and a new custom mill will be installed. The district has abundant water power and labor is efficient and cheap.

*El Chico, Hidalgo, Mexico.

San Rafael y Anexas Mining Company, Pachuca

Total Ore Broken, 1,490,983 Tons Averaging 1080 Grams Silver and 4 Grams Gold per Metric Ton; Vizcaina Orebody 3 to 4 m. Wide

BY E. GIRAULT*

The San Rafael y Anexas Mining Company is a Mexican corporation, organized Aug. 31, 1874, by Messrs. Jose Marie Barros, Jose Olmedo y Lama and Jose Sebastian Segura. The capital of the company is 60,000 pesos, having never been increased. It is largely through the efforts and financial support of the late Jose M. Barros that the San Rafael y Anexas property has been developed into such a profitable mine. The holdings of the company are: The San Rafael, Sorpresa, Soledad, Previsora, Ampliacion de San Rafael, Barros, and Polo Norte, 123 percenencias in all. With the exception of the Barros, all are *aviadas*, or controlled on a working contract.

Produced Ore Four Years after Formation of Company

The San Rafael mine commenced to produce ore in 1878, the Sorpresa in 1891 and the Soledad in 1892. The total output to July 2, 1910, was 990,983 metric tons sold and milled by the company, and about 300,000 metric tons of ore on the dump, making a grand total of 1,290,983 metric tons mined to date. Until the end of 1908 all ore was sold to custom mills or to smelteries. The net proceeds from this ore after deducting freight and treatment charges were 31,472,973 pesos; mine expenses for the period amounted to 18,318,867 pesos and 13,360,779 pesos were paid in dividends. The value of the silver and gold produced to the end of 1909, deducting 10 per cent. as treatment loss, was 51,240,692 pesos. All improvements, including 800,000 pesos spent on the new mill have been charged to current expenses and paid out of mine profits.

Lower Grade Ore Payable Since Erection of Mill

Prior to 1909 about 1000 grams of silver per ton were required to cover the expense of mining and milling. Since the introduction of cyaniding, from 300 to 350 grams per ton will cover all costs, and 500,000 tons of ore, half in filling and half on the dump, averaging about 500 grams per ton have become available for milling at a profit. Since the beginning of 1909, when the new mill was started, a shortage of power has forced the company to curtail production and to resort to expensive sorting.

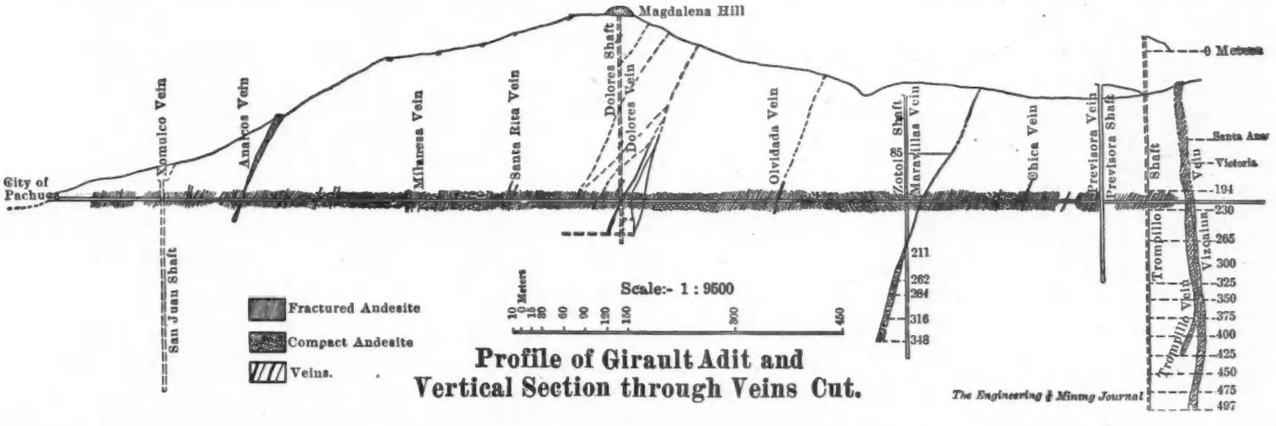
The cost figures for the second half of 1909 are as follows: Mining and extracting, 4.135 pesos; sorting, 0.890; sampling and assaying, 0.231; development and prospecting, 2.464; pumping, 0.443; new machinery, construction, freight, taxes and extraordinary expenses, 2.084; total cost per ton mined 10.247 pesos, adding to which the milling cost of 4.040 pesos gives a total cost per ton of ore milled of 14.287 pesos. The average assay value of the ore treated during the above period was 888 grams silver (31.1 grams = 1 oz. Troy) and 4.08 grams gold per ton. Waste from the sorting assayed 166 to 300 grams silver per ton.

Mill Extraction Improved

The capacity of the new mill[1] has been increased and some improvements introduced, as a result of which the capacity has been raised from 400 to 500 tons per day according to the class of ore treated. The present equipment of the mill comprises: Three 9x15-in. Blake crushers, one pair of 36x16-in. Denver Engineering rolls; 80 stamps; 18 concentrating tables; seven Dorr classifiers; seven pulp thickeners of some make; seven 4x20-ft. Krupp tube mills; twelve 15x45 ft. Pachuca tanks; three Moore filter units, each of eighty 10x6-ft. leaves, and other machinery in proportion. The silver extraction has recently been raised to 94 per cent. and that of the gold to 96 per cent. The milling and cyaniding cost is about four pesos per ton.

The Vizcaina, the Chief Lode of the District

The outcrop of the Vizcaina vein, which is the principal one of the district, can be traced on the surface for more than 16 km. The country rock is a pyroxene-andesite, and the vein crosses the formation from east to west, showing for about 800 m. on the property of the company. The accompanying vertical section on the course of Girault adit shows a number of the other veins of the district. The average width of the mineralized portion of the Vizcaina vein is from 3 to 4 m., increasing to 14 or more, at junctions of veins, etc. The width, including the South lode, is from 6 to 12 m.; the North lode and branches are narrower, usually from 1 to 2 meters.



Profile of Girault Adit and Vertical Section through Veins Cut.

Ore First Found at Depth of 100 Meters

The mines began to produce at a depth of about 100 m., the best level being the 350 m. At the 500-m. level the shoot is still 400 m. long, and the ore of about average value. In the upper portions of the veins small amounts of manganese oxide and of native silver were found; in the central portion, silver sulphide and

NOTE—Abstract of an article in *Informes y Memorias* del Instituto Mexicano de Minas y Metalurgia, June, 1910.

*General manager, San Rafael y Anexas Mining Company, Pachuca, Hidalgo, Mex.

[1]ENG. AND MIN. JOURN., July 9, 1910, p. 67.

some galena, blende and iron pyrites; in the bottom, on the 500-m. level, an increase of blende and galena is noted. The character of the ore has not, however, undergone any remarkable alteration, still being amenable to amalgamation and cyaniding. The gangue averages about 70 to 75 per cent. silica and 10 to 20 per cent. calcite.

The great San Rafael oreshoot, extending beyond the boundaries of the company's property was more than 1200 m. long in the middle levels and has been worked for 400 m. on the incline.

A total of 1,490,983 metric tons of ore, including that left in the fillings and being drawn at present, has been broken in the San Rafael mines. Of this total 990,983 metric tons averaged 1400 grams silver and 5.6 grams gold; 300,000 tons on the dump average 500 grams silver, and 200,000 in the fillings average 400 grams silver per metric ton. The average assay of the total is 1080 grams silver and four grams gold per ton.

Development Work Done by Hand

All development work is done by hand; the average advance made in drifts in medium-hard rock is three meters per week, and the maximum, working five or six pairs of miners at a time, is eight meters. In the hard andesite two to five meters are made, in the winzes on the veins two to five meters, in the Girault tunnel (3x3 m. in cross-section) eight meters per week. In shafts where water must be pumped the average advance per week is two meters, in dry shafts, three meters per week.

Levels are from 2.25 to 2.59 m. high and from 1.9 to 2.5 m. wide. Double drifts under stopes three meters or more wide are carried four meters wide and three meters high, and each gangway is 2.25x1.5 m. in cross-section. A uniform grade of 1 per cent. is carried in all the mine workings.

The prices paid to contractors per meter of advance are: For levels, in soft ground, eight to 18 pesos; in average ground, 45 pesos; in hard rock, 60 to 75; winzes, 2x2.5 m., in soft ground, 25; in average ground, 45; in hard ground, 70; wet shafts, 3x5 m., 250 to 300; dry shafts, 125 pesos per meter.

Main Shaft Carried in Advance of Other Workings

The Trompillo shaft is sunk in advance of other workings, Sulzer sinking pumps being used to drain it. At a short distance to the north a countershaft is sunk to carry pipes, electric lines and spare pumps. Auxiliary underground shafts, provided with 25-h.p. hoists and electric pumps, are also sunk in order to drain the extreme portions of the mine and to help in the opening of the levels.

Owing to the necessary slow speed in sinking, due in former times to lack of proper appliances and in the last few years to irregular supply of power, and hence frequent flooding of the workings, levels are carried only 25 m. apart. As soon as a supply of power can be relied upon, it is proposed to increase the interval between levels to 40 m., and thus reduce the working costs.

The common pine wood of the eastern Sierras sells at 35 to 45 pesos per thousand board feet at Pachuca. This is the only timber used in the mines. The timber will stand a crushing load of about 1000 kg. per sq.cm. Caps 1.5 m. long and 6x10 in. in cross-section are given a uniform load of three tons. In wet and hot places the timber will stand for about two years.

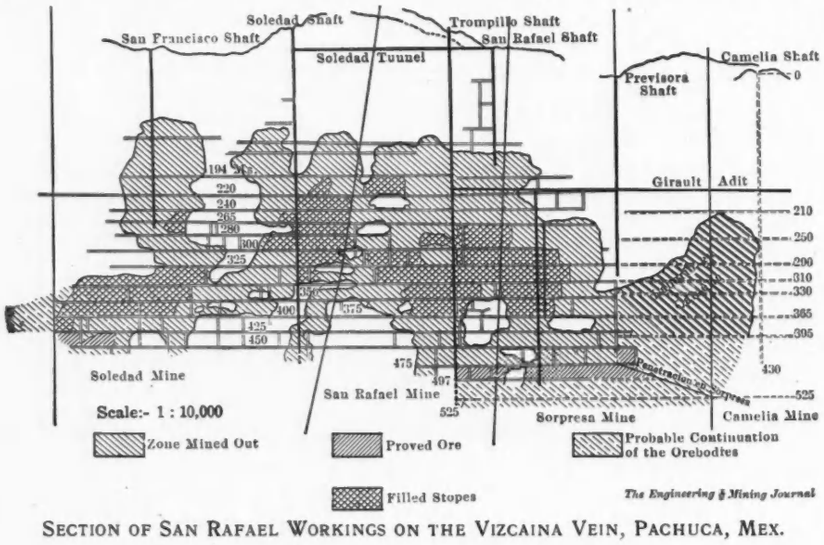
Eight-hour Day in Vogue—Bonus Paid on Tonnage

The men work eight-hour shifts, with an hour for dinner at noon or at midnight; this applies both in the mill and mine. The wages actually paid, or figured, for the contractors are as follows: Contractors on drifts, 2 to 10 pesos; miners, head men, 1.50 to 2.25; common miners, 1.15 to 1.37; peons, on day's pay, 0.62 to 1; on contract work, 0.87 to 2; peon bosses, 1.50 to 3; timbermen, 1.50 to 3; timbermen's helpers, 1.15 to 2.25; hoist men, 3 to 5; pump men, 1.75 to 2; mechanics, 1.50 to 4; electric workmen, 2 to 4; carpenters, 1.50 to 3; blacksmiths, 1.50 to 4; ore sorters, 0.75 to 1.50. All employees are paid by the week and a bonus is granted to those connected with the production in the mine as well as in the mill. The weekly pay, including bonus, for engineers, master mechanics, surveyor, captain, mill superintendent and shift bosses is between 55 and 120 pesos; for office employees between 25 and 80 pesos; for watchmen and surface employees in the mine and mill, from 10 to 30 pesos per week.

Girault Adit Cut a Number of Veins

The Girault adit serves to connect the San Rafael, Camelia, Maravillas and Encino mines with the city of Pachuca. It greatly facilitates the drainage of the northern mines and the tramming of ore from the Camelia, also the prospecting of the ground north of the Vizcaina, which is capped by a later flow of andesite. Before reaching the Vizcaina lode, the tunnel crosses a number of less important veins, as is shown in the accompanying vertical section taken on the course of the tunnel. The tunnel was proposed by me in 1895 before the flood that drowned the mines on this part of the district, but was not started until May, 1908, owing to the Encino and Maravillas mines refusing the needed permission to cross their ground. It connected with the San Rafael workings in December, 1902. The total length to the Vizcaina lode is 1600 m., and the actual development, including the branches in the Camelia and San Rafael, is about 2600 meters.

The Girault tunnel was driven by hand



SECTION OF SAN RAFAEL WORKINGS ON THE VIZCAINA VEIN, PACHUCA, MEX.

at an average speed of 8 m. per week, the price paid the contractor being 75 pesos per meter. The cross-section of the tunnel is 3x3 m., the grade 1: 1000. On one side, below the floor, there is a masonry ditch 0.8x0.8 m., arched and covered by a concrete walk. Track is laid with 50-lb. rails, set at 3-ft. gage. The depths attained in the various workings are: 213 m. in the San Rafael shaft; 270 m. in the Dolores of the Encino mine; 156 m. in the Zotol, and 170 m. in the Camelia.

Close Filling of Stopes Necessary

The average stoping width on the Vizcaina lode is from 3 to 4 m., and that of the secondary veins from 1 to 2 m. The stoping width, of course, increases at the junction of veins. The North vein in the higher levels and the South one in the lower form orebodies several meters wide in places. The ground is much fractured and the ore soft and heavy. The vein filling varies from a crushed mixture of quartz and andesite that caves readily to hard compact ma-

terial. There is no appearance of banded structure, the andesite being much fissured and showing cracks and voids cemented by quartz. The stopes must be closely filled with waste, the opening being kept less than two meters high. Props and temporary sets are frequently required. Waste is being sorted out and used in the stopes for filling.

Waste from dead work is run down through chutes to the stopes, or raised by means of auxiliary hoists. Some waste is also supplied from crosscuts run for prospecting the walls of the veins. Winzes for filling and for proving blocks of ore are sunk every 15 to 20 m., and timbered chutes built in the stopes at the same intervals.

Stoping Done on Contract

Ore is stoped by contract, the price paid being from 0.75 to 2.50 pesos per car of half a cubic meter capacity, for rock broken to a maximum of 8-in. size. Ten to 15 centavos extra is paid for haulage to the plat, and 15 centavos is allowed for filling the stope. The cars hold from 600 to 800 kg., according to the class of ore. The contractor in every case must deliver the ore free of entirely barren rock.

Caved Workings Reopened

Under the old management, in order to reduce the cost of timber and of filling, a scheme of work was devised that consisted of sinking winzes every five meters and opening intermediate levels at the same distance from each other. The result was that the orebody was not well prospected, and that pillars, weakened by the stripping of the ore, slipped and one night in October, 1895, the entire workings of the Soledad, for a distance of 250 m. on the strike and 100 m. on the pitch, collapsed. Unwittingly the caving system had been applied on a great scale.

In the lower levels, that for three years remained under water on account of the flood, the fills in the caved stopes packed sufficiently to allow them to be reopened in their entirety and stoped as a new lode in loose ground that required timbering and close filling. These old stopes were found to contain a large amount of good ore and their exploitation constituted for many years the most important source of income to the mines. At the present time nearly all the levels are doubled, and most of the filling of the mine is being drawn through the numerous crosscuts five meters apart.

Contract with Custom Mill

The company has still to deliver 230,000 tons of ore to the Union mill, at the rate of 700 tons per week, an average charge on this ore being 14.5 pesos. The surplus is, however, treated in the company's own mill at a cost that does not exceed four pesos per ton. Sorting is thus limited to the coarse ore which is cobbed and hand picked, anything running below 100 grams silver per ton being discarded as waste. The sorting is done by contract at the rate of 0.85 peso per ton of clean ore. The dump is for the great part fines, running about 500 grams; middlings of about 2-in. size running from 160 to 300 grams, and coarse ore that requires sorting, 75 per cent. going as waste and 25 assaying more than 500 grams. For the last class of ore 2.10 pesos is paid per ton.

Electricity Used for All Hoists

All the hoists at the San Rafael y Anexas mine are operated by electricity. Denver Engineering Works, 5-h.p. electric hoists are used for sinking small winzes and draining them so long as the waterflow remains below 60 liters per minute, rawhide buckets holding about 300 liters and filled by hand being employed for bailing. For sinking the main and the auxiliary underground shafts 25,- and 50-h.p. hoists of the same make and fitted with cages and buckets are used. Pumping is done with Sulzer centrifgal pumps.

Trompillo Hoist of Ilgner Type but Flywheel Disconnected

The Trompillo hoist is of the Ilgner type, being a combination of a flywheel and an induction motor driving a continuous-current generator, and a continuous-current, shunt-wound winding motor. This type of hoisting machine is known to be successful and has been described and discussed at length. The flywheel has, nevertheless, been disconnected in the San Rafael, owing to the frequent interruptions of the power and to the time lost in starting after every stoppage.

Another unit to duplicate the Trompillo has been ordered to adapt it to a Union Iron Works, flat-rope, steam hoist that is to be electrically driven and installed at the Soledad shaft to replace the first-motion hoist, which does service at present. The two main shafts are also provided with compressed-air hoists that are temporarily used whenever the other engines are out of commission.

The Trompillo hoist was figured to hoist 30 cars, with 800-kg. load, per hour from the depth of 500 m. Drums are 2 m. in diameter, the rope 1⅛ in. The weight of an empty car is figured at 400 kg., that of ore 800 kg., of the cage 600 kg., and the rope 1500 kg. In balanced hoisting the maximum load is 3200 kg. at a speed of 7 m. per second, and the power required is 300 h.p., the speed of the winding motor being 350 revolutions per minute.

Mine Subject to Sudden Floods

The mine makes water at the rate of 1600 liters per minute. Of this 1300 liters are lifted 290 m. to the Girault adit, and the balance 500 m. to the surface for mill supply. With the opening of a new level there is an increase of about 2000 liters per minute. This gradually decreases as the upper ground is drained. The mine is, however, subject to sudden floods, of which the most damaging started on the night of December 15, 1895, and resulted in the drowning of the bottom levels for nearly three years.

Sinking Pumps Used for Continuous Service

The Sulzer centrifugal sinking pumps are used for continuous service. Weiss & Monski, and Knowles pumps are kept in reserve. Of the three Sulzers, one lifts 1500, and the others 2000 liters each to a hight of 30 m., with 25-h.p., 220-volt motors. The pumps are balanced with counterweights in such a way that they can be raised or lowered in a few minutes.

At present the sinking pumps lift from the 500-m. level to the temporary station at the 475-m. level, which is fitted with: Two movable triplex, vertical pumps with 165-mm. plungers, 300-mm. stroke, run at 75 r.p.m., and pumping 1440 liters each; two sinking Knowles pumps of 600 liter capacity each; and one stationary Sulzer pump, lifting 2000 liters either 100 or 200 m., according to the number of turbines kept in the pump. These pumps will be lowered to the new temporary stations opened every 50 m., and combined with a Aldrich Triplex of 400 gal. per minute capacity and with sinkers, will be ample to handle the water to the next fixed station that is contemplated for a depth of 600 meters.

The 400-m. station is equipped with: Three horizontal, triplex, Hoppe pumps with 150-mm. plungers, 300-mm. stroke, raising 1123 liters per minute each to the adit; one 2000-liter Sulzer and one Dow, duplex, double-acting steam pump, changed to electric drive, the capacity of the latter pump being 850 liters per minute. At the 265-m. station there are two Sulzer pumps of 1000 liters per minute capacity, lifting 300 m., and one duplex Dow of 1200 liters capacity for supplying water to the mill.

Pumps Handy but Not Efficient as Operated

The pumps are not well adapted to the conditions under which they are operated, being ordered with too large a margin so as to take care of the drops in the current which are likely to occur. Working under the actual conditions, they use nearly twice as much power as plunger pumps, and for this reason a centrifugal station pump is kept in reserve and run only from time to time. The efficiency of the sinking pumps cannot be determined as the wear on the moving parts from sand soon alters them. They are very handy, however, and take up little room in the shaft, and also have the great advantage of running steadily over long periods without stoppages for repairs. For this reason they have been adopted as the standard for the operations at the San Rafael y Anexas.

La Blanca Mine and Mill at Pachuca

The annual report of La Blanca Mining Company at Pachuca, Hidalgo, Mexico, shows that for the year 1909-10 the output was 39,304 metric tons, an average of 766 tons per week of an average content per ton of 1250 grams silver and 6.38 grams gold. The ore averaged 25.37 pesos per ton, The cost of extraction was 17.02 pesos per ton, but to this must be added haulage, customs charges and stamp duties corresponding to the metal extracted and also the cost of exploitation, dead work and necessary repairs in the mine, bringing the average cost of extraction up to 24.01 pesos per ton. The extraction for the year is lower than for the preceding year. The policy of the management has been to extract only ore to meet the current expenses of the mine, holding that the interests of the shareholders were better served by waiting for a better price of silver, and also reserve the ore for treatment in the new mill and cyanide plant now nearing completion and which is confidently expected to produce a profit of 10 pesos per ton greater than heretofore.

Description of La Blanca Mill

H. A. Barker and J. B. Empson, in a report to the stockholders of the La Blanca company, give the following data concerning the mill:

The mill is designed for a certain capacity of 200 tons per day, and can be depended upon to treat 240 to 300 tons with but slight addition to the equipment.

The first operation after the ore reaches the surface is to pass it through a Sandycroft breaker 30 by 12 in. of a capacity of 30 tons per hour, from which the ore is carried by belt conveyer to a vertical elevator by which it is raised to a circular bin constructed of steel 36 ft. high by 24 ft. in diameter. From this bin the ores fall behind two breakers, to an 18-in. conveyer provided with an automatic mechanism connected with the hoppers that regulate the supply of ore to the stamps. Before reaching this point an automatic sampler extracts a fixed proportion of from 5 to 10 per cent. of the total which is conveyed to the sampling room, where it is treated by an automatic sampler supplied by the Allis-Chalmers company.

The equipment of the mill consists of a Sandycroft battery of 40 heads of 1250 lb. each, with correspondingly heavy seats. The ores pass from the stamp to eight Deister concentrators, type No. 2, and eight of type No. 3. After concentration the slimes pass to six double Dorr classifiers, whence it passes to three settling tanks, 30 ft. in diameter by 12 ft. high. The coarser product passes for further treatment in the Krupp tube mills of which the plant contains six. The tube mills are 20 ft. long by 4 ft. in diameter with special Brown-Arey lining. The pulp discharge from the tube mills is raised by bucket elevators for reclassifying in the Dorr classifiers. The pulp of sufficient fineness passes to the settling tanks and thence to eight Pachuca agitating tanks of 15-ft. diameter and 60 ft. in hight. From the Pachuca tanks the pulp passes directly to a 300-ton pneumatic filter of special design.

All the tanks for holding the solutions are of steel on cement foundations and have been so arranged so as to simplify the operation of the plant. The solutions containing the metals will be filtered by a Burt patent clarifier before precipitation by the Merrill zinc-dust system. The manipulation of the various solutions will be effected by Aldrich triplex pumps, each unit being complete with independent Westinghouse electric motors.

All the principal buildings are of solid masonry with roofing of steel frames and covered with corrugated sheet iron. This style, although more costly than wood, possesses advantages in more rapid construction, durability and freedom from fire risks. The mill will be completed in October.

Operations of the Mexican Petroleum Company

By Edwin Higgins*

The Mexican Petroleum Company of California and the Huasteca Petroleum Company, both operating in Mexico, are controlled by the Mexican Petroleum Company, Ltd., of Delaware. The Mexican Petroleum Company of California owns in fee 448,000 acres of oil lands lying about 35 miles west of Tampico, Mexico. Most of the property is in the State of San Luis Potosi, only a small acreage etending into the State of Veracruz. The company has 20 wells drilled and producing, the average depth being 2000 ft. Seven new wells are being drilled. The average daily production from the 20 wells is 6000 bbl. per day. The oil registers 12 deg. and contains little water, the oil from one-third of the wells testing 5 per cent. Fifty Americans and from 200 to 400 Mexicans are employed and the monthly pay roll amounts to about $30,000. Practically the entire output of oil goes to the Mexican Central railroad, with which the company has a 10-year contract to supply 6000 bbl. of oil daily at 50c. per barrel.

Huasteca Petroleum Company

The Huasteca Petroleum Company controls, through ownership and leases, 200,000 acres of oil lands. Beginning at a point about 55 miles south of Tampico the properties comprise various tracts scattered over a distance of 40 miles toward the south. The company has three producing wells of an average depth of 2000 ft. Two wells are being drilled in producing territory. Production averages 10,000 bbl. per day, the oil registering 20 deg. and containing no water.

In addition to its oil lands this company owns an 8-in. pipe line from Casiano to Tampico, a distance of 65 miles. This has just been completed to Tampico and when all of the branches from Casiano are installed the line will have a total length of 130 miles. Prior to the completion of

Steel Barges for Transporting Oil Across Lake Tamiahua

the pipe line oil was transported across lake Tamiahua to Tampico on steel barges, two of which are shown in an accompanying illustration. The full capacity of the pipe line is 26,400 bbl. per day. The company employs 15 Americans and 100 Mexicans and is spending about $30,000 per month in field operations and pipe-line construction.

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Vanadium and Molybdenum in Chihuahua Lead Mines

The ores in a lead mine near Cuchillo Parado on the Conchos river in the eastern part of Chihuahua contain vanadium in the form of vanadate of lead, and wulfenite, or molybdate of lead. Heretofore no attempt has been made to save these minerals, but recently a contract was made by which concentrates of the vanadate and of the wulfenite are made and saved. The wulfenite concentrates run about 30 per cent. molybdic acid, and the vanadium ores about 18 per cent. vanadic acid. Small shipments are being made to an American ore agent.

Mexican Mine Titles

Only 881 title deeds to mines, embracing 13,737 claims, were issued in the second half of last fiscal year (Jan. to June, 1910), which, added to the 1367 title deeds issued in the first half of the fiscal year, make a total for the year of 2248 deeds, embracing 35,206 claims of one hectare each, showing, as compared with the preceding year, a falling off of 47 per cent.

Analytical Methods in the Cananea Laboratory

Methods of Routine Chemical Analysis Used at Cananea Consolidated; The Hawley Balance Readily Indicates the Amount of Flux Required

BY F. G. HAWLEY*

A condensed description is given herewith of the methods of routine chemical analysis used at the Cananea Consolidated Copper Company's smeltery laboratory at Cananea. As a rule, well known and standard methods have been followed, with such adaptations as experience has proved beneficial with these ores, or as may increase speed or accuracy. Some new or little known methods have been introduced and may prove of interest.

Silica in Ores

Run with either a bisulphate or carbonate fusion, the bisulphate being used on ores containing no garnet, feldspar or similar refractory silicates.

Bisulphate Fusion—Take 0.5 to one gram of ore in a 2-in. porcelain capsule, add five to 10 drops of nitric acid (according to amount of sulphides present) and take to dryness on the hot plate. Add 15 grams c.p. potassium bisulphate, or preferably, equal parts of potassium and sodium bisulphates. Place in a 2½-in. scorifier and place in the muffle for 15 to 20 min. at a gradually increasing temperature, finishing at a medium red color. Remove and cool, when cold the melt is easily removed and placed in a 300-c.c. tall beaker containing about 25 c.c. of water. Fill the empty capsule with dilute HCl (1:1) to dissolve any adhering particles of the melt and rinse into a beaker. Cover and boil on the hot plate until the melt is all dissolved and the silica shows clean and white. Filter through 12½-cm. ashless filter; wash, ignite and weigh.

Carbonate Fusion.—Weigh 0.5 to one gram of ore into a 30-c.c. platinum dish two-thirds filled with fusion mixture (10 Na_2CO_3, 7 K_2CO_3, 1 Na_2O_2) and thoroughly mix. Set in scorifier and fuse in the muffle at an increasing temperature, finishing at a bright red. Remove and pour on a clean, smooth, iron slab and while still liquid quickly flatten with a smooth iron disk. Place the dish and cake in a 4-in. casserole containing about 30 c.c. of water. Slowly add 25 c.c. HCl (if all acid is added at once the silica may form a rather insoluble coat on the melt and hinder rapid solution). When everything is in solution rinse and remove dish and add 2 or 3 c.c. of HNO_3. Evaporate on hot plate until solution is half gone, then set in sheet-iron ring and take to dryness. This ring is made a little smaller than the casserole and of a hight to keep it ¼ in. above the hot plate; its use greatly lessens the tendency to spit. Bake on hot plate at a moderate temperature for 20 to 30 min.; the residue should be brown but not black. Cool, add 10 c.c. water and 20 c.c. HCl, cover and boil five minutes, add 25 c.c. more water and boil again. Filter through 12½-cm. ashless filter; wash once with hot water, once with hot dilute HCl and twice with hot water; ignite and weigh.

For ordinary routine work a second evaporation is not made, but an addition of 0.6 per cent. is made for silica still in filtrate. For careful work the filtrate from the silica is again evaporated to dryness, treated as before and the small amount of silicia recovered added to the main portion. The purity of the silica should be tested with hydrofluoric acid and any foreign matter found deducted from the total weight.

Alumina

The filtrate from the silica determination is neutralized with ammonia and a slight excess added; boiled a few minutes; filtered through a 15-cm. S. & S. No. 604 filter; washed twice with hot water, once with ammonium-chloride solution (10 per cent. NH_4Cl, 5 per cent. NH_4OH), and again with hot water. If much copper is present more washing with ammonium-chloride solution or a double precipitation will be necessary. With a fine jet, rinse the bulk of the hydroxides from the funnel into a 400-c.c. Griffin beaker, replace beaker under funnel and dissolve any remaining hydroxides from the filter paper with hot dilute HCl and wash once. To the filtrate add 10 to 15 c.c. concentrated HCl and heat until sure that all aluminum hydroxide is in solution. Add a little cold water, just neutralize with ammonia, add 3½ c.c. HCl, 10 c.c. ammonium phosphate (200 grams per liter), dilute with cold water to 350 c.c., add 25 c.c. hypo solution (400 grams per liter) then 5 c.c. glacial acetic acid. Boil 15 min., filter and ignite, beginning at a low temperature. Use conversion table to obtain Al_2O_3 (factor = 0.4185). All solutions are made up in bulk and delivered through properly marked dispensing burettes. Antimony interferes with this method and must be removed. On ores high in alumina and low in iron, more accurate results may often be obtained by the difference method.

Lime Determined as Oxalate

To the filtrate from the precipitated hydroxides add 0.5 to one gram ammonium oxalate, boil on hot plate five to 10 min., cool, filter through 12½-cm. S.&S. No. 597 filter, and wash thoroughly Open the filter and spread upon the side of the beaker. With a fine jet wash the calcium oxalate into the beaker, leaving the filter upon the side above the liquid. Dilute to 75 c.c., warm to about 80 deg. C., make acid with 5 c.c. H_2SO_4 and titrate with permanganate (1 c.c. $KMnO_4 = 0.005$ CaO). When near the end drop the filter into the solution, stir vigorously and carefully complete the titration. On ores low in lime, the titration may commence more quickly if a few cubic centimeters of manganous sulphates be added.

Magnesia by Phosphate Method

To the filtrate from the lime deterioration add a gram or two of sodium or ammonium phosphate in solution and then quite a large excess of ammonia. Place in a cooling trough, stir vigorously and let stand for several hours. Filter, wash and ignite at high temperature. Multiply weight by 0.3603 for MgO. If manganese is present, in the ore, remove it by adding bromine water at the time the hydroxides are precipitated.

Iron and Sulphur

Iron and sulphur are usually run from the same sample. Weigh ½ gram of ore into a tall 300-c.c. beaker, add pinch (about 100 mg.) of $KClO_3$, then 10 c.c. of chlorate mixture. Keep cool for five minutes, set on hot plate and boil to dryness. To ore high in sulphides add, little by little, pinches of $KClO_3$ until the sulphur is entirely oxidized and red fumes are no longer given off. With heavy sulphides, it is advisable to keep the mixture cool by placing on a screen in a cooling trough, the screen permitting a ready circulation of water under the beaker.

After expelling nitric acid, take up with 10 c.c. HCl and boil until acid is about half gone and all oxides are thoroughly decomposed. Remove from hot plate, dilute to about 100 c.c., add an excess of NH_4OH, boil a few minutes and filter through a 15-cm. S. & S. No. 604 filter into a 400-c.c. Griffin beaker. Wash four or five times with hot water. The iron is now all upon the filter and the sulphur in the filtrate.

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Sulphur.—Boil the filtrate until most of the NH_4OH is expelled, neutralize with HCl and add about 5 c.c. excess. Now, while boiling, add a little at a time, an excess of hot, half-saturated solution of $BaCl_2$, 20 c.c. being in all cases sufficient. Boil five to 10 min., remove and let settle a short time and filter through a 12½-cm. S.&S. No. 589 filter. Wash four times and weigh as $BaSO_4$; use conversion table for obtaining the per cent. of sulphur.

Sintering Method for Heavy Sulphide Ores

On some ores, as those carrying heavy copper or zinc sulphides, the above method will give low results. In such cases run as follows: Thoroughly mix ½ gram of ore with six to eight times its weight of a mixture of ZnO and Na_2CO_3 (4 : 1); sinter at a low, red heat for 15 min. in a porcelain crucible, leach with warm water and filter. Acidulate the filtrate with HCl and 5 c.c. excess and finish as above.

Iron.—Wash the bulk of the hydroxides into a tall 300-c.c. beaker with a jet of water. Place the beaker under the funnel, dissolve the little remaining hydroxides through the filter with dilute HCl (1:1) using not more than 10 c.c. and wash the filter once. Dilute the filtrate to 100 c.c., add 10 grams of test lead, place on the hot plate and boil until colorless. Remove from the hot plate and cool in cooling trough to room temperature. Decant into a 600-c.c. Griffin beaker, wash twice by decantation, dilute to 500 c.c. with cold water, add 10 c.c. of manganous-sulphate mixture and titrate with permanganate to a faint pink. As this method tends to run high, deduct 1/10 c.c. for every 8 c.c. of permanganate used.

If accurate results are desired on ores high in iron the potassium-dichromate titration is preferably used, the above procedure being followed except that no manganous-sulphate solution is used and the bulk is kept smaller. If it is known that no copper has been retained by the hydroxides, the reduction may be made with stannous chloride, the excess of which is taken up by mercuric chloride and titrated as usual.

If the ore contains garnet, or insoluble iron silicates, all the iron will not be obtained by acid treatment and a carbonate fusion should be made; or, as an alternative, the finely ground ore is treated in a large platinum dish with 4 c.c. HNO_3, 6 c.c. HF, 10 drops of H_2SO_4 and evaporated to dryness. If no sulphides are present, use HCl instead of HNO_3; take up with HCl and run as usual.

Copper determinations are usually made by the permanganate method, occasionally checked by electrolytic or iodide methods.

Permanganate and Electrolytic Determinations for Copper

Permanganate Method—Weight 0.5 to one gram ore into tall 300-c.c. beaker, add 12½ c.c. of "dope" mixture (1 H_2SO_4, 2 HNO_3, 1 saturated solution $KClO_3$ in HNO_3), four to 10 drops HF and evaporate to strong SO_3 fumes. Cool, add 60 c.c. water and just neutralize with ammonia. Add 5 c.c. HCl and 10 to 12 c.c. of sodium sulphite (200 grams per liter), cover and set on hot plate. Bring to boil, add five to 10 c.c. (according to copper present) of potassium thiocyanate solution (40 grams per liter), boil two minutes and remove from hot plate. Let stand five minutes with covers on, then five minutes without, and filter through 12½ cm. S. & S. No. 597 filter. Wash four times with hot (not boiling) water. Place original beaker under the funnel and with a wash bottle treat the precipitate with a boiling hot 5 per cent. solution of sodium hydroxide. Use a medium-fine jet and thoroughly stir the precipitate. Wash four times with hot water, cool the filtrate somewhat, make acid with slightly diluted H_2SO_4 and immediately titrate with standard solution of permanganate, 1 c.c. which is equal to 0.01 gram Fe. Use conversion table to obtain per cent. of copper. High coppers should be titrated cold and have a bulk of not less than 200 c.c.

Electrolytic Method—Weigh 0.5 to two grams of ore into a 90-c.c. sloping-sided beaker, add 6 c.c. HNO_3, 2 c.c. H_2SO_4 and 2 c.c. water and heat until HNO_3 is almost but not quite expelled. Add 4 c.c. HNO_3 and 10 c.c. water and boil two minutes. Cool, nearly fill with water and electrolyze for four to five hours at 1½ amp in a Guess-Haultain electrolytic cabinet. Wash electrode with water then with alcohol, dry and weigh. The weighing is greatly facilitated by using the following system of counter balances: The electrodes are numbered in series and a similarly numbered system of aluminum weights is made, each weight being made about five milligrams heavier than its platinum partner. The two are then placed in balance pans, the electrode in the left hand pan and the aluminum weight in the right, the left-hand rider then manipulated until the two are in exact balance and its position entered in a record book.

When the copper-coated electrode is to be weighed it is but necessary to place the proper counter balance in the right-hand pan, place the left-hand rider at the mark indicated by the record and with the right-hand rider and weights, directly weigh the copper present, thus doing away with all subtractions. As the electrodes slowly decrease in weight through use it is necessary to occasionally check the position of the rider and enter the new position in the record book.

Zinc Determination

Weigh 0.5 to one gram of ore in a casserole and add 15 c.c. of chlorate mixture. Boil off most of acid and add 5 c.c. more of the chlorate mixture. Boil dry but do not heat more than enough to expel all HNO_3. Remove from hot plate, add about eight grams ammonium chloride, 75 c.c. water, 15 c.c. ammonia. Boil two minutes and filter through 12½-cm. S. & S. No. 597 filter. Wash once with water and once or twice with ammonium chloride solution (10 per cent. NH_4Cl, 5 per cent. NH_4OH). If zinc is high, dissolve and reprecipitate hydroxides and combine filtrates, which should have bulk of about 175 c.c. Neutralize with HCl and add four to six drops excess. Add test lead and boil five minutes. Remove, add five drops of sodium sulphate solution, and 5 c.c. HCl. Cool to about 90 degrees C. and titrate with potassium ferrocyanide (1 c.c. = 1 per cent. Zn on ½ gram) using 1 per cent. solution of ammonium molybdate as indicator. This method insures a minimum amount of lead going in solution and a definite amount of HCl being present.

Lead by Electrolytic Assay

Treat 0.885 gram (use special lead weights) of ore in a tall 300-c.c. beaker with 15 cc. of the "dope" mixture and evaporate to fumes of SO_3. Cool, add 25 c.c. water and bring to boil to insure everything possible being in solution. Now set the beaker in an inclined position in a funnel so that the lead sulphate may collect in one place, cool and carefully decant through a S. & S. No. 597 filter, keeping the lead as far as possible in the breaker. Wash the precipitates once with a small amount of cold water, let it settle, again decant through filter, wash filter once with a little cold water. Place the beaker under the funnel and wash the filter with 40 c.c. of boiling hot mixture made of 20 c.c. HNO_3, 15 c.c. saturated solution of ammonium nitrate and 5 c.c. of water. Boil to insure complete solution of $PbSO_4$, rinse into 90 c.c. of electrolytic beaker and electrolyze hot for two hours at from 1½ to two amperes. Wash electrodes with water, then with alcohol, dry over hot plate and weigh, using system of counter balances as described for electrolytic copper. The lead is precipitated as a firmly adhering coating or hydrated lead peroxide. By taking 0.855 milligrams of ore results are read directly into percentages of lead.

If no interfering elements, antimony, bismuth, molybdenum, arsenic, tellurium, are present, the above method may be shortened as follows: Treat 855 mg. of ore in a tall 90-c.c. beaker with 10 c.c. HNO_3; when decomposed, add 15 c.c. saturated solution of am-

monium nitrate, 10 c.c. HNO_3, fill with hot water and electrolyze as above.

Manganese

Manganese is usually determined according to Volhard's method, but for routine work titrate directly in presence of precipitated iron oxides.

Antimony

Thoroughly mix one to two grams of ore with eight to 10 parts of sodium carbonate and sulphur (1 : 1) mixture and fuse in a covered porcelain crucible. Heat slowly for 15 minutes, finishing at a medium red heat. Cool with cover on, leach with hot water, and boil five minutes.

If precipitate does not settle well, or solution appears green, add three or four grams of sodium sulphite (Na_2SO_3) and boil again. Make up to 200 c.c. and filter through dry filter into dry beaker. Remove 100 c.c. with pipette to 300 c.c. beaker. Acidify with acetic acid using 10 c.c. excess, and boil one minute. Settle and filter through a smooth 12½-cm. filter. Wash precipitate with a jet into a clean 300-c.c. beaker; if any precipitate adheres to filter dissolve through with dilute (1:1 HCl). Add an amount of HCl equal to solution already in beaker, cover, heat slowly for 20 minutes and boil five. Cool somewhat, remove 40 c.c. of solution, just neutralize balance with ammonia, replace the 40 c.c., dilute to 400 c.c. and titrate with permanganate, 1 per cent. Fe equal 1.07 Sb.

For accurate work on high-grade ores and those containing arsenic the sulphur on filter should be dissolved in ammonium or sodium sulphide, re-precipitated with acetic acid and run as above. Up to 1 per cent. antimony may be recovered.

Arsenic

Mix 0.5 to one gram of ore with six to 10 parts of ZnO-Na_2CO_3 mixture (4:1) and sinter in a porcelain crucible for 15 to 20 minutes. Start at low heat and increase to full redness. Leach with hot water and filter. Boil solution, carefully neutralize with HNO_3 and add just four drops excess. Use litmus paper for indicator. See that any alumina or zinc oxide that may have run through filter is dissolved. Boil off CO_2, remove from hot plate and add a solution of silver nitrate; 0.7 gram $AgNO_3$ is sufficient for 0.1 gram As. There should be no red precipitate formed; if there is, add a little HNO_3. Now add about one gram of sodium acetate and stir rapidly. Let stand 20 minutes, filter and wash. Dissolve silver arsenate through filter with dilute HNO_3, dilute and titrate with a standard solution of ammonium thiocyanate, using ferric sulphate as an indicator.

Assay of Gold and Silver in Ores

Except in special cases run all ores by crucible assay on ½ a. t. charge and flux with object of obtaining lead button of approximately 24 grams. For careful work run four charges of ½ a. t., combine and scorify buttons in sets of two, weigh the resultant silver buttons in duplicate and combine the two buttons for gold.

Use a scoopful, 80 grams of a stock flux to a charge, adding flour or niter as described below to produce a button of the proper size. The two stock fluxes, both of the excess litharge type, are so made that one, the reducing, will give a button of the proper size on a strictly neutral ore. The other, the non-reducing, will produce a 24-gram button on an ore containing 15 per cent. of pyrite or an equivalent amount of other sulphides. With ores containing much iron or manganese oxide, add from ⅓ to ½ gram of flour. Determine the amount of sulphides present either by panning or by preliminary fusion. With experience, good results by panning can be obtained with ores containing not over 40 per cent. of pyrite.

For high sulphides and ores requiring accurate results, proceed as follows: Weigh out 3.64 grams of the ore, using a special weight made for the purpose, and run as a preliminary in a 10-gram crucible using about 50 grams of non-reducing flux. This will give a lead button weighing exactly as much as the niter necessary to oxidize all the sulphides in ½ a. t. of the same ore. Place the lead button obtained in one scale pan and from the hook above the other scale pan suspend by means of a fine wire loop another weight. This weight and loop are united and weigh 6 grams. Now add niter to the side having the 6-gram weight until the scale is in balance.

This is just the amount necessary to add to the ½-a. t. charge to oxidize the excess sulphides. If this is properly done the whole operation can be quickly performed and the results will be accurate.

Using the Hawley Balance

About the same results can be obtained by means of the Hawley balance, which is so constructed that when the lead button from a preliminary of 1/10 a. t. is placed on the scale pan, the pointer will indicate on the dial the number of scoopfuls of niter necessary. A scoopful contains 4.2 grams and will oxidize 10 per cent. of pyrite. As part of the cover, place about 20 grams of litharge in a pile on one side of the charge. As the charge melts, this litharge, owing to its heavier weight, sinks through the molten mass to the button and is useful in oxidizing copper and other impurities in the lead. Use salt as a general thing for the rest of the cover, though borax is preferable on a basic charge.

On all unknown ores, insure a silver button large enough to readily weigh, by adding to the charge 1 c.c. of a solution of silver nitrate containing 1 mg. silver to 1 c.c. of solution, and then subtract 1 mg. from the weighing.

The excess litharge charge used will permit of successfully running an ore containing up to 12 per cent. Cu. If the copper content is higher than this, run as follows: As soon as the charge is poured, put into the crucible about 60 grams of litharge with which has been mixed a little silica and place back in the muffle. As soon as this is melted, drop the button into the litharge and leave in the muffle for four or five minutes. Withdraw the crucible, and with the tongs give the contents a rapid swirling motion for several minutes. This brings every part of the button in contact with the molten litharge and rapidly oxidizes the copper. One treatment will oxidize and force into the slag 12 to 15 per cent. Cu. and will therefore be all that is necessary on an ore running not over 25 per cent. Cu. The lead button is cupelled at the temperature to form "feathers" and the bead is weighed and parted in the usual manner.

Chilled Blast Furnace Slags

Silica—Run in duplicate. Weigh 0.5 gram into a 3½-in. casserole, add 5 c.c. of chlorate mixture and agitate for two or three minutes to prevent sticking; then while still agitating, add five to six drops HCl. Place on the hot plate, shake for a minute or so more, and evaporate to dryness. When apparently dry, cover with watch glass and bake at a gentle heat for 10 minutes. Remove, cool, add 5 c.c. water, 10 c.c. HCl, digest a few minutes and break up any lumps with a blunt stirring rod. Rinse off rod and heat contents of casserole to boiling. Add 25 c.c. of water and boil again. Remove, settle, decant through 12½-cm. S. & S. filter, wash once by decantation, rinse silica into filter, wash with hot dilute HCl and then twice with water. Place filter in an annealing cup, ignite and weigh. This method is not applicable with slags containing barium.

Alumina—The filtrate from one of the silicas is caught in a 500-c.c. Erlenmeyer flask, just neutralized with ammonia and then run by phosphate method as for ores. If much copper is present it must be eliminated by making a preliminary precipitation of the hydroxides.

Lime—Catch the filtrate from the duplicate silica in a 300-c.c. Erlenmeyer flask and carefully add ammonia until about half the hydroxides are precipitated. Now add six to eight grams of ammonium oxalate and boil five or 10 minutes. The hydroxides should be entirely dissolved. Filter, wash four or five times with hot water and titrate with

permanganate as described for ores. The precipitated calcium oxalate frequently appears a trifle yellow from traces of iron, but this does not affect the results.

Iron—Weigh 0.5 gram into a tall 300-c.c. beaker, add 75 c.c. water, cover with watch glass and heat to boiling. When boiling briskly add a little at a time 15 c.c. of HCl. Boil gently for 10 minutes, add sufficient stannous chloride to reduce the iron, and place in cooling trough. When partly cooled add an excess of mercuric chloride and titrate with potassium bichromate. Report as ferrous oxide; 1 c.c. $K_2Cr_2O_7$ = 0.005 gram FeO. In grinding slags to 100 mesh on an iron bucking board much metallic iron, 1 per cent. or more, is introduced into the sample. For this reason grind only to 50 mesh on the iron plate and finish grinding to 100 mesh in an agate mortar, this keeping the iron introduced down to 0.2 or 0.3 per cent.

Reverberatory and Unchilled Slags

Silica—These slags do not decompose well with acids and are run for silica by a carbonate fusion, the same as for ores.

Lime—The filtrate from the silica is run for lime exactly as on the furnace and settler slags.

Iron—Weigh 0.5 gram into a large platinum dish. Add 3 c.c. HNO_3, 10 drops H_2SO_4, then add 10 c.c. of HF. Heat until perfectly dry but not enough to decompose ferric sulphate. Cool, add 30 c.c. water and 5 c.c. HCl. Heat until solution is effected, but do not heat longer than necessary as the ferric chloride and HCl together will slowly attack the platinum. Rinse into a tall beaker, reduce, and titrate with bichromate as with other slags.

Alumina—Weigh 0.5 gram into a large platinum dish and decompose with HNO_3, H_2SO_4, and HF as in iron determination. After all H_2SO_4 is driven off, add 10 drops more H_2SO_4 and heat again to complete dryness. This is to expel all traces of HF which even in small amounts seriously lowers the alumina assay. Dissolve the residue in water and HCl, rinse into a 600-c.c. beaker, and just neutralize with ammonia. From this point run as for chilled slag.

Zinc, manganese, magnesia and sulphur are determined by the same method in both chilled and unchilled slags.

Zinc—Weigh 0.5 gram into a 3½-in. casserole, add 5 c.c. chlorate mixture, 5 c.c. HCl, 12 drops H_2SO_4 and 15 drops HF, in the order named, at the same time shaking the casserole to prevent sticking. Put on hot plate and heat until all acids, including H_2SO_4 are expelled. Remove, cool somewhat, add 5 c.c. chlorate mixture and 3 c.c. water. Again evaporate to dryness, taking care not to over-heat. Then run as for ores.

Manganese—Weigh 0.5 to one gram in a tall 300-c.c. beaker and while agitating, add 5 c.c. HNO_3, 3 c.c. H_2SO_4 and 15 drops HF. Heat the fumes of SO_3 and run as for ores.

Magnesia—Weigh 0.5 to one gram and treat as for manganese, only 1 c.c. H_2SO_4, however, being used. Heat to SO_3, fume, cool, add 5 c.c. water, 25 c.c. HCl and boil until all anhydrous sulphates are in solution. Dilute to about 100 c.c., add a slight excess of NH_4OH and five to 10 c.c. of bromine water and boil. Filter, precipitate lime as oxalate and run as for ores.

Sulphur—Weigh 0.5 to one gram in tall 300-c.c. beaker, add 10 c.c. chlorate mixture and let stand in cool place, with frequent agitations, for five minutes. Place on hot plate and when boiling add 5 c.c. HCl. Boil briskly five minutes and again add 5 c.c. HCl. Repeat still a third time and then take to dryness. Take up with 5 c.c. HCl, boil and dilute to about 75 c.c. Add excess of ammonia, boil, filter into 400-c.c. Griffin beaker and boil down filtrate to about 50 c.c. Make acid with 2-c.c. excess of HCl and while boiling slowly add an excess of hot barium-chloride solution. Boil 10 minutes, settle in hot place for an hour or more. Filter through 12½-cm. S. & S. No. 589 filter, ignite and weigh.

Copper by Electrolysis—Weigh one gram of slag into tall 150-c.c. beaker, add 8 c.c. of nitric sulphuric mixture (1 H_2O, 2 HNO_3, 1 H_2SO_4). shake around in beaker and add 20 drops hydrofluoric. Place on hot plate while still agitating and heat until nitric fumes are almost but not quite expelled. Remove, cool, add 3 c.c. of HNO_3 and 15 c.c. water and heat until everything possible is in solution. Rinse into special 90-c.c. sloping-sided beaker and cool. Fill with cold water and electrolyze for four hours at 1.2 amperes, using Guess-Haultain electrolytic cabinet. Now remove the beaker and original solution from the cabinet and substitute in its place a clean beaker containing 10 c.c. of special acid mixture (1000 c.c. H_2O, 500 c.c. HNO_3, 500 c.c. H_2SO, 75 grams NH_4NO_3) and then fill with water. By means of a double-throw switch reverse the current for a few seconds, the copper quickly going into solution again. Now, throw off the current, remove the solution to another portion of the cabinet containing clean electrodes and re-precipitate the copper. About 3½ hours is sufficient. The first deposit of copper always contains a small amount of impurities, usually 0.02 to 0.04 per cent. but the second one is pure.

Matte Determinations

Copper—Run by electrolysis if very accurate results are wanted, as the permanganate method is not altogether satisfactory for copper over 25 per cent. For quick results use the cyanide method and apply correction for amount of zinc known to be present. For the electrolytic determination, weigh one gram of pulp into an extra tall 200-c.c. beaker, add 10 c.c. H_2SO_4, 3 c.c. water and 10 c.c. H_2SO_4. Boil off about two-thirds of the HNO_3, remove and add HNO_3 to make up to a 15-c.c. mark previously placed on the beaker. Add 30 c.c. of water, 2 grams ammonium nitrate and three drops of permanganate. Dilute to 200-c.c. mark and electrolyze over night at ½ ampere.

Iron—By same method as for ores.

Sulphur—By sintering method given for ores.

Bullion Analyses

Copper—Weigh 10 grams into a large flask, add 150 c.c. water and, a little at a time, 90 c.c. HNO_3. See that solution is complete and boil off nitrous fumes. Add a slight excess of sodium-chloride solution (5 grams per liter; 1 c.c. NaCl equals about 10 mg. Ag), boil a minute to coagulate silver chloride, cool somewhat and filter through a Munktell's No. 0 filter into a liter flask. Cool to room temperature, make up to liter mark and shake until thoroughly mixed. With a pipette take duplicate portions of 100 c.c. each into special tall beakers (5½ in. tall by 2 in. diameter), add 20 c.c. of ammonium-nitrate solution (600 c.c. H_2SO_4, 300 c.c. HNO_3, 500 c.c. H_2O, 400 grams NH_4NO_3) and electrolyze 18 to 20 hours, beginning at ¼ and increasing to ½ amp., using cathode of 100 sq.cm. surface of the Guess-Haultain pattern. Remove electrode, wash once with water, rinse with used alcohol and once with pure alcohol, dry over hot plate and weigh, using system of counterbalances as described under electrolytic copper assay, to facilitate the weighing.

Gold and Silver—Weigh one assay ton in duplicate into 600-c.c. covered Griffin beakers, add 150 c.c. water and 90 c.c. HNO_3, a little at a time until dissolved. Rinse down cover and sides, cool in cooling trough, dilute with cold water to 400-500 c.c., add a slight excess of dilute NaCl solution (5 grams per liter), stir vigorously for a minute or so and let stand over night. Next morning filter through Munktell's No. 0 filter, wash once, scatter a few grams of standard reducing flux over the precipitate, place filter in 20-gram crucible containing a small amount of reducing flux, heat in door of muffle until filter paper is charred and add enough more flux to make a regular charge and run as usual. If quick results are wanted, follow the sodium chloride with a little H_2SO_4 and lead acetate, stir vigorously for several minutes, filter and run as before.

In the equipment of mines in Mexico the delay in securing repairs or new parts is often overlooked by those who have not had experience in that field.

The Altar Gold Placer Fields of Sonora, Mexico

Exploitation of Placers in Country Previously Worked. Successful Treatment for Cemented Conglomerate Claimed for Quenner Machine. Available Country All Denounced

SPECIAL CORRESPONDENCE

The Altar gold-placer fields are at present attracting widespread attention in the Southwest, so a description of the country and the mining methods there employed will be of interest. The rush to the Altar district so far has been confined to the denouncement of the ground under the Mexican mining laws, and since it is not possible to acquire title to work the ground within five or six months it will be autumn before there can be great activity in operations. Some denouncers of ground have made application to the department of fomento of Mexico to operate the Quenner dry-pulverizing and separating machine on their ground for the purposes of exploration only. If this permission is granted it is possible that a number of the machines will be installed in the Baludo and Cienega districts, and the value of the ground will be proved before any great expenditure of money is made.

Early History

The history of the Altar goldfields of Sonora dates back to 1799, when gold was discovered by a party of soldiers sent out from Altar, the capital city, to chastise the Seri Indians, a tribe that inhabitated the Tiburon island and which made depredations on the west coast, along the Gulf of California. Gold ranging in size from a lentil to that of a bean (many larger nuggets were picked up on the surface of the sands) was discovered in a gulch at what is now Baludo. A rush followed, and gold was found in many cañons adjacent to this original discovery. The old San Francisco mine, a tunnel mine, was opened in the bed of gold-bearing cement gravel, or *argamasa*, which is the predominant formation of the Altar fields.

The discoveries led further west, till finally the rich deposits of Cienega were encountered. Cienega is about 14 miles west of Baludo, and gold was found in almost every cañon and in the wide valley between Baludo and Cienega itself. In these cañons nuggets ranging in weight up to 14 lb. were found practically on the surface. Then the loose soil and sand were worked over and over, and many millions were taken out of the field, the gold in 25-lb. bricks being transported on the backs of burros. When the loose sands were all worked over the *gambucinos* continued to delve into the *argamasa* wherever they could, long tunnels were run to follow rich streaks and many lives lost from the caving of workings.

Country All Worked Over

This work was continued for a period of 200 years, and now for miles and miles in every direction, at Baludo, at Cienega, at Las Palomas, Cajon and a dozen other places the whole surface of the country is torn up, presenting a curious mingling of heaps of tailings from dry-washing machines, caved-in tunnels, wide trenches and great holes in the ground. The caving continues, and several times in riding over this treacherous ground on my mule, which is the only animal that may be trusted in such exploration, I passed caverns which had evidently only been exposed a few hours. In some places the pits are 40 ft. deep, and occasionally one notices at the bottom of these the arc of what was originally the mouth of a tunnel, now filled in with débris. The native workmen seem to have followed no general method of mining, merely following the channel wherever it went; when the shallow surface caved in behind them, they opened another shaft on the extension of the channel as indicated.

District Received Setback from High Government Royalties

In the year 1844 the government officials issued a decree which the gold workers considered arbitrary, and the fields were partially abandoned, as with the heavy royalty exacted they could not make the operations pay. At this time, following the rush into the Cienega fields, the city of Cienega had been established, and, augmented by a rush from Chihuahua, Durango, Sinaloa and other parts of Mexico, had rapidly grown to a population of between 20,000 and 30,000 inhabitants and become the capital of the district. Every now and then a great nugget was uncovered. Many of these bore strange resemblances to men and beasts, and were christened accordingly. One was named after "Our Lady of Guadalupe," another, found in Bocoachi, was named "La Cabeza del Burro," because it so much resembled the head of a burro. Much of the mining was done by *peons*, and under some of the *padrones* the workmen were given all the nuggets that would not pass through the screen used to separate the pulverized *argamasa* before feeding it over the dry washer. The workmen were required, however, to sell the gold to their masters at a price not exceeding $12 or $14 an ounce, if they sold it at all. The *padrone* or gold baron thus realized nearly half the value of the big nuggets, as well as acquiring outright all the *oro fino*.

Typical Views in the Altar Goldfield, Showing Primitive Native Diggings

Stamp Mill Proved Failure

Several years ago, following the reports of many engineers sent into the Altar field, operations were revived. Americans and French especially laid out many gigantic schemes for handling the ground that the Spaniards and Mexicans could not work, at depths ranging from

five to 500 ft.; but the necessity of bringing water from the gulf, or of solving the crushing problem, proved so much of a barrier that none of these schemes were ever perfected. Then followed the installation of the 50-stamp mill at El Tiro, Baludo. Water was piped from Trincheras, 16 miles away, and the mill started to operate on material from the old San Francisco workings. The stamp mill did not recover the gold, and after a consolidation with the Llanos de Ore mine owners, operated for a while on ore from the Tiro lode. The mill is now in litigation.

The Quenner Machine Perfected

About a year ago M. Quenner perfected his dry-pulveriing machine.[1] Its merit is in its simplicity. It is merely a 6-ft. trunnion-driven trommel screen (revolved at the rate of 28 r.p.m.) through which passes a shaft to which are attached, in spiral arrangement, chains on the ends of which are hammers. These hammers are revolved at the rate of 400 r.p.m., and have a striking power of about 1800 lb. They clear the trommel screen's inside surface by ¼ in. and are suspended so as to strike edgewise. It was found that this machine would crush the *argamasa* into dust, at the same time discarding the useless pebbles and rock at one end, thus giving a product for the dry-washing machines. It is claimed to have a capacity of about 500 tons per day. The machine weighs only 800 lb. and costs $1500. The other necessary equipment for a plant to treat the *argamasa* comprises an engine to operate the machine, boilers and hoisting engine, not representing in all a first cost of more than $4000.

Quenner took a lease on the tailing dumps of the stamp mill, and put through his one machine 80,000 tons of material at a great profit. Then the American Ore Milling Company was organized at Douglas, Ariz., to protect the patents on the machine and to put it on the market. The American rights have been sold to New Yorkers, and it will be manufactured in that city. At present the machines are sold in Douglas, and turned out by Roy & Titcomb, of Nogales, Ariz.

High-grade Channel Worked at Profit

The American Ore Milling Company, to demonstrate the machine, took a lease on what is termed the Bray ground at Baludo. The high-grade gold channel is there developed, bedrock being 130 ft. deep. The one machine is now recovering gold from the Bray lease at the rate of 50 oz. per day. I saw one day's clean-up that ran sixty odd ounces. So far the company has not been able to put more than 100 tons per day through the machine. Half of this tonnage is taken from the mine and half from a dump.

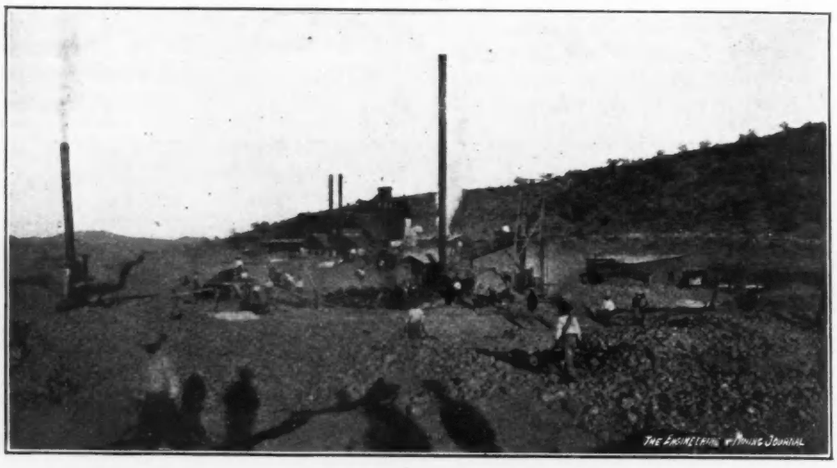
The rich underground channel at this place is already developed; hence the returns realized are phenomenal. But meantime others have demonstrated that it is not necessary to have the original channel developed to make the *argamasa* in the Altar field pay. At Santa Rosa, Stonestreet and associates have installed a Quenner machine, using conveyers to take the fines from the machine to the dry washers, and with a force of six men are operating successfully on material quarried from a slope.

Old Workings Shallow

The old timers in the Cienega and Baludo fields could not work the *argamasa* at any great depth. Because of the great scarcity of water, work has seemed hopeless unless some dry method of recovering the gold could be devised. The question that naturally arises now is this: Did the former workers follow the underground channels in the Cienega field to the point of taking out so much of the gold that those now denouncing the ground therein will be disappointed in reopening these old workings? My observations would lead me to believe that just as they neglected to follow the original discovery into the Baludo valley, so they could not follow the hundred ravine channels in the Cienega field far below a point where the *argamasa* ran to a depth of 30 or 40 ft. At the same time I personally examined cañons where tunnels had been run in as far as 500 ft. This, however, was possible only where the *argamasa* was comparatively soft, and where bedrock was not below 40 ft. from the surface. These shallow tunnels were usually followed from the workings at the head of the cañon, with bedrock rising on either side to indicate the direction of the flow, and in no instance in the whole field does one of these tunnels run below the mouth of the cañon leading immediately away from the lode which enriched the ground. This means that the valley country is practically unexplored.

Altar Field in a Region of Much Erosion

The gold-bearing *argamasa* reaches such great depth in the Altar fields as to indicate that erosion must have been unusually heavy between the Sierra Madres and the Gulf of California. Mountains which are today gentle ridges have been cut down and washed away by the action of the sea and of torrential rains, so that what appears today to be the apexes of gold-bearing quartz veins are in reality their roots, which accounts for the fact that although the Altar gold district has for years been known as an inviting auriferous placer field, nearly every denouncement of white quartz vein has proved a disappointment. What rich veins were left by the action of erosion were followed by the Spanish workers to the shallow depths that exhausted them. The notable gold mines of the Altar district occur almost without exception in the later intrusives.



Dry-placer Operations with Quenner Machine near Baludo, Sonora

The Argamasa a Cemented Conglomerate

The *argamasa* is a conglomerate of varying degrees of fineness, containing much mica, hematite, black sand, quartz and country-rock fragments cemented with calcite. The gold is embedded with the black sand. The Quenner machine pulverizes the conglomerate, and the dry washers leave only the black sand and the gold, which is hand panned. The black sand is saved as a concentrate, and contains a residue of fine flour gold. At Baludo the conglomerate is rather coarse, and the underground channel which is proving so rich is easily differentiated from the more barren *argamasa* on either side by a delicate iron stain. At Baludo, on the Bray lease, the channel of an ancient water course between rock banks is proving rich in gold; this formation is also pink. In the Cienega district two former waterfalls were encountered by the Spanish and Mexican

[1] Eng. and Min. Journ., April 23, 1910, p. 858.

workers. At both the tunnels were abandoned, as the miners did not seem to realize the conditions or the fact that highly enriched pockets might be uncovered just below the falls. At Las Palomas the *argamasa* is in a great measure much finer than that at Baludo, and the stain of iron more pronounced. In the original discovery made by the Papago Indian, Huaquila, the gold content ran extremely high, and the Spokane men who have organized a five-million-dollar corporation to operate there have denounced all the ground surrounding this original discovery.

All Available Ground Denounced

As previously stated, nearly all the Altar gold district has been denounced and redenounced several times within the last few years, but usually given up when it was found that development by water processes or stamp mills would not pay. Some of the men who released their holdings, on learning of the success of the Quenner machine, were the first to again rush into the fields. Under the Mexican mining law exploration of a prospect is permitted, but it is not permitted to make shipment of metal or ore. It will therefore be October or November before the shipment of gold from Cienega and other points other than Baludo will begin. Meantime, however, the denouncement of ground has gone on at a rate probably never before equaled in the republic of Mexico. Thousands of pertenencias have been denounced within 60 days and there is not an acre of ground open in all the vast fields of Cienega, Baludo or Las Palomas. The ground is usually picked because of the evidences of placer workings in the past and on the record of the various cañons, together with dry washing conducted on the field. There is no virgin ground in any of the districts of the Altar goldfield mentioned, one cañon being merely a repetition of the next, up and down the mountain ranges. The same is true of the placer fields to the east of the Southern Pacific railroad, at Bocoachi, Magdalena and Santa Ana.

No Copper in Campeche

Discussing the mention of copper mines in the State of Campeche, Mexico, near Champoton, referred to by Sapper in his book entitled "Geology of the Peninsula of Yucatan," Fernando Urbina in a communication to the Mexican Geological Society says he could obtain at Champoton no data concerning the location or existence of such mines and for this reason he believes they do not exist. Nor had any resident heard of them. He was informed that two days from Champoton was a spring, the water from which appeared to contain copper. He procured samples of this water and by test found it contained no trace of copper.

Batopilas Mining Company

With assets of $12,716,970 and liabilities of $9,448,436, the Batopilas Mining Company for the fiscal year 1909 shows a surplus of $3,268,534. The bullion in fine silver amounted to 1,047,625 oz. in 1027 bars, returning an average of 51.43c. per oz. Of the total returns, the native silver ores yielded 68 per cent., although constituting only 3 per cent. of the tonnage treated.

A concentration of 57:1 was secured in milling 30,267 tons of low-grade ore. The first- and second-class concentrates, averaging 8055 and 193 oz. per ton respectively, yielded 259,376 oz. of silver, an increase of 30 per cent. over the year 1908. This class of ore is largely a by-product in mining the native silver, although it paid 33⅓ per cent. of the total mining and reduction costs for the year.

The total amount of underground development was 26,491 ft., producing 31,258 tons of ore of all classes. The Porfiri Diaz tunnel and Todos Santos yielded 66 per cent. of the total; San Miguel, 26; Camuchin, 6½, and Exploration, etc., the remaining 1½ per cent. During the year several new shafts were sunk, old ones retimbered and the San Miguel and Camuchin mines dewatered.

Extensive Improvements, Including Cyanide Plant

The machinery of both haciendas was completely overhauled, and the San Antonio aqueduct repaired at points along its entire length of 9900 ft., increasing the available water power over 50 per cent. A cyanide plant, installed at a cost of $14,620, has rendered possible the treatment of lower grade sulphide ores. It has resulted in an annual saving of about $35,000 by decreasing the treatment costs 60 per cent. and increasing the extraction 12 per cent., an actual recovery of 97.19 per cent. being obtained.

The expenditures for new equipment amounted to $39,245 and included besides the cyanide plant, a 45-h.p. double-drum hoist, costing $13,585, electric mine pumps, ore cars, mine telephones and a 12-h.p. hoist. In accordance with the terms of the concession from the Mexican government, 247 acres (100 hectares) were denounced, making a total denouncement of 1870 acres in the four years, 1906-1909. The capital stock of the company was transferred to the regular list of the New York Stock Exchange on May 13, 1909.

Principal Production from San Domingo Vein

The greater part of the year's product came from the Santo Domingo vein in the Todos Santos and Roncesvalles mines, during the first four months of the year. This vein was cut the previous year. The silver was found at the junction of several small flat veins with the vein of the Santo Domingo.

In the San Miguel mine, 10,976 ft. of development was carried on, at a large expense, owing to the amount of dead work done. The lower workings were pumped dry of surface water which had accumulated for ten years. The 45-h.p. double-drum hoist was installed at the head of the vertical shaft. It is driven by a gas-producer plant, using charcoal for fuel. Some old workings, 300 ft. below the surface, were encountered in the San Antonio vein, probably made over 100 years ago as they were unknown by any living person or by tradition. Considerable dead work was also done in the Camuchin mine in order to give access to the old workings. The lower levels on some of the veins were dewatered, a shaft retimbered and a hoist installed.

Milling Operations

The amalgamation plant of eight pans and four settlers is now used for both amalgation and cyanidation. The discharge from the settlers, containing 80 per cent. of dissolved metal contents, flow to a Dorr thickener, where the separation of most of the silver-bearing solution from the pulp takes place. The solution is then pumped to the precipitation boxes and the thickened pulp to Pachuca tanks for further treatment by agitation.

The contents of the Pachuca tanks, after suitable agitation, are discharged to a Blaisdell vacuum filter, where the final separation of solution and tailings takes place. After washing, the tailings are discharged to the river practically free of cyanide and metal content.

Concentrates are leached for 40 days in cement-lined masonry tanks of 80 tons capacity when filled to a depth of two feet. The solution is precipitated by zinc shavings in four three-compartment boxes, each having eight cubic feet effective capacity. The precipitate, containing 80 per cent. silver, and the retorted silver from amalgamation and the native silver from the batteries are smelted in a *vaso*, taking 20 to 30 bars to a charge. The costs, exclusive of labor, to Nov. 30, 1909, were $8.68 per ton treated, but in December were reduced to $7.07 per ton.

Guanajuato Output

The estimated production of the mines in Guanajuato district, Mexico is as follows: Mother Vein mines, $700,000,000; La Luz district, $150,000,000; other mines, $150,000,000; total, $1,000,000,000.

The bullion returns reported are: 1548 to 1766 (estimated), $450,000,000; 1766 to 1887 (mint records), $476,585,531; 1888 to 1899 (mint records), $65,689,458; 1899 to 1909 (tax records), $50,000,000.

Mining Operations in the State of Chihuahua

Two General Types of Ore Deposits. Revival at Cusihuiriachic; Cole-Ryan Interests in Ocampo District; Developing Gold at Batopilas

BY W. H. SEAMON*

The mines of Chihuahua produce silver, gold, lead, copper and zinc. There are also large deposits of iron ore which will in time be worked. The mineral deposits are of two types: First, cave, or contact, deposits in limestone, associated with porphyry intrusions. To this class belong the zinc deposits and most of the copper and lead deposits. Second, quartz veins in connection with rhyolite and andesite. Where the veins occur at contacts of rhyolite with andesite, gold usually predominates. When the veins occur in rhyolite walls silver predominates and in many instances gold is entirely absent.

The deposits of the first type are confined to the eastern and central portions of the State. The most important camps containing deposits of this type are Santa Eulalia, Naica, Santa Barbara and Almoloya. The deposits at Terrazas, Las Plomosas, Coyame and Los Lamentos also belong to this type.

Geology of Chihuahua

The eastern part of the State is mainly Cretaceous and Quaternary with isolated and usually small areas of eruptive rocks. Recently I have seen a few fossils, found in this section, which are certainly as old as the Devonian and may possibly be of Lower Silurian age. The western part of the State is very mountainous and andesite is the prevailing rock formation, with intrusive dikes of rhyolite. The andesite is largely covered with a flow of dacite and tuff. This flow will generally be seen between 7000 ft. and 8200 ft. above sea level. Peaks rising above the latter elevation are usually found to contain diorite. Where the country is eroded the andesite is almost sure to be seen at all elevations below 7000 ft. and the rhyolite intrusive dikes appear at about the 6500 level, or between that and 5700 ft. There are, of course, instances where the rhyolite will be found above the 7000-ft. level, but most mass exposures resembling rhyolite found above 6500 ft. will prove to be dacite on closer study. Near the 4000-ft. level dikes of eruptive granite are occasionally found.

The intervening region is generally covered with dacite and tuffs; sometimes with a sedimentary conglomerate, derived mainly from igneous materials. These will be found in what were once lake beds and also along the banks of many arroyos. At certain points in this area, as well as in the eastern region, there will be found isolated areas, sometimes in the form of peaks of andesites and rhyolites, in which frequently occur workable deposits of silver, or even gold, ores. In these areas are found the mineral camps of San Pedro, Parral and Cusihuiriachic.

The western area is characterized by high-grade deposits of silver ores, usually carrying a good gold content. Some of the veins carry no gold, while others carry small amounts of silver with a high gold content.

Railways and Mining

The railway building now in progress in the State is of great importance to the future of its mining industry. The most active construction is that of the Pearson interests, who recently acquired the old Chihuahua & Pacific and the Rio Grande & Sierra Madre railways. The two ends of these roads are being connected in the Sierras and the work is being pushed as vigorously as is possible. Several large tunnel constructions will delay the completion of the work to the latter part of 1911. The same interests are at work on a 12-mile connection of the Cusihuiriachic camp with the main line at San Antonio. This is to be in operation before the end of the year. There is no difficult construction on this branch, almost all of which is over a level plain. The same interests have been looking into the matter of putting a branch line into the camp of Ocampo and also to connect with the Southern Pacific lines in Sonora.

Construction work on the Orient railroad which has been kept to a minimum for several years past, is now to be increased on both ends. It is hoped that the eastern portion will be most rapidly pushed, as the opening of a direct connection with Kansas City will be of greatest immediate benefit to the mining industry, furnishing a new and competing inlet for supplies.

While the railway building is satisfactory, yet none of it is of much immediate help in the matter of shortening the hauls of ore from the mines. The railways have as a rule not held to the mining camps as objective points. To help the mines materially, a campaign of wagon-road building will have to be inaugurated. This should be undertaken by the Government, which does not yet appear to realize the importance of this work to the prosperity of the country. Almost without exception, there is no concerted action in any district in the matter of road building. Each mine usually builds its own trail and if it unites with some main trail the main trail is left to keep itself in good condition. Most of the mines still freight to and from Miñaca, although many of them are 40 to 50 miles nearer to a railway. The reasons for this are that new trails would have to be constructed and the mines affected prefer to use the old and longer routes and the local railway freight rates are very high and have recently been heavily increased. The mines consider that they gain nothing by giving the railways a longer haul.

It is highly important that a vigorous campaign should be waged for building wagon roads under the supervision of the Government. In spite of the generally prevalent opinion that there are unusual difficulties in the matter of building wagon roads in the Sierras I do not find anything more difficult than what I have seen overcome in New Mexico and Arizona. The Greene wagon road from Madera to Ocampo was easily constructed but it is falling into bad repair.

Revival in Cusihuiriachic

The old Cusihuiriachic silver camp has taken on a new lease of life. About a year ago the Palmer interests of Chicago bought the Promontorio mine, then little more than a good prospect, and placed Murray Crossette in charge. The ore shipments have averaged about 1000 tons monthly and from the proceeds has been paid the original cost of the property, and of a model power plant and a new working shaft, leaving a large sum for dividends. The development shows a large orebody of good milling ore, but for some time to come the owners will have all they can handle in taking care of the shipping ore. The shipments frequently run high enough in copper to receive payment for that metal from the smelteries.

The British interests, represented by R. M. Raymond, have taken bonds on a number of properties from which are being made occasional shipments under the management of L. M. Cockerill. Several other properties are undergoing development; one of the most promising prospects being that of a local company, the San Ignacio. The Princessa and La Reina are promising properties. The old Santa Elena mine is still idle.

The orebodies occur in rhyolite and are connected with the andesites which are abundant in this district. The construction of the railway connection has caused many locations to be made.

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Activity at Parral Confined to Large Companies

Mining at Parral has been comparatively inactive for several years past. The large companies have, however, kept up a steady production which must be satisfactory to them. The generally prevalent dullness seems to me to be confined to the small operators who were so numerous a few years ago about Parral and may be entirely due to the inability of these companies to maintain themselves from their production.

The Palmilla company, a strong American corporation, which acquired the mines so famous when in bonanza, has just completed the first unit of the 1000-ton cyanide plant. It has been erected under the supervision of Bernard MacDonald and is one of the finest plants in the Republic. The company has large resources in its dumps, to say nothing of the so called low-grade ores in the mines that were neglected by Pedro Alvarado, the former owner.

The English company owning the San Francisco del Oro mines is constructing a branch railway and erecting a new plant, which it is claimed will solve the milling problem. In spite of the complaint that Parral is "dead," I cannot help but be impressed with the fact that so far as the economical handling of its ores on a large scale is concerned, Parral is now in better condition than it has ever been.

Batopilas Developing Gold

The mines at Batopilas have kept up their steady output of silver and the company has recently begun the development of some promising gold veins. It has long been known that gold veins existed in this section; but little attention has been paid to their development. The bonanzas of silver that have characterized this section have apparently overshadowed the gold prospects. One fairly good gold property has been partially opened up by a company of Mexicans and those who are familiar with it are of the opinion that it would make a heavy producer under intelligent management backed with sufficient capital to put in a good plant for treating the ore. The Batopilas concession has been merged into a British corporation and the new company is taking up many veins, particularly gold veins, which the old company had ignored. There is a fine trail from Batopilas to the Orient railway at Creel, from which point all supplies are now handled.

British Interests at Guadaloupe y Calvo

At Guadaloupe y Calvo, an English company has just taken over the old bonanza mine, Rosario, and is erecting a 400-ton plant to handle the dumps and the ore in the mine. The dumps on this property contain not less than 150,000 tons of ore that will yield 0.36 oz. of gold and 7 oz. of silver to the ton. The mine was never operated to a greater depth than 400 ft., and there still exists large amounts of workable ore in the immense vein, which is 150 ft. wide. Nothing has been done of moment during the last four years at the Los Angeles gold mine, about 16 miles from Guadaloupe y Calvo. This property is opened to 400 ft. and for a length of 1300 ft., showing 66,930 tons of ore with a gross value of nearly $800,000. It has never been worked as a producer and is a virgin property. There are five parallel veins practically unprospected in the same basin, all connected by a cross-fault plane.

Rio Plata Has Paid for Itself

The Rio Plata mine in the Guazapares district has kept up to its reputation during the last year, regularly shipping concentrates and bullion. It is a silver property exclusively in rhyolite and has the record of paying for itself out of its own production, including the equipment. The ore reserves have also been increased.

New Life at Candamenia

The Candameñia camp not far from Ocampo has been a producer of silver-gold ores for many years past. There is an old mill and the property has been worked by a Mexican company. During the last year it has been thoroughly examined by a New York syndicate and the terms of purchase have been agreed upon. Up to the present time the new company has not taken it over, owing to some defects in the titles which will be shortly settled.

Capital Promised for Sahuayacan

At Sahuayacan everything has been at a standstill for more than three years past. The company owning the principal properties has been handicapped for lack of sufficient funds for energetic working and the mines have had to be self-sustaining and carry on all development and improvements. The ore carries gold and silver in quartz veins in andesite. A party of Eastern capitalists have recently returned from the district and it is reported that their examination impressed them so favorably that the camp will be the scene of renewed activity at an early day.

Other Properties

The company operating the Socorro is undergoing reorganization and the management has been changed. The most important metal in this ore is gold but it is accompanied by silver and copper.

The Cienguita property, near the Socorro, has been opened during the last few years, under the management of R. O'Leary, with little capital. The money was mostly spent below ground and recently a small mill has been built. The property is now turning out gold bars and there is about two years' ore supply in sight.

The Republica mine was taken over about four years ago by an El Paso company, which sold out to a new company. A cyanide plant has been erected and the mine has produced a large silver output. A desire for quick dividends resulted in a policy that has not been for the best interests of the mine. About one year ago the company was confronted with a pumping proposition, for which it was not at the moment prepared; this caused a severe setback. The new pumping plant is now in operation and shipments of precipitates will begin once more. The orebody on this property is supposed to be large, but it has not been well developed and there are no large reserves available. Those who know the property best have great confidence in its future.

The Dolores camp has kept up its record during the year, shipping concentrates, bullion, precipitates and assorted ore. It is a gold property, mainly, with a large and well constructed plant. The manager is W. H. Paul, under whom the ore reserves have been largely increased and the value of the property greatly enhanced. This mine has been recently merged with the El Rayo mines at Parral and the Creston mines in Sonora.

The San Pedro company has maintained a steady production during the year from its silver-lead ore. A large pumping plant has been successfully installed in the Congresso mine. This camp is in the northern part of the State on the line of the Sierra Madre railway.

At the San Juan copper camp, near the Rio Grande about 20 miles from Fort Hancock in Texas, little work has been done. The principal mine has only about 1000 ft. of work completed, mainly drifting. The orebody is about 25 ft. wide, and is a contact deposit in lime with porphyry. It is said to average 5.5 per cent. copper and 4 oz. of silver per ton.

The Pinos Altos district is covered by one of the few old government concessions and the development, confined to a single company, has not given the progress that this great zone should show. The recent depression in financial circles crippled the operating company seriously and it has had to be self-sustaining. The production has been small, as was to be expected under these adverse conditions and there has been no development of any consequence completed. The ores carry silver and gold.

Ocampo Is Active

At Ocampo the Sierra mining company, which acquired some of the best of the holdings of the defunct Grenne Gold-Silver Company, has been pursuing a policy of development and the general public knows but little of the results. Corrigan,

McKinney & Co., have resumed operations on the old mine at Concheño, which they had sold to Colonel Greene. There are large numbers of men at work in this camp.

There has been but little activity at Terrazas, except in the construction of a converting plant for the Rio Tinto smeltery. This has just been completed and when it is blown in the camp will resume its former activity. The capacity of this plant is now 500 tons of ore daily. Mackenzie & Co. gave up the bond on the Elena mine after shipping a large amount of low-grade ores. Felix McDonald is now working it and is shipping 100 tons weekly of a desirable smelting ore.

At Calabacillos is a newly opened gold-silver section. It is about 20 miles northwest from the city of Chihuahua, is still in the prospect stage of development. The Evans property there has recently been taken over by a San Antonio company. A mill will be erected.

The production from Naica has been about 75,000 tons of silver-lead ore, much needed by the smelteries. The chief recent event of interest in this camp has been the reported purchase by a United States company of the mines of the Naica Company. It is said that negotiations are still pending, in spite of the fact that the six-months period of the option has expired. The ore reserves have been largely increased by all of the companies, but no new strikes are reported.

Earthquakes and Mine Accidents

At the time of the earthquake in Mexico, on May 30, 1910, a cave occurred at the Esperanza mine at El Oro, which resulted in the imprisonment for a short time of 27 miners, all of whom, however, were rescued without serious accident. This recalls the fact that notwithstanding the numerous earthquakes in Mexico there have been few accidents reported as due to earthquake shocks. In fact, it has been stated that the men underground frequently do not experience as severe a shock as those on the surface, and this is probably due to physical conditions. In the State of Oaxaca several of the abandoned mines have caved in as a result of the repeated shocks in that locality, and some other mine accidents are undoubtedly due to the earthquakes, but ordinarily the damage is confined to the surface, and particularly to within a few feet of the actual surface of the ground.

The mineral-bearing area of Mexico extends from Sonora to Oaxaca, a distance of 2570 km. and has a breadth of 400 km. There are in all 1900 mining districts in the Republic, of which 550 are silver and silver-lead bearing, 240 gold-bearing, 140 coal- and petroleum-bearing, 70 mercury-bearing, 40 copper-bearing, and 20 tin-bearing districts.

The Arteaga District, Chihuahua*

BY L. T. POCKMAN†

On the extreme western border of the State of Chilhuahua, with Sonora for its western boundary and with the District of Urique, Chihuahua, on the south, is the Arteaga district. Chinipas, the largest town of the district, is also the *cabecera.* The entire district is dependent upon mule-back transportation for the entry of all freight and supplies, from the west, from Alamos, Son., which is the terminus of the Southern Pacific branch, and from the east, from Sanchez, present terminus of the Kansas City, Mexico & Orient road. Alamos is 60 miles from Chinipas and from Sanchez 75 miles. This inaccessability has held Arteaga back to a considerable extent, but not wholly, as is evidenced by the number of operating mills and mines.

TRANSPORT DIFFICULT OWING TO PRECIPITOUS NATURE OF COUNTRY

Topographically the country may be said to be "standing on end," as the western boundary is a high range of rough precipitous mountains (from 5000 to 7000 ft.), while practically all the rest of the district consists of spurs and ranges which make up the foothills of the Sierra Madre. Many sheer peaks dot the country, rising to high altitudes, and many small arroyos run through box cañons. Add to the above the heavy thorny brush which exists, it makes hard work for the prospector. On the other hand, however, he is probably more greatly benefited by the fact that the overburden of soil, etc., is usually shallow, due to the precipitous character of the ground, and is further helped in that the geologic features are easily discernible.

MAP OF THE ARTEAGA DISTRICT, CHIHUAHUA

ARGENTITE THE PRINCIPAL MINERAL

In general, it may be said that the most frequent occurrences of the orebodies and veins are within strong intrusions or dikes of diabase, although in portions of the district there are what appear veins (principally gold carriers) in an altered andesite, the veins themselves being porphyritic in structure. The original ore depositions in one of the larger mines, shown by its workings, has been along fracture planes of diabase intrusions, after this "primary" deposition there has been a further movement which was confined mainly to the veins as being lines

Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, April, 1910.

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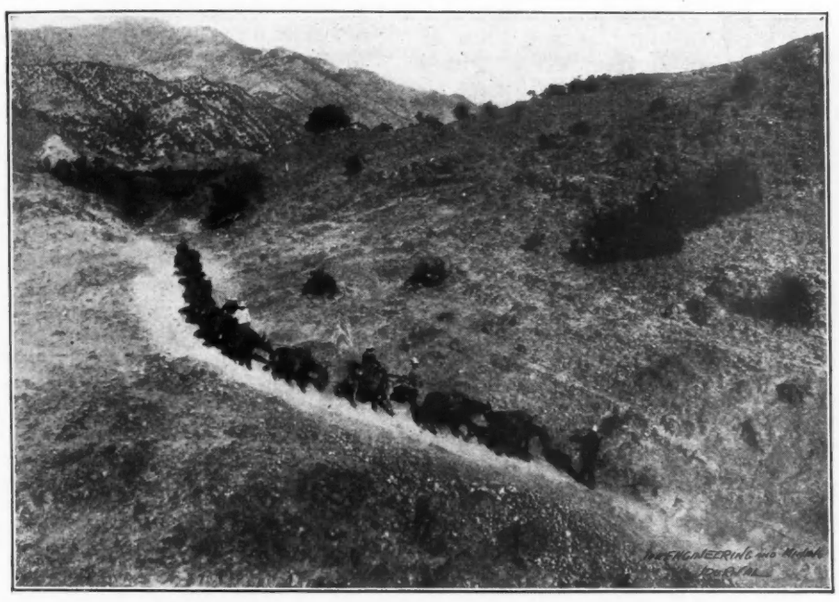
of least resistance, this movement seems to have been a shearing vertically or nearly so and was the cause of the brecciating of the orebodies, a second filtration of solutions subsequent to this second movement having recemented the orebodies into a solid mass, the present ore showing angular pieces of diabase bound with the primary ore.

Throughout the entire district the principal mineral is argentite, the gangue itself being a highly silicious matrix, with iron sulphides ranging from ½ to 2 per cent. Free gold is also present in varying proportions, running as high as 60 per cent. of the total value of the ore at the mill of the White Chief company, where from 40 to 60 per cent. of the metals are saved by plate amalgamation. Besides silver and gold, there are also numerous prospects of copper, zinc and lead, but high transportation charges have precluded operation or development up to the present.

All of the veins being worked at present carry shoots or kidneys of high-grade ore ranging from a few hundred pounds to several tons in size and in value from two hundred to several hundred dollars per ton.



PACK TRAIN WITH 2500 FT. OF ¾-IN. STEEL ROPE FOR THE PALMAREJO MINE, CHIHUAHUA

IMPORTANT MINES OF THE DISTRICT

Among the more prominent producing mines of the district are the Palmarejo, with a record of some 110 years of steady production. This company has installed a 50-stamp mill with a cyanide plant. The ore is crushed through 20-mesh wire cloth, concentrated, and tailings separated to sands and slimes, the former going to 100-ton percolating tanks, the latter to agitating tanks, thence to Butters filters. At present the company is changing the method of treatment to all sliming and are about to install a complete 300-ton plant. It has a 12-mile narrow-gage steam tram (20-ton locomotives) connecting mine and mill, but this is to be superseded by an aërial tram. The company has a 14-mile masonry ditch taking water from the Chinipas river, which supplies power.

The White Chief Mining and Milling Company has been operating a 40-ton plant near Chinipas for ten years. The ore here contains a high percentage of free gold, so the company is using plate amalgamation, concentration and cyaniding the tailings.

The Rio Plata Mining company, near Guazapares, has been operating a 100-ton plant on a high-grade silver ore for three years. Pachuca tanks have recently been installed.

The Durazno-Tetamoa Mines Company is operating a small mill on its mine, 12 miles from Chinipas.

Aside from the above, there are several companies developing promising prospects and many smaller prospects being opened up, some of which are shipping.

Chihuahua-Monclova Railroad

Surveys have been completed for the proposed railroad between Monclova and Chihuahua, a distance of about 450 miles, and liberal Federal and State concessions have been granted to the enterprise. The project is being promoted by a group of local and American capitalists headed by E. Hartmann, of Durango, and it is considered likely that the road will be built at an early date.

The road starts at Monclova and traverses a region heretofore without railroad facilities. It passes roughly parallel to the Rio Grande border at a distance of 100 to 150 miles south and through a more or less level plateau country, avoiding the "lost" mountains. Along the line of the proposed road are extensive coalfields at its eastern end, and near the border between the States of Coahuila and Chihuahua are important iron deposits. Numerous localities in which it is known that zinc and lead minerals are found are in the country through which the road will pass. The line is of importance as an outlet for the coalfields and to the mining interests of Chihuahua as affording a direct access to a fuel supply. It is believed that deposits of quicksilver and of gold will also be discovered and developed along the line of the new road. The country through which it traverses is dry and is now practicably inaccessible for any mining or commercial undertakings.

The Torreon Smeltery

The smeltery of the Compañia Metalurgica de Torreon, at Torreon, Coah., is the largest independent plant in Mexico. It is owned by Mexican capital, largely controlled by Ernesto Madero, the president of the company. The company was organized in 1900 and now has a capital of 5,000,000 pesos. It has paid liberal dividends except in the last two years, during which time a reserve fund has been provided for retiring of the bonds of the company.

The plant is equipped with nine furnaces for the treatment of lead-silver ores, each having a capacity of about 115 tons daily and a copper stack with a capacity of 250 tons per day. A copper converter is also installed with a capacity of 15 tons per day. The plant was erected in 1902 and additional equipment has been added from time to time, until the above capacity was attained.

The company controls several mining properties in tributary camps to supply base ores, and has ore-buying agencies in all the northern mining districts of the Republic.

The plant is modern in every respect, and is conveniently situated just outside of the city of Torreon. The company provides for its employees comfortable houses, schools, a modern hospital with physicians and surgeons. The general manager of the company is F. F. Villarreal and the superintendent, Ernest Harms.

In recent years there have been several attempts to purchase the property by outside interests, but so far no sale has been consummated. The smeltery is an important factor in the development of the mining districts of northern and central Mexico.

The construction of the Veracruz, Tabasco & Campeche railway will soon be begun. According to the official papers the concessionaires have complied with all the conditions contained in the contract.

Peculiar Water Problem at Candelaria Mines

Must Drain Saturated Bodies of Soft Ore Surrounded by Impermeable Country Rock. Air Lifts and Pump Used. New Equipment to Be Added

BY GEORGE A. LAIRD*

The water problem at the mines of the Candelaria Mining Company, San Pedro, Chihuahua, Mex., is somewhat out of the ordinary and the method of handling it, so far as I know has no precedent. In order to give an understanding of the existing conditions, a general description of the ore occurrences is necessary, as their nature has a direct bearing on the water situation.

Limestone and Porphyry the Common Rocks

The Leon mine of the Candelaria company is situated in a limestone-porphyry zone, the country rock being limestone with porphyry occurring as intrusions varying in width from ½ in. to 40 ft. Ore occurrences are directly attributed to metamorphic action, the orebodies being limestone replacements.

The porphyry varies from a highly altered and almost talcy mass to a very hard and finely grained material; the limestone, from nearly pure to highly silicified varieties, and occasionally dolomite. The ores, composed entirely of oxides and carbonates of lead and iron, also vary in hardness, and, above all, in porosity.

The territory surrounding the workings contains many dikes and faults, also of varying degrees of hardness and compactness, i.e., dikes of porphyry, and quartz-filled faults, both to a greater or lesser degree impermeable to water, forming a territory from which discharge or intake of water is exceedingly slow, and from observations covering a period of some 24 months would appear to be practically negligible.

Orebodies Hold All Water

The orebodies, like huge sponges, are saturated with water, the country rock practically dry. Ore occurrences along the lines of contact terminate with the harder porphyry, and unless, as is seldom the case, open water courses exist, these contacts afford but slow flow to the quantities of water which the orebodies contain. In brief the water is trapped in the ore deposits, about which dikes and quartz-filled fault planes serve as natural dams.

The exact level at which the water was first encountered is unknown to me, but the amount handled was considerably less than now being handled. This is probably due to the fact that the ore zone is increasing in area with depth. The main shaft was sunk in limestone and is practically dry to its present depth of 500 ft. The water handled from the shaft during the sinking was easily taken care of by a No. 7 Cameron sinker, the drainage of the district being slowly accomplished by means of air lifts, the water level being as high as 80 ft. above the bottom of the shaft.

Air Lifts Found Insufficient

The first pumping plant consisted of two Bacon air lifts, working from an average depth of about 750 ft., with a 300-ft. head, through 14-in. casing, for the installation of which two 16-in. holes were bored with shot drills.

The difficulties connected with this work were great. Ore, with accompanying water, was encountered at a depth of 566 ft. more by chance than through any logical conclusion drawn from geological conditions. Up to a head of 300 ft. these air lifts, supplied with 3300 cu.ft. of free air at a pressure of 140-150 lb. by a Laidlaw-Dunn-Gordon compressor, furnished a maximum of 2000 gal. per min., but at 300 ft. reached the limit of efficiency, and, either through lack of submergence or lack of flow, surged to such an extent as to reduce the capacity to not to exceed 1200 gal. per min. At the 300-ft. level two 1500-gal. triple-expansion, plunger pumps, built by the Jeanesville Iron Works, were installed, and the discharge from the air lifts was turned to a sump, and the water, now about 3000 gal. per min., is being pumped to the surface, being raised about 70 ft. from the actual water level by the lifts. The foregoing is the general scheme.

Equipment of Primary Plant

The plant consists of three Babcock & Wilcox 266-h.p. boilers, hand fired, working under 160-lb. pressure and a Laidlaw-Dunn-Gordon, 18x32x30x17x36-in. Meyer-valve compressor, working under 120 to 150 lb. Inside the well casings of 14 in. diameter, are, in one, a 10-in. and in the other an 8-in. casing, through which pass 2-in. air pipes, with return discharge, i.e., up discharge. Air is led from the compressor through a 7-in. main to the shaft collar; then through a 4-in. main to the top of the wells. A 2-in. pipe extends 325 ft. in the 8-in. casing, and 175 ft. in the 10-in. casing below the discharge, and 255 ft. in the 8-in. and 105 ft. in the 10-in below the water level as indicated in the stopes. The tops of the wells are boxed, the boxes containing baffle plates to deflect the discharge, and water is flumed 60 ft. to the main pump sump, in order to allow all air in the water to escape before reaching the suction end of the station pumps.

Usually 140 lb. of air is indicated at the compressor gage before the wells start, the actual pressure at the air discharge being less than that indicated, owing to the friction in the 2-in. pipe and to throttling. Once started, the air flow is governed by throttling and the pressure at the receiver is allowed to drop to 120 lb., although surging does not occur until indicated pressure at the receiver drops to 90 lb., and then only in the deeper well.

Each well "spouts" approximately 1500 gal. per min., the flow being frequently higher, the inflow of water apparently being retarded at times, probably due to the clogging of the water courses leading to the wells.

An auxiliary plant, composed of three 650 gal. per min. Jeanesville duplex sinking pumps, to pump direct from the shaft, is in place, but at no time has it been worked to over 50 per cent. capacity, as the inflow to the shaft, even through the overflow of the wells, is of insufficient volume to require more.

Pumping Causes Formation of Hydraulic Basin

Pumping 3000 gal. per min. reduces the water level throughout the mine at an average of less than 3 in. (one fifth of a foot) per 24 hours, but forms a hydraulic basin, which, when pumping is suspended, equalizes with the true water level by a raise of about 10 ft. Upon starting unwatering, this basin is rapidly formed again, the level at the nearest point of the wells, or practically the entire worked territory, commencing to lower at as high a rate as two feet per 24 hours, and gradually diminishing until the maximum hydraulic head is reached, when the slower drainage commences.

Territory which drained slowly has now proved to be of larger mineralized area than that which gave more rapid unwatering. The arched and irregular backs of limestone over the orebodies apparently hold the water, through atmospheric pressure, until such a level is reached as to relieve this condition, when the water so retained is released and may cause a rapid rise of level, which may also be very rapidly lowered.

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Difficulty Is in Reaching Water

From the foregoing it will be understood the difficulties are not of handling the water, but of securing it at a point where it can be handled. The shaft being comparatively dry and affording no point for drainage, the country rock being practically impervious to rapid flow, and the only available points of attack being from the wells by air lifts or from stopes, which, although of great extent, are not suitable for pump stations.

The orebodies, always having a back or hanging-wall of limestone, contain crevices and openings of considerable extent, caused primarily by the sinking or settling of the filling material away from the wall. These openings are calcite-covered and contain clear water, and are sufficiently large to admit of placing suctions in them, and might provide a steady flow of sufficient quantity to supply the station pumps. Turbines and centrifugal pumps could easily be handled in the stopes, but the openings are not necessarily continuous for any great distance, and are sometimes so flat as to require long suctions for comparatively low lifts, and a few hours' pumping might drain them, yet have but little or no effect on the general water level.

Some of these openings have proved to be continuous down to the present water level, while others of equal or greater extent and of just as promising a nature, have narrowed down or entirely closed. Even did these afford sufficient supply, a continual changing of the pumps would be required. Shaft sinking is now under way. At 435 ft. in depth a flow was struck which made it necessary to suspend sinking operations for a few days; the flow was passed in a few feet.

Sinking Necessitates Additional Pump Equipment

Increased area of orebodies with depth means also increased area for water drainage and increase of pumping capacity must naturally follow. An additional plant of 6000-gal. per min. capacity has been ordered. It will consist of two 23 and 48x12x36 cross-compound, condensing, crank-and-flywheel type, station pumps, each with capacity of 3000 gal. per min., and three sinking pumps, consisting each of two 6-in. vertical centrifugal turbines, direct connected to 200-h.p. Kerr steam turbines designed to operate under a 250-ft. head with a capacity of 2000 gal. per min., or 1000 gal. per min., at a 500-ft. head at turbines running with suction condensers.

A station will be cut at the lowest possible depth, i.e., at the latest possible moment before the arrival of the pumps, so that when the actual unwatering commences with the new plant the sinkers should handle approximately 3000 gal. per min. each, as the head will be but a few feet. The triples—two 12, 18 and 32x14x24 condensing engines—will be lowered to the new station, giving a total station capacity of 9000 gal. per minute.

The pumping equipment will then consist of:

Two 23 and 48x12x36 flywheel, Corliss station pumps; two 12, 18 and 32x14x24 triple-expansion pumps; three 2- 6-in. two-stage centrifugal sinkers; and three 14x8x18 duplex sinkers, steam being furnished by two 450-h.p. and three 266-h.p. Babcock & Wilcox boilers.

Hazard Great in This Case

The entire operation of this plant depends upon the main problem of draining saturated bodies of soft ore, which are practically submerged in an underground lake in a hard-rock basin, the general extent or whereabouts of the sides of which are unknown, and where costs of installation and operation must be governed by the value and the quantity of the product to be secured. The quantity of product to be secured is undeterminable until all of these costs have been incurred. No great flow of water is expected until a depth of 566 ft., (where ore was encountered in the wells) is reached, 66 ft. below the present shaft bottom. It is expected that the flow of water encountered will be great enough to require the lowering of the entire basin level in order to continue sinking to the second orebody, which was encountered at a depth of 607 feet.

Calculation of Ore Area from Drainage

One interesting feature of the problem lies in calculations based on the assumption of saturated orebodies and dry country rock. Pumping 3000 gal. per min. is equivalent to 4,320,000 gal. per day, which equals 518,607 cu.ft. The actual average lowering of the water level in the mines was 0.198 ft. per day (30.07 ft. in 151 days). Hence, pumping 518,607 cu.ft. and lowering the level 0.198 ft. per day are the same. (It required 5 days to lower the water level 1 ft.) Thus 518,607 cu.ft. pumped being equivalent to lowering the level ⅕ of a ft., multiplying by five gives 2,593,037 sq.ft. as the water area. Now one acre equals 43,560 sq.ft.; therefore, a water area of 2,593,037 sq.ft. equals 59.52 acres.

On an average the open water courses do not exceed 5 per cent. of the total open, water-soaked country: 59.52 less 5 per cent. equals 56.54 acres of mineralized territory.

A large part of this territory is unprofitable from a mining standpoint, yet drainage must be accomplished in order to mine the profitable ore, two-thirds of the prospected territory being profitable, ore in the other one-third apparently increasing in value with depth, the grade of the profitable ores increasing in practically a like ratio. The probable-ore question is one of great interest, there certainly being unlimited prospects.

Two Interesting Articles on Mexico

An interesting and classical article on Mexico, describing the conditions at the Santa Eulalia camp in Chihuahua, Mexico, was written by Gen. Lew Wallace, and was published in *Harper's Monthly*, November, 1867. Some type-written copies of this article are extant in Mexico, and are now read with a great deal of interest.

Another interesting article on early Mexico was written by James P. Kimball, and published in 1870 in the *American Journal of Sciences and Arts*, vol. XLIX. In this article Mr. Kimball describes the condition existing at Santa Eulalia at that time.

He says that the discovery of the district is reported to have been made in 1591, but that the official register is only from 1705, 12 years after Chihuahua was founded. The production of the camp from 1705 to 1737, according to this writer, was equal to $112,000,000. The population of the camp at the date of the article, 1870, was reported as 6000. There were 63 reduction establishments with 188 smelting furnaces of the *horno* type, and 65 cupelling furnaces, with other similar establishments at Chihuahua. The mining cost at the Parcionera, a type of the horizontal or sloping working, is stated to have been $1.50 per *carga*. At the Santo Domingo there was a greater cost, on account of hoisting. The ores were delivered at the furnace from the mine for from 20c. to 37c. per *carga*, or ordinary donkey-loads (about 300 lb.). The furnaces employed were of the *adobe-horno* type, a blast furnace, 47 in. high and 18 in. wide at the top. Hand-bellows were used, or at some of the larger establishments bellows worked by mules. The ordinary furnace charge was made up according to the notion of the smelter, 75 lb. of spalled ore was ordinarily used, and with this about 20 lb. of litharge and 12 to 25 lb. of old slag, called *grasa*, for flux. The fuel was mesquite, a single plant sometimes giving as much as a cord of heavy root, excellent for fuel either as wood or as charcoal. The total cost of reduction and production is reported to have been $31.84 per ton. The reason the patio process was not used in the district was the scarcity of water.

The same author made a report about the same time upon the silver mines of Cusihuiriachic.

In northern Oaxaca in the Tlaxiaco district near Mixtepec y Juxtlahuaca are extensive deposits of stibnite not now worked. They are controlled by the Cookson company, of London, England.

San Javier, an Old Silver District of Sonora

Scene of Important Early Operations in Mining and Metallurgy; New Developments; Smelting Facilities Needed; Operations in Coalfields

BY C. N. NELSON*

San Javier, one of the older silver-mining camps of Sonora, is 12 miles west of the Toledo station of the new Yaqui River line of the Southern Pacific, and 90 miles east of Minas Prietas. Good trails connect it with Toledo, and a wagon road runs to Minas Prietas.

The camp has been a producer for nearly 300 years, having been worked by the *antiguos* for the rich oxidized ores. The real importance of the camp began about 1860, when Matias Alsua, a native of South America, started to work the Animas, Marhuila and Carmen groups. He built a leaching plant at Los Bronces, and there treated the ores from the entire camp. He is said to have taken out several million ounces and was one of the wealthy men of the State. Alsua owned mines as far east as Trinidad and prospected a number of smaller districts. In his time the camp was booming, 12 *vasos* were smelting ore and a large population, said to be from 10,000 to 15,000, was supported by the mines of the district.

At the death of Alsua in the late '70's, the Apaches were troublesome and a revolution in the State had drained Alsua's resources, so the properties were sold to a British company. This company's chief activity seems to have been the building of expensive wagon roads. It failed in two or three years from bad management, and the camp fell into hard times. The Yaquis in the surrounding country closed the trails, transportation was expensive and the highest grade ores had been mined.

In 1900, when the Santa Rosa mine was started by some Colorado miners, the camp was in ruins. With the Yaquis subdued, a railroad within 15 miles, and another building in from the west, San Javier is in a good way of again becoming of importance.

Geology of the District

The surrounding country is composed of many strata of sandstones and shales inclosing several beds of Triassic coals, forming the coal fields of Los Bronces, Tarahumari, San Marcial and Pilares. At San Javier these beds have been upturned and broken by an intrusion of diorite. Near the contact of the measures with the diorite runs the main veins of camp, the San Juan, Animas, Santa Rosa and Buena Vista. A number of other fissures form separate systems of iron, and narrow high-grade quartz veins.

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The Transportation Situation

The outlet at present is *via* Toledo station by 15 miles of trail and a drop of nearly 1600 ft. To put in a wagon road would need not more than five miles of actual road building, as much of the route is over table land. This road will probably be put in before another year. It is reported that the Torres & Prietas railroad, recently bought by a British company, will build into San Javier and Barranca on its way to the Yaqui river. It would tap a well wooded country and farming lands, besides the mining region.

Principal Mines

At present the Animas, San Juan, Santa Rosa and Buena Vista are the principal mines of the camp, though a number of others, such as Narhuila, Carmen and Mina Grande have records of silver production running to a million ounces. The Animas mine, owned by the Wyman Mining Company, of Toledo, O., is opened 1000 ft. in length by a 200-ft. vertical shaft and the vein dips at about 40 deg. and is 12 to 15 ft. thick in the main ore-shoot. The ores are silicious with lead, zinc and iron sulphides, running probably between 40 and 50 oz. of silver to the ton. The ores are complex and rather troublesome to treat on account of antimony and arsenic sulphides present, but as about 2,000,000 oz. are said to be developed at this moderate depth, proper treatment will be secured. Up to the present time the ores of this mine and others of the camp have been treated as high-grade ores. The Animas has a small concentrating mill of about 20 tons capacity and attempts have been made to produce a shipping product, which to pay transport duties and smeltery charges at El Paso must run over 100 oz. This plan has proved unsuccessful, and an attempt is now to be made to treat the ores locally. The mine is a good one but has suffered for years from poor management, but the management has recently changed, and the future looks bright. The Santa Rosa property has three parallel veins, 3 to 4 ft. thick, of quartz carrying iron sulphides. The mine is opened to 250 ft. depth, but not well developed, some small faults have confused the work, and it is difficult to claim any definite tonnage in sight. A costly experiment of installing a smeltery before the mine development warranted it, caused a shutdown. The ores probably are concentrating or cyaniding.

The San Juan mine adjoining the Animas is operating under lease to C. N. Nelson. It has a wide vein (10 to 12 ft.) opened up for 600 ft. along the vein at a depth of 500 ft. on the vein by an 1100-ft. crosscut tunnel. It shows a 4-ft. ore-shoot averaging about 30 oz. silver with a little gold. The predominant mineral is iron sulphide.

The Buena Vista mine has had over 10,000 ft. of development done, much of which was unnecessary. It shows a 4-ft. vein of hematite with gray copper carrying silver. The vein as a whole probably will average low in silver, though the iron keeps constant at around 50 per cent. As the mine is at present

MAP OF PORTION OF SONORA

there are probably blocked out over 50,000 tons of hematite, carrying a little silver, which would make an excellent flux if a local smeltery was established.

The other veins in camp, such as the Uvalama, Carmen, Recuerdo, Mina Grande, Narhuila, Sierra, Cruces, etc., have all produced much high-grade ore, but have not had much development. They will, undoubtedly, be able to help swell the production of the camp when better marketing facilities are furnished.

The Sonora Coalfield

East of the Santa Rosa and Buena Vista veins, lies the coalfields of Los Bronces. Six larger seams, running up to 8 ft. in thickness, have been opened up by shallow work. The field is considerably faulted and crushed, but with devel-

opment may show up important stretches of unbroken coal. For local use this field will be able to supply all the fuel needed. By installing a gas-producer plant much of the coal could be used that is at present useless. The coal occurs in lenses and is of a good grade of anthracite when not too much crushed and metamorphosed.

The Sunset Development Company, a subsidiary of the Southern Pacific railroad interests, is developing a similar coalfield at Tarahumari, about seven miles east. The company does not seem satisfied with the results so far, though the latest developments have been more satisfactory.

Smelting Situation

The nearest market at present for ores is El Paso, Tex. Freight rates to the railroad and for railroad transport to El Paso are prohibitive on any but high-grade ores. The smelting plant at Toledo, which has been held back by lack of funds and the scarcity of copper and lead ores, is being revamped preparatory to starting operations. The smeltery at Fundicion, Sonora, is also said to be preparing to resume. If these two smelteries could see their way to start ore buying, a great stimulus to development would take place.

The recent purchase of the La Dura mines by the Dolores-El Rayo-Creston Colorado combination, the activity of Cole-Ryan interests at San Antonio, of the Lewisohns at Suaqui Grande, and of the Chicago Exploration Company, at the Mina de Mexico, all within a radius of 30 miles of San Javier, will doubtless soon attract attention to this district.

Revival in Ures, Hermosillo and Sahuaripa Districts

BY W. L. WILSON*

A marked revival in mining is taking place in the Ures, Hermosillo and Sahuaripa districts of Sonora. Two years ago everything was at a standstill except Minas Prietas and San Javier. General panic prevailed during the years of Yaqui Indian depredations; then financial stringency in the United States brought on further suspension of work and a great lack of interest.

Mix-Ryall Concession

The Mix-Ryall concession, which has endured for four years to the great detriment of Sonora, expired and the ground was declared open April, 1910. This concession carried the exclusive right from San Antonio northwest to the Tecoripa river, then down the east bank of that stream to its confluence with the Rio Yaqui, and then from Cumuripa up that river to San Antonio. It included some of the best mineral territory in the State. But the Ryall interests were unable to organize any systematic prospecting campaign during the activity of the Yaquis so that little ground outside of San Antonio was acquired under that concession. During last winter this territory was closely examined by prospectors so that when the land became open many denouncements were immediately made.

Above Tonichi at San Antonio de la Huerta are the mines of the San Antonio Copper Company. The nucleus of this group was bought four years ago for $50,000. Development, then started, has continued without intermission. A large body of 7 per cent. copper has been exposed for 137 ft. in the oxidized zone and the sulphides are being opened through tunnel No. 16. There are good prospects in this vicinity and adjoining the San Antonio, held by native Mexicans and by Americans who lack the money or experience.

*Mine manager, Hermosillo, Sonora, Mexico.

In the Santa Barbara District

Northwest of Soyopa, near Rebeica, two large deposits of low-grade copper have been denounced. To the west in the old Santa Barbara district several valuable veins were filed on by Colorado men. Much free gold was extracted from the veins in this section by the primitive methods of the natives prior to the Yaqui outbreak, but this being the heart of the Yaqui country there was a total cessation of work until April, 1910. A syndicate of Eastern men under the management of W. L. Wilson, of Denver, Colo., secured a large area of good ground there and are vigorously pushing development on several veins. The Mazatan Mining Company, a Boston corporation, has about 125 acres in this district, with three large veins running through the property, outcropping at intervals for a mile and a half. One of these veins is cut by a tunnel at 200 ft. and shows 6 ft. on the hanging-wall, which will average $45 per ton in gold. This is a quartz vein between limestone and andesite and gives no evidence of refractory character. On the footwall side there is about 4 ft. averaging 30 per cent. copper and $2 gold.

North of Soyopa and 12 miles east of Yaqui river, W. E. Pomeroy has partially developed a vein of high-grade copper that gives promise of making a mine.

Operations Near Rayon

In the vicinity of Rayon some copper veins of fair grade are being developed. The El Tajo company, of New York, has been developing the old Geronimo mine, east of La Poza for two years, and is now putting in a concentrating plant. A few miles north, on the San Miguel river, some *antiguas* of noted production in the past will soon be reopened. El Alamo and La Cendrada, famous producers of rich silver ore in the days of Governor Gandara, are in this section. One hundred *arrastras* and nine *vasos* are in evidence to corroborate the tradition of former great activity in this camp.

Purchase of La Dura and Figueroa

The Mines Company of America has acquired La Dura mines on the Rio Yaqui. La Dura mines under Mexican management were large producers of bonanza silver ore, carrying copper with some rebellious elements, but paying a big profit although worked in a most primitive way. O. P. Posey, of Los Angeles, has bought the Figueroa mine in the same section. A 9-ft. vein of copper sulphide shows at the surface.

Other New Undertakings

During the winter of 1909-10, the Chicago Exploration Company bought the Mina de Mexico from the estate of Don Carmen Ortega and active development and equipment is in progress. The high-grade product formerly shipped amounted to more than a million pesos. There are several thousand tons of ore on the dumps averaging 59 oz. silver, that will pay for matting.

Above Santo Niño and overlooking that camp the Lluvia de Oro is in a fine body of 20 per cent. copper sulphide, carrying $8 to $10 in gold and silver. This vein, between the limestone and andesite, is promising. North and west of the Lluvia de Oro, in the vicinity of Suaqui de Batuc, there are some rich silver veins. Also several low-grade copper deposits.

West of Hermosillo, James Penman is sinking a deep shaft on the Verde Grande to reach the sulphide zone which is proved in the neighboring Lluvia de Cobre. He is now installing a 30-h.p. hoist and compressor plant. Further south a California company is sinking on the Creston de Cobre in fine ore at 260 feet.

Railroad Extension Planned

The Torres & Prietas railroad running from Torres to seven miles east of Minas Prietas, was transferred in the spring of 1910 to a British company. Arrangements were made to broad-gage the road and to extend it to the Rio Yaqui at Soyopa. This will give transportation to the mines around Matepe, Llano Colorado, Santa Barbara, Soyopa and points on the river above Soyopa, and stimulate production from that region. The western end of Ures district is showing new life. The San Miguel Mining Company over the hill from the Sultana, is building a mill and tramway. The Sultana has been idle since Mr. Giroux sold it to the Cole-Ryan interests.

Smelting Plans

The Pacific Mining and Smelting Company, successor to the Douglas Copper Company, is planning to start the smelting plant at Fundicion to treat custom ores as well as ore from the El Cobre property of the company. Courtney De Kalb is in charge.

The Toledo smeltery of the Yaqui Smelting and Refining Company is unloading coke, preparatory to blowing in at the end of the rainy season.

Points about Mexican Labor

By Hugh G. Elwes*

The Mexican *barretero* meets the conditions of mine work admirably, and, if properly treated is a good workman. He stands bad conditions as to ventilation, bad ladders, etc., well and above all, does not strike or allow walking delegates to interfere between himself and the management. As timbermen Mexicans as a rule are not acquainted with the elaborate systems of framing employed in the United States, but the timbers they put in stay, and the ground holds. As hoistmen they are not used to complicated, modern hoisting machinery in most instances, but a Mexican mechanic is quick to learn. A Mexican helper to American machinists soon picks up much knowledge, and becomes competent to do practically all the work around a mine. It is not suggested that an American master mechanic is not a good investment in the case of a large concern operating much machinery, but his helpers can be Mexicans, and I believe that any sincere American machinist will admit that his Mexican helpers are willing and faithful assistants. In many cases large salaries are paid for American help which could be distributed with great advantage among the poorly paid Mexican help. In underground work there is no foreman as good as a Mexican foreman for getting work out of his own countrymen, and he is not more liable to be found asleep on duty than his northern competitor.

*Mining engineer, Papantla, Veracruz, Mex.

Mexican Miners Should Be Given Contracts

Mexican miners are not much good at single jack work, but a *parada* (pair of miners), one turning the drill and the other as striker will do an astonishing amount, even in hard rock. They should always be given contracts, since they are not any more conscientious than other laborers when paid by the day.

In a few mines the Mexicans have learned to handle air drills, and do good work. There is no necessity to pay high wages to a foreign air-drill man after the Mexicans have learned to run the machines. The craze for foreign help among foreign-owned mining companies in Mexico is accounted for by the reports of men incompetent to handle Mexicans owing to their ignorance of Spanish and of the customs of the country.

As trammers the Mexicans are far better than foreigners, though few of the latter condescend to do such menial work as tramming in Mexico. As masons, Mexicans can build good foundations, retaining walls, mine buildings, etc., at a small fraction of the cost of foreign help for this class of work.

Drill sharpening machines are not much used in Mexico, since the blacksmiths are expert, quick workers and cheap. Crosscutting, driving levels, and stoping can generally be best done by contract. Sometimes the price is arranged by the number of centimeters drilled, or by the advance made in the work of a certain cross-section, or by the weight of ore produced of a certain grade. Tramming is often done by contract, too.

In connection with the metallurgical treatment of the ore, and the technical work such as surveying, assaying and testing solutions, foreigners are necessarily employed since there are few Mexicans trained to do such work. Mill helpers, stokers, tank men, etc., can and should be Mexican, being cheap and efficient.

The Ajuchitlan Mine in Queretaro

The Ajuchitlan mine in the State of Queretaro, Mexico, near the station of Bernal on the National railway has been for several years under active development by an American company of which C. Crowell, of Monterey, is president and John C. Brennon, of Mexico City, vice-president. The company has installed a mill and an electric plant. A new dam has just been completed which will furnish 400 h.p. additional. A 500-ft. Sullivan, two-stage compressor has been installed and diamond drills will be used in exploration.

The last report of the company to March, 1910, shows for the year, that 20,563 metric tons were milled of an average content of 23.574 pesos. The mining expense was 2.289 pesos per ton and milling expense 3.925 pesos per ton, a total of 6.214 pesos. This left an operating profit of 127,778 pesos of which 16,524 pesos was spent in mine development and 1979 pesos for general expense.

During the year dividends to the amount of 75,000 pesos were paid, the sum of 56,306 pesos was spent upon permanent improvements and 40,000 pesos were loaned to the electrical company.

President Crowell in his report says:

"While the operating costs are not excessive when compared with those of other plants, neither are they entirely satisfactory to the management, and they will certainly be lowered within the present year. Various causes have contributed to our inability to get costs down to what we consider a reasonable figure, chief among them being the small tonnage. It was our intention to bring the capacity of the mill up to 3000 tons monthly by the middle of 1910 but our plans were changed when it became evident that the necessary power could not be secured. It was, therefore, decided to make the additions to the mill and cyanide plant gradually. The working of the mill and cyanide plant during the year was quite satisfactory, though the extraction was still low, being a little under 72 per cent. As usual this was principally due to inefficient washing. Though the water supply is better now than heretofore, we will be unable to wash the slimes thoroughly until some form of filter is installed. The matter is under consideration. Good washing with the present treatment would give us an extraction of from 78 to 80 per cent. and this can be attained by the installation of a filter. Any further increase in extraction will require finer grinding, and it is still a question whether the increase would not be secured at prohibitive cost. The development done during the year was 890 m. A large part of this was in ore already discovered, to facilitate extraction. Some drifting was done on the vein at the level of the main tunnel, showing ore of an average of 12 to 13 pesos per ton. The vein which was lost in the upper, or Santo Niño, level, has not yet been found. It was at first thought to have been faulted, but investigation showed that we had encountered what was a deep gulley or ravine in the mountain, prior to the volcanic overflow that left the shale covered with a capping of andesite. It seemed advisable to prosecute the search for the vein at the main tunnel level rather than in the upper level. The indications are that we will soon be through the andesite and into the shale where the vein should be found."

E. F. Russell is the general superintendent and Angel Carnavali, mine superintendent.

Mining and Smelting at Achotla Mine, Guerrero

Property in Balsas River Region; Suffers from Lack of Transport Facilities. Only Oxidized Silver Lead Ores Smelted; Bullion Cupelled

BY W. B. DEVEREUX, JR.*

The Achotla mine, owned and operated by the Suriana Mining and Smelting Company, is situated in the district of Aldama, State of Guerrero, Mexico. This district is about 50 miles down the Balsas river from Balsas station, the terminus of the Cuernavaca branch of the Mexican Central railroad. Achotla can be reached by 18 to 24 hours riding over a rough mountain trail from Balsas station, or by floating down the river in flat-bottom boats to Pezuapa—the river point for Achotla and Campo Morado, the boat trip requiring from 8 to 10 hours. The mine is at an elevation of 2800 ft. above sea level, and about 6½ miles north of the river in an air line, but by trail it is over eight miles. At Campo Morado is the rich Reforma mine, owned by Jose Maria Ortiz, and which is said to have produced upwards of $500,000 net per year for several years.

Orebodies in Greenstone

The ore deposits of the Achotla mine are similar to those of the Reforma and occur in a fissured zone of eruptive rock, classed as greenstone. The vein, which strikes southeast and northwest, is from 80 to 150 ft. wide across the outcrop and is so prominent that it can be seen from across the barranca running up the mountain for over a mile in length. The gossan outcrop is the usual surface expression of a sulphide of iron deposit, often carrying more or less copper, but in this case it is unusual on account of the high lead content of the oxidized ores; part of it is highly stained with red and yellow iron and lead oxides. There are at present two known bodies separated by a horse of slate—the northern one is low-grade with the exceptions of small portions; the southern end, however, which is from 7 to 20 ft. in width and has been opened for a horizontal distance of 370 ft., is of a good smelting grade.

Mining Only Oxidized Ore at Present

The ore consists chiefly of oxide of lead and iron in a silicious gangue carrying gold and silver. Near the hanging-wall soft and sandy lead oxides occur with an increase in silver, and sometimes in gold, but at a distance of from five to 12 ft. from this wall the ore becomes harder through the increase of oxide of iron, while the lead diminishes in quantity. Apparently no fixed relation exists between the gold and silver contents, and the amount of the former in the ore is decidedly variable. Three types of ore are mined: (1) Iron ore; (2) lead ore; (3) low-grade ore. The analyses of the ores are given in the accompanying table.

ANALYSES OF ACHOTLA ORES.

	Class I. Per Cent.	Class II. Per Cent.	Class III. Per Cent.
Lead	7.1	8.0	11.1
Silica	40.1	43.8	33.5
Iron	22.3	16.2	20.6
Lime	.....	.....	....
Zinc	trace	.....	....
Sulphur	3.2	3.1	....
Alumina	11.0	13.4	....
Arsenic	6.4	2.3	....
Antimony	none	.....	....
Bismuth	none	.....	....
Gold, oz	0.42	0.50	....
Silver, oz	52.6	60.5	....

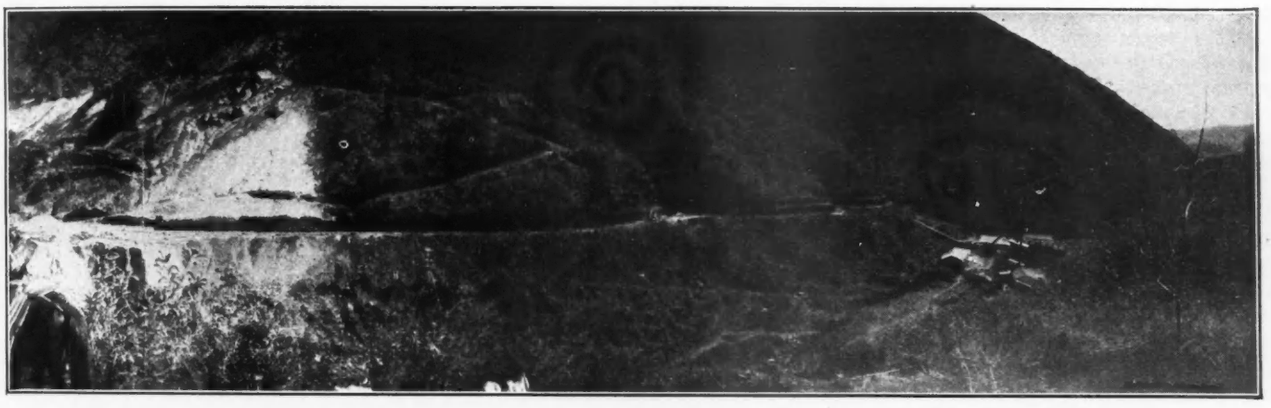
Sulphide Ore, Containing Copper in Lower Levels

Large bodies of iron pyrites have been opened; also a large block of sulphide ore containing a high percentage of copper has been partially developed on the lowest level, which is about the top of the sulphide zone.

The mine is opened by adit tunnels on three different levels which are all connected by winzes, and above the breast of the lowest, or "No. 0" level, there are about 900 ft. of backs. The ore stoped from the upper levels is brought down in chutes to "No. 0" and trammed from there direct to the smeltery. Drilling is done entirely by hand and practically all of the mining is let on contract.

Smelting Oxidized Lead Ores in Small Water-Jacketed Furnace

The ores smelted are oxidized lead and iron ores, containing a variable quantity of gold and silver, but on the advent of a railroad the company will be able to mine and smelt a large body of copper ore and to ship the resultant production of matte. After coming from the mine the ore is dumped on a grizzley, the oversize going to the crusher. It is then bedded by alternating a layer of fines with a layer of coarse, which gives a mixture that is just right, neither too coarse nor too fine. From the beds it is brought to the smeltery in wheelbarrows. The furnace, which is of the water-jacketed type, is 36 in. wide by 60 in. long, and is now handling 30 metric tons (dry weight) of ore per day or 51 tons of charge. The fluxes are barren and consist of iron oxide and limestone. The coke amounts to 11 per cent. of the charge and the charcoal is 14 per cent. of the charge. The company has found that the furnace works much better and gives a higher extraction when coke



Achotla Mine and Smelting Plant of the Suriana Mining and Smelting Company, Guerrero, Mexico

*Mining engineer, Mines Management Company, 40 Wall street, New York.

only is used, instead of coke and charcoal, and in spite of the cost of coke, which is 54 pesos per ton, would use it alone were it possible to secure transportation for the desired amount.

Bullion Cupelled and Lead Used Again on Furnace Charge

An average smelting mixture will carry about 1500 grams of silver, 12 grams of gold and 10 per cent. of lead. The matte fall is about 4 per cent. of the charge. The matte and slag are crushed and about two tons of matte and nine tons of slag are resmelted daily. The plant is equipped with a machine for briquetting fines and flue dust, which is done when a sufficient amount has accumulated. The lead bullion produced carries an amount of silver varying from 15 to 20 kg. and from 140 to 180 grams of gold per metric ton. Owing to the scarcity of lead in the ore, the lead bars are cupelled and the litharge recovered is used in the furnace to make up the deficiency in lead. The silver bullion is about 600 fine and is shipped to Mexico City and sold there.

In spite of the small size of the furnace, it has run constantly for six months, the only trouble experienced being with the lead well, which at times could not be kept hot enough and required frequent barring—this was due to the small amount of lead. Great difficulty has also been experienced in obtaining enough iron for use as flux. For a time iron-oxide ore was mined from the company's property, but the supply is practically exhausted and experiments are now being made to determine whether the pyrite ores can be successfully roasted in heaps or in stalls. If satisfactory results are obtained by either method the question of iron for fluxing purposes will be solved, as there is a large enough supply of this ore to last for many years. It carries sufficient gold and silver to pay the cost of mining and roasting.

Difficult Operating Conditions

Owing to the great distance of the mine from the railroad and the many mountain ranges to be crossed, operating conditions are most difficult and costs high, the latter being largely due to the excessive freight charges from Balsas station to Achotla. The country is sparsely populated and the demand for laborers is greater than the supply—in fact, the district can hardly produce the food necessary to support the men and animals required to operate the Reforma and Achotla mines, and until a railroad is built down the river from Balsas station it is doubtful if the country could support another mine. During the rainy season, which extends from May to October, the rains are heavy, with the result that freighting is brought to a stand-still. Inbound freight is floated down the river to Pezuapa and packed from there to Achotla on mules, but out-bound freight has been packed from Achotla to the railroad and the lack of animals has, up to the present time, precluded the shipment of lead bullion or matte. The company has its own houses and stores, and the grounds, works and buildings are lighted by electricity.

The mine is managed by the Mines Management Company, and is under the direct supervision of F. A. Provot, who has had charge of operations for the last eight months; G. P. Robinson is superintendent.

British Mining Companies in Mexico

In a recently issued book entitled "Twenty-five Years of Mining," Edward Ashmead, of London, has included a chapter on the British mining companies formed to operate in Mexico during the 24-year period from 1881 to 1904.

The British mining investor has taken well to Mexican mines, and not stinted capital for working. The large-capital concerns, that is, those over £100,000, number more than a hundred. Taking the years under review, a total of 184 companies were formed with a total capitalization of £30,060,478. The larger companies were:

In 1881, La Gran Gold and Silver, £130,000 capital. 1882—Zubrate Mining, £200,000. 1883—Anglo-Mexican, £325,000; Montezuma, £240,000. 1884—Grand Barranca, £300,000; La Trinidad, £500,000; Mexican Mining, £400,000; North Mexican Silver, £200,000, and Pinos Altos (Mexican), £250,000. 1885—Almada & Tirito, £210,000 (this company has been reconstructed more than once); Great Las Nieves, £250,000; Mesquital Del Oro, £100,000 (reconstructed in 1897); the Silver Queen United, £250,000, and the Trojes United Mining and Smelting, £450,000. 1886—Aztec Silver, £150,000; the Consolidated Gold Mines of Mulatos, £650,000; East Arevalo (Mexico), £150,000; La Velera, £100,000 (reconstructed in 1891); the Palmarejo Mining Company, £400,000 (this company in 1898 became the Palmarejo & Mexican Goldfields, with £700,000 capital); the Pintos Altos Bullion, £300,000; San Petro Silver and Gold Mines, £180,000; San Ricarda, £100,000; and the Sonora Silver, £365,000. 1887—Batopilas Mining, £400,000; La Luz Mines of Mexico, £210,000 (reconstructed in 1890 and 1893); Mansfield-Mexican Silver Mines, £100,000; Mexican Copper, £250,000 (reconstructed in 1898); Mexican Santa Barbara, £300,000; Oaxaca Mining, £100,000; San Acasia Mining, £400,000 (reconstructed a year later); and the Smelting Company of Mexico, £120,000. 1888—Anglo-Californian Onyx, £100,000; Cerro Blanco Mine, £150,000; El Padre, £200,000; La Gloria, £150,000; Mexican Coal and Iron, £800,000; Mina Grande, £100,000; North Mexican Mining and Smelting, £200,000, and the Santa Teresa Copper, £250,000. 1889—Chiapas Mining, £252,500; Chiapas Zone Exploration, £250,000; Imuris Mines, £175,000 (reconstructed in 1892); Mexican and General Concessions, £200,000; San Pablo (Mexico), £150,000; Torreon Silver and Copper, £200,000.

In 1890, the Great San Anton Gold, £300,000; Guadalcazar Quicksilver, £400,000 (reconstructed in 1895); Mexican Mineral Zone Exploration, £100,000, and the Ventanas Silver and Gold Mines, £500,000. 1890—Princessa Gold, £125,000. 1891—Abaris Mining Corporation, £150,000; El Refugio, £375,000; El Progreso Native Copper, £100,000; Santa Rosalia del Carmen (Mexican) Copper, £250,000; and the Tominil Mines, £150,000 (merged into another company in 1903). 1892—Bacis Gold and Silver Mines, £200,000; Macate Mining Syndicate, £160,000; Mexican Mining, Smelting and Land, £210,000, and the New Pachuca Silver, £100,000. 1893—Mexican Gold and Silver Recovery, £200,000. 1894—Lyonnaise Mexican Concessions, £200,000. 1895—La Bufa Mexican Gold Mines, £100,000; Malacate Mining and Smelting, £500,000; United Mexican Mines, £150,000, and the Laguna Zacatecas Minerals Deposit, £1,000,000. 1896—British Gold Mines of Mexico, £100,000; the Consolidated Goldfields of Mexico, £400,000; the Goldfields of Mexico, £100,000; Grand Central Mining, £250,000, and the Mazapil Copper, £200,000. 1897—Campaña Consolidated Gold Mines, £200,000, and the El Mundo (Mexican) Gold, £100,000. 1899—El Oro Mining and Railway, £1,150,000; Avino Mines of Mexico, £500,000 (this company was reconstructed in 1903, and the capital increased to £1,000,000); Durango Copper, £300,000; Las Peras (Mexican) Gold, £100,000; Mexican Esperanza Gold Mines, £850,000; Panuco Copper, £500,000, and the Sonoma Mines of Mexico, £500,000.

In 1901, the Casteleña Consolidated, £100,000, and the Dorste Gule Gold, £100,000. 1902—Abundan (Mexican), £175,000; Cherokee (Mexican) Proprietary, £400,000; and the Westerton Mine, £250,000. 1903—Esperanza, £455,000; Mexican San Felix, £100,000; and the San Francisco del Oro, £375,000. 1904—Dolores, £330,000; Mexico Mines of Del Oro, £180,000; and the Tetela Mining, £100,000.

The use of fuel oil in mining operations having proved profitable to the Greene-Cananea company, originally granted the concession to import petroleum free, the Mexican government subsequently accorded other companies the same privilege for the purpose of offsetting adverse market conditions by cheapening the handling of lower grade ores.

Iron Resources of the Republic of Mexico

Numerous Unexplored Iron Deposits, but Resources Generally Overestimated. Principal Operations are in Northern Mexico. Coal Reserves

BY EZEQUIEL ORDONEZ*

Only recently has attention been drawn to the iron-ore deposits of Mexico, although for two centuries past a few small iron foundries, established chiefly in the mountainous regions and near the precious metal mining districts, have been operated, yielding iron used for common tools. These early operations used primitive metallurgical methods. The fuel was entirely furnished from the neighboring forests, either as wood or as charcoal. With the discovery of important coalfields in northern Mexico about 12 years ago, increasing interest was directed to the iron-ore resources of the country. However, it must be recognized that even at the present time the iron-mining industry of the country is in the development stage, and that many of the deposits are practically undiscovered and entirely unexplored, and that there is not sufficient data for even an approximate estimation of the industrial value of the known or operated deposits.

Mexican Iron Ore Overestimated

On the imperfect data available there has heretofore existed an over estimation of the available iron-ore resources of Mexico, the idea prevailing that the iron existed in sufficient quantities to supply at least the needs of the country for an unlimited time. The facts about the iron resources of Mexico, are not in entire justification of the ideas which have prevailed more or less generally in Mexico and abroad concerning the iron resources of the country.

It is difficult to determine the actual iron-ore reserves of Mexico, or even to give a complete sketch of the known deposits, for the country is large and there is difficulty in gathering precise data. Also, the statistical and economic investigations by the Government and by individuals are incomplete. This article expresses personal views, which are in a large part the result of my own investigations, carried on for scientific and industrial purposes during a period of more than a decade. It should be understood at the outset that the country as a whole is not well explored, especially for iron, and there is reason to expect an important enlargement of the known iron-ore reserves in the future, as well as a better understanding of the importance of the deposits already operated and explored.

Note—Revised from an article in "Iron Ore Resources of the World." International Geological Congress, 1910.

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Mostly Contact Deposits

Deposits of iron ore are found widely distributed in Mexico, but few of them can be considered of great commercial importance. Almost all of the commercial iron deposits of Mexico are in the nature of contact deposits. Usually the sedimentary rock is limestone of the Cretaceous period, especially in the deposits in the central and northern part of the country. In many of the contact deposits in the south of Mexico and along the Pacific coast, the iron deposits are beneath crystalline schists and other Paleozoic sediments and rest upon plutonic rocks greatly varied from granulites, diorites and monzonites to porphyries of various types. It often occurs that the outcrop of these contact deposits furnish considerable quantities of iron ore, but the deposits are really not true iron deposits, but are deposits of sulphide minerals; the commercial iron ore being replaced at depth with iron and copper sulphides and forming, in fact, only "gossan" or "iron hats," typical of the deposits of this class throughout the world. Some of these deposits yield at the surface commercial iron ore of a high grade, but with increasing depth there is an increase in the pyrite, which ultimately replaces the commercial iron ore and contains in some of the deposits above referred to, chalcopyrite, often carrying gold. The question may be raised whether or not some of the so called true iron-ore deposits, limited in number, will not also become pyritiferous at moderate depth, below the already explored portion.

Most Deposits Indicated by Surface Exposures

From these facts it can be assumed that the reserves of oxidized iron ores in Mexico are practically all indicated by the surface exposures, as owing to the far-advanced erosion, at least in certain regions, the oxidized ore is often almost entirely exposed. For example, the deposits of the western part of the country along the Pacific coast. Here the Paleozoic coverings of the iron ores have almost entirely disappeared, and intense tectonic action has broken the country into blocks unequally displaced and readjusted, and the result is a notable and remarkable abundance of masses of iron ore, spread over a considerable area, and occupying, in the form of relatively thin beds the tops of the hills and mountains. These deposits have been isolated by the forces of nature, and the abundant erosion has removed an enormous amount of the iron. Fragments of all sizes cover the slopes of the hills and the smaller pieces, disintegrating under a tropical climate, have enriched the soil around the deposits. Deposits of this kind are found abundantly on the Pacific coast in the States of Colima, Jalisco, Michoacan and Guerrero. I have noted the same destruction of originally extensive iron-ore deposits in the Eastern Sierra and the Sierra Madre, where there is a cool but moist climate, and in places where there has been extensive tectonic action.

There are also deposits that are mere remnants of much more extensive deposits, which, under the action of the sea, have been so distributed that the ore is no longer commercially available. In the State of Michoacan are masses of iron ore on the shore of ancient sea beaches, a hundred meters above the present shore. On the west coast of Guerrero is an ancient mass of iron ore, the remnant of a much larger mass which has been destroyed under the influence of the waves of the sea.

Some True Iron Veins

In addition to the prevailing contact type of deposit are true veins containing iron and lenticular masses of iron ore occurring in diorite formations or passing through sedimentary formations. Excellent examples of this type of deposit may be seen on the coast of Michoacan, where veins of magnetite cut through the limestone formation as at Coalcoman. Small veins of cobaltite and nickelite traverse these magnetite deposits at Pihuamo, in Jalisco. On the Las Truchas hill near the mouth of the Balsas, is a large lens of magnetite, with crystals of garnet found in a diorite formation. Near Puerto Angel and in other localities on the Isthmus of Tehuantepec are numerous veins of magnetite occurring in granite. However, many of these veins of iron ore cannot be considered as commercial, because of their comparatively limited extent, and the difficulty and expense of extracting the ore under the conditions in which it occurs.

Iron Deposits on the Pacific Coast

In portions of Jalisco and Michoacan the destruction of iron deposits, which were important features of an earlier topography, has been so great that now only rounded blocks remain scattered on the hill slopes. On the coast of Guerrero, Michoacan and Jalisco and in the Sierras facing the sea are to be found a remark-

able number of iron deposits. Here more than 30 iron deposits with good ore are distributed along a line more than 300 km. long, all occurring under similar geological conditions.

The situation of the more important of these deposits is, unfortunately, unfavorable to industrial development. Near the boundary between Jalisco and Michoacan, on the top of a mountain range 2000 m. above the sea level, I examined on one occasion a contact iron deposit, which had already been investigated, with the result of showing more than a million tons of iron ore of commercial quality in sight. Here the iron ore was apparently deposited in layers between diorite and limestone formations. An iron deposit near the mouth of the Balsas river on the Pacific coast contains, on the estimate of the surface exposure, nearly 9,000,000 tons, much of which is in the form of "float," being detached blocks covering the sides and about the foot of the hills of which it forms a cap.

Iron in Oaxaca

Recent commercial explorations have called attention to the iron-ore deposits of the State of Oaxaca, which are said to be important. According to these reports, the iron resources of this State amount to many millions of tons, but an exact figure as to available iron ore from this source is not obtainable.

Deposits in Central Mexico

The iron deposits of the central part of the country are the best known, for they have been worked for a long time, although on a small scale. In reference to these it may be said that the reserves are small and the deposits are apparently limited and not important for commercial exploitation on a large scale. A type of these deposits referred to is that at Zimapan, where there exists a contact deposit of magnetite between monzonite and limestone. Although this is situated near the City of Mexico and not far from railroads, it is in an inaccessible mountain region. In a barranca in the State of Veracruz, on the descent of the Inter-Oceanic railroad to Jalapa, are contact deposits which are estimated to have developed more than a million tons. The difference in elevation between the railroad and the deposit is more than 500 m., a matter of considerable importance from the economic standpoint. This ore is found in places to contain sulphur in small quantities. North of Tulancingo, in the State of Hidalgo, are beds of limonite with 40 per cent. iron. These are exposed about 100 m. below the plateau level, where it is cut by the barranca of Vaquerias. Explorations have not yet been made to determine the extent or importance of these deposits. Other small deposits in the Central States of the country and in the Central Plateau region are found at Comanja, Tula and Providencia, in Jalisco, where are foundries operated on a small scale near the deposits. These also are probably limited in extent.

Most Important Deposits in Northern Mexico

In the present state of knowledge of the iron resources of Mexico, it must be noted that the important iron reserves are found in the north and northwestern parts of the country. These deposits are also of the contact type, but the information I have of the region is unfortunately incomplete, as, only now, is serious and competent study of the deposits being made. The abundant occurrence of iron ore in the northern part of Mexico, particularly in the great plateau-basin country, is of great economic importance, for here also are found the large coalfields, and the topography affords conditions for the easy construction of railroads. The large iron and steel works at Monterey, the only one which is at the present time utilizing the Mexican ores to any large extent, is exploiting two group of contact deposits in the State of Coahuila, one at the Cerro de Mercado de Monclova and the other near the high peak of Candela. The amount of iron which the deposits may furnish has been estimated at several million tons. Although the available tonnage of these deposits has been exaggerated, they are sufficient to meet the requirements of the Monterey plant for many years. Other deposits in Coahuila are also available, as for example in the region of Cuatro Cienegas and in the north near the Rio Grande, in a virgin country, in the region of the "lost" sierras and in the great desert plains are other deposits more or less definitely known.

PARTIAL ANALYSES OF MEXICAN IRON ORES.

	Fe, Per Cent.	S, Per Cent.	P, Per Cent.	Mn, Per Cent.
Pic de Candela	64.0	0.21	0.006	0.07
Cerro Mercado de Monclova	65.0	0.19	0.005	0.14
Rio Conchos, Chihuahua	65.9	0.20	0.052	0.8
Las Truchas, Michoacan	68.0	0.09	0.06	0.02
Iron Mountain, near Aguililla	67.0	0.01	0.01	....
La Piedra Iman, near Ahuijullo, Jalisco	60.2	0.02	0.018	....
Ferreria de Coalcoman, Michoacan	62.7	0.02	0.017	....
La Leona, near Chilpancingo, Guerrero	58.0	0.05	0.015	....
Los Chapones, Sierra del Alo, Jalisco	65.1	0.02	0.057	....
La Desconfianzo Sierra del Alo	67.0	0.03	0.024	....

In the States of Sonora and Chihuahua are iron deposits which promise important results upon exploitation and development. It is said in the district of Camargo in Chihuahua the deposits exceed 30,000,000 tons. These figures, however, are not as yet competently verified. There is no doubt that in the region between Jaco and Santa Rosalia and Presidio del Norte occur some of the largest deposits in the State, and deposits of possible future economic importance to the country.

Character of the Ore

In most of the deposits which we have noted, the ore is oxidized. It is usually a mixture of magnetite and hematite, the former predominating. Although the ore is massive and high in iron, it is accompanied, particularly near the walls of the deposit, by various characteristic metamorphic minerals, such as wollastonite, garnet, epidote, crystalline, limestone and quartz. The accompanying analyses from average samples give an idea of the character of the iron in several Mexican deposits.

Many Deposits Inaccessible

Many of the iron deposits of Mexico are at the present time unavailable because of their distance from coal, of their situation in inaccessible mountainous regions. The deposits in the northern part of the country are best favored in regards to both transportation and availability of fuel. As to the deposits on the Pacific coast, they lack available seaports or short routes to the interior of the country. Two conditions may favor the exploitation of these deposits; first, the possible discovery of important coal beds near the Coast, which is not unlikely, or the active exportation of the crude ore, either to the United States for consumption at Pacific Coast ports, or to the Orient. The possibility of export has been investigated, with favorable results. Recently it is said that a contract has been let for the exportation to Japan of nearly half a million tons of iron ore from an important deposit near Magdalena bay, in Baja California.

Estimate of Reserves

By reason of the incomplete knowledge of the extent, number and character of the iron deposits of Mexico, and the fact that the country is not well explored, it is impossible to make any definite estimate of the country's iron-ore reserves. However, my own calculations, based on the best data available, place the reasonably certain reserve at between 50,000,000 and 60,000,000 tons. It is understood that these figures refer only to deposits now known, and those which, by their extent, may be considered as available in the near future. While these figures may seem low, yet the quantity is sufficient to supply the needs of the country for many years. The annual consumption of iron and steel in Mexico does not exceed 250,000 tons for all purposes, and if this consumption were doubled, which it may be in a few years, the country would still be able to supply itself for a hundred years.

Electrical Smelting of Iron

With the improvement in the metallurgy of iron we may hope to see new features developed in the Mexican iron-ore situation, particularly with reference to the electrical smelting of iron. Mexico is marvellously well adapted for this process, because it will enable the commercial treatment of iron-ore deposits of small extent, many of which are situated in mountainous districts where cheap hydraulic power can be developed. The possibilities from the development of electrical smelting of iron are truly very great.

Ample Coal Reserves

The exploration for coal in Mexico is as active as the investigation for iron, and if we may look for an early doubling of iron-ore reserves, it is necessary to hope at the same time that they will be distributed in available portions of the country. We can at present count upon coal reserves in Mexico of five times as great as the iron reserves.

The Coke Industry of Mexico

Special Correspondence

The Mexican Coke Industry in the Sabinas Coalfield of Coahuila is rapidly increasing. The largest producer is the Compania Carbonifera, the mines and ovens of which are situated in and around the towns of Agujita and Lampacitos respectively. There are three large mines at Agujita and 400 coke ovens; these mines produce about 40,000 tons of coal per month. The Lampacitos plant of three mines and 69 ovens, produces between 4000 and 5000 tons of coal monthly and makes 1700 tons of coke.

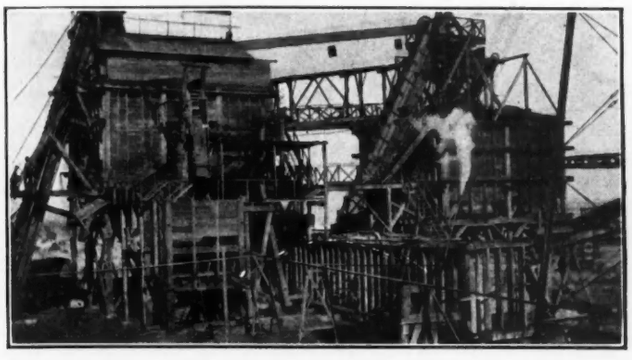
Mexican Mines Gaseous

The Lampacitos plant is a new enterprise, and a good one and both the output of coal and coke will rapidly increase in the near future. The next largest company in this field in the output of coke is the Mexican Coal and Coke Company, which has 226 ovens in operation. This is the oldest producer of coke in the field, having been making coke for eight years; the Hondo mine, now abandoned, was the pioneer company in this district and operated the mine for 20 years. Its first miners were Americans, but they were soon replaced by native Mexicans, and now there is not an American coal miner in the Republic. Some of the mine bosses and one of the superintendents, as well as most of the managers, are American mining engineers, who were educated and trained in the mining colleges of the United States. They have hard propositions to meet and overcome. Firedamp, that terrible scourge of coal miners, which the priests of Germany in a remote age tried in vain to combat with religious exercises and pious frauds, and which still baffles the skill and judgment of this enlightened age, has been met in practically every coal mine in the Sabinas field; several recent explosions have produced terrible consequences.

The coke ovens in the Sabinas field are of the beehive pattern; they are made 7 ft. 3 in. high, and 12 ft. in diameter. The flues from adjacent ovens communicate with each other, and with the outside air. This coking arrangement has been patented by the American coke expert in charge of the ovens at the Agujita coking plant, and is a reliable idea.

Free Baths at Pachuca

The American colony of Pachuca decided to abandon entirely the Centennial celebrations which were originally planned, and instead to install and provide for the permanent maintenance of a pubpublic bath house for the working classes of Pachuca. For this purpose, a house belonging to the Real del Monte company has been donated by that company rent free, and workmen are engaged in tearing out the interior and installing piping, etc., for the baths. Twelve shower baths will be provided with three tubs and a large masonry plunge, all with hot and cold water and general conveniences. The building is near the Loreto hacienda and the mouth of the Girault tunnel. The expense of the operations and equipment is being borne by several of the American companies jointly, together with some private subscriptions.



New Shaft at the Lampacitos Mine

Pay-day at the Agujita Mines

Recording Titles in Mexico

The Mexican mining law of June 4, 1892, repealed by the present law, made it optional with individuals to record or not record their mine patents, and obligatory on the companies to do so. The patent was the only instrument accepted by this provision. The provision itself was diametrically contrary to the provision of the federal civil code and the civil codes of the States, which required that all documents affecting real property or rights real constituted upon them should be recorded. The new mining law simply removes this anomaly, and requires that these documents shall all be recorded, whether they be in the name of an individual or a corporation.

The now idle mines at Guadlacázar in the State of Luis Potosi have an official production record of more than 100,000,000 pesos of silver, gold and quicksilver. One mine, the Promontorio, produced in a few years more than 27,000,000 pesos from above 188 meters.

Mexican Law on Monuments

The new mining law for Mexico provides in placing monuments the following requirements shall be observed:

"1. They shall not be changed in position so long as the properties they delimit are not modified. They shall be solidly constructed and shall always be kept in good condition.

"2. They shall be located in convenient places and in such number as may be necessary to enable the preceding and following monument to be seen from one of them; and by their dimensions, form, color or some other feature, they shall be distinguishable from the monuments of adoining mining properties."

The foregoing comprises the provisions concerning monuments in the existing mining law of Nov. 25, 1909, and the regulations of the same, both effective Jan. 1, 1910.

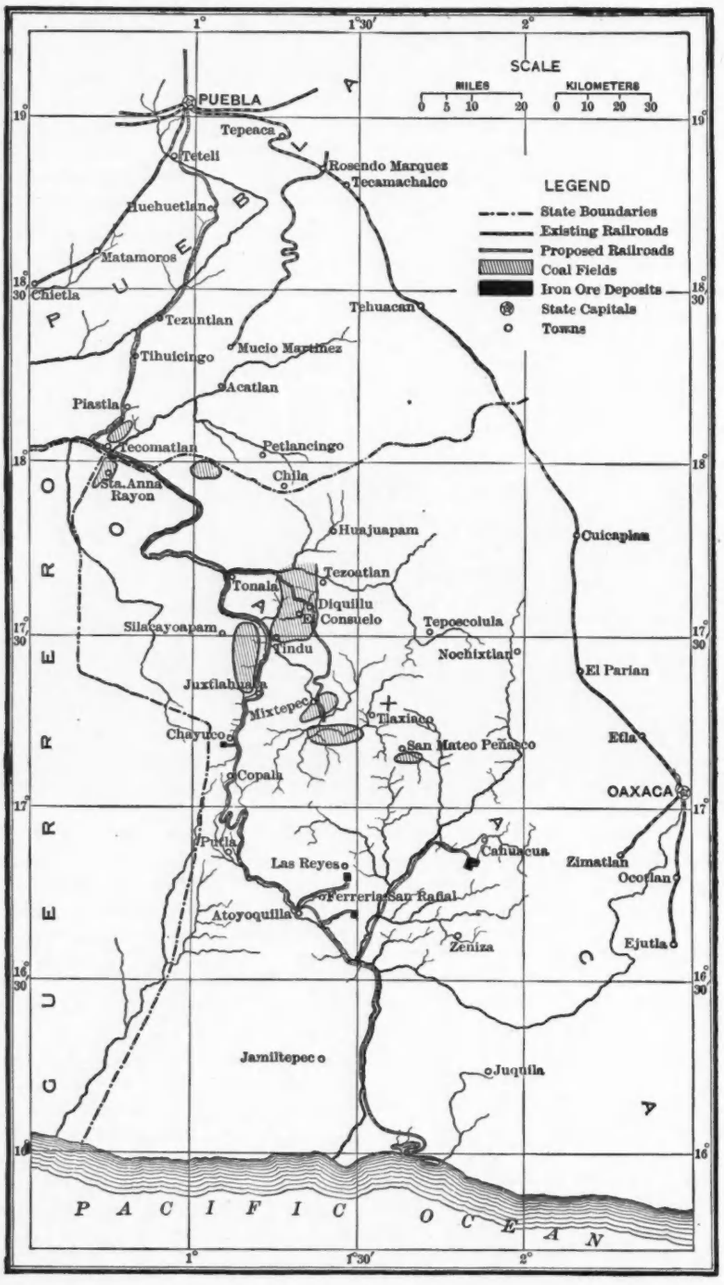
Coal and Iron Explorations in Oaxaca

Extensive Explorations in the Mixteca District Reported to Have Disclosed Commercial Deposits of Coal and Iron. Railroad Planned

BY J. L. W. BIRKINBINE*

The coal deposits in the Mixteca region, of Oaxaca, Mexico, must have been known for more than half a century. There is an old drawing, bearing the title, "Croquis de la Area Carbonifera de Tlaxiaco Descurbierta por Jose Vincente Comacho en 1850." ("Sketch of the Tlaxiaco Carboniferous Area Discovered by Jose Vincente Comacho in 1850"), upon which are shown several drifts and outcrops; but no work, except a few short drifts scattered over a large area, and a trench near Mina Consuelo, had been done in the region prior to 1907.

The first geological study of the Mixteca region, of which records can be found, was made by Santiago Ramirez, who examined, in 1881, some coal outcrops near the boundary between Oaxaca and Puebla. In the same decade, Messrs. Felix and Linke made geological studies in the vicinity of Tlaxiaco, and in 1887-88 Jose G. Aguilera, now director of the Mexican Geological Institute, examined the vicinity of Tezoatlan and the northern part of the State of Oaxaca. The activity of the Oaxaca Iron and Coal Company attracted to this undeveloped field the interest of the Geological Institute which, in the fall of 1908, sent an engineer to visit the Mixteca region. He collected for the institute considerable geological data and numerous fossils, and examined some coal outcrops, which, however, he regarded as possessing no importance, since he was able to find but few samples that carried less than 18 per cent. of ash, which he considered to be a maximum for useful coal. In the spring of 1909, the Director accompanied me in an inspection to some of the deposits; and later commissioned another party, composed of Prof. G. R. Wieland and Inginiero Bonilla, to visit the Mixteca region. They spent several months in the field, but the work of these geological parties was directed rather to the correlation of the various strata, to petrographical determinations, and to the collection of fossils, than to economic geology.



MAP OF THE MIXTECA COUNTRY, STATES OF OAXACA AND PUEBLA, MEXICO, SHOWING COAL BASINS, IRON-ORE DEPOSITS AND EXISTING AND PROPOSED RAILROADS

GEOLOGY OF WESTERN OAXACA

In the territory under discussion the general geology may be described as follows: The lowest formation is the Archaic, consisting of gneiss, mica schists, and mica slates. On this are superposed small areas of Jura-trias, while over larger areas appears the Cretaceous formation. The Pre-cretaceous Mesozoic rocks generally consist of shales (varying greatly in composition), coarse and fine sandstones, and conglomerates, also some quartzites. The Cretaceous is represented mostly by massive limestone, although in some parts slates and calcareous sandstones are found. Above the Mesozoic formations occur in some places the Tertiary red sandstones and conglomerates, and in other places *caliche*, which is either of Tertiary or Quartenary age.

Throughout these various formations, although more predominant near the junction of the Archaic and the upper

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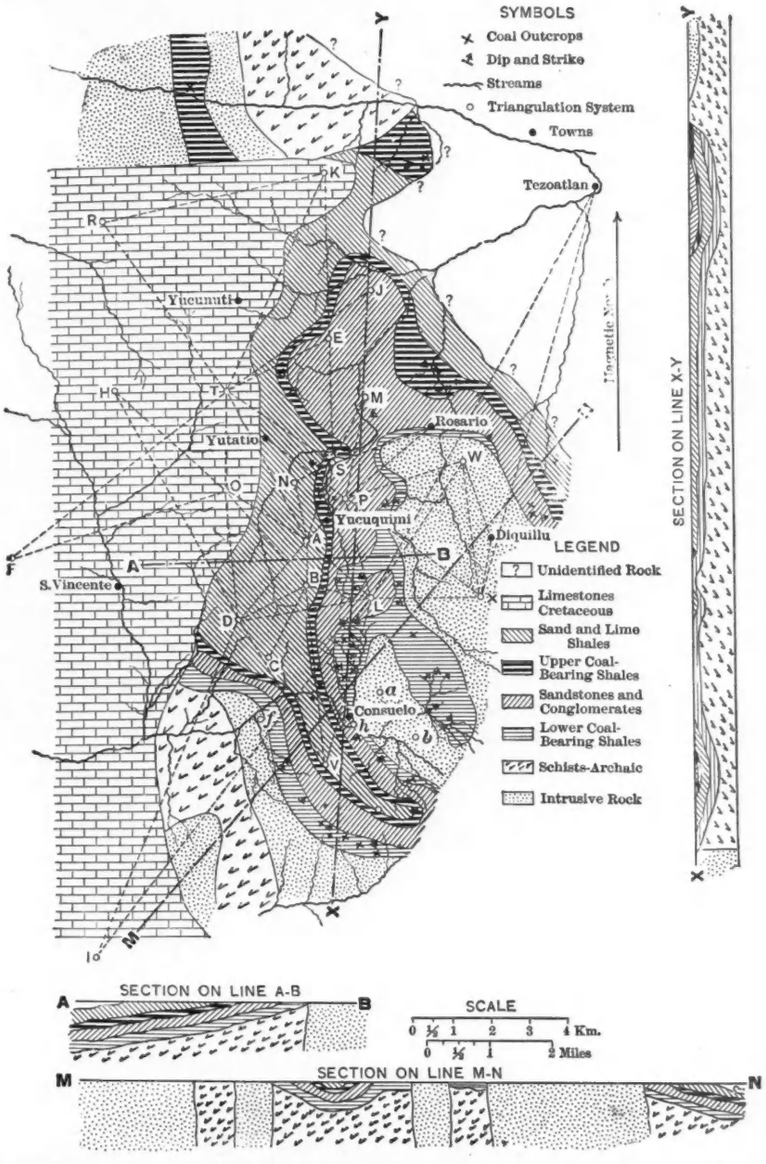
NOTE—Excerpts from a paper in *Bull.* A. I. M. E., Sept., 1910.

sedimentary rocks, large areas are covered by Tertiary intrusives (andesites, basalts, rhyolites, etc.), while in some localities lava flows and masses of obsidian are found. The Mesozoic formations of the region are extremely interesting to palæontologists, on account of the large number of fossils which they contain. The Jura-triassic carries a great variety of mollusca and plant forms. The mollusca include several forms of *trigonia* and *stefonigero;* while among the plant-forms cycads are predominant, although there is beyond doubt a great variety of other forms. Professor Wieland, in his paper entitled "The Williamsonias of the Mixteca Alta," says: "I am of the opinion that the Mixteca Alta is one of the most promising and accessible regions for the student of fossil plants yet discovered[1]."

[1]*The Botanical Gazette,* Vol. XLVIII, No. 6, page 427, et. seq.

The various formations of the Pre-cretaceous Mesozoic have not been correlated, being grouped under a general term as Jura-trias; but the thick Cretaceous limestone is sufficient as a geological horizon for field purposes; and an intermediate horizon has been used, consisting of layers of black oyster shells, and called by the members of the corps "the black-shell rock."



GEOLOGICAL MAP AND SECTIONS, VICINITY OF MINA CONSUELO, OAXACA, MEXICO

SECTION OF TEZOATLAN COALFIELD

The Tezoatlan coalfield has been more closely examined than any of the others, and the following section of it may be regarded as typical: Cretaceous limestones, massive and of great thickness; calcareous and arenaceous shales, including the "black-shell rock," about 500 ft.; upper coal-bearing shale, 110 ft.; sandstones and conglomerates, 800 ft.; lower coal-bearing shales, at least 800 ft.; intrusive or Archaic rocks.

The upper coal-bearing shales have not been examined, except superficially, since the lower shales appeared to have greater value. Several sections have been made of various portions of the lower coal-bearing shales, which vary in thickness according to where they are cut off by the intrusive rock.

A section shows a total of 83 ft. 2 in. of coal, in which 15 seams over 2 ft. in thickness aggregate 72 ft. 8 in., and 9 of these, exceeding 3 ft., give an aggregate thickness of 64 ft. 8 inches.

The intrusive rocks cut these formations at various points, but, in the coalfields proper, the nearest they come to the coal seams is (excepting one or two places) about 100 ft. below a coal seam about 77 ft. from the bottom of the section.

The formations are faulted and folded, but not as much as would be expected. The dip is generally between 30 deg. and 50 deg. west at Mina Consuelo, and the same amount to the east at the opposite side of the basin. In places, the coal lies horizontal in small areas, while the faults, with the exception of quite a large one on practically the axis of the cynclinal (where there has been a displacement of nearly 1000 ft.), are unusually small, although numerous. Three faults have been found, of 200, 120 and 55 ft. displacement, respectively, while there are many others which vary from a few tenths of an inch to a foot or more. The general strike in the vicinity of Consuelo is north to south but in approaching the town of San Juan Diquillu it swings around to east to west.

COALFIELDS AND CHARACTER OF COAL

The field headquarters were situated in Tlaxiaco, and the relative situation of the various fields will be referred to this place.

In the Penasco field, 10 miles southeast of Tlaxiaco, a high-grade coal in small deposits was found by an exploring party. A sample of the Junuzma mine gave, upon analysis, moisture, 9.45; volatile matter, 28.85; fixed carbon, 60.45; and ash, 4.25 per cent.

The Tepejilla field, about 20 miles northwest of Tlaxiaco, covers a small area; and the coal found there is high in ash and apparently small in quantity.

The Juxtlahuaca field includes outcrops in the vicinity of the towns of Juxtlahuaca and Silacayoapam, where preliminary investigation showed the coal to be noncoking and high in ash.

The Tecomatlan field, embracing the outcrops in the vicinity of Tecomatlan, in the State of Puebla, and Santa Ana Rayon, Oaxaca, is 75 miles northwest of Tlaxiaco. The coal here is soft and pulverulent.

The Tlaxiaco field, the Mixtepec field, 12 miles west of Tlaxiaco, and the Tezoatlan field, 25 to 30 miles northwest

of Tlaxaico, are those in which most development has been done, and will be described in detail under separate headings.

In addition to the above localities, coal is reported as occurring in four or five other places; but samples showed it to be of inferior quality.

Tlaxiaco Field

The Tlaxiaco field was subdivided into three tracts, the Villaverde, the Stein and the Rio Tlaxiaco. The work done upon the Villaverde and Stein tracts consisted in mapping and uncovering some 14 outcrops and securing samples, which show the coal to vary greatly in composition, much of it appearing to be too poor for commercial use. Analysis from one of these coals gave the following results: Moisture, 2.07 per cent.; volatile matter, 16.77; fixed carbon, 52.69; ash, 28.47 per cent.

The work on the Rio Tlaxiaco tract consisted of eight drifts, which had a total length of 900 ft., including crosscuts, and exposed seams varying from 10 in. to 6 ft. in thickness. Most of these seams are very dirty and show the effects of considerable faulting, the seams consisting of flakes of coal and and slate. Analyses of some of the better seams run from 42.1 to 53 per cent. in fixed carbon and from 15.1 to 19.2 per cent. in volatile matter.

Better Coal in the Mixtepec Field

Upon the discovery of better coal at Mixtepec, the work was transferred to this locality and a large number of drifts were driven, the longest being over 1100 ft., which showed that the seam was 25 ft. thick and extended over a large area. Numerous samples were taken, an average of the seam showing: Moisture, 1.3 per cent.; volatile matter, 16.2; fixed carbon, 67.5; ash, 13.0 per cent.

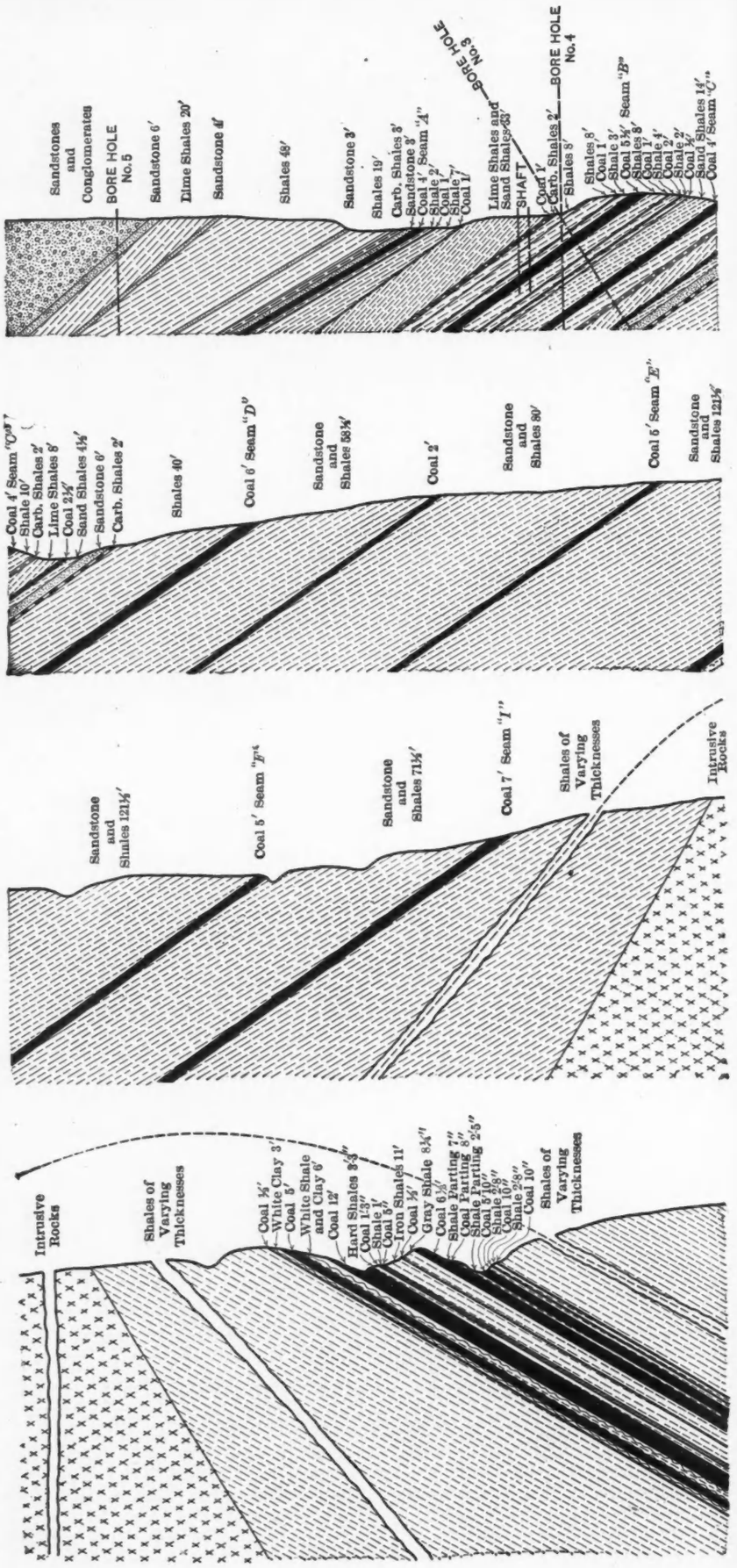
Besides this seam, known as the Esperanza, there are three others, designated as Fabrica, Soledad and Southern. The Fabrica seam, 6 ft. thick, gave: Moisture, 1.24; volatile matter; 16.21; fixed carbon, 60.23; ash, 22.32 per cent.

The Soledad seam, 5 ft. thick, showed: Moisture, 1.06; volatile matter, 14.03; fixed carbon, 66.69; ash, 16.22 per cent.

The Southern seam, 3 ft. thick, appears to be rather a lignite than a true coal, and is about four miles from the Mixtepec field proper.

All of the above analyses represent the "run-of-mine," the large pieces of slate only being removed. As the Mixtepec coal is soft, some crude tests showed that the ash could be reduced to one-half the original content by sizing on revolving screens, while washing or jiggling would make a still greater reduction.

As the percentages of ash appeared high, two samples were taken and tested in a calorimeter to determine their fuel value. The dirty coal, carrying 29.38



Geological Section, near Mina Consuelo, at Right Angles to Strike

per cent. of ash, yielded 11,400 B.t.u., while a clean picked sample, containing 3.85 per cent. of ash, gave 15,900 B.t.u.

As the evidence of the value of the coalfields appeared to increase greatly upon examination, it was decided to purchase a diamond drill; and, the nearest point of the railroad being the Tezoatlan field, the drill was sent there. Later a second drill was erected at the same place, and the entire force was moved to Mina Consuelo.

Tezoatlan Field

For 18 months all the development of the company has been confined to the Tezoatlan field, and here the work has reached its highest development, although still in progress. Thirty-five drifts have been driven into the coal in order to show the continuity of the coal seams along the outcrop, while seven diamond-drill holes and a shaft have been sunk to determine its extent in depth. More than 71 sq.mi. have been covered by a geological survey; and the data thus collected have been mapped, while detailed geological and topographical surveys have been completed on 350 acres, and are now in progress on 1000 additional acres.

As shown in the geological section, the coal seams 3 ft. or more thick in this locality have a total true thickness of 64 ft. 2 in., although in part of the field the intrusive rocks have cut out the lower 29 ft. 2 in. of the seams, leaving available 35 ft. of coal. As the average dip is 30 deg. or more, these true thicknesses will be equivalent to vertical thicknesses of 74 and 42 ft., respectively, and would yield, according to the rule of thumb (that 1 ft. vertical thickness gives a yield of 1200 tons of coal per acre), 88,800 and 50,400 tons per acre, respectively. The upper 35 ft. of coal has been traced over an area of 3000 acres, while the total thickness of 64 ft. has been traced for a distance of 1.25 miles, though the work has not yet reached a stage permitting the determination of the area underlain by the total thickness of seams.

Tezoatlan Coal Classed As Anthracite

The coal may be called an anthracite, being hard and dense, and burning without smoke, a typical analysis showing: Moisture, 1; volatile matter, 5.5; fixed carbon, 73.5; ash, 20; sulphur, 0.06 per cent., 11,500 B.t.u.

This analysis represents the coa when mined and picked; the "run-of-mine," unpicked, carrying about 25 per cent. of ash.

The Tezoatlan coalfield is a large basin, extending in a general north to south direction, the distance between the eastern and western outcrops being, near the southern end, about 2 miles, while, on the north, the western outcrop is hidden by the Cretaceous limestones, which are unconformable to the lower strata.

An interesting feature in this coalfield is that the intrusive rocks, which are considered to be Tertiary, have had practically no effect on the coals. In some places, coal seams are found occurring with surprising uniformity within 20 ft. of the intrusive rocks. The formations of the various strata in this vicinity are extremely interesting; and the rapid alteration of the strata (consisting of coal, shale, fine and coarse sandstones) shows that there was a constant variation of the depth of water during deposition.

Iron Ore Deposits

Although the preliminary reconnoissance in 1906 had for its object the investigation of certain deposits of iron ore, with the idea of utilizing them in the manufacture of iron, using either charcoal or imported coke as fuel, the coal deposits appeared to be of more immediate value than those of iron ore; and therefore nearly all the work has been done on the fuel deposits.

The iron ores in the State of Oaxaca are of high grade. Thirty-three samples, taken from within an area of 4 sq.mi and tested in the field laboratory, showed an average of 60.87 per cent. of metallic iron. George C. Davis, chemist, of Philadelphia, made an analysis of a sample, closely representing the average of the Cahuacua ore, which showed Fe, 65.86; S, 0.06; and P, 0.03 per cent. The phosphorus and sulphur are low in all the iron ores of this district, and in the deposit which has been most largely developed there are indications of large quantities of high-grade bessemer ore. Samples from a deposit at El Carnero averaged 66 per cent. of metallic iron, and Mr. Davis made an analysis of a hand sample, with the result: Fe, 63.20; SiO_2, 8.25; P, 0.024; and S, 0.03 per cent. In the locality known as La Ferreria, the average iron content of the ore, as determined in the company's laboratory, was 66.02 per cent.; and an analysis by Mr. Davis from a different sample showed Fe, 68.93; SiO_2, 2.80; P, 0.026 per cent. In the vicinity of Tlaxiaco iron ores were found containing Fe, 51.71; SiO_2, 4.61; P, 0.026 per cent. Some iron-ore deposits examined in the State of Puebla gave Fe, 42.40 to 67; SiO_2, 1.30 to 15; CaO, trace to 8.80; P, 0.004 to 0.051; and S, 0.01 to 0.15 per cent.

These analyses are offered to show that ores are collected from deposits scattered over a large area are rich in iron and low in sulphur and phosphorus. A few months' work at the Cahuacua deposit disclosed about 4,000,000 tons of iron ore. El Carnero ore is mainly magnetite; that of Cahuacua, mixed magnetite and hematite; that of La Ferreria, hematite and limonite; and that near Tlaxiaco, limonite. In the State of Puebla, the iron ores are limonite and magnetite.

Transportation

Coal and iron ore having been found in sufficient quantity to warrant the construction of railroad communications, reconnoissances of several railroad routes have been made. Notwithstanding the mountainous country traversed, practical routes were found, which would connect the present railway system of Mexico with the coal and iron-ore deposits of Oaxaca, and might be extended to the Pacific coast; the estimated construction cost being moderate for the character of the territory traversed.

The Mexican Oilfields

The oil lands in Mexico extend from the hacienda of San Jose de las Ruinas, in central Tamaulipas, to the district of Valles, in San Luis Potosi (where the Ebano oil deposits are being worked), through the counties of Usuluama, Tuxpan and Panantla, in the State of Veracruz. Farther to the south is a region which embraces the Veracruz counties of Acayucan and Minatitlan, and extends southward through the States of Tabasco, Campeche and Chiapas. Petroleum has also been found in small quantities in the Federal district, in the States of Jalisco and Oaxaca, and at other points along the Isthmus of Tehuantepec. Some recent discoveries in the States of Chihuahua and Coahuila show the existence of paraffin oil in that district.

The Mexican oilfields, which cover an area of over 800 square miles, increased their output in 1908, as against that of 1907, by more than 500 per cent., and the production for the year 1909 was still further increased, aggregating more than 3,000,000 barrels.

Igneous Rocks of Pachuca

The Sierra de Pachuca is formed of eruptive Tertiary rocks, the three principal of which are in the order of their age, andesite, rhyolites and basalts, each occupying comparatively different areas. The andesites cover the largest and in this rock are found the mineral veins of the districts of Pachuca, the Real del Monte, El Chico, Santa Rosa, Capula and Tepeneme. The rhyolites are found most abundantly in the extreme southeast, and also in the loftier portion of the range near Real del Monte and in the western slopes between Pachuca and the Sabanilla. The basalts are found only in ruptures in certain of the loftiest hights, running down in basalt streams on the eastern slope.

H. T. Payne, president of the Compañia los Tres Metales, of Ameca, Jalisco, Mexico, reports that ore containing nickel and cobalt has been discovered in the Ameca district.

Mineral Resources of the State of Guerrero

Important Operations Under Way in This Section of Mexico. Lack of Transportation a Drawback; Railroad Plans; Navigation on the Balsas

BY WILLIAM NIVEN*

Whether or not the Aztecs, as has often been declared, obtained their golden treasures from the State of Guerrero, Mexico, there is abundance evidence that this great unexplored region is destined to become one of the most important gold producers of the Republic.

Notwithstanding the almost total lack of adequate transportation facilities, a few localities adjacent to the Balsas river have yielded millions of dollars of gold, during the last 10 or 12 years.

Placeres del Oro District

One of these rich sections is the Placeres del Oro district, in the municipality of Coyuca de Catalan, about 230 km. southwest of Balsas station, the present terminus of the Cuernavaca division of the National Lines of Mexico. The Garduño Mining Company has been operating there for over 20 years and two of its principal mines, the Pinzan and Garduño, have a record of several millions of gold to their credit. The mineral zone is over 20 km. long and six km. wide. The Pinzan mine has been furnishing abundant ore from 30 to 60 grams of gold per ton for a 10-stamp mill for many years. The main shaft is over 300 ft. deep and many thousands of tons of this class of ore are blocked out. The concentrates and bullion—the former running from 300 to 500 grams of gold per ton, are shipped by mule freight, which costs from 60 to 75 pesos per ton. The Garduño mine has produced many bonanzas, and over a million dollars of concentrates and high-grade ore have been shipped to ore buyers in Mexico City. This vein, like the others in this district, occurs in a formation of black slate, and the deepest working is not much over 100 ft. from the surface, where water was struck. For some years little mining has been done, except by *buscones* (Indian prospectors), who occasionally work on shares, gophering out the rich streaks and pillars at the risk of their lives. A vast amount of money has been spent in the development of the other mines belonging to this company, covering over 800 pertenencias.

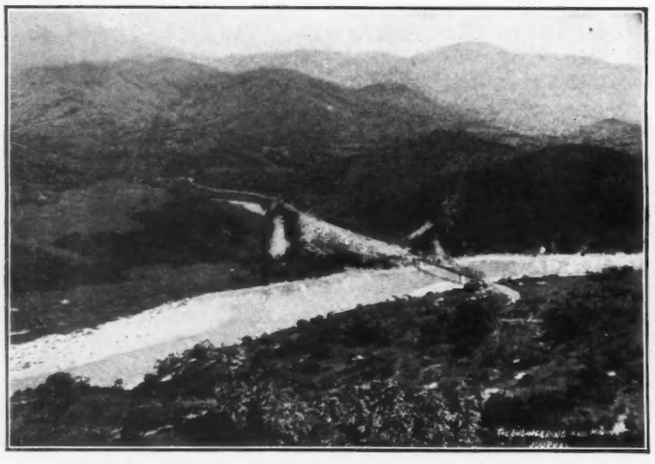
The Patambo Mining Company has a large amount of low-grade gold ore in sight and a favorable report has just been completed by C. C. Bancroft, who has recommended a 40-ton amalgamation and concentration plant to treat the ore, while developing. The properties are favorably situated near permanent running water. There are a number of parallel veins all carrying fair gold content. One 85 cm. in width, assays 24 grams gold per ton. In the past these veins have been worked by *buscones*, who only mine the richest parts and judging from the extent of these primitive excavations a large tonnage must have been extracted.

Rio del Oro Properties

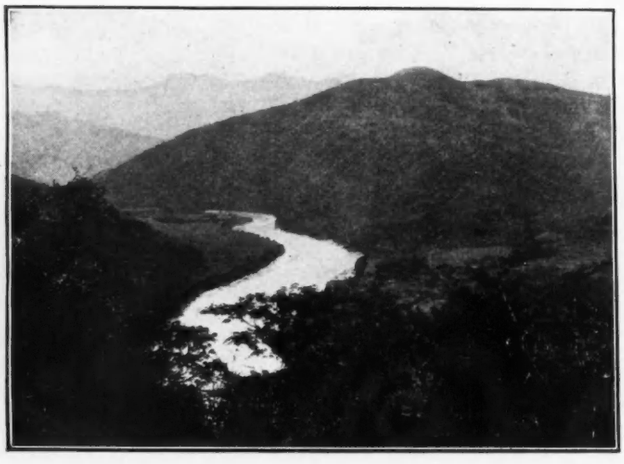
The Rio del Oro Exploration Company has a number of notable properties. A few years ago bonanza ore was struck in its La Lucha mine, but shortly afterward some difficulty arose among the directors and work has been suspended since. Efforts are being made to adjust the matter and to have machinery installed. Two of the properties, the Presidente and Rio del Oro, the former having over 300,000 pesos of ore in sight, cover completely the extensions and dip of the Pinzan mine. The Elnita mine of this company has a large tonnage of 18-gram gold ore blocked out and the Garduño Nuevo, an extension of the Garduño mine, is also a low-grade gold property.

Some of the richest prospects in this mineral zone have been at a standstill for nearly 20 years. They were located in the interests of Prof. Antonio Castillo, who was the geologist, secretary and director of the school of mines at Mexico City for 50 years. He had great faith in this district, but since his death in 1895, his heirs have only paid the mining taxes on the property; meanwhile bonanzas have been taken out by the *buscones*, chiefly from the Trinidad mine. The group consists of 20 mines, all partially developed, the principal ones being the Trinidad, La Mexicana, La Reina, San Nicolas and San Antonio. Two engineers have recently been making an examination of the group, and the owners are considering the advisability of installing machinery.

The governor of the State, Damian Flores, has located through his agent, over 100 pertenencias of a low-grade gold-bearing porphyrytic vein in diorite, about 3 km. north of the contact with the slate zone. The width of this deposit is over 300 m. This large body of ore has been examined recently by several engineers, who have recommended a diamond drill to determine its extent and grade. Governor Flores has



Balsas Bridge Terminus of the Railroad



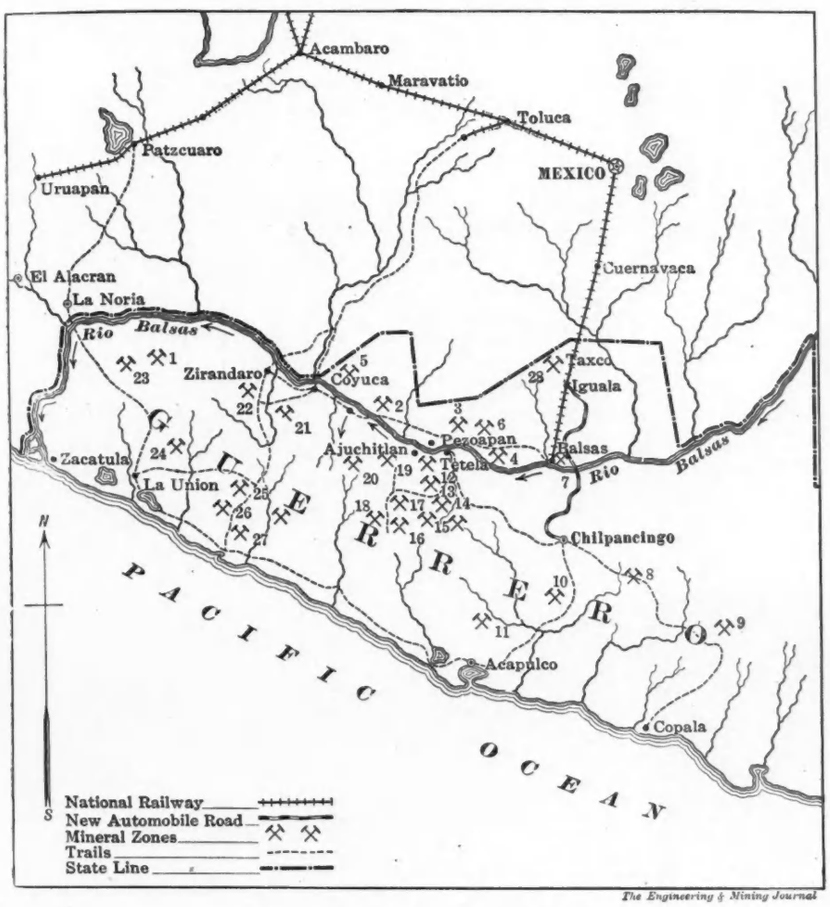
Balsas River from the Campo Morado Trail

*Mining engineer, Gante 10, Mexico, D. F.

also located a large iron deposit near this district. Other promising properties here are the Estrella de Oro, La Fortuna, Papallo, El Rayo, Once y Media, Davis and Metate.

Campo Morado District

The next and more recently producing district is the Campo Morado, where are the Reforma Mining and Milling Company mines, which have yielded over 7,000,000 pesos during the last seven or eight years. This camp is at present by far the biggest producer in Guerrero and the tonnage of low-grade pyritic gold and silver ores blocked out by this company is enormous. Recently 13,000,000 pesos have been offered and refused for the properties. These mines stand among the first in the entire Republic for quantity of ore in sight. Over 1000 tons of coke are shipped monthly down the Balsas river and by mule-freight to supply the smelteries on this property.



Mine Map of Guerrero, Mexico

Reference numbers for mines and mining districts: 1, Gallina; 2, Raton; 3, Asturiana; 4, Cacalotepec; 5, San Vicente; 6, Campo Morado; 7, San Lucia; 8, Mochitlan; 9, Pascalalan del Oro; 10, Iron Deposit, Guayabo; 11, La Dicha; 12, Tepantitlan; 13, San Nicolas del Oro; 14, Guerrero del Oro; 15, Teotepec; 16, Pandaloma; 17, Las Rosas; 18, Gallegos; 19, San Miguel Totoloapan; 20, Tepehuajue; 21, Placeres del Oro; 22, Penuela; 23, Gallo; 24, Guadalupe; 25, Pacific Copper Mines; 26, Iron Deposit; 27, Iron Deposit; 28, Taxco.

Other Mining Districts

From the Balsas bridge to the Pacific there are over 30 known mineral zones, situated within a few miles from the river, rich in gold, silver, copper and iron. This Balsas region is just far enough south of the great volcanic belt to be free from the lava and to have received its richness from eruptive upthrusts. These eruptions have been on such a vast scale as to render almost the entire State a labyrinth of mountain ranges, which has few equals.

The first of these mining localities referred to above is three kilometers east of Balsas station, where the Maine & Nebraska Mining and Milling Company has recently installed a 100-ton smeltery and preparations are being actively pushed to begin operations in the near future; one of the principal properties is the Santa Lucia, a silver-gold-copper vein, which has been steadily developed for over 4 years, with satisfactory results. There are a number of other promising prospects adjoining this mine, which are showing up well.

From Tetela del Rio, about 50 km. down the river, and south about 50 km., are Los Grados gold mines, which have been worked for some years, and a few kilometers west of here is the Teotepec district, where a 5-stamp mill has been operated at irregular intervals for about 6 years. The veins contain high-grade silver ore with some gold. Occasional shipments of this ore is made, but the high freight rates are almost prohibitory. About halfway on the return journey to Tete'a del Rio, Guerrero del Oro is reached, where a number of gold and silver prospects have been worked at intervals during the last 12 years. Here again the high freight rates have retarded development.

San Nicolas del Oro and Tepantitlan

About 30 km. northwest is San Nicolas del Oro, which was a favorite camp of the Spanish prospectors nearly 200 years ago. The principal mine is the Mina Grande, on which about a million pesos have been spent by an American company, blocking out a large body of silver ore. The company is now awaiting the coming of the railroad before installing machinery.

Some of the other well known mines in this locality are the San Rosario, Alfonso XIII, Aurora, San Cayetano, etc., on all of which extensive development has been done.

Tepantitlan is the next camp north of San Nicolas; the Santa Ana mine is the largest and is honeycombed with old Spanish workings miles in extent. Old wagon roads cut in solid rock in the mountain side for several miles are still visible, and the ruins of houses and churches extend hundreds of yards along the trail. Once the town of Tetela del Rio had a population of 30,000, but now it has only a few hundred.

From Tetela del Rio to Pezoapan, the distance down the river is less than 30 km. Five hours north over a good wagon road, are the famous mines of Campo Morado, already referred to. Near Santo Tomas some recent denouncements have been made on a gold deposit, which shows good yield on the surface. There are also old Spanish workings in this neighborhood. Down the river, near San Miguel Totoloapan, is a copper region on which some prospecting has recently been done and a few denouncements made; this zone extends into the foothills of the Sierra Madre del Sur south of Ajuchitlan and over the divide is the Placeres del Oro district before described.

San Vicente and Zirandaro

Going north to Coyuca de Catalán, the next important mines are at San Vicente near Tlalchapa, where the San Vicente Mining Company has spent in development nearly a million pesos during the last few years, on a large silver zone. From recent reports this camp may prove to be one of the great producers of the State.

The next important mineral locality and which is little known is south of

Zirandaro, about 20 km. distant, between the Metate and Papallo mountains. The principal mines are the Penuela and Penuela Anexas, 32 pertenencias. The vein, carrying copper, silver and gold, averages 60 pesos per ton, chiefly gold. Development has been going on for 4 years and the main drift on the vein is over 250 m. long, blocking out 200,000 pesos of ore, gross value.

Another camp west of Zirandaro and about two hours south of the river, is the Gallo—where a number of silver properties are being developed. Two days south is the old silver mining district of Real de Guadalupe. Regular monthly shipments of high-grade silver ore and concentrates are made and notwithstanding the remoteness of the region, great activity has been displayed for several years past. Machinery is being installed and many new denouncements have recently been filed.

Districts on the Coast

Just north of Petatlan, near the coast, are the great iron deposits of Guerrero and the big copper properties of the Pacific Copper Company. Near the Acapulco trail, 60 km. from the coast, are the La Dicha copper mines of the Mitchell Mining Company, of New York, on which over a million pesos has been expended. Near Chilpancingo, on the Acapulco trail, is an immense magnetic iron deposit belonging to the Guerrero Iron and Development Company, and south of Chilpancingo at Mochitlán is a lead-silver-copper belt, on which many locations have recently been made. Two days south and about 50 km. from Copala on the Pacific, is an unexplored gold region, the chief centers being Pascalalán del Oro and Totomixtlahuacan.

Transportation Will Be Bettered

The general belief by all who are interested in the Balsas region is that the solution of the perplexing problem of transportation either by river or rail is now a foregone conclusion. For the last year engineers have been looking into the present and probable output of the natural products of the country and their investigations have been very satisfactory. Mr. Harding, of the engineering staff of the National Lines of Mexico, has recently returned from a trip down the Balsas river to the coast and his report of the conditions and route has been favorable. The survey of a railroad from Toluca to Coyuca de Catalán has been completed by well known English capitalists and it is believed that efforts are at present being made to obtain a concession from the Federal Government to continue the line down the Balsas from that point to the Pacific. Acapulco will soon be reached by the new automobile road which has recently been built from Iguala to Chilpancingo, the capital of the State, through the efforts of Governor Flores.

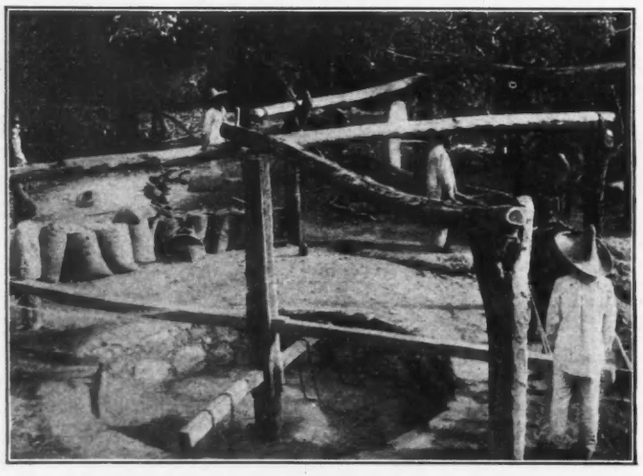
Plans for River Navigation

Meanwhile the plan of navigating the Balsas river, proposed in a recent concession granted by the Mexican Government, by 12-in. draft, stern-wheel steamers, with capstan and cable, has been approved by an experienced rapid-river expert.

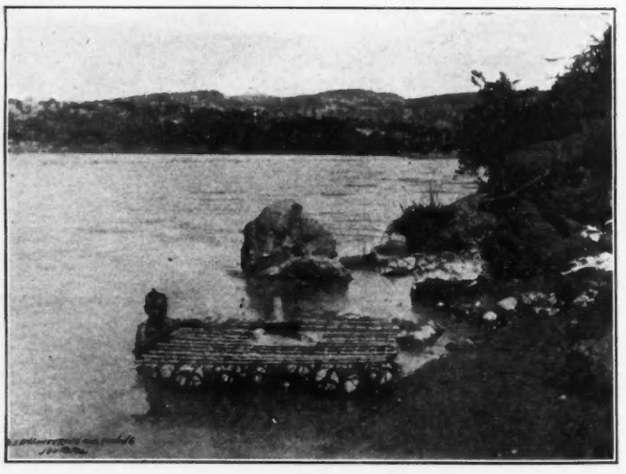
This expert has just visited the Balsas and reports that there is not the slightest difficulty or danger in navigating the river with boats of the proper construction. It may, therefore, be stated with authority that the opening up of this rich region by the navigation of the Balsas river is assured.

Making a "Tintadura" (Test) at Placers del Oro

"Buscones" Working Tailings at Placeres del Oro



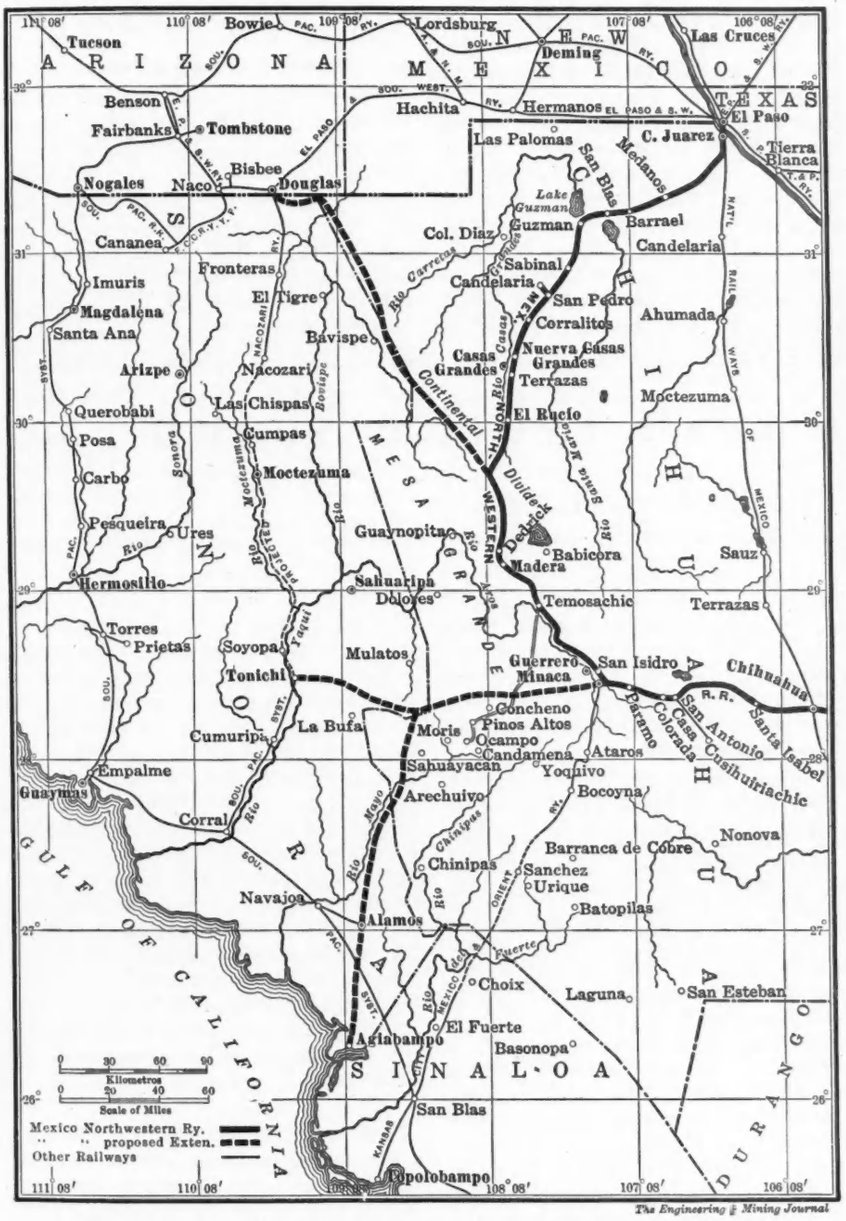
Arrastres at Patamro Mine, Placeres del Oro



Indian "Balsa" (Raft) from which Balsas River is Named

Mining along the Mexico Northwestern Road

The Mexico Northwestern Railway system, now entirely within the State of Chihuahua, is at present composed of the railroads formerly known as the Rio Grande, Sierra Madre & Pacific, the Sierra Madre & Pacific, the Chihuahua & Pacific and the El Paso Southern, with a mileage of 590 km., which will soon be increased to approximately 800 km. (500 miles) by the building of a connecting line between the old Rio Grande, Sierra Madre & Pacifico at Terrazas (district of Galeana) and the present terminus of the old Sierra Madre & Pacific at Madera, and other branches now under consideration, for which federal concessions have been granted. Its present termini are: Chihuahua, where connection is made with the National Railway of Mexico, the Kansas City, Mexico & Orient and the Mineral Railway; El Paso, Tex., where connection is made with the Atchison, Topeka & Santa Fé, the El Paso & Southwestern, the Southern Pacific, the Texas & Pacific and the National Railways of Mexico; Terrazas and Madera, where connection is made with various stage lines, etc., and Miñaca, where it connects with the Kansas City, Mexico & Orient Railway.



MAP OF MEXICO NORTHWESTERN RAILWAY AND PROPOSED EXTENSIONS

The Mexico Northwestern system is the outgrowth of the purchase by a syndicate headed by Dr. F. S. Pearson, of Montreal and New York, of Col. William Greene's road running southwest from El Paso and the Chihuahua & Pacific road running west from Chihuahua, built by New York interests. Connecting links have been built and are under construction, and extensions into Sonora and to the Pacific port of Agiabampo are planned.

ROAD IMPORTANT FOR MINING

The road is of vast importance to the mining interest of Chuhuahua and Sonora as is evident from the accompanying map. Data as to the mining interest directly affected by this railroad are furnished by T. E. Ryan, traffic manager of the road.

Outward bound from El Paso, Tex., the first important mining operations are at Guzman. Here are several important properties now idle. Among them is the old Bismarck mine now owned by the Londres company. This mine has developed large orebodies, but is greatly troubled with water in the mine. It is supposed that there is a connection between a neighboring lake and the mine, but this has not been proved and it is probable that an attempt may be made to unwater the mine and resume production. There is talk of installing a smelting plant at the mine but a concentrator is advised in view of the railroad facilities for shipping the concentrates to El Paso. There are a number of large dumps in this locality which it is reported can be worked profitably by concentration. It is likely that the district will become more active and that the problems of handling the water will meet with proper equipment.

TELLURIDE GOLD ORE AT SABINAL

Between Guzman and Sabinal at Guano station are the Lolita mines, controlled by Mr. Gerber. These properties have produced some copper ore of high grade. Operations are being carried on at present in the way of development and shipping high-grade ore. At Sabinal the Aventurera mine is operating steadily and shipping. This is a low-grade property. In the same camp James Parker and associates are shipping high-grade ore from the Grand Central to El Paso. This is a silver property in which rich orebodies are found irregularly distributed. The Mexican Mines properties are being developed by Mr. Sutton. These yield, according to report, a tellurium-gold ore of high grade, a fact of interest because telluride ores are rarely found in Mexico. In this locality some rich tellurium-gold float has been found but the source of it has never been traced

definitely. Eighteen miles from Sabinal in the Capulin mountains are a number of prospects. The Paul Taylor is operating the Progreso mines in which is said to be developed 300,000 tons of $9 ore. A branch line to connect with the railroad would be of easy construction and is being considered. The ores of the district are generally low-grade.

Operations at Casas Grandes

At San Pedro is the Candelaria mine, an operation of importance. The pumping problem of this mine is discussed in a separate article in this issue of the JOURNAL. At Summit station, three miles from the railroad, is the Sierra Madre mine controlled by Patrick Durack. This property is equipped with a steam plant and is shipping silver-lead ore. Twenty miles from Nueva Casas Grandes is the Fortuna mine, owned by Homer A. Hoyt of New York. There are other properties adjoining this; much development is under way and a concentrating plant is projected. Sixty miles from Casas Grandes is the Dos Cabezas mine, a privately owned property of importance. A short distance from here is the Montezuma district in Sonora and the famous El Tigre district.

Other Tributary Districts

Between Casas Grandes and Madera there is at present little mining development. The country is composed of eruptive formations, heavily covered with detritus, but the streams are reported to show no encouraging float.

From Summit and between there and Madera there are a number of excellent properties in the Guaynopita district, most of which are in the development stage. The country is difficult of access. The deposits now yield chiefly gold and silver with some copper. Presumably the district will ultimately yield much copper. Beyond this district is the Sahuaripa camp and beyond that the Mulatos mine. In this region the properties are being operated chiefly for high-grade ores, for the limitations of transportation prevent extensive undertakings. The proposed extension of the Mexico Northwestern to Tonichi, Son. will serve this district and stimulate it greatly.

Along the line between the city of Chihuahua and Madera are a number of important districts and deposits most of which are referred to in other articles on mining in Chihuahua in this issue of the JOURNAL; also several important districts in western Chihuahua which are at present served either by the Mexico Northwestern road from Miñaca or by the Orient road from Creel. This section will be greatly benefited by the proposed extensions of the Mexico Northwestern.

Report of Railroad Expansion

There is some report that the Mexico Northwestern road would have control of the Moncolva-Chihuahua road now projected, when it is built, but this matter has not developed definitely. At any rate the road is an important extension into the Chihuahua and Sonora country and particularly in making El Paso the tributary point in connection with mining in northern Mexico.

Tales of Mountain Travel in Mexico

BY MARK R. LAMB*

The end of the rainy season in Mexico is the really pleasant time for the final stage of a journey on muleback. A slicker keeps out the occasional shower while the shower keeps the air cool in the deep cañons, called the "hot country." The rains and warm weather will have brought the grass knee-high, so the pack mules will be lively and willing. On account of possible malaria, quinine should be taken in quotidian, prophylactic, diaphoretic, antipyritic doses. (See Chester and Semple.)[1] The guide who runs ahead to show the way will not need the quinine since the cool rain is his antipyretic, the rough trail serves him as a diaphoretic and his simple diet of corn and chile acts as a prophylactic cathartic.

Hand Sorting of Asses

Use generalship in choosing mules and guides for such a trip. A membership in the Mining and Metallurgical Society of America is no guarantee of ability to judge asses and men, so since what one requires is an animal used to mountain trails, not exhausted with recent travel nor green from pasture, hire someone to choose the required mules, and beware of animals with such significant names as "Flatwheel" and "Concentrator." Be not deceived by tales of fast traveling on the trails. The guide afoot has no difficulty keeping ahead of the man on horseback. While on the subject of time, attention should be called to the fact that in Mexico, time is depreciated even more than is the money, and on this account, when informed that it is "two hours to Cuiteco," it is necessary to ask, "Gold or Mex?"

Eating and Sleeping

It is advisable to take plenty of corn, if provided with mules which will eat grain, while a cooking outfit can be omitted if the trail passes enough houses. Eating at native houses sometimes entails fighting the dogs for your beans, but the dogs are not large. There need be no fear of not obtaining food at such houses, since entertaining a guest is merely a question of "adding more water to the family bean-pot." A large sheet of heavy canvas should be taken, twice the width and three times the length of the blankets. Under this, and by using a little judgment in choosing a spot of ground for a sleeping place, a heavy rain will cause no discomfort. Let the guide shiver. Even if given a warm outfit, the chances are that he would gamble it off or trade it for a mescal. In the mines of Chihuahua a miner can earn 2.50 pesos per day, while in Guanajuato 75 centavos is the rate—and the laborer in each section is chronically broke. (The same comparison is applicable to gold miners of Nevada and coal miners of Virginia, so it will be seen that no racial slur is intended.)

It is not advisable to sleep in a native hut. One is liable to find sarcophagous bedfellows. A shelter is only necessary in case of heavy snow or hail and such an emergency is only met with on the higher portions of the trail, while it is usually possible to plan a sleep in the "hot country" each night. The huts in the cañon districts are sometimes perched in impossible places. As an example of the difficulties of the region, I have seen Indains planting corn with an iron bar while hanging suspended from a cliff on the end of a rope. The depth of the cañons may be realized when it is known that when a pack-mule falls off the trail, his splash into the river is not heard until you are on your way back from the mine! (*sic*).

Practice and Theory of Sectionalizing

The mining machinery in this region seems to be composed mainly of bolts. Boilers, unless of the water-tube type, appear to be all seams. Engine frames and cylinders are series of short rings bolted together. Tall tanks and short have the appearance, at a distance, of being made of plates the size of postage stamps. After the excellent and exhaustiev article by F. C. Roberts and Walter W. Bradley on the subject of mule-back transportation, that topic, as well as the readers, would seem to be exhausted. Mr.

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[1]ENG. AND MIN. JOURN., Oct. 9, 1909.

Roberts' bravery in buying mules and in teaching them to eat corn is rarely equaled. The usual course is to contract with local freighters. This makes it desirable to have the carloads of freight arrive—not all together, but one at a time, and far enough apart so that no accumulation of freight emboldens the freighters to raise the rates. Only when it is planned to own and feed mules, is it safe to figure on heavy individual loads.

It is possible (witness the Greene Gold-Silver Company) to decline to sectionalize any machinery whatever, and instead, build a wagon road. But such roads are expensive. The Greene road is even now so out of repair that machinery is again going into the Ocampo district of Chihuahua sectionalized. Sometimes, as is the case of Lluvia de Oro Company, also in Chihuahua, machinery can be rolled and skidded over flat country with an army of mules, and dragged up and over such rivers as the Fuerte with its rapids and shoals, but the expense is rarely warranted by the saving in cost, comparing standard with sectional machinery. The difference in such cost is usually 20 per cent. The above company is now building a sectional hydroelectric power plant and Manager Conklin, who had the pleasant job of taking in solid machinery purchased by a former manager, had no trouble in deciding between sectional and standard designs for his new plant.

Foresight in Ordering Supplies

It is the ordinary and natural custom for companies operating in the mountains to spend the necessary time in deciding on just the size and type of mill required, where it can be purchased to the best advantage and in obtaining the necessary funds. It is then equally natural that every effort should be made to get the machinery to the mine before the snow flies, before the rains set in or before some other disadvantageous condition obtains. On account of this great rush, it is sometimes necessary to take a standard machine with heavier parts, rather than to await the manufacture of special, sectional machines, and purchasers should bear in mind that, given the necessary time, any machine can be made sectional. A mine manager in these distant and difficult localities finds that it pays to provide supplies far in advance of requirements, out of all proportion to the usual practice. Steel wearing parts for batteries are ordered usually at least a year in advance, as steel castings are not obtainable at a moment's notice. The heat treatment alone of some specially tough shoes and dies runs into weeks. Unless one can afford to follow Mr. Roberts' example in the matter of owning mules and feeding them grain, the end of the rainy season should be set apart for beginning transportation. Pack trains can be forced through during rains, but it is no unusual thing for the rains to swell the streams and trap an outfit for days and even weeks.

Knowing When to Come in out of the Rain

At home on lower Broadway, no attention is paid to the gathering clouds and heavy rain can come and go without discomforting, thanks to subway and "taxi," but it is well to give the sky some thoughtful attention before following the trail into any of the multitude of deep-walled cañons. A sudden flooding rain anywhere on the watershed may trap the traveler where it is impossible to escape the wall of water which goes as quickly as it comes. Huge boulders weighing tons are tossed and tumbled through the cañon like pebbles in a tube mill. Though the grinding efficiency cannot be high, the quantity of slime produced must be immense.

The Little Things of Life

The trip presents some little discomforts. A small, black fly in the hot, humid valleys has the faculty of biting the hands and face and satisfying his appetite before the assault is felt. As the bite is poisonous, the hands and face promptly swell and itch, and the traveler is prone to become exasperated, if not peevish. Even the butterflies are different from those in the States. A few days of suitable weather brings out myriads, and due to their inexperience with the grasping American, an encounter with a cloud of them leaves one covered with a golden layer to such an extent that there is a startling resemblance to a Broadway chorus girl. The microscopic red chigger of our own country is also found in these mountains, though for some reason he prefers the Mexican and Indian diet. My guide explained it on the ground that the American is too clean at the beginning of a trek. The guide had noted that after a few days' journeying the chigger shows no preference, the explanation being that the American develops "that animal smell!"

"Agua Blanca Es Buena"

The waters of the small streams and springs are sometimes a milky white, due to suspended impalpable particles of tufas. My first experience with such water, when thirsty, resulted in a laborious climb up a cañon in an endeavor to "get above where the stream was being polluted with soap." At another place where I reproved the mozo for drinking from a slimy, green pool, he replied "But if it is poisonous, Dios has made it so, and he knows I am drinking it."

Fairy Tales of Mines

Each and every native of these regions knows of unworked mines and can give good, attractive reasons for their neglect, the attractiveness of the reasons not being diminished by any superstition about lying. Rich ore specimens are on every table and doorstep. In describing and theorizing on ore formation the native lacks, not the desire, but only the imagination to equal those among our own neoteric theorists, whose statements make even the rocks laugh. It is easy to spend much time examining embryonic mines all of which carry from $100 to $1000 per ton, and which will make a millionaire of whosoever will provide merely water and a coffee mill. Nevertheless, it is the lucky—and persistent—American investigator who (usually by getting an option for nothing down) has dotted these western mountains and cañons with dividend-payers.

Fellow Travelers

The trip is enlivened daily by meetings with travelers who are bent on similar errands. Such chance meetings are made particularly interesting by the difficulty of properly judging your fellow-traveler. On a city street one judges by the silk hat and frock coat, or by the overalls and bunch of waste, but on the trail there is nothing to guide. The noted mining geologist and his wife, after a month's reconnaissance, must be detected in two people far removed from conventional appearances. A string of mules, loaded with rolls of bedding, steamer trunks, boxes of provisions, camp utensils, ore samples and mining tools, together with tents and lethal weapons makes a picture worth preserving. Judgment cannot be based on the condition of boots and hair, as elsewhere. Such a meeting means an hour's chat and the exchange of information on what is ahead. News from the "outside" is traded for advice and information regarding trails and game. Acquaintances thus formed are cemented, if by chance a messbox or medicine chest affords some required article.

Hastening to Broadway

The journey is undertaken with a thorough disgust for civilization and with a delightful anticipation of the pleasures of the mountains. The traveler spurns the railway and telegraph. When the return trip is about ended, however, and the rail-head is but a day or so away, every nerve is strained in an effort again to get in touch. The poor, astonished mules and guides make forced marches. Night nor swamps nor rains can delay the traveler, and the first, faintly heard whistle of the locomotive makes sweeter music than a choir of angels.

Additions to the Mexican Federal telegraph lines were made between January and June, 1909, to the extent of 2144 miles, making the present mileage over 42,750 miles.

Mining and Smelting in Aguascalientes

The Largest Custom Lead and Copper Smeltery on the Continent. Diamond Drill Exploration at Asientos. Other Camps Are Active

BY BRUNO NEWMAN*

The smeltery at Aguascalientes is the largest custom plant of the American Smelting and Refining Company's chain of smelteries in the United States and Mexico. At the present time it is running at about two-thirds capacity, five of its nine furnaces being in operation. This partial shutdown is due to various causes: To reduced shipments on account of the low metal prices; to the increase of the practice in cyaniding in Mexico, chiefly at El Oro, Pachuca and Guanajuato; to the recent increase on railroad freight rates in some sections of the country; but chiefly to the recent acquirement by the American Smelting and Refining Company of the smeltery at Matehuala. This purchase has caused the diverting of ores to the Matehuala plant from several neighboring mines which formerly shipped to the Aguascalientes plant, the Dolores mine being the most important shipper thus diverting its ores.

The Aguascalientes Smeltery

The Aguascalientes smeltery presents exceptionally difficult metallurgical problems, as its custom ores are derived from mines scattered all over Mexico, thus causing a constantly varying charge on the furnaces. The daily smelting capacity of the five furnaces in operation is about 1000 metric tons. The copper on the charge is about 5 per cent., and the slag is a bisilicate slag, high in lime and contains 0.2 to 0.25 per cent. copper. The copper production is about 1500 metric tons of blister per month, exceptionally high in precious metals, the bullion assaying 30 to 50 kg. of silver and 200 grams of gold to the ton.

The unloading of all ores is done by natives by hand, and the first sample then cut out is run through a Vezin sampler. Three briquetting machines are in operation, briquetting the many rich concentrates received from all over the country. The baghouse is one of the earliest installed and has given satisfactory results for years. At present only the converter gases are passed through the baghouse. There have been no signs of smoke-nuisance controversies, and any attempts could be quickly disproved by the fine condition of the company's garden and alfalfa patch, at the foot of the slag dump, and the fine aspect of the many ranches close to the plant.

The outlook for business this year promises to be better, notwithstanding keener competition by the San Luis Potosi smeltery, which is about to build another copper blast furnace besides the reverberatory and lead furnaces it now operates, and has invaded the Asientos district, which supplies a large tonnage to the Aguascalientes smeltery. The Zacatecas smeltery is also operating one copper furnace, although mostly on ores from mines controlled by the owners of the plant.

This competition is being met by better prices, the miner consequently benefits, and the relations between shippers and the Aguascalientes smeltery are more harmonious than ever before. Kuno Doerr is manager of the plant at Aguascalientes and R. H. Webb is superintendent.

Asientos District

Activity in the Asientos camp is gradually increasing. Several properties are being reopened, and with a little rise in metal prices the camp would soon be flourishing.

The Santa Francisca mines of the American Smelting and Refining Company, are making excellent progress under the direction of T. M. Hamilton. Two diamond drills have been installed, at 600 ft. and 800 ft., and at 1500 ft. one will also soon be installed. The drilling is being done from the station of the seventh level, 992 ft., and it is intended to drill 22 holes at an angle of 30 deg. to tap the vein and also the water courses, and an attempt will be made to control the water with valves on the casing of these drill holes. The smaller drills are making 15 to 20 ft. per day. The result of this diamond drilling will be of great value to the mine and the camp, as it will definitely decide the question of deep mining in this district.

The water in the mine has been lowered considerably, the mine pumping about 500 gal. per minute. At the present all development, except the diamond drilling, has been stopped, but there is a large tonnage of ore blocked out in the mine and a large quantity on the dumps. With the arrival of some new ore cars and double-deck cages, the mine will be able to handle an output of 400 tons per day. The mine at present has curtailed its shipments to about 2000 tons per month, all of which is shipped over its spur road to San Gil and from there to the Aguascalientes smeltery over the Tampico branch of the National lines.

The Alta Palmira mine, belonging to the Asientos Mining Company, and under lease to Abram Rapp, has encountered a fine orebody below the water level. This ore at a depth of about 125 m., is about 8 ft. wide, and carries silver and gold with the copper. It is, by far, the richest copper-silver ore in the camp. The installation of pumps has delayed the mine output somewhat, but its present shipments of two cars per week to Aguascalientes will be increased as soon as the water is lowered. The mine promises to be a very profitable producer.

The Lead Queen properties are being opened, under rental, by the Compañia Metalúrgica Mexicana, a Towne company, under the direction of J. A. MacAllep. The two shafts have reached a depth of about 120 m. and crosscuts are soon to be started, and it is confidently expected that these crosscuts will cut good orebodies in the Cince de Febrero and Tajos de Purisima claims. These claims have been worked as opencuts to a depth of 80 m., and have yielded good lead ores with gold and silver.

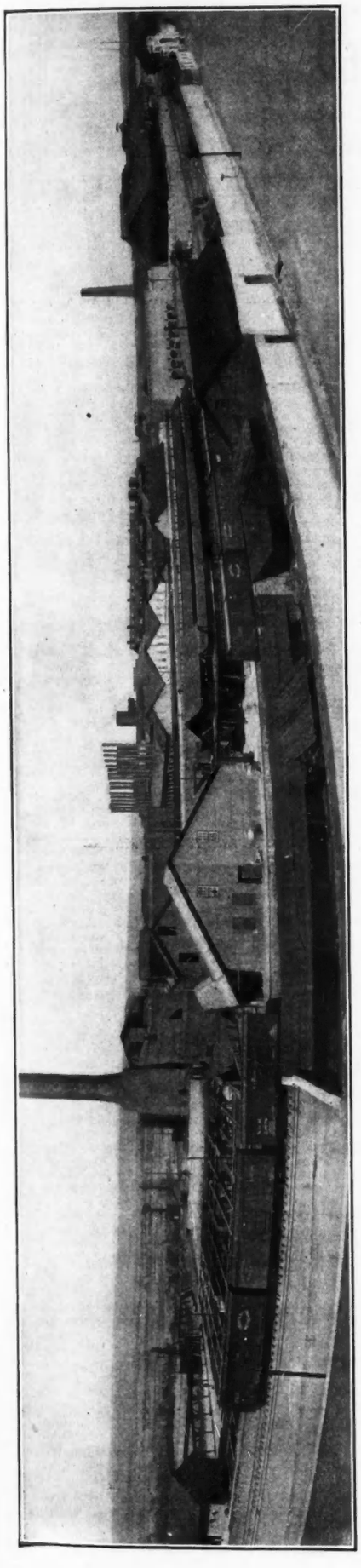
The Aguascalientes Metal Company, operating El Orite and La Merced mines, has for some time past restricted its work, shipments have been reduced to cover expenses only, and the mines are being put in shape for a good output at better copper prices. The Orite shaft has been sunk to 160 m., but the mine is still put to heavy expense for packing water, as none has been encountered in the shaft. Mr. Koeberlein is in charge.

El Tabor y Anexas Company is at present operating its Purisima mine only. In this new property the Santa Rita vein was cut in good ore at the 100-m. level, and drifting has been started on this vein to the south of the junction of the Santa Rita, Veta Rusia and Purisima veins. The copper ore encountered has exceptional gold yield, the gold contents being from 15 to 20 grams. The Tabor mine remains closed on account of the low lead prices; the orebody was encountered at 110 m. in this mine and development may soon be commenced. The mines are in charge of Bruno Newman.

Gabriel Chavez, who recently bought the Socorro mine, on the Peñuelas vein, is sinking a shaft 120 m. and is about to start a crosscut at the 60-m. level. This mine produced good ore at the surface and is a likely prospect.

Several of the mines and prospects are being considered by leasers, and on the whole the camp is in good condition with every indication of still better prospects in the near future.

*Mining engineer, Aguascalientes, Mexico.



AGUASCALIENTES PLANT OF THE AMERICAN SMELTING AND REFINING COMPANY

TEPEZALA DISTRICT

In Tepezalá, the Guggenheim mines, Minas Tepezalanas, some time ago about to be abandoned as worked out, are now shipping as much ore as at any period of their production. The property is in charge of Charles Lucas, and development has proved up several years' ore supply at the present rate of production. Practically all of the mines of the group are being worked and every one of these is producing ore. A 700-ft. crosscut has been started from the 100-m. level of the San Pedro shaft to cut all of the veins, and the Patrocinio vein will be cut at 70 m. below its present level. The latter mine is producing copper ore of good grade and already a large tonnage has been proved up. The long-abandoned Peñuelas, Santa Clara and San Fernando are also producing ore. The output is about 3000 tons per month, which is shipped over the Mexican Union road, a Guggenheim line leased to the Mexican Central, to Rincón de Romos, and thence over the Mexican Central to Aguascalientes.

The Santa Catarina camp, northwest of Rincón de Romos, has recently shown signs of new life; several examinations of properties have been made and others are planned, but up to the present no work has been started. The New Providencia company, the only company working in this camp, shut down a few months ago. This is a silver camp and at one time, many years ago, was worked extensively.

Zinc Mining in Chihuahua

BY W. H. SEAMON*

The changes in the tariff laws of the United States have had a depressing effect on the zinc mines of Chihuahua, limiting their production and discouraging prospecting and development. Naturally, all mines shipping their production to the United States have had to bear the tariff imposts, shipments have gradually decreased, and some of the largest producers have now suspended shipments entirely.

LOOKING TO EUROPEAN MARKET

The zinc miners have a feeling of discouragement, but I and some others share the belief that the European zinc buyers will enter the field and when the freight rates are adjusted satisfactorily as good a market as we have ever had will be available and the profits and operations of the zinc mines will be greater than ever before. Unfortunately, the railways increased, instead of reducing, the freight rates on zinc ores, thereby placing in the path of the European buyers at the outset, an impediment of considerable magnitude.

The shipments for the year have been as follows: From the Faivre mine near Coyame, 800 tons; Las Plomosas district, 4000; Calera mines, 4650; Santa Eulalia mines, 30,000; Almoloya mines, 16,000; sundry shipments, 1200; total, 46,650 tons.

The ores from Santa Eulalia are mainly carbonate ores with a content of 40 per cent. zinc; those from Almoloya and Coyame are also carbonate ores with some zinc silicate; while those from Calera and Las Plomosas are mainly sulphides.

CONDITIONS AT SANTA EULALIA

The Calera mines suspended shipments of zinc ore about two months ago and will not resume until there can be a satisfactory arrangement of prices. The shipments of the properties at Almoloya have also been heavily curtailed and it is reported that arrangements are being perfected for a zinc smeltery to be located at Torreon, but I doubt whether sufficient capital has been secured for this enterprise.

The only new discovery of zinc ores of any amount was made in the Buena Tierra mine at Santa Eulalia, where large bodies of 30 per cent. carbonate ore have been opened up during the last year.

The Calera mine has the largest known body of zinc ore in Chihuahua. There are many more zinc prospects in the Coyame country and the part of the State lying close to the Rio Grande river. Under present conditions there is no encouragement for prospecting, so I do not expect much further development for some time to come.

LOS LAMENTOS AND PLOMOSAS DISTRICTS

In Los Lamentos district, about 45 miles east of Villa Ahumada, all operations and shipments have been suspended. There are large deposits in this range and with railway connections the district would be an important producer. The San Ignacio mine, east of Ahumada, has shipped some zinc ore and the Mojonera property, west of Gallegos, produced several hundred tons of 42 per cent. zinc ore.

The most noteworthy event of the year has been the taking over of the Lago properties in the Plomosas district by a French company, managed by C. Clerc, of Paris. This is a strong corporation apt to be an important factor in the future of the zinc industry of Mexico. This company is planning the building of a modern zinc mill and has begun development on a large scale. The property acquired has always been considered one of the best properties in the State and the mountain range in which the mines are contains many good zinc prospects. The zinc properties at Terrazas have been idle.

*Mining engineer, Apartado 247, Chihuahua, Mexico.

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13,592—CONCENTRATION OF SLIME—II. Edwin A. Sperry. (Min. and Sci. Press, Aug. 13, 1910; 5½ pp., illus.) 20c.

13,593—CRUSHERS—Comparison of Gyratory and Jaw Crushers. H. L. Wollenberg. (Eng. and Min. Journ., Sept. 10, 1910; 3 pp., illus.) 20c.

13,594 — DEWATERER — Description of Slime Settler or Dewaterer in Use at the Brownhill Consols Gold Mine, Kalgoorlie. Rollo E. Huntley. (Journ., West. Aust. Chamber of Mines, July 30, 1910; 3 pp., illus.) 80c.

13,595—SLIMES—The Chemical Control of Slimes. H. A. Ashley. (Bull. A. I. M. E., Aug., 1910; 16 pp., illus.)

13,596 — SLIME TESTING — Method for Testing Slime. George J. Young. (Min. Mag., Aug., 1910; 1¼ pp., illus.) 40c.

METALLURGY—GENERAL

13,597 — BLAST FURNACE — Untersuchungen über die Stoff- und Wärmebilanz des Hochofens. W. G. Gillhausen. (Metallurgie, July 8, 22, and Aug. 8 and 22, 1910; 44 pp., 1 table.) Researches on the balance of material and heat in the blast furnace. $1.40.

13,598 — CHIMNEYS — Steel Chimneys. W. R. Edwards. (Mech. Wld., Aug. 19, 1910; 2⅛ pp., illus.) 20c.

13,599—FERRITES—Ueber Ferrite und Andere Oxydverbindungen in hüttenmännischen Prozessen. Kohlmeyer. (Metallurgie, May 22, 1910; 17½ pp., illus.) 40c.

13,600 — FIREBRICKS — Changes in the Composition of Firebricks. Blasberg. (Iron and Coal Tr. Rev., Aug. 26, 1910; 1¾ pp.) Paper before Internat. Congress of Mining, Metallurgy, etc., at Düsseldorf. 40c.

13,601—SINTERING—Notes on Roasting and Sintering with Particular Reference to the Dwight & Lloyd Process. F. M. Smith. (Journ. Assn. Eng. Soc., July, 1910; 7 pp.) 40c.

13,602—SMELTERY—The Tooele Smelter of the International Company. Will C. Higgins. (Salt Lake Min. Rev., Aug. 15, 1910; 4 pp., illus.) 20c.

13,603—SMELTERY SMOKE—The Condensation of Fume and the Neutralization of Furnace Gases. F. T. Havard. (Bull. A. I. M. E., Aug., 1910; 16⅛ pp.)

13,604—SMELTING—Hydrocarbon Gas vs. Coke in Smelting Furnaces. John S. Loder. (Min. Wld., Sept. 3, 1910; 1½ pp., illus.) 20c.

MINING AND METALLURGICAL MACHINERY

13,605—BELT CONVEYER — Die Anlage eines Gurtförderers auf Zeche Mansfield. Schödeling. (Bergbau, Apr. 14, 1910; 1 p., illus.) 20c.

13,606 — BELT CONVEYER — The New Sandvik Steel Belt Conveyer in Use in Sweden. Alfred Gradenwitz. (Eng. and Min. Journ., Sept. 3, 1910; 3 pp., illus.) 20c.

13,608—BLOWING ENGINES—Ueber die Wirtschaftlichkeit der verschiedenen Antriebsarten von Stahlwerks-Gebläsemaschinen. Mauritz. (Stahl u. Eisen, June 22, 1910; 4¾ pp., illus.) Read before the International Congress at Düsseldorf. Compares the costs of installation and operation of blowing engines for steel-works, using as motive power steam, gas from producers or from blast furnaces, and electric current. 40c.

13,609—COUPLING—Eine neue elastische Kupplung. (Stahl u. Eisen, July 20, 1910; 2½ pp., illus.) A new elastic coupling for large rolling mills and hoisting engines. 40c.

13,610—CRANES — Overhead Traveling Cranes. (Ind. Mag., Aug., 1910; 4½ pp., illus.) 20c.

13,611 — DREDGE CONSTRUCTION — Neuere Baggerkonstruktionen. Paulmann and Blaum. (Zeit. des Vereines deutscher Ing., July 30, and Aug. 13, 1910; 17 pp., illus.) Conclusion of article previously indexed.

13,612—DRILLING MACHINE—Handbohrmaschine. (Bergbau, Apr. 21, 1910; ½ p., illus.) 20c.

13,613—EXCAVATOR—A New Type of Giant Excavator. F. A. Talbot. (Eng. and Min Journ., Sept. 17, 1910; ¾ p., illus.) 20c.

13,614—GAS ENGINE—The Two- and Four-Cycle Gas Engine. Richard Froboese. (Pac. Miner, Aug., 1910; 1 p., illus.) 20c.

13,615—HOIST—Tests of an Ilgner Electric Hoist. R. R. Seeber. (Bull. A. I. M. E., Sept., 1910; 10½ pp., illus.)

13,616—HOISTS—Bibliography to Accompany Paper on Electric Mine Hoists. D. B. Rushmore and K. A. Pauly. (Bull. A. I. M. E., Sept., 1910; 11 pp.)

13,617—HOISTING ENGINES — Abnahmeversuche an einer Dampffördermaschine. (Glückauf, Apr. 23, 1910; 2¾ pp., illus.) Tests made previous to receiving a steam-hoisting engine. 40c.

13,618 — HYDROELECTRIC DEVELOPMENT of the Michoacan Power Company. Irwin C. McBride. (Eng. Rec., Aug. 27, 1910; 2 pp., illus.) 20c.

13,619 — HYDROELECTRIC POWER — A General Review of Hydroelectric Engineering Practice. Frank Koester. (Eng. Mag., Sept., 1910; 16 pp., illus.) Fifth article of series, dealing with financial aspects of hydroelectric undertakings. 40c.

13,620—HYDROELECTRIC POWER—The Arizona Power Company. R. S. Masson. (Elec. World, Aug. 18 and 25, 1910; 9¼ pp., illus.) Description of hydroelectric development, including novel intake, concrete flume, tunnels, siphons and concrete pipe line. 40c.

13,621—METALLURGICAL EQUIPMENT—Die Maschinenanlage auf modernen Hüttenwerken. Langer. (Stahl u. Eisen, Apr. 20, 1910; 8¾ pp.) 40c.

13,622—MINERS' TOOLS—Sharpening and Tempering the Miner's Tools. M. W. Alderson. (Min. Wld., Aug. 6, 1910; 1 p., illus.)

13,623—MINING LOCOMOTIVES and Liquid Fuel: Their Probable Influence on the South African Labor Problem. Kenneth Austin. (Journ. of the Transvaal Inst. of Mech. Engrs., Aug., 1910; 8½ pp., illus.) 60c.

13,624—STEAM POWER—The Cost of Steam Power in a Mill Plant. Howard S. Knowlton. (Eng. Rec., Aug. 13, 1910; 1 p.) 20c.

13,625 — STEAM TURBINES — Low-Pressure Steam Turbines in Mining Plants. F. C. Perkins. (Min. Wld., Sept. 3, 1910; 2⅓ pp., illus.) 20c.

13,626—STOKER CONTROLLER — The Tilden Automatic Stoker Controller Used by the Federal Lead Company. (Eng. and Min. Journ., July 30, 1910; 1 p., illus.) 20c.

13,627—TRANSFORMER — Neue Anordnung einer Hochspannungsschaltanlage unter Tage. (Glückauf, Apr. 16, 1910; 11¾ pp., illus.) 40c.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. W. D. Moodie, of Los Angeles, Cal., is in New York.

F. A. Heinze will hereafter make his headquarters at Butte, Montana.

F. C. Lincoln, of New York, is on an extended trip to southern Arizona, examining mines.

Todd C. Woodworth, manager of the Mary Mine at Alamos, Chihuahua, Mexico, is in New York.

J. B. Tyrrell, of Toronto, Ont., returned last week on the "Mauretania" from a short visit to London.

Charles Graham has retired from the management of the Princeton colliery, Similkameen, British Columbia.

Fayette A. Jones has been appointed mining geologist for the Oriole Gold Mining Company, of Galice, Oregon.

Morton Webber, mining engineer, New York, has returned to business after a two months' vacation in Europe.

E. Girault, general manager of San Rafael y Anexas Mining Company, of Pachuca, Mexico, is visiting New York.

T. H. Tipps, of Bridgeport, has been chosen chairman of the Texas State Mining Board, in place of F. C. Von Rosenberg, resigned.

Dr. William B. Phillips, director of the Texas Geological Survey, has returned to Austin, Tex., after making some mine examinations in Mexico.

Henry Kehoe and Otto F. Riebel, of Spokane, Wash., have been examining the Standard silver-lead mine, in Slocan Lake district, British Columbia.

William Hollister has returned to California after a couple of years spent as assistant superintendent at the Mina Gigante, Jocoro, Salvador.

A. Gordon French has been investigating conditions in the Nelson and Slocan districts of West Kootenay, B. C., with a view to arranging for smelting zinc ores there.

A. E. Borie has resigned from the New Jersey Zinc Company, New York, to accept a vice-presidency of the Taylor Iron and Steel Company, High Bridge, New Jersey.

F. W. Hopkins, of the Mill and Smelter Engineering Company, New York, has returned from the West, where he has been for six weeks in the interests of his company.

Walter Bloomfield, formerly purchasing agent for the Quincy Mining Company, has been appointed chief clerk of the Lake Company, succeeding Wm. Keast, resigned.

Alexander P. Rogers, who for the last three months has been in Siberia on professional work, will reach New York about Oct. 1, returning by way of Japan and San Francisco.

William Keast, formerly chief clerk of the Lake Copper Company has taken the position of chief clerk of the Algomah, North Lake and Indiana companies, in the Lake Superior copper country.

James McEvoy and R. G. Drinnan have returned from an exploring trip in the Rocky mountain region west of Edmonton, Alberta, where they located valuable coal lands for a Toronto syndicate.

President Robert E. Harris, of the Nova Scotia Steel and Coal Company, and a party of directors recently visited the Sydney mines and New Glasgow plants of the company and the Wabana mines, Newfoundland.

Governor Miguel Ahumada, formerly governor of Chihuahua, Mexico, and recently of Jalisco, has announced that he will not be a candidate for reëlection, but will spend some time traveling in the United States and Europe.

W. J. Sherwood has turned the management of the Rambler mine, Wyoming, over to Professor Dart, formerly of the University of Wyoming, and with his family has gone to Denver to finish up some business for the company.

Walter Douglas, general manager of the Copper Queen Consolidated Mining Company, has been made general manager of all the mining interests of Phelps, Dodge & Co. S. W. French succeeds Mr. Douglas at the Copper Queen.

Charles T. Nicolson, until Sept. 1 engineer for the Folsom division of the Natomas Consolidated, of California, has accepted a position with the Bucyrus Company. Mr. Nicolson sails for Rangoon, Burma, about Oct. 1 in his new capacity.

James Donaldson and G. W. Theiss, president and vice-president of the Monongahela River Consolidated Coal and Coke Company, have been inspecting the company's coal wharves and stations at New Orleans and other points along the Mississippi.

The Pittsburg Testing Laboratory has moved its New York office to 50 Church street, Hudson Terminal building. The company's interests in New York and New England have been placed in the hands of William F. Zimmerman, second vice-president of the company.

Dr. G. W. Sargent, formerly with the Carpenter Steel Company, Reading, Penn., has resigned, and is now connected with the Crucible Steel Company of America, Pittsburg, for the purpose of developing a research department. He has been elected a member of the board.

S. R. Kaufman, H. D. Dumaresq, E. L. White and J. W. Clarke, all directors in the Alvarado Consolidated Mining Company and the Palmilla Milling Company, together with A. J. McQuatters, president of the Alvarado company, have been visiting the mines in the Parral district, Chihuahua, Mexico.

OBITUARY

William Russell Quinan died at Sydney, N. S. W., Aug. 15, aged 61 years. He was born in Maryland and graduated from West Point, serving in the United States Army for several years and retiring with the rank of captain. He studied the manufacture of explosives, and became an expert in high explosives. For 12 years he managed a dynamite factory in California. When the Cape Explosives Works, Ltd., was founded in 1899 by the late Cecil Rhodes, with the avowed object of cheap dynamite for the development of the South African mines, Capt. Quinan was selected to design the whole factory. It was completed early in 1903 and manufacture was begun shortly afterward. In 1908, the South African works having been thoroughly established, Capt. Quinan went to Australia to place the explosives of the company on the local market.

SOCIETIES and TECHNICAL SCHOOLS

Mexican Institute of Mining and Metallurgy—At the annual business meeting in the City of Mexico last week, A. Grothe was reëlected president. The meeting was closed by a dinner.

West Virginia Mining Institute—It has been decided to hold the annual meeting at Wheeling, W. Va., in December. A large attendance is expected.

Zacatecas Mining Institute—A meeting was held in Zacatecas, Mexico, Sept. 25, on a call signed by P. J. McDonald, C. O. Gilbert, E. von Gehren, Russel H. Scott, J. M. Perscher and Doctor Taube, for the purpose of organizing a miners' association. The aim of the association is first, the advertisement abroad in the most effective and widest manner of the many advantages enjoyed by Zacatecas, as a legitimate mining field. Another purpose of importance to be served, is the interchange among the mining men of ideas, touching the cheapest and best methods for mining and ore treatment.

Wilkes-Barre Mining Institute—In pursuance of the plan adopted in several coal-mining centers in Pennsylvania, to enable men who desire to become firebosses, assistant foremen and general foremen to qualify, the Young Men's Christian Association and the Wilkes-Barre District Mining Institute are promoting a three-years' course of instruction. Charles Enzian, the newly appointed engineer for the United States Bureau of Mines, will have supervision of the teaching of the classes. Under his direction William D. Thomas, Edward Roberts, Milton Evans and others will do the actual work of instruction.

EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on Important Events From Many Important Mining Centers of the World

San Francisco

Sept. 24—The recent sale of two celebrated Mother Lode mines in Tuolumne county—App and Rawhide—will, doubtless lead to important and extensive development in that section. These properties have for some years been owned by Capt. W. A. Nevills, who sold them to a company represented by W. H. Stinger. They have both been producers for years, although of late most of the work has been done on the App. The App is at Jamestown and the Rawhide at Rawhide, nearby. The improvements planned at the App include the sinking of the shaft, the remodeling of the 60-stamp mill, and the addition of 40 stamps. At the Rawhide a new shaft will be sunk at the north end, the 40-stamp mill will be overhauled, and 30 stamps of the Omega mill will be added. The ore in these two mines has usually been of high grade for Mother Lode properties, and occasionally remarkably rich chimneys have been found. The suit of E. W. McGraw against the Rawhide Mining Company for alleged extraction of ore from the Dutch mine adjoining, has been dismissed by stipulation on the report of Charles W. Terry.

The revival in mining in Sierra county is not confined to the districts around Alleghany and Forest, although it was the reopening of old mines at those places and the finding of exceptionally rich ore, which again called attention to the mining possibilities in the county. Downieville was at one time during the hydraulic-mining days, a very prosperous place, but until lately had been long in decadence. The strike in the Standard quartz mine last winter showed the possibilities of the vicinity and a number of properties in the ravines opening out of Downieville are being operated under lease or bond. Much prospecting is also being done along the trails between Downieville and Forest. In the section tributary to the town, drift mining in particular is active all along the Blue Lead within Sierra county, and much capital is being expended in driving bedrock tunnels. It is estimated that there are yet left in the county about 200 miles of virgin gravel channels. Secret cañon, three miles from Forest, is another place becoming active again. Control of the Squires Mining Company, owning a large acreage, has passed to E. R. Agersinger, John C. Donnelly, of Sacramento, and Thomas Kirkpatrick, of San Francisco, and the property is being prospected. These same people have taken bonds on a number of other mines in the vicinity. Machinery has been installed and a mill will be built later.

The old camp of Howland Flat, near Table Rock, is also coming in for its share of renewed prosperity. This was at one time a productive hydraulic-mining section. It was only last year that the last hydraulic-mining company quit because it was ordered to put in concrete dams instead of log ones. Attention has, perforce, been turned to the lava-capped deposits of gravel, a number of which are now being drifted. Table Rock considers its future assured by the strike of rich gravel in the Sugar Loaf mine nearby and the developments in the new gold mines at Sawmill ridge and in Illinois cañon. Good quartz has been found in the Gladstone also.

Fire has destroyed the mining town of Hayden Hill, Lassen county, and about 150 miners have had to leave, there being no houses, and the supplies for winter having been burned. The Lassen Mining Company has had to close and work cannot be started again until spring.

Denver

Sept. 26—A representative of the Empire Zinc Company has examined the newly discovered bodies of zinc ore in the old workings of many Leadville mines, and he is quoted by the local press as making the unqualified statement that they are the largest bodies of oxidized zinc ore found in the United States or Mexico, that the extra tonnage will amount to several hundred tons daily, and that it will take several years of mining to exhaust the ore now in sight. This astounding discovery demonstrates the fact so widely known, and so generally disregarded, that every mine ought to have an assay office, and it should be the business of the superintendent or the foremen to keep the assayer busy with daily samples, and also the fact that the "beautiful walls" of the lode, that so many superintendents are so proud of, should be often shot into and crosscutted. Just imagine the cream of the mining talent of the United States for 30 years passing by thousands of tons of carbonate of zinc ore, thinking it was country rock!

In Cripple Creek, the Golden Cycle company has adopted the very sensible policy of the "change room," and has posted notice that the men will all be expected, on going to work, to get into their "digging clothes," and leaving the mine, to change back again. Why this has not been universally adopted 20 years ago is hard to understand. In the early days of the camp, when the ores in the workings down to, say, 500 ft. were abnormally rich, and worth dollars per pound, the amount of "high grading" was tremendous, and it has continued ever since in spots. The miners themselves should welcome the order, instead of being squeamish about it, for the simple reason that in a shift of 100 men, 99 of whom are honest, one thief in the number would cause suspicion to be cast on the whole lot; and as the company usually furnishes, or should furnish, the jumpers and overalls, the men are distinctly benefited and protected from undue suspicion. It would seem, therefore, that all honest miners would welcome the new arrangement, and if only in their own interests, endeavor to make it universal. At the same time, it has been perfectly well known in the past that the miners do not take that view of it. They looked on it as a reflection upon their honesty as a body instead of, as in fact, a reflection on the possible dishonesty of an individual who might have come among them. And so, some years ago when the manager of one of the big mines at Cripple Creek introduced the "change room," he had two strikes on his hands before he made it stick, which he did, and it has continued in force ever since.

Salt Lake City

Sept. 26—An agreement has been made between several Park City properties, which will bring about development of ground now idle in the southwestern part of the camp. A contract was signed Sept. 20 between the West Quincy and Thompson mining companies, on the one side, and the Ontario, Daly and Daly West on the other. By the terms of the contract the last named companies agree to allow the extension of their drainage systems to the property of the Thompson and West Quincy mining companies, for drainage and working purposes in consideration of stock in the new consolidation of these two companies. Negotiations were first begun about three years ago. The Thompson and West Quincy agree to consolidate their title interests and organize a corporation with a capital stock of 1,250,000 shares. The Thompson company, which has 400,000 shares outstanding, is to receive 333,333 shares, and the West Quincy, 285,890 shares, being share for share of the stock issue of the company. The two companies together own about 162 acres adjoining the Daly-Judge,

Daly West and Little Bell properties. The Ontario is to receive 75,000 shares of the capital stock, the Daly West, 50,000 shares and the Daly Mining Company, 75,000 shares.

The Daly West agrees to give the right to the consolidated company to all of its drifts and tunnels for drainage and for the transportation of ores and other materials necessary to the mining operations. It will extend its tunnel at once on the 1200-ft. level to the new company's property. When the extension is made, the new company will continue the workings into its ground. It also has the right to extend any other drift or tunnel from the Daly West property, and use the workings for the discharge of water as well as for the transportation of ore. The Daly West reserves the right to receive and remove any ores encountered in its development, so long as its operations do not interfere with those of the new company. If the latter desires to use the hoists and machinery of the Daly West, it shall pay for the expense incurred.

The Ontario and Daly mining companies are to give the new company the right to use the Ontario drain tunnel No. 2 or any other tunnel for the discharge of water, the water to become the property of the Ontario and Daly companies after it is discharged. The new company agrees to pay the Ontario and Daly for the use of their machinery in hoisting the output from its property, and also will pay a royalty on its ores. The Ontario and Daly companies reserve the right to extend the Ontario or any other tunnel or drift through the property of the new company to any adjacent property. The new company agrees not to mine within 100 ft. of the boundary lines of any adjoining company except the Daly West. There is an express provision in the contract that adjacent territory shall not be benefited by the drainage privileges, without the consent of the Daly West, Daly and Ontario companies. The new corporation is to be called the Thompson-Quincy Consolidated Mining Company.

Goldfield

Sept. 26—After two and a half years, during which time $350,000 is said to have been mined, the Bullfrog-Pioneer lease has suspended operations, probably permanently. A dividend amounting to $56,000 was declared at one time but subsequent litigation, operating expenditures and the failure of the First National Bank at Rhyolite dissipated the funds before they reached the stockholders. The control of the property is now in the hands of D. R. C. Brown and George Wingfield, stockholders of the parent company, the Pioneer Consolidated. The leasing company has done extensive development but a royalty of 25 per cent., prohibited the extraction of anything but high-grade ore. It is probable that the parent company will continue operations, and if sufficient ore can be developed through the three or four well equipped shafts on the property, a mill will be erected.

The report of the Tonopah-Belmont company for August, showing net earnings amounting to $211,250, fixes a record not only for this company but for any company in Tonopah during the history of the camp. The Belmont orebody according to reports has been exposed for 450 ft. on the 1000-ft. level, 700 ft. on the 1100-ft., and for 250 ft. on the 1166-ft. level, while raises at various points have established the continuity of the ore between levels. The width of the vein varies between 14 and 40 ft. throughout and as yet practically no stoping has been done. The 60-stamp mill at Millers is working full capacity and shipments are being made to the smeltery.

Cordova, Alaska

Sept. 20—The opening of the Copper River & Northwestern railway to Chitina at milepost 135; also the connecting of the railway with the Fairbanks trail at Chitina, were celebrated Sept. 17, on which day a long train with materials and supplies reached Chitina. The remaining 60 miles of the road has been graded and rails and bridge steel are being hurried to the front in an effort to have the railway completed to the Bonanza copper mine by the end of the year.

Prospectors from Knik arm, a northerly embayment of Cook inlet, report at Seward the discovery of a new field of bituminous coal that promises to prove of larger area than that at Matanuska. The latter lies about 25 miles from tidewater at Knik arm and covers a total known area of 46½ square miles. The known commercially valuable coals of the Matanuska field vary in quality from a sub-bituminous to a semi-bituminous, with some anthracite, and the beds range from 5 to 36 ft. in thickness. A. H. Brooks, who has lately completed a further study of the Matanuska field, is taking steps to investigate.

Shipments of gold from Haiditarod are much in excess of forecasts of miners who returned South when the season's yield was estimated at not more than $70,000. The Miners and Merchants' Bank at Haiditarod has already made shipments, of which three have reached the U. S. Assay Office, Seattle, as follows: Aug. 15, $53,820; Sept. 12, $82,884; Sept. 19, $82,858; total, $220,526. Other shipments are *en route.*

Cobalt

Sept. 24—The directors of the Dome Mining Company, Porcupine, have decided to erect a 40-stamp mill as soon as transportation facilities will permit. This company has spent $200,000 practically all in proving the property. All the veins have been accurately sampled, and part of the ore from development, goes to a small 2-stamp mill, from which accurate records are kept. Diamond drilling has proved gold at a depth of 300 ft. Although working under great difficulties, over 900 ft. of underground development has been accomplished.

The Timmins property is also showing up in a remarkable manner. This property employs 130 men, and with the high cost of supplies, the expense is heavy. A 2-stamp mill is in operation, which treats only a small part of the ore produced in development; but the returns are nevertheless sufficient to cover the entire expense of running the property and to leave a surplus besides.

There is great indignation expressed in the Gowganda and Elk Lake districts, over the failure of the Government to complete the road between Charlton and Elk Lake. The contractors were ordered to stop work as it was believed that driving over it in the autumn and next spring would spoil it.

Competition on the Porcupine trail has been the means of effecting a very material reduction in freight rates. A short time ago the rate was $6 per hundredweight, but now goods can be brought in for $2.75 and $3.

Mr. Benson, president of the Bailey property and one of the heaviest shareholders, is erecting a small smelting plant at the mine to treat the ore which the company shortly expects to start mining. The process was worked out by Mr. Benson and the experiments were carried on in the shops of the Pullman Car Company. Two oil-burning furnaces, each having a capacity of six large crucibles, will be installed. No information is available as to the process, the cost of treatment, the percentage of extraction or capacity of the plant.

Toronto

Sept. 27—Four hundred tons of peat prepared at the Government plant at Alfred, Ont., have been shipped to Ottawa. A portion of it is being used at the government fuel-testing plant and at the Public Works Department, and the remainder was sold off in small lots at $3.25 per ton to citizens desirous of trying it. A large number of orders were filled and the demand was so great that 300 tons more have been ordered.

Alfred W. G. Wilson, of the Mines Branch, Ottawa, who has been investigating the copper resources of eastern Canada during the summer, has returned to Ottawa. He states as regards the copper deposits of New Brunswick, that the ore does not occur in such quantities or richness as would make its exploitation commercially successful. There may be small pockets of excellent quality but in these cases there is not enough ore in sight to warrant mining operations.

THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

Alaska

Seward is excited over the richest quartz strike ever reported in that section. Two prospectors reached town bringing 100 lb. of quartz rich with gold. It is said to be a true fissure vein, and was found in the Moose Pass country.

Charles C. Hubbard has taken an option on the placer ground of C. G. Cunningham, at the head of Kenai river. As the ground is covered by water most of the year, Mr. Hubbard is considering the installation of a dredge for next season.

Arthur Wakefield has taken a bond on about 2000 acres on Dahl island, near Ketchikan, said to contain valuable marble.

Lone de Van—Arthur Lonsdorf is working this property on Gregory inlet, and has equipped it with machinery.

Mt. Andrew—This property, one of the best equipped mines of southeastern Alaska, under the management of Harry Bellen, is shipping about 1500 tons per month to Ladysmith.

Governor—This property, on Fairbanks creek, is owned by Cook Brothers. A new 30-in. vein has been discovered.

Jerome—Active work is being done upon this lode in the Bonnifield country. This property is owned by Messrs. Hess, Gardner and Crawford.

Alaska-Treadwell—For the month ended Aug. 15: Tons crushed, 86,184; total product, $197,268; operating expenses, $100,972; net operating profit, $86,930; construction expenses, $32,515; yield per ton, $2.29.

Alaska United—For the month ended Aug. 15 at Ready Bullion and "700" mills: Tons crushed, 38,066; total products, $80,706; operating expenses, $49,120; net operating profit, $27,169; yield per ton, $2.01 and $2.25 respectively.

Alabama

Watt Brown has purchased 1500 acres of coal land in St. Clair county, and will begin development on three mines.

Machinery is being placed by the Birmingham Coal and Iron Company at its Vanderbilt furnace plant, near Birmingham. Within a short time both furnaces will be put in operation at the same time. Heretofore there has not been enough blowing power.

The old-time output is being obtained by Sloss-Sheffield Steel and Iron Company, from its Sloss ore mines, which were flooded by an underground stream. The company placed powerful pumps and the mining is going on as actively as before.

Arizona

Development Company of America—This company will issue $1,500,000 6 per cent. one-year collateral notes which will be offered for subscription at par to the security holders of this company and those of two of its subsidiaries, the Imperial Copper Company and the Tombstone Consolidated Mines Company. Funds derived from the proceeds of the sale will be used to meet the company's requirements, including the July interest on its bonds and also to make advances to subsidiaries. The Tombstone bondholders will be asked to subscribe to about $300,000 of the new notes, while Imperial stock and bondholders will be asked to take $200,000. Between $8,000,000 and $9,000,000 has been expended in acquiring title, development and equipment of the Imperial and Tombstone properties. Building of the Port Lobos railroad will furnish a water outlet for the Imperial company's mines and smeltery and would place this plant in a position to handle ore from the west coast of Mexico and South America, now shipped to Vancouver. The balance sheet as of Aug. 31, shows that the company's obligations, including July 1 bond interest, amounted to $2,317,818, which includes final payment on the Saddle Mountain property and completion of agreement with the London Arizona Copper Company.

Cochise County

The California mining district is active and the prospects for a producing camp are reported good.

Bisbee-Sonora—This development company in the California district has been developing for four years. It is driving a crosscut tunnel to tap the contact orebody at a depth of 700 ft. A compressor and drills will be installed.

Manhattan—It is reported that this Duluth-owned property in the California district will resume. It adjoins the Bisbee-Sonora.

Whitetail—This company will erect a 50-ton mill at Paradise according to report of F. W. Flanigan of Stanton, Tex., vice-president. The property is two miles from the Bisbee-Sonora in the California district and will be actively developed. The shaft is down 70 ft. on a 7-ft. orebody.

California & Paradise—This California District property has installed a hoist. The shaft is down 160 feet.

Coconimo County

Mint—This new company is developing a gold property in the Skull Valley district. Frank D. Shea is president.

Gila County

Live Oak—The effort of a minority stock interest to secure control with the view of close affiliation with the General Development Company has failed.

Lost Gulch United Mines—Operations on this gold property are at a standstill, owing to lack of water to run the 10-stamp mill. J. T. Harrington is president.

Miami—The company is operating only seven machine drills underground and beside the force at work constructing the concentrator and powerhouse, is not employing over 200 men. All the underground work is being done on and above the 420-ft. level, where several haulage drifts tributary to the main one are being completed. Two raises also, are being put up from the 420-ft. level to the large dump at the main shaft, known as the Red Rock. The first ore extracted after Jan. 1, 1911, when the concentrator is expected to begin, will come from shaft No. 2. Three churn drills are sinking holes around the outer edges of the orebody as developed by the underground workings and in some cases notable extensions of ore are being proved.

Inspiration—At the Inspiration property a number of drifts are being driven to connect the workings of the Joe Bush, Scorpion and Colorado shafts. About 430 ft. of driving will be necessary to connect the Joe Bush and Scorpion shafts on the tunnel level and about 900 ft. will have to be done before the Colorado shaft is connected with the other two. On the 400-ft. level of the Joe Bush shaft six drifts are being driven north and south in the course of blocking out the ore. The experimental mill of 75-tons capacity, built near the Joe Bush shaft, will be ready to operate in about a month.

Graham County

Shannon—August figures show net earnings of $28,000, which will bring net figures for the fiscal year up to about $180,000. Net cost for copper of 10½c., due to the treatment of the higher-grade ores opened below the ore-tunnel level, was reported.

Yuma County

Clara Consolidated—The operation of the smeltery was resumed Sept. 23, after a shutdown for repairs and additions.

California

Amador County

Lincoln Consolidated—The reopening of this Sutter Creek mine is proceeding rapidly, the machinery having been repaired and the shaft put down 125 ft. where water was found. The new electric pump has been started.

Bunker Hill—At this mine, Amador City, grading has begun for the additional 20 stamps, making 40 stamps in all. The cleanup for August was $24,000.

Jose Gulch—This company at Jackson has leased its mine at Butte to H. H. Mandigo and C. E. Brown, of Mokelumne Hill.

Kennedy Extension—The Mercantile Trust Company, of San Francisco, has guaranteed the issue of bonds of this company at Jackson to the value of $250,000.

Humboldt County

Horse Mountain—The copper deposits of this company are extensive. The company will this fall build four miles of road, connecting with the county road, and next spring ore will be shipped. Asbestos has been discovered on the property.

Nevada County

Erie—A concentrating plant has been added to the mill at this mine and an assay office built. Twenty stamps of the mill are running and the 10 stamps are being put in order. The Erie vein, which, in some places is 40 ft. wide, has been intersected.

Delhi—J. H. English has repaired the chlorination plant at this mine, Washington, and the plant has been accepted by Manager Hamilton Eddie. The shaft is being sunk.

Black Bear—This mine, a few miles from Grass Valley, J. H. English, superintendent, will be reopened, the litigation having been amicably settled. A compressor has been installed and a 10-stamp mill is nearly completed. There is a 700-ft. tunnel and a 300-ft. shaft on the mine. The shaft will be pumped out and deepened and larger pumps put in.

Golden Dream—A crew of men has been started on this river-bed mine on the Yuba river.

Pittsburg—A start has been made in sinking the shaft of this Nevada City mine from the 1150 to the 1350 level. The Pittsburg is now using electric power, water being only used in the 10-stamp mill, which is running on good ore.

Plumas County

Horse-Shoe Bend—W. E. Oddie is opening this river claim on the Middle Fork of Feather river with T. C. Halstead as manager. The tunnel being run will drain the river into it, leaving bare a certain amount of river bed. Burleigh drills will be installed.

Rost Quartz—At this mine on Pooi-man's creek, a new Knight ball mill has been installed.

Dixie Queen—This mine, at Round lake, owned by Sullivan & Lavezola and under bond to Martin Miller, is making a good showing of free-gold ore from the vein in the tunnel.

Gold Mountain—This company on Willow creek near Buck, has completed its pipe line for bringing in water for hydraulicking. G. W. Fagg is superintendent.

Squirrel Creek—The mine of George Penman and John Dutre at this place is worked by ground sluicing through a 500-ft. flume. Several new companies are operating quartz claims along Squirrel creek.

San Benito County

The quicksilver mine, owned by A. I. Leonard, a mile from the New Idria, will shortly start. Work is being pushed on the modern furnaces.

Shasta County

Mammoth—The smeltery is running two furnaces and will not increase this capacity for some time.

First National—One furnace will probably be blown in Sept. 20 when it is expected that the Cottrell process for eliminating the fume nuisance will have been installed. It will probably be Oct. 1 before the plant is running full capacity.

Victoria—The new mill of this mine, at Harrison gulch, will be soon completed. Drifting has been done for several hundred feet on the Gold Hill vein, which crosses both the Midas and Victor claims.

Sierra County

South Fork—This company has started a shaft on the Amethyst mine at Forest in hope of striking a north extension of the Tightner vein.

Rio Antiqua—The South Fork placer is being operated by this company under lease, a bedrock tunnel a mile long having been run to catch the Bald Mountain channel.

North Fork—In reopening this property to recover the vein of the Uncle Sam bonanza, the incline has reached 700 ft. and a hoist of larger capacity will be installed. George T. Stone is manager.

Omega—This drift-gravel mine has had to close owing to a water shortage.

Roosevelt—A strike has been made in this claim at Mountain View, three miles from Forest. The vein is 6 ft. wide and carries arsenical sulphides as well as free gold.

Tuolumne County

At Italian camp place a group of mines owned by Joseph Roleri and others is being opened. A four-stamp mill is being installed.

Mohican—At this Tuolumne property, repairs have been made to the mill and the mine will soon be a producer again.

Eagle-Shawmut—The report that high-grade ore has been found in this mine at Chinese, was erroneous. The workings are still in low-grade ore and the mine continues to be run at a loss, but with the hope of finding good ore again.

Colorado

Boulder County

It is reported that the Swarthmore tunnel at Eldora, now driven 1600 ft., has cut a vein 1000 ft. below the surface 8 ft. in width, 30 in. of which mills $25 per ton, and 18 in. of it $900 per ton, chiefly gold.

Lost Lake—This mine, in the same belt, is working 15 men, and shipping $40 ore by the carload. Wilson Davis is manager.

Chaffee County

Monarch-Madonna—This company, operating at Monarch, reports the sale of 27 cars of ore from the sixth level during July, the proceeds of which were $14,454. The mine expenses were $3911 and royalties $3408, leaving a cash surplus of $7134. Kenneth E. Burton, Salida, is manager.

Clear Creek and Gilpin Counties

Gambetta—From this mine, on Republican mountain, Georgetown, two cars of zinc ore per month are being shipped to Oklahoma. The width of the streak varies from 10 to 30 in., and carries 50 per cent. zinc. This mine is awaiting the running of the Malm electrochemical mill before installing a plant.

Pelican—The Burleigh company, leaser at Georgetown, sent out a car of 300-oz. silver ore last week from the Pelican orebody, said to be 5 ft. wide.

Morgan—This lode at Idaho Springs shows in a shaft 10 ft. deep ore that runs $25 to $50 per ton according to report. It will be developed at depth with a tunnel 300 ft. long already driven 75 feet.

Old Town—This mine, which is being worked by Pike & Co., leasers, through the Newhouse tunnel, has shipped 20 tons of $50 smelting ore.

Treasure Vault—A carload of ore from this mine to the local sampler gave returns of 4 oz. gold per ton. A shipment of 24 tons of third-grade ore made to the Mixsell mill yielded 12 oz. gold on the plates and two tons of $50 concentrates.

Gunnison County

United Colorado—The company has suspended operations temporarily.

San Juan District

Trilby—This mine, under the management of the Danville Leasing Company, is producing a car per week of lead, copper-silver ore, that will run $110 a ton.

Shenendoah—This mine, on the Trilby lead, is working under lease and producing sulphide ore.

Kankakee—This mine, at Bear creek, is getting out a rich ore while drifting under the shoots discovered on the surface this spring.

Kansas City—This mine, in Georgia gulch, is shipping lower-grade copper ore of $50 value per ton.

Old Green Mountain—This mine, closed 10 years ago on account of zinc in the ore, is now working with a 10-stamp mill, running some of the dumps, from one of which sphalerite ore, carrying over 50 per cent. zinc is being extracted.

TELLER COUNTY—CRIPPLE CREEK

Dante—M. B. Rapp, lessee on Dante No. 2 shaft, shipped 1700 lb. of ore this week that yielded at the rate of $647 to the ton, and 650 lb. realized at the rate of $380 to the ton. The ore is sylvanite, and carries from 19 to 32 oz. gold to the ton.

Jerry Johnson—For the year ended Aug. 31, the Jerry Johnson mine, on Ironclad hill, produced 12,460 tons of gold ore, with a gross value of $279,361. The company received $31,230 in royalties. Last December a dividend was paid of $25,000, and the balance in the treasury amounts to $44,393. Edwin Gaylord, of Denver, is the lessee.

Golden Cycle—This mine has the deepest shaft in the district, 1680 ft., which will now be sunk to 1710 feet.

Idaho

COEUR D'ALENE DISTRICT

Callahan—This lead-silver mine has been sold by J. F. and John Callahan, to J. H. Roberts, of Duluth. A contract for 1000 ft. of development has been let.

Lum Ferguson—This group of lead-silver claims has been sold to H. P. McGuire, of Seattle, for $40,000.

Indiana

GIBSON COUNTY

Operations in the high-grade oilfields for the week show the most active week of the year. Wells that are being completed in old developed territory are found to be good producers. The bulk of the development is in the southwest part of the county. A test well completed at 1400 ft. is producing 20 bbl. a day. The fact that this well is far removed from other producers makes it valuable. New ventures are starting all around the new well. While the lately completed wells are producing on an average of 75 bbl. per day against 100 per day by the early wells, the interest increases and the work of drilling multiplies. Ten new wells were completed during the week.

OWEN COUNTY

Eel River Block Coal Company—This is the name of a new mining company incorporated to mine coal and other minerals. The first shaft will be sunk in Owen county with principal offices in Coal City. John J. Smith, Washington; Charles and Curtis A. Smith, Coal City, directors.

SULLIVAN COUNTY

Fifteen damage suits for personal injuries, aggregating $90,000, against the Alliance Coal Mining Company, and $75,000 against the Consolidated Indiana Coal Mining Company, have been filed in the circuit court. In a majority of the complaints the injuries are alleged to have been due to falling slate.

VANDERBURG COUNTY

The State mine inspector, through his deputy William Sams, has ordered the Banner coal mine closed on the ground that the management has repeatedly failed to live up to the State mining laws.

Kentucky

Consolidated Kentucky Coal Company—This company, headed by J. C. C. Mayo, of Paintsville, Ky., has bought 10,000 acre sof coal land in the eastern district of Kentucky and is arranging to begin work on its development.

Haly Coal Company—This company, of Lexington, Ky., has bought the lands owned by the Lost Creek Coal Company, with some adjoining tracts in Letcher, Pike and Leslie counties. Plans for opening mines are now being prepared.

Jewell-Jellico Coal Company—This company has been organized to develop coal lands in Whitey county. The office is at Barboursville, Ky. Surveys of the property are being made.

Michigan

COPPER

Calumet & Hecla—The repairs at the Red Jacket shaft are about completed.

Ojibway—Sinking is going forward in both shafts. No. 1 shaft is down 1300 ft. No. 2 shaft is down 1530 feet.

Isle Royale—Operations at "A" shaft on the Baltic-Superior lode are confined to drilling from the south drift of the 750-ft. level to determine the value of a strip of copper rock cut in the opening of this drift. The hole driven horizontally toward the east from this level has been discontinued after penetrating the sandstone for 200 ft. At the main mine, No. 2 shaft is sinking below the 28th level while at the new shafts, Nos. 4, 5 and 6 lateral openings are being extended.

Cliff—The opening on the Kearsarge lode is down 40 ft. and it is expected that the lode will be encountered soon. Drill cores from this lode on the Cliff lands showed mineralization.

Twin Lakes—The company continues operating one drill on section 28. Work on sections 23 and 27 has been stopped without revealing any mineral. The treasury is about depleted and unless some encouraging results are obtained in the drill on section 28 it is likely that the options will lapse. This company was organized as an exploratory company to develop the lands in the above sections near the Elm River and Wyandotte tracts, but from results obtained it is evident that it lies too near the sandstone formation.

IRON

That the Marquette range for miles west of Ishpeming, extending to Michigamme and beyond, will be thoroughly tested with diamond drills the next few years now seems certain.

Newport—This Ferdinand Schlesinger mine, on the Gogebic range, will ship this year more than a million tons of ore. The Newport is the biggest producer on the Gogebic, as well as one of the largest underground mines in the Lake Superior iron region. Not infrequently upward of 600 six-ton skips are hoisted to surface through a single shaft in a 10-hour shift, from a depth of 2000 ft. or more. The mine is the deepest on the range.

Minnesota

Oliver—Work has started on stripping the ground formerly occupied by the machine shops. This will connect the Hull-Rust with the Sellers mine and make a continuous pit over three miles long. The overburden is about 80 ft. at this point.

La Rue—Work has been discontinued temporarily at this Nashwauk mine.

Utica—The new hoisting plant is now in commission. This replaces the one burned last June. Robert Murray, Hibbing, is superintendent.

Shenango—The new steel headframe at the Webb mine is nearing completion. The new shaft is timbered with steel. A new power plant and hoisting machinery are being installed. Frank Kennedy, Chisholm, is engineer.

Montana

BUTTE DISTRICT

Butte & Superior—The directors of the company have authorized $1,000,000 of 10-year, 6 per cent. semi-annual convertible, refunding and improvement bonds. The stockholders will have the prior right to subscribe on a pro rata basis. There is already a $500,000 bond issue outstanding, part of which matures Jan. 1, 1911, and the balance Jan. 1, 1913. The mine is producing 200 tons daily. The gravity tramway, 1287 ft. in length, is being used successfully to convey the ore by means of 3-ton skips, from the mine to the Great Northern spur.

Pilot Butte Mining Company—This company has been organized with a capital of $1,000,000 by P. H. Nelson, of Duluth, John A. Percival, of Minneapolis,

Edward Hickey, Patrick Sheehan and J. W. Pratt, of Butte, Thomas E. Murray, of St. Paul, N. J. Bielenberg, of Deed Lodge and William P. Jahn and O. C. Trostel, of Milwaukee. The new company will pay off the debts of the old Pilot Butte Copper Mining Company and receive all its property. The Pilot claim is developed by a 530-ft. three-compartment shaft. It is near W. A. Clark's Elm Orlu and Poser claims and the Butte & Superior. Patrick Sheehan, superintendent of the Tuolumne company, will also have charge of the Pilot operations.

Butte & Veronica—In the case of Northern Pacific against this company, Federal Judge Rasch has issued a temporary injunction preventing the mining company from mining within the railway-company yards in Butte.

North Butte—A station is being cut on the 2400-ft. level and the sump extends about 100 ft. below. About 1500 tons are being shipped daily. An excavation is being made for the foundation of a "chippie" engine, which will be considerably larger than the one now in use. The policy of the Anaconda company in laying off the men on Sundays took effect at the Speculator recently. The management is pursuing a policy of development rather than production and, while the output is normal, the development has been increased. It is understood that the exploration done from the shaft of the Diamond mine has disclosed 40 ft. of copper ore at a depth of 2800 ft. in the North Butte ground, and that the ore will average better than 6 per cent. copper. It is probable that the shaft will be sunk to 2800 ft. so that this orebody may be reached. The principal producing levels at the present time are the 1800 and 2000.

Elm Orlu—The mine, owned by W. A. Clark, and W. A. Clark, Jr., is producing 1250 tons of zinc ore weekly. The concentration is about 3.5 wet tons into one ton of dry concentrates, averaging 50 per cent. zinc, making the weekly zinc output equivalent to 175,000 lb. of spelter.

Madison County

A two-stamp mill, run with a gasolene engine, is being operated on the five claims owned by A. G. Grosso, in the Silver Star district.

Elfleda—Gainan & Kadell, leasing on this property a mile south of Virginia City, have shipped 30 tons to the Washoe smeltery.

Missoula County

Kansas City Commerical Company—E. H. Kinzie has been appointed receiver on the application of Harry M. Walker, who instituted suit for $2000 due him as manager. The company owns a dredge and placer ground, which cost about $250,000, but is deeply involved, and the receiver was appointed by consent.

Nevada

Churchill County

Nevada Wonder—Foundations are being put in for the mill. Material is freighted 35 miles from Fallon.

Esmeralda County

Goldfield Consolidated—A steel gallows frame 75 ft. high is being erected at the Laguna shaft. The new frame is so large that it is being built around the old one without interfering. Connections are being driven on the Laguna 600-ft. level to connect with the Red Top workings and afford a deep outlet for the ore from the Red Top vein system.

Silver Pick—The Golden Pick lease is employing three shifts, sinking to the 450-ft. level where a 75-ft. crosscut is expected to "tap" the vein developed on the 350 level.

Lincoln County

Mendha-Nevada—A 4-ft. vein of lead-silver ore being developed on the 800-ft. level has been followed for 30 ft. with no decrease in width. Shipments of 150 tons per week are made to Utah.

I. X. L.—The Smith-Fessler lease is developing high-grade ore between the 100- and 165-ft. levels and will commence stoping as soon as a connection to the lower level is completed. The property is in Searchlight.

Nye County

Tonopah—The mill report for the week shows crushing 3277 tons of ore, with an average valve of $21.50. Shipments included 58 bars valued at $5,000 and 39 tons of concentrates worth $14,500.

Tonopah Extension—Plans are under way for the prospecting of the ground included in the Red Rock and McKane groups, recently purchased by the company. The original holdings are now being developed on the 500-ft. level.

Keane Wonder—An additional supply of water has been developed for milling operations and as a result pumping costs have been materially lessened and economies effected in discharging tanks by sluicing instead of shoveling.

White Pine County

Nevada Consolidated—It is said that a sufficient block of the stock of this company has recently been exchanged for stock of the Utah Copper Company to give the latter an actual majority of Nevada Consolidated.

New Mexico

Socorro County

Lynchburg—This group at Kelley has been sold to the American Zinc, Lead and Smelting Company by the owner, C. R. Ross.

Mistletoe—This company has started its dry concentrating mill and is treating 30 tons daily of mostly carbonate zinc and lead ores.

Pennsylvania

Wilkes-Barre Coal Company—This company was recently organized, and has taken options to buy and lease several tracts in Schuylkill, Columbia and Luzerne counties, adjoining property of the Reading and the Lehigh Valley companies. The company, it is said, is preparing to begin work on the development of some of its property. It has $5,000,000 capital stock and $2,500,000 bonds, some of which have been issued to pay for land. Charles F. Kindred is president of the new company. The other directors are John P. Persch and John P. Lenahan, of Wilkes-Barre, and John F. McIntyre, of New York; George A. Edwards, Jr., of Philadelphia, being counsel.

South Dakota

Mogul—The company has commenced sinking the Mark Twain shaft to the quartzite.

Portland—This company has acquired the American Eagle cyanide mill.

Homestake—A cave in part of the property is reported. The damage is not great and will not interfere with the operations.

Utah

Beaver County

Horn Silver—Regular shipments are being made to the American Smelting and Refining Company. A directors' meeting will be held shortly to select a successor to President Harrison, who died Sept 1.

South Utah—The ore treated during the first week's run of the reconstructed mill averaged 2.23 per cent. copper. Ore running 5.64 per cent. is being mined from a stope on the 700-ft. level. The mill is being brought up to capacity and shipments of concentrates are made to Tooele.

Utah Mining, Milling and Transportation—During August, 6 cars of ore were shipped from the Lady Bryan group. Development is being carried on at the same time. Heavier equipment is needed and will probably be ordered soon. A cave has been found in the orebody on the 200-ft. level south of the shaft.

Moscow—This company is awaiting the completion of the new water system into the Star district before resuming. During August, three cars were shipped, netting about $5500.

Juab County

Crown Point—The shaft, which is being sunk under contract, is down 45 ft. Now that the air-line from the Colorado is completed machines will be used.

Tintic Standard—Prospecting is being carried on with a diamond drill from the 970-ft. level east of the shaft. The drill is 203 ft. horizontally from the station, and has encountered mineralized quartz. The directors have been reëlected.

Yankee—The contractors sinking the

shaft are reported to have made over 50 ft. during the week.

Buckeye—Work on these claims will be resumed. An order has been given to retimber the shaft, and sinking will be started.

SALT LAKE COUNTY

The output of the Alta district is larger than during the same period last year. Twenty-five teams are hauling to the sampler at Murray. The bins at the Utah Ore Sampling Company plant have been added to lately to care for the increased tonnage. The transformer house at this plant was struck by lightning but little damage was done.

Ohio Copper—The mining costs for August were 37c. per ton less than originally estimated and the milling costs were 20c. less per ton than anticipated earlier. The actual costs are said to be in the neighborhood of 33c. a ton for mining and 29c. for milling. The mill is treating an average of about 1500 tons per day.

Tom Moore—Quartz carrying specks of native copper has been cut in the tunnel.

Columbus Extension—The cave from which a heavy flow of water was encountered is now accessible, and a 20-ft. face of first and second class ore is reported in the drift. Three cars have been shipped.

South Hecla—The Alta & Hecla mining company filed a quit claim deed Sept 14, conveying its claims to this newly incorporated company.

Cardiff—A house for the miners is being built and supplies hauled in, while the roads are good. It is expected to work during the winter. Approximately 100 tons of ore were shipped during September. The faces of the north and south drifts have 5 ft. of ore exposed.

Carbonate—Action has been brought by Charles Burkhalter against this company to recover $22,500, being treble damages for $7500 worth of ore that Burkhalter alleges the defendants have taken from his claims, the Carbonate, Sailor Jack and Baker. A temporary restraining order was issued Sept. 13.

SUMMIT COUNTY.

Daly-Judge—Work is being done on the 1600-ft. level, recently unwatered. Cleaning is in progress, and some milling ore has been mined. Workings on the Daly-Ontario fissure are badly caved, and it may be necessary to drive around this portion to reach the fissure again.

Daly West—Notice was mailed Sept 20 as follows: "On account of increased development and reduced production, which is considered advisable for reasons given in the last quarterly report, dividends will be suspended until further action of the board of directors."

Wisconsin

A number of the larger zinc mines at Benton, are operating with electric power furnished by the Interstate Light and Power Company, of Galena. New milling plants have begun production at the Little Minnie and Lucky Twelve properties, at New Diggings.

Kohinoor-Blende—This mine, on the Hayden land, southwest of Platteville, has been subleased to Julius I. Wile.

Forcite—This company has been reorganized under the name of the Mound City Mining Company, and has taken over the Hodge mine.

Homestead—Shepherd Brothers are assembling machinery and material for a 200-ton mill to replace the 75-ton plant destroyed by fire.

Klar-Piquette—This company is installing 1500 ft. of the Lawson loop-section aërial tram to connect shaft No. 2 with mill.

Klondike—The mill house for the Sutton, Steele & Steele dry-process plant has been completed on the Brunton land, five miles southwest of Platteville.

Wilkinson—A heavy run of sheet-jack has been opened up below the lead ground and a mill will be built. George Wilkinson, Benton, is manager.

Rowley—The Vinegar Hill Zinc Company has obtained control and is prospecting this property.

Wisconsin Zinc—This company purchased the Winskill lease of 240 acres for $50,000 and is equipping it with a 75-ton mill. Drilling has been resumed on the 1900-acre tract of the LaFayette company, near Schullsburg.

Canada

BRITISH COLUMBIA

Tyee—During August the plant smelted 7000 tons, valued at $75,000.

ONTARIO

Shipments from Cobalt for the week ended Sept. 17 were: Buffalo, 62,940 lb.; Chambers-Ferland, 64,000; Coniagas, 140,470; Crown Reserve, 41,780; Hargraves, 60,000; La Rose, 290,040; McKinley-Darragh 47,700; Nipissing, 190,040; O'Brien, 40,000; total, 936,940. pounds.

Beaver—The quarterly report shows a balance of $50,342. Two veins have been found and another oreshoot opened on No. 5 vein. Ore ready for shipment consists of two cars of low-grade and one of high-grade.

Hargraves—The Kerr Lake vein has been discovered on this property and shows rich ore.

Northern Customs Concentrator—The capacity of this mill has been increased to 160 tons a day by the installation of two additional Nissen stamps.

Crown Reserve—Additional machinery is being installed in the ore house, so that instead of shipping three grades as formerly, only high-grade will now be sent out.

Bartlett—Work has been resumed on the Gowganda property, and trenching has exposed an entirely new vein, 7 in. wide, of high-grade ore.

Armstrong-McGibbon—A test pit sunk on a strong quartz lead on claim No. 12,886, at Porcupine, owned by the syndicate, shows free gold at 10 ft., extending entirely across the bottom of the pit.

Stewart & Hewitson—A vein of silver was recently found in the rock quarry, at Port Arthur, owned by Stewart & Hewitson, contractors, which gave good assays. An option on six acres of the property has been taken by Cyrus E. Baker, of Denver, and B. Wilcox, who will begin work at once, and will spend $20,000, and sink a shaft to 100 feet.

NOVA SCOTIA

Dominion Steel Corporation—Shipments of coal for the first eight months of 1910 were 1,972,344 tons, against 1,701,362 tons for the corresponding eight months of 1909—an increase of 270,982 tons.

Mexico

The capital stock of the Mines Company of America has been increased from $2,000,000, consisting of 2,000,000 shares of the par value of $1, to $9,000,000 consisting of 900,000 shares of the par value of $10 each, and that $2,499,140 par value of the new stock of Mines Company of America, namely, 249,914 shares, has been set apart for the purpose of acquiring all or so many of the 357,020 shares of El Rayo Mines Company as can be obtained by the issue of $7 par value of the capital stock of Mines Company of America for each share of El Rayo company of the par value of $2, and that $4,000,000 of such new stock, being 400,000 shares, has been appropriated for the purpose of acquiring the 400,000 shares of Dolores Mines Company, or so many thereof as can be obtained, by the issue of one share of Mines Company of America for each share of Dolores company of the par value of $5. The remaining shares of the Mines Company of America, amounting to $500,860 par value, are reserved for the purchase of additional property and general corporate purposes.

CHIHUAHUA

Mary Mining Company—This company, owning extensive gold and copper deposits in the Uruachic district, has declined an offer for its copper property and will now develop it on an extensive scale. A small mill is operating on the gold property. This will be increased to

30 stamps at once. Todd C. Woodworth is manager.

Rio Plata—This company reports August crushing 1741 tons containing 72,134 oz. silver gross. The cyanide plant heated 2108 tons of tailings containing 71,558 oz. silver.

Providencia—This property, at Parral, has been transferred to the Molly Gibson Mining Company, of Boston, under an exchange of stock plan. W. W. C. Spencer, of Boston, is treasurer of the company and E. Putnam manager.

Veta Colorado—This company is developing underground extensively and is completing the cyaniding plant, which will have a capacity of 500 tons daily.

Candameña—Efforts to straighten out the title to this rich property have failed so far. It is owned by a Mexican estate.

Compañia Minera Ignacio Rodriguez Ramos—The last report of this Almoloya property shows 9,800,000 pesos of ore in sight. The monthly dividend of 2.50 pesos per share was suspended for three months to provide funds for exploration.

DURANGO

Carmen—This copper mine, 50 miles southwest of Rosario, is being operated by F. C. Alley. Freight and smelting charges are 50 pesos per ton.

Matrical—This, and other properties at Indé, controlled by Willis J. Hullings, of Oil City, Penn., are being examined by engineers for New York interests.

GUANAJUATO

El Monte—E. J. Kimball, of Guanajuato, and E. A. Montgomery, of Los Angeles, Cal., are developing these mines at Guanajuato. A vertical shaft is being sunk on the Pasadena claim to cut the vein.

Mitchell Mining Company—Interests in the company are fighting in the courts the move by the stockholders to have a receiver appointed. A sale of the property under judgment in Mexico is planned. The company owns La Dicha mine, near Chilpancingo, a copper deposit extensively developed and a large tract of timber and agricultural land. The capital stock of $12,000,000 was widely distributed at high prices a few years ago. George Mitchell was president.

Cedral-Lajuela—This Boston Company will erect a 500-ton cyanide mill on the Cedral group in Taxco.

Atlixtac—This Taxco company will install a mill at the mouth of the main tunnel.

HIDALGO

The Mexican Light and Power Company has extended its power service to Pachuca.

Many mining denouncements are being made in the State, particularly now in the camps of El Chico, Actopan and El Grande, in the municipality of Omitlan.

Purisinia Grande—This hacienda at Pachuca, which is principally supplied with ore from the Guadalupe-Fresnillo mine is making good progress in the construction of the new mill and cyanide plant, under the direction of Edmundo Girault.

Santa Ana—This Pachuca property has installed electrical equipment, including a large Wellman-Seaver-Morgan hoist, with a capacity of 900 lb. at a hoisting speed of 700 ft. per minute.

Cinco Señores—A second payment on the purchase price of this property, near the Santa Gertrudis, has been made to Carlos Landero y Cos and assocates. It is expected that development will begin soon.

JALISCO

Old Mexico Southern Mine and Smelter Trust—This company will exploit mines in Jalisco. J. E. Landon, of St. Louis, and G. E. Miller, of Denver, are interested.

Candelaria—This *antigua*, near Ahualuco has been sold to J. B. Shale, of New York, who is developing it. A mill will be erected shortly. The property has yielded rich ore in the past.

MEXICO

Esperanza—In August the mill ran 29 days and crushed 22,402 dry tons of ore; estimated realizable value of bullion and concentrates, $154,882; mine expenses, $107,597; allowance for depreciation of plant, $5000; consulting engineers' fees and New York office expenses, $2027; London expenses, $47,506; estimated profit, $47,425. This low production is reported due to temporary causes.

Rincon—This company, operating at Temascaltepec, is remodeling its mill, using Richards pulsating classifiers, Frenier pumps, Pachuca tanks, Diester concentrators and King revolving screens.

OAXACA

Alta Gracia—This old mine in the Tolalapam district, owned by the Rickards Brothers, will be operated with Harold Sturges in charge.

SINALOA

San Javier—W. C. West and H. L. Roper, who have acquired more than 20,000 tons of tailings on the dump of this mine northeast of Culiacán, are remodeling the mill.

SONORA

Sonora Central—This company has started the first unit of the concentrator at Alamos, on the Santo Domingo mine. James R. Hendra is superintendent.

Pacific Smelting and Mining Company—The company has purchased the Greene lead stack at Guaymas and will operate it as an auxiliary to the copper smeltery at Fundicion. Courtenay De Kalb is manager and M. E. Cary president.

ZACATECAS

Zacatecas Mining and Metallurgical Company—The mill south of Zacatecas is completed and will be in operation as soon as the electrical equipment from Germany arrives. The company owns the San Cristobal gold mines in the slate area of the camp. Custom work will also be done. M. E. MacDonald is president of the company.

Magistral—This smeltery will treat the surface ores from the San Roberto. The Magistral company is now sending 2000 tons monthly to the smeltery. The matte is sent to Torreon.

Africa

RHODESIA

Gold production in August was 43,458 oz., or 91 oz. more than in July. For the eight months ended Aug. 31, the total was 408,211 oz. in 1909, and 409,830 oz.—or $8,471,186—in 1910; an increase of only 1619 oz. this year.

TRANSVAAL

Gold production in the Transvaal in August is reported at 649,269 oz., being 10,255 oz. more than in July, and 37,732 oz. more than in August, 1909. For the eight months ended Aug. 31 the total was 4,868,989 oz. in 1909, and 4,950,488 oz.—or $102,326,587—in 1910; an increase of 81,499 oz. There were 71 mills with a total of 9870 stamps at work. Of the August output 623,129 oz. came from the Witwatersrand and 26,140 from the outside districts.

The labor report for the month shows negro laborers employed as follows: Gold mines 180,831; diamond mines, 10,320; coal mines, 8743; total, 199,944, a net loss of 1728 during the month. In August, 1909, there were 166,343 negroes and 5361 Chinese employed, a total of 171,704; or 28,240 less than this year.

Central America

HONDURAS

An effort is being made to interest capital in the gold mines near Tegucigalpa; Henry A. Spears is engineer in charge.

South America

CHILE

Braden—This company is now said to have blocked out 8,000,000 tons of ore, averaging 2.9 per cent. copper. The concentrating mill of 2000 tons daily capacity is expected to be ready for operation next spring. Railway connections between the mine and the Chilean railroad, a distance of 43 miles, has been completed, furnishing transportation to tidewater. The Braden company has an authorized bond issue of $4,000,000, of which $500,000 were exchanged for debentures, $625,000 exchanged for preferred stock of the old corporation, and $2,500,000 sold to provide funds for development and construction.

THE MARKETS

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal Trade Review

New York, Sept. 28—The West is gradually quieting down, as the mines in the districts recently on strike resume work. There has been some discussion over the details of contracts, but these are being settled. The Illinois mines are, many of them, in poor shape; it will be several weeks before they are making anything like full shipments.

Through a large part of the West the stocks of coal in the hands of consumers are small. These will have to be made up, and it looks as if a heavy tonnage from the mines will be needed for some time. But there are already complaints of car shortage, and these are sure to increase as time goes on. To make up lost time at the mines and to keep up supplies for the winter is going to keep coal operators in trouble.

In the East there is nothing new in the anthracite trade. The seaboard bituminous trade is in better condition than it has been for some time.

Mississippi River Trade—The long continued low stage of water in the Ohio this summer has left the Pittsburg trade down the Mississippi specially open to competition. Kentucky operators have not been slow to take advantage of this; and Alabama operators have also been shipping unusual quantities of coal to New Orleans and other points on the river. The Alabama people especially have found this trade quite a help to them, and propose to push their competition.

Coal Traffic Notes

Receipts of domestic coal at San Francisco, seven months ended July 31, were 218,536 long tons in 1909, and 166,391 in 1910; decrease, 52,145 tons.

Coal passing Davis Island dam on the Ohio, seven months ended July 31, was 2,354,070 short tons in 1909, and 1,458,205 in 1910; decrease, 895,865 tons.

Coal passing through the locks on the Monongahela above Pittsburg, seven months ended July 31, was 5,494,720 short tons in 1909, and 5,575,620 in 1910; increase, 80,900 tons.

Coal shipments out of Great Kanawha river in West Virginia, seven months ended July 31, were 861,677 short tons in 1909, and 872,808 in 1910; increase, 11,131 tons.

Coal receipts at St. Louis, seven months ended July 31, were 3,582,624 short tons in 1909, and 4,580,377 in 1910; increase, 997,753 tons.

Coal shipments over railroads in the Ohio Coal Traffic Association, seven months ended July 31, short tons:

	1909.	1910.	Changes
Hocking Valley.....	1,525,042	2,416,367	I. 891,325
Toledo & Ohio Cent..	657,046	1,126,609	I. 469,563
Baltimore & Ohio ...	752,224	1,332,413	I. 580,189
Wheeling & L. Erie..	1,670,910	2,117,183	I. 446,273
Cleve., Lorain & Wh.	1,274,280	1,843,063	I. 568,783
Zanesville & Western	582,094	697,264	I. 115,170
Toledo Div., Pen. Co.	970,097	1,259,261	I. 289,164
L.Erie,Alliance&Wh.	541,508	648,384	I. 106,876
Marietta, Col. & Clev.	43,208	57,417	I. 14,209
Wabash-Pitts. Term.	11,608	33,397	I. 21,789
Total.....	8,028,017	11,531,358	I.3,503,341

Total increase this year 43.6 per cent. Baltimore & Ohio tonnage is of the Ohio lines only; main-line tonnage is given elsewhere.

Anthracite carried over Baltimore & Ohio railroad, seven months ended July 31, was 455,745 tons in 1909, and 501,748 in 1910; increase, 46,003 tons.

Bituminous-coal and coke tonnage of leading railroads in Pennsylvania and West Virginia, seven months ended July 31, short tons:

	Bituminous.	Coke.	Total.
Pennsylvania.....	23,358,512	8,278,953	31,637,465
Balt. & Ohio.....	16,235,367	2,614,475	18,849,842
Buff., Roch. & Pitts.	4,114,022	368,323	4,482,345
Buff. & Susqueh'na	783,686	157,496	941,182
Penn. lines, N. Y. C.	4,568,246	34,597	4,602,843
Pitts. & L. Erie.....	6,107,065	3,880,078	9,987,143
Pitts., Shawmut&N.	645,270	12,847	658,117
Norfolk & Western.	9,786,885	1,750,879	11,537,764
Ches. & Ohio.....	9,100,051	276,477	9,376,528
Virginian.....	479,976	15,462	495,438
Total.....	75,179,080	17,389,587	92,568,667
Total, 1908.....	62,061,285	13,337,032	75,398,317

Total increase this year, 17,170,350 tons, or 22.8 per cent. Anthracite tonnages of Pennsylvania and Baltimore & Ohio are given elsewhere.

New York

Anthracite

Sept. 28—There has been a quiet time in the domestic trade. Unusually warm weather for the season does not incline people to put in their winter stocks. Steam trade is steady, about as usual.

Schedule prices for large sizes are $4.75 for broken and $5 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes, current quotations are: Pea, $2.95@3.25; buckwheat, $2.15@2.50; No. 2 buckwheat, or rice, $1.65@2; barley, $1.35@1.50; all according to quality, f.o.b. New York harbor.

Bituminous

Notwithstanding the settlements in the West there is still a good deal of coal going that way from mines that generally serve the seaboard trade. Conditions are generally good, the mines working pretty well under the demand. Coal at the seaboard is selling better. The shoal-water ports are beginning to sit up and think about winter supplies. All-rail trade is quite as good as it has been.

Quotations are unchanged, gas coal selling at prices which realize $1@1.05 at mines for run-of-mine and 65@70c. for slack. Good steam coals bring $2.50@3, according to quality, f.o.b. New York harbor.

Transportation is good, with few delays. Car supply is not quite so good, but complaints are not general so far.

In the coastwise market there is no change. For large vessels from Philadelphia quotations are: Boston, Salem and Portland, 55c.; Portsmouth, 60c.; Lynn, Newburyport and Bath, 65c.; Bangor, 75c.; Gardner, 85c. From New York harbor small boats get 50@55c. to Boston and Portland, 30@40c. to Providence and the Sound.

Birmingham

Sept. 26—There is need for men in some parts of the mining section of Alabama. The production of coal in this State is large. There is a little car shortage still reported. The home consumption is fairly good. There is a large quantity of coal being shipped to New Orleans, Mobile, Pensacola and other Southern ports, while railroads in the South and Southwest are drawing on the Birmingham district for coal. Good prices still obtain.

Coke is in good demand and the production is steady. Very few coke ovens in condition are idle.

Chicago

Sept. 26—Buying of Illinois coals has been large in the last week and the return to normal conditions has proceeded rapidly. There is now little doubt, to all appearances, that the mines of the State will very soon—sooner than was expected, indeed—be able to take care of the needs of most steam-coal users in this territory. Between 40 and 50 per cent. of the output capacity is now ready or coming from the mines; the rest is soon to be on the market. Under the pressure for immediate shipments prices keep up to the level of last week and may continue on this level, though the prospect is that they will drop with the resumption of the normal output. Buyers are still preferring screenings for present needs; on contracts they show a preference for lump which makes that size strong.

Illinois and Indiana coals bring $2.75@3.50 for lump, $2.30@2.50 for run-of-mine and $2.20@2.40 for screenings.

Eastern coals are in plentiful supply and mild demand, except in the case of Hocking, the market for which is very strong, at $3.25 for ¾-in. lump. Smoke-

less is rather weak at $3.95 for lump and $2.30 for run-of-mine. Youghiougheny is in fair demand at $3.32 for 1¼-in. lump and $3.22 for ¾-in. Anthracite is sluggish.

Cleveland

Sept. 26—Local trade is active both for steam and domestic coals. Car supply conditions are getting worse, especially in West Virginia. Pocahontas coal is practically out of the Cleveland market, as none is coming forward.

Prices are unchanged, except that some consumers who are short of fuel have had to pay premiums of 5 or 10c. to get the early deliveries they need.

Indianapolis

Sept. 26—The demand for coal from Indiana mines is on the increase. Not only the Indiana roads, but several of the Chicago lines, are sending cars to the Indiana mines to be loaded. The Chicago & Northwestern, the Chicago, Burlington & Quincy, the Chicago & Great Eastern and several other roads brought in cars to be loaded during the past week. These shipments are reaching several thousand cars a day; while the Vincennes division of the Vandalia now has 36 engines in actual service daily hauling coal. The average is 1500 cars a day, the largest in the history of the road.

It was expected the resumption of mining in Illinois would materially affect business in the Indiana field. This has not proved to be the case so far. Many mines in Illinois were found to be unfit for operation and several days will be required to place them in lawful condition. It is thought no further increase in prices will be made.

Pittsburg

Sept. 27—Demand is fair in the local coal market, as Lake shipments continue fairly heavy and domestic demand is increased. There is no change in industrial requirements. Prices are being cut a little more, but only on odd lots, regular tonnages going at prices previously quoted: Mine-run and nut, $1.20@1.22½; ¾-in., $1.30@1.32½; domestic 1¼-in., $1.45@1.47½ and slack 75@82½c. per ton.

Connellsville Coke—The Midland Steel Company has covered for its October requirements for its furnace at Midland, Penn., and it is understood gives pig iron in exchange. A sale of about 50 cars of prompt has been made at $1.60, which remains the minimum of the market. Generally speaking, the coke market shows no change. We quote standard grades per net ton: Prompt furnace, $1.60@1.65; contract furnace (nominal), $1.75@1.85; prompt foundry, $2.10@2.25; contract foundry, $2.25@2.50, at ovens.

The *Courier* reports the production in the week ending Sept. 17 at 343,630 tons, a gain of 2000 tons, and shipments at 3626 cars to Pittsburg, 5441 cars to points west and 875 cars to points east, a total of 9942 cars.

St. Louis

Sept. 26—The market this week has been a trifle lower on steam sizes, but has maintained itself on the domestic size. All mines in the Southwest signed up and went to work on Sept. 20. While this does not have any effect on the St. Louis market locally, St. Louis will lose a portion of the railroad tonnage which has been moving from this district during the past four or five months.

The domestic demand is strong, though it is the general opinion that it actually is not a circumstance to what it will be in 30 days from now. Salesmen report that dealers and householders throughout the entire West are absolutely bare of soft coal. Dealers are stocking up as heavily as possible, but state that householders, on account of the frequent articles in the daily papers about the price of coal coming down after the strike is settled, seem to be slow to buy.

The average dealer is alive to the situation and is buying as much coal as he can take on.

Next week the operators of the fifth and ninth districts are going to establish a Coal Exchange here where operators will meet daily from 10.30 to 11 a.m. This has been attempted several times before but the operators have not been successful. However, they are now close enough together and think that the market is in such a condition as to make the operations of a coal exchange entirely feasible and that it will have a beneficial effect on the market during the ensuing winter at least.

Current prices on the St. Louis market are as follows:

	Mine.	St. Louis.
Illinois, Standard:		
6-in. lump and egg	$2.00	$2.52
2-in. lump	1.85	2.37
Mine-run	1.45	1.97
Screenings	1.10	1.62
Trenton:		
6-in. lump and egg	2.50	3.02
3-in. nut	2.00	2.52
Staunton or Mt. Olive:		
6-in. lump	2.25	2.77
2-in. nut	2.00	2.52
Mine-run	1.70	2.22
Screenings	1.20	1.72
Carterville:		
6-in. lump or egg	2.25	2.92
3-in. nut	2.00	2.67
Mine-run	1.50	2.17
Screenings	1.30	1.97
Pocahontas and New River:		
Lump or egg	1.90	4.40
Mine-run	1.25	3.75
Pennsylvania Anthracite:		
Nut, stove or egg	.....	6.95
Grate	.....	6.70
Coke:		
Connellsville foundry	.....	5.40
Gas house	.....	4.90
Smithing	.....	4.15

East St. Louis prices on soft coal are 20c. less than the St. Louis quotations.

The railroads are still buying heavily on the open market, though they are beginning to line up contracts from their own mines for the ensuing year and they will probably gradually draw away from the open market as the season proceeds.

Anthracite—The demand for anthracite continues good on all sizes. Chestnut has been coming forward freely, though the demanl for this size is easing off a trifle.

FOREIGN·COAL·TRADE

Nova Scotia Coal—Shipments of coal from Nova Scotia mines, eight months ended Aug. 31, long tons:

Company:	1909.	1910.	Changes.
Dominion	1,701,362	1,972,344	I. 270,982
Nova Scotia Steel	459,331	514,415	I. 55,084
Inverness	145,436	171,502	I. 26,066
Acadia	174,904	168,545	D. 6,359
Intercolonial	153,603	164,038	I. 10,435
Total	2,634,636	2,990,844	I. 356,208

The total increase reported this year was 13.5 per cent.

Transvaal Coal—The total coal mined in the Transvaal in July from 28 mines was 445,510 tons, of which 114,144 tons, or 25.6 per cent. was sorted or screened out as waste. The coal sold was 331,033 tons, the average price realized being $1.24 per ton at mine.

Spanish Imports—Imports of coal in Spain seven months ended July 31 were 1,253,681 metric tons in 1909, and 1,191,759 in 1910; imports of coke, 167,568 tons in 1909, and 155,750 this year.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of Welsh coal as follows, on Sept. 17: Best Welsh steam, $3.90; seconds, $3.78; thirds, $3.60; dry coals, $3.60; best Monmouthshire, $3.54; seconds, $3.42; best steam smalls, $2.04; seconds, $1.80. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, Sept. 28—Nothing came of the steel conference in New York last week, at least nothing that it has been possible to get hold of. No low prices were made to meet independent competition; on the other hand no action was taken to secure a maintenance or increase of quotations. It is quite possible that the talk as to the latter course was put out to test the general feeling. Its reception was not all cordial, and it has been dropped. Matters are going on much as before. The so called cutting on sheets and some other articles by independent concerns has continued, and is being generally met by all parties. It is recognized that there is a good volume of business, though it is not up to the capacity of the mills now in existence; while it would not take a great deal more to satisfy everybody, the additional trade must be waited for patiently, and cannot be forced. It will be a question of gradual growth of consumption.

A fair business is reported in structural steel mainly in orders of the smaller class, with some larger contracts in near prospect. In most other lines there is a moderate business, except in sheets, which are generally dull. Railroad orders are still slow, but some contracts for bridges have been placed. Jobbers report an improvement in the current demand for bars and for small building material.

In pig iron the situation is unchanged. Nothing is being done for deliveries beyond December. Sellers do not want to take 1911 contracts at current prices, and buyers do not want to pay more. There has been some business done in foundry iron in Eastern territory, and some in basic in the Central West. Pipe foundries in the East have been inquiring for iron.

Export business is reported good. An order for 10,000 tons of rails for the Canadian Northern has been taken by the Illinois Steel Company. A good deal of miscellaneous business is going on to Panama, on canal contracts.

Lake Superior Iron Ores—Notwithstanding the reported slowing down, shipments of iron ore from the Lake Superior region in August reached a total of 6,964,381 tons, or 19,092 tons more than in July. For the season to Sept. 1 the totals are reported by the Cleveland *Iron Trade Review* as follows:

Port.	1909.	1910.	Changes.
Escanaba.....	3,053,846	3,162,271	I. 108,425
Marquette.....	1,413,568	2,249,775	I. 836,207
Ashland.....	1,701,168	2,878,970	I. 1,177,802
Superior.....	3,686,323	5,227,587	I. 1,541,264
Duluth.....	7,713,377	9,823,644	I. 2,110,267
Two Harbors.....	5,020,667	5,485,682	I. 465,015
Total.....	22,588,949	28,827,929	I. 6,238,980

The total increase this year over 1909 was 27.6 per cent.

Receipts of Lake ore at Lake Erie ports in August were 5,681,434 tons. The leading ports were Ashtabula, 1,627,633; Conneaut, 1,124,623; Cleveland, 996,892; Buffalo 705,027 tons.

Deliveries of Lake Superior iron ore at Lake Michigan ports in August were: South Chicago, 728,177; Gary, 297,282; other ports, 86,792; total, 1,112,251 tons.

Birmingham

Sept. 26—The month of September is closing with general conditions in the Southern pig-iron market in better shape than they have been for some time. Several of the companies have sold more iron during the month than the probable make; the accumulated stocks have been reduced more than during any previous month, and the inquiries have been steady. It is estimated that the stocks are now only a little over 100,000 tons in Southern territory. Quite a number of sales have been made for delivery during the last quarter of the year, and a few sales for delivery during the first quarter of 1911. The belief is firm that quotations are soon to take on some strength, though at present $11.50 per ton, No. 2 foundry, appears to the up figure. Reports are heard that a number of sales have been made during this month at $11.25. The consumption and sales in the past few weeks have been better than the production.

Charcoal-iron demand is still sluggish, but the production and quotations have not been reduced.

Chicago

Sept. 26—The iron market continues quiet, though the volume of small steady buying for needs of one to three months ahead is large. Most buyers have a good supply of iron up to the first of the year; for 1911 needs they are proceeding cautiously and show the customary reluctance to crossing the imaginary barrier of the New Year. It would seem that the average buyer is by no means satisfied yet that the output of pig iron is reduced to consumptive needs, and his policy is evidently to proceed with all brakes ready for setting. He sticks to his policy of contracting for a carload to 500 or 600 tons as often as he needs the iron on an outlook of 30 to 90 days ahead. For such business quotations continue practically unchanged, Southern No. 2 selling for $11@11.50 Birmingham ($15.35@15.85 Chicago), and Northern No. 2 for $16.25@16.75. The demand for Northern seems somewhat weaker, relatively, than for Southern. For 1911 business on both, selling agents are demanding 25@50c. over the above quotations.

Iron and steel products have a quieter market, even structural steel being less active. Wire products alone are active. Coke has a rather strong market at $4.90 for the best Connellsville.

Cleveland

Sept. 26—The movement of iron ore continues, though the reports from the head of the Lakes indicate an early closing of mines. Ore is moving more freely from the docks to the furnaces.

Pig Iron—The market is still rather dull, but there is a fair run of orders for 500 tons and under. Quotations are $15.65@15.90 for bessemer pig; $14.50@14.75 for No. 2 foundry; $14@14.25 for forge; $18 for Lake Superior charcoal; all Cleveland delivery.

Finished Material—Business has been rather held back by reports of coming reductions in prices. It does not appear likely, however, that there will be any drop below the cut figures which have been current for several weeks past.

Philadelphia

Sept. 28—Buying of pig iron has been a little better, but is still all for this year's delivery. Plenty of buyers are inquiring for 1911 deliveries, but stick on the additional 50c. which makers ask for such iron. Some speculative Southern iron is being offered here. For Northern, No. 2X can be quoted at $16; No. 2 plain, $15.50; basic, $15; forge, $15 for Northern and $14@14.50 for Southern.

Steel Billets—More inquiries, but small sales at $26.50 for ordinary and $28 for forging billets.

Bars—Iron bars are irregular, owing to competition for orders. Steel bars are steady. Store trade is better.

Sheets—Demand is uneven, and there is still some shading in prices.

Plates—Quite a lot of small business is coming out, but large orders are held back.

Pipes and Tubes—Tubes are being used in good quantity. The demand for merchant pipe in small lots is good.

Structural Material—Small orders are coming in, making quite a large total. Negotiations are on for some large contracts, but none have been closed.

Scrap—More inquiries are coming in, and dealers are beginning to sit up and count their stocks. It is reported that the agreement, under which a number of Eastern steel mills have been getting their scrap through a joint central agency, may be abandoned.

Pittsburg

Sept. 27—Steel manufacturers expect good results to follow the publicity given to the fact that a meeting of leading interests was held Sept. 21, at which it was decided to make no reductions in prices. The situation has been clouded by numerous reports that there was serious price cutting and that some sweeping reductions might be made by leading interests. These reports were unfounded, for the market for finished steel products has not shown as much weakness or declining tendency in the past two month as in the preceding six months, as any comparison of price declines will show.

Business in the lighter lines has shown a fair increase this month over last, and the most serious unfavorable feature is the fact that orders for rails, steel cars and large steel structures have been so light that the business in these lines which has kept the plants quite well employed in the past few months is beginning to play out. While there is an increase in buying of the lighter lines, it is not sufficient to make up for the loss in the other direction. No effect has been felt thus far, since in the past week or two steel mills on the whole have been able to maintain as large a production as in the early part of the month.

The general market level on plates, shapes and merchant steel bars is 1.40c., Pittsburg. This level was first reached in June as to shapes and plates, and about Aug. 1 as to bars. At the present time bars are not being shaded, or at any rate they are shaded only occasionally, and then by only a few small interests. Shapes are being shaded at intervals when large structural contracts are involved, and one

or two mills removed from Pittsburg are shading say $1 a ton on current business. In plates some of the smaller mills, both in the Central West and in eastern Pennsylvania, are shading, generally $1 or $1.50 a ton. The large interests, according to the best information, are holding strictly to the open prices, and while they do not like to lose business to small interests and observe them running at a higher rate than the general average, they prefer this condition to that of a general reduction which might distribute the business more uniformly but would afford smaller profits all around. In the event of market conditions arising which would promise a considerably larger volume of business were prices reduced, it is not improbable that the large interests would favor a reduction. Such a position, however, is not offered at this time.

Pig Iron—The local pig-iron market has shown more strength and activity than for many weeks. Several sales of bessemer have been made at the full price which has been quoted for a month as the market, one of them for first quarter, and sales of malleable and foundry for the first half have also been made, at 50c. advance over the market for prompt delivery. The sales represent more activity, and in addition there is the first definitely reported business for next year, showing a confidence in the future which has hitherto been lacking on the part of buyers. Bessemer-iron sales made since last report are: 1500 tons for first quarter at $15, Valley, the iron to go to Cleveland and Chicago steel-casting interests; 1000 tons at $15 for early delivery to a foundry interest in Cleveland; 2000 tons for fourth quarter for an ingot mold foundry at $15, and 1500 tons to another ingot mold foundry at $15.25, the extra 25c. being on account of special terms. There has been a fair run of small business in foundry iron for prompt shipment, on the basis of $14, Valley, while the new year has opened up by 2000 tons being sold for first half delivery at $14.50, Valley. A sale of 1200 tons of malleable has also been made for first half at $14.75. These transactions are regarded by the producing trade as very encouraging. Basic iron can still be had at $13.50, Valley, for this year, but it appears that nothing could be done for next year at less than $14. We quote the market at Valley furnaces, 90c. higher delivered Pittsburg, as follows for prompt and nearby delivery: Bessemer, $15; basic, $13.50; No. 2 foundry, $14; gray forge, $13.25; malleable, $14 per ton.

Ferromanganese—A sale of about 1000 tons is reported for delivery over the balance of the year at $39.50, Baltimore, which practically represents the market, freight to Pittsburg being $1.95 per ton.

Steel—The steel mills are holding prices pretty firmly at the level already reported, but there are reports of occasional sales of small lots of sheet bars at slight concessions in order to move the material. We quote prices at Pittsburg as follows: Bessemer billets, $24@24.50; sheet bars, $25@25.50; open-hearth billets, $25.50@26; sheet bars, $26@26.50; forging billets, $29; rods, $28@29 per ton.

Sheets—There is a slight improvement in demand, and in some quarters it is held that prices are a trifle firmer, although they are not quotably higher. We quote: black sheets, 2.15@2.20c.; galvanized, 3.20@3.25c.; blue annealed, 1.60@1.65c. Nominal prices for corrugated roofing are $1.70 per square for painted and $3 for galvanized, these being shaded $4 to $5 a ton on painted and $5 to $6 a ton on galvanized.

St. Louis

Sept. 26—The pig-iron market remains about the same, though a number of small orders were received this week. Inquiries are coming in freely and stocks in the hands of melters are very low. The activity seems to be entirely restricted to third-quarter deliveries. Prices remain unchanged at $11@11.50 Birmingham, or $14.75@15.25 f.o.b. St. Louis, for No 2. foundry.

METAL MARKETS

New York, Sept. 28—The metal markets have been quiet and show no material changes from the conditions reported last week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Aug. 1910..	$3,150,423	$12,818,606	Imp.$ 9,668,183
" 1909..	9,230,273	5,348,757	Exp. 3,881,516
Year 1910..	53,495,605	42,489,786	" 11,005,819
" 1909..	89,726,392	28,754,235	" 60,972,157
Silver:			
Aug. 1910..	4,755,708	4,119,362	Exp. 636,346
" 1909..	4,494,552	3,190,988	" 1,303,564
Year 1910..	36,934,397	29,815,770	" 7,118,627
" 1909..	38,903,584	29,979,133	" 8,924,451

Exports from the port of New York, week ended Sept. 24: Gold, $400; silver, $873,193, principally to London and Paris. Imports: Gold, $140,818, from the West Indies, South America and Japan; silver, $75,311, chiefly from Mexico.

Gold production in the Transvaal for the eight months ended Aug. 31 was $102,326,587; an increase of $1,684,584 over the corresponding period last year.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, Jan. 1 to Sept. 15:

	1909.	1910.	Changes.
India.....	£4,576,200	£4,458,000	D. £ 118,200
China.....	1,555,200	1,118,500	D. 436,700
Straits.....	82,800	.....	D. 82,800
Total.....	£6,214,200	£5,576,500	D. £ 637,700

India Council bills in London brought an average of 16.03d. per rupee for the week.

Gold—Prices on the open market in London have been unchanged at 77s. 9d. per oz. for bars and 76s. 5d. per oz. for American coin. Most of the supplies coming forward were taken for Germany and for Egypt, where the cotton-shipping season has caused a demand.

Platinum—Business is steady at the recent advance. Jewelers are beginning to prepare for the winter season and are taking an unusual quantity of the metal. Dealers ask $34@34.50 per oz. for refined platinum, and $39@40 per oz. for hard metal.

Our Russian correspondent writes, under date of Sept. 15, that the demand is good and the market strong. There has been some advance in prices. At Ekaterinburg small sellers quote 7.50 rubles per zolotnik—$28.20 per oz.—for crude metal, 83 per cent. platinum. At St. Petersburg the same grade brings 28,500 rubles per pood—$27.93 per oz. The customs returns give the exports of platinum from Russia for the year ended June 30 at 150 poods—78,960 oz.; an increase of 35 poods over last year.

SILVER AND STERLING EXCHANGE

Sept.	22	23	24	26	27	28
New York....	53½	53¾	53⅝	53¾	53⅞	53¾
London.....	24 11/16	24 11/16	24 11/16	24 11/16	24⅞	24¾
Sterling Ex..	4.8610	4.8615	4.8625	4.8675	4.8645	4.8675

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The silver market has again improved during the past week on demand from the Indian bazaars, selling up to 24⅞d. on Sept. 27; but closes lower on selling by Chinese Banks at 23¾d. in London. The holdings of silver rupees by the Government of India show a small decrease and are about 25 per cent. less than the amount held this time last year.

Copper, Tin, Lead and Zinc

NEW YORK

Sept.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. New York, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
22	12⅝ @12¾	12.25 @12.35	34½	4.40	4.25 @4.30	5.52½ @5.55	5.37½ @5.40
23	12⅝ @12¾	12.25 @12.35	34¾	4.40	4.25 @4.30	5.52½ @5.55	5.37½ @5.40
24	12⅝ @12¾	12.25 @12.35	34¾	4.40	4.25 @4.30	5.52½ @5.55	5.37½ @5.40
26	12⅝ @12¾	12.25 @12.35	34½	4.40	4.25 @4.30	5.52½ @5.55	5.37½ @5.40
27	12⅝ @12¾	12.25 @12.35	35	4.40	4.25 @4.30	5.52½ @5.55	5.37½ @5.40
28	12⅝ @12¾	12.25 @12.35	35	4.40	4.25 @4.30	5.52½ @5.55	5.37½ @5.40

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Sept.	Copper.			Tin.		Lead, Spanish.	Zinc, Ordinaries.
	Spot.	3 Mos	Best Sel'td	Spot.	3 Mos		
22	55⅛	55¾	59	157⅜	157⅞	12½	23⅜
23	55	55⅛	59	158⅛	157⅞	12½	23⅜
24	.....	.....	.....	.....	.....	.....	.....
26	55⅛	55⅛	59	158¼	158	12⅝	23⅛
27	55⅛	55⅞	59	159⅜	159⅛	12¾	23⅛
28	55⅛	55⅞	59	159⅛	159	12¾	23⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months ,and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market remains dull. While manufacturers both in this country and abroad are busy and consumption is proceeding at a good rate, there is little buying at the moment. On the other hand, producers are confident that the position of the metal is improving and are not pressing sales. The market has been made chiefly by two or three sellers who have been desirous of moving relatively small lots and by offerings of second-hand lots which increased buying would quickly absorb. An encouraging feature of the week has been some substantial transactions in Lake copper at prices ranging up ot 12¾c. At the close, Lake copper is quoted at 12⅝@12¾c., electrolytic copper in cakes, wirebars and ingots at 12.25@12.35c. Casting copper is quoted nominally at 12⅛@12¼ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 14c. base, carload lots at mill.

The standard market has been quiet but firm. In the absence of any speculation, the turnover has been small. The market closes 7s. 6d. higher than last week, at £55 2s. 6d. for spot, and £55 17s. 6d. for three months.

Exports of copper from New York for the week were 9118 long tons. Our special correspondent gives the exports from Baltimore for the week at 1533 tons.

Tin—Good sized orders placed by American dealers in the London market tended to give the latter an appearance of strength. Prices advanced easily from the low of last week to close at £159 2s. 6d. for spot, and £159 for three months.

In the domestic market, the principal transactions took place among dealers, who took advantage of the lower prices to accumulate some stock. Consumers seem still to be holding aloof. A further lot of 100 tons was reshipped to London. At the close October tin can be bought at about 35 cents.

Exports of tin from the Straits, seven months ended July 31 were: United States, 7819; Great Britain, 19,473; European continent, 3775; China, 122; India, 1076; total, 32,265 long tons. This is a decrease of 2544 tons from last year.

Lead—There has been a somewhat better demand at last prices, 4.40c., New York, and 4.27½@4.30c. St. Louis.

The European market is strong and has advanced to £12 15s. for Spanish lead, and £12 18s. 9d. for English.

At a meeting of the board of directors of the National Lead Company, Wm. W. Lawrence, formerly vice-president, was elected president to succeed the late L. A. Cole. E. J. Cornish, a director, was elected vice-president. M. D. Cole, a son of the late President Cole, was appointed treasurer.

Spelter—The market is quiet but firm. Consumption is good, both in the galvanizing and brass trade, and buyers generally do not appear to be well covered. The market closes at 5.37½@5.40c. St. Louis, and 5.52½@5.55c. New York.

The European market continues strong and it is reported that the metal is becoming scarce. Good ordinaries are quoted at £23 10s., and specials at £23 15s. per ton.

Base price of zinc sheets is $7.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Referring to some recent remarks in the JOURNAL on the subject of special brands of spelter, a prominent smelter informs us that it now finds it impossible to make any brass special out of any Joplin or western ore that does not contain 0.20 to 0.40 per cent. cadmium, 0.30 to 0.80 lead and 0.03 per cent. iron.

The quotation for spelter, good ordinary brands, at London for the week ending June 29, 1910, was given erroneously, by a clerical error, in the JOURNAL of July 2, 1910, as £22 15s. instead of £22 5s., the latter being the correct figure for that date.

Other Metals

Aluminum—The market is dull, with little or no business doing. In the absence of sales, prices are nominally unchanged at 21½@22c. per lb. for No. 1 ingots.

Antimony—There is no change in the market, and business remains on a retail basis. Prices are nominally unchanged at 8¼@8⅜c. per lb. for Cookson's; 7⅞@8c. for U. S., and 7¼@7⅜c. for outside brands.

Quicksilver—Business remains good and prices unchanged. New York quotations are $46 per flask of 75 lb. for large lots; $47@48 for jobbing orders. San Francisco, $45.50 for domestic orders and $2 less for export. The London price is £8 12s. 6d. per flask, with £8 6s. 3d. quoted by second hands.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 500-lb. lots. up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Cadmium—Current quotations are 60@70c. per lb. in 100-lb. lots, f.o.b. New York, according to quality of metal.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 24—The highest price paid for zinc-sulphide ore was $48, the base, $41@45 per ton of 60 per cent. zinc. Zinc-silicate ore sold at $20@24 per ton of 40 per cent. zinc. The average price, all grades of zinc ore, was $39.80 per ton. The highest price paid for lead ore was $56, and the average prices, all grades, was $54.52 per ton.

For the first time in a couple of months zinc ores grading 60 per cent. zinc and better sold on a higher base price than ores under that, the demand for the lower grades dropping very hastily to $41 base and the best ores to a $42.50 base at the week-end.

SHIPMENTS, WEEK ENDED SEPT. 24.

	Zinc, lb.	Lead lb.	Value.
Webb City-Carterville	4,749,020	928,090	$127,625
Joplin	2,095,300	161,020	50,518
Granby	2,186,050	12,900	35,600
Badger	103,280	826,170	24,874
Duenweg	1,014,930	63,630	21,548
Alba-Neck	836,580	.....	19,240
Galena	706,780	85,070	17,181
Miami	462,180	128,390	10,463
Carthage	388,600	.....	8,549
Spurgeon	324,670	80,090	6,808
Aurora	247,310	66,680	5,667
Jackson	261,440	8,410	5,359
Quapaw	250,530	4,660	4,886
Oronogo	210,530	.....	4,162
Sarcoxie	315,990	.....	4,065
Carl Junction	64,600	.....	1,454
Cave Springs	51,450	.....	1,080
Seneca	61,390	3,680	713
Totals	14,330,630	2,368,790	$349,792
9 months	436,849,470	63,683,010	$10,223,899

Zinc value, the week, $285,204; 9 mos., $8,581,480
Lead value, the week, 64,588; 9 mos., 1,642,419

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore.				Lead Ore.	
	Base Price.		All Ores.		All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$41.25	$47.31	$38.46	$45.16	$52.17	$56.99
February	36.94	40.69	34.37	39.47	50.50	53.64
March	37.40	43.60	34.71	39.71	50.82	51.26
April	38.63	41.00	37.01	39.33	55.63	49.72
May	40.06	40.19	37.42	37.51	56.59	48.16
June	44.15	40.20	40.35	37.83	57.52	48.80
July	43.06	39.63	41.11	36.80	53.74	48.59
August	48.25	40.13	44.54	37.32	57.60	49.75
September	47.70	.....	44.87	.....	56.11	.....
October	49.50	.....	45.75	.....	55.02	.....
November	51.31	.....	48.29	.....	53.94	.....
December	49.45	.....	47.57	.....	55.26	.....
Year	$43.98	.....	$41.20	.....	$54.60	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Sept. 24—The base price paid for 60 per cent. zinc ore was

$44@45 per ton; no premium was paid over the base. The base price paid for 80 per cent. lead ore was $52 per ton. The week's ore shipment is the highest on record for this district; the total shipped from the mines was 6,079,685 lb., all grades of zinc ore.

SHIPMENTS, WEEK ENDED SEPT. 24.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	751,270	.....	353,500
Mineral Point	710,730	.....	.....
Galena	660,985	.....	.....
Harker	355,300	.....	.....
Cuba City	336,920	54,610	631,635
Benton	289,920	.....	.....
Highland	180,800	.....	.....
Dodgeville	52,000	.....	.....
Shullsburg	30,000	88,000	.....
Linden	.....	88,410	120,790
Hazel Green	.....	.....	85,900
Total	3,367,925	231,020	1,191,825
Year to date	72,029,690	7,251,924	19,983,650

Shipped during the week to separating plants, 3,764,860 lb. zinc ore.

Other Ore Markets

Iron Ore—Current quotations for Lake Superior ores, on dock at Lake Erie ports, are: Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—$5 per ton for Old Range and $4.75 for Mesabi; nonbessemer—base 51.5 per cent. iron—$4.20 for Old Range and $4 for Mesabi.

In the East there is no organization of sellers, and a wide range of prices exists, according to quantity and location of mines. A good nonbessemer ore, around 50 to 55 per cent. iron, can be had at $3@3.50 per ton, f.o.b. mines; but no general quotations can be given.

Manganese Ore—The base price, as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent. or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess of phosphorus and silica.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, $6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ores, 50c.@$1.50 per unit less.

Zinc Ores—For Rocky Mountain blende, of good quality, especially as to iron and lead content, delivered at Kansas smelting points, the current price is for the zinc content, less eight units, at the St. Louis price of spelter, less $14@15 per 2000 lb. of ore. See also Joplin and Wisconsin ore markets.

Pyrites—Domestic furnace sizes fetch 11@11½c. per unit at mines; fines, 10¾@11c. Pyrites containing arsenic realize from ½@1½c. per unit less. Delivery to Eastern acid works costs from 2 to 3c. per unit more. Most contracts are made f.o.b. mines.

New Caledonia Ores

Shipments of ore from New Caledonia for the six months ended June 30 were 38,859 metric tons nickel ore, 15,240 tons chrome and 800 tons copper ore. June shipments of chrome ore included one cargo, 2095 tons, for New York, direct.

CHEMICALS

New York, Sept. 28—The general market exhibits a slight stiffening in prices although the trading is still comparatively quiet.

Announcement is made of the transfer of the Peyton Chemical Company to the General Chemical Company, of California; and of the removal of the general offices to the Royal Insurance building, San Francisco.

Copper Sulphate—There is a fair market for this article, with quotations firm at $4 per 100 lb. for carload lots and $4.25 for smaller parcels.

Arsenic—There is a slight stiffening in the market. White arsenic is now quoted at $2.37½ per 100 lb. for all positions.

Nitrate of Soda—The West coast of South America and Europe both hold nitrate at firm prices; but there is little trading in New York just now. Prices here are 2.12½c. per lb. for spot nitrate and 2.15c. for futures.

Petroleum

Production reports from various regions, as reported by *Oil and Gas Journal* for the month of August, in barrels of 42 gal. each:

Eastern districts	2,642,544
Illinois	2,572,859
Gulf coast	1,025,983
Oklahoma and Kansas	4,541,318
California	6,743,159
Total	17,525,863

The Eastern districts include New York, Pennsylvania, West Virginia, Kentucky, Ohio and Indiana; Gulf Coast includes southeast Texas and Louisiana.

MINING·STOCKS $

New York, Sept. 28—The general stock market has again been dull and has lost some of the advances made last week. The trading has been mainly of a professional sort and there has been no special tendency, but an evident waiting for something to turn up.

Sales of Homestake, of South Dakota, were reported, at $85.50@86.50 per share.

The Curb was again dull and showed small fluctuations on moderate trading. Jumbo Extension recorded some sales, but the other Nevada stocks were slow. There was some trading in the Cobalts, chiefly in Kerr Lake and Nipissing. In the copper stocks Chino, Keystone and Ray Central were the active ones, but made only small changes.

At auction in New York, Sept. 23, one $1000 bond of the New York, Lake Erie & Western Coal and Railroad Company, brought $1062.50; a lot, including 1,000 shares Trout Lake Copper Company, with several overdue notes, sold at $6 for the lot.

Boston, Sept. 27—This market is one of specialties and a few have done some good stunts marketwise, which has tended to create a better feeling all around. Sentiment is purely optimistic. Trading is largely professional in the mining-share list and almost without significance.

The heaviness of Amalgamated in New York tends to restrict trading, although belief is general that this stock is pretty well controlled by inside interests. Lake Copper had a sharp spurt last week, but

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company.	June.	July.	August.
Arizona, Ltd.	2,802,000	2,910,000	2,620,000
Balaklala	1,226,000	1,100,000	.....
Boleo (Mexico)	2,115,314	2,272,600	2,039,520
Copper Queen	10,219,687	10,730,372	9,426,763
Calumet & Ariz.	2,490,000	2,705,000	2,560,000
Cananea (Mexico)	4,280,000	4,500,000	3,526,000
Detroit	2,017,000	1,800,000	2,100,000
Imperial	800,000	800,000	400,000
Nevada Con.	6,186,832	6,896,429	5,800,000
Old Dominion	2,092,000	2,000,000	2,693,000
Shannon	1,528,000	2,207,000	1,546,000
Superior & Pitts.	2,245,000	2,224,000	2,520,000
Utah Copper Co.	8,358,496	8,677,000	7,440,035
Butte District	23,750,000	23,750,000	23,750 000
Lake Superior	18,000,000	19,000,000	18,800,000
Total production	88,130,329	90,804,411	85,221,318
Imports, bars, etc.	20,817,978	17,714,034	.....
Imp. in ore & matte	5,579,618	6,637,836	.....
Total	114,527,915	115,156,281	.....

Butte district and Lake Superior figures are estimated; others are reports received from companies. Imports duplicate production of Cananea, and that part of Copper Queen production which comes from Nacozari. Boleo copper does not come to American refiners. Utah Copper report includes the output of the Boston mill.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
IX, 1909.	118,023,139	52,105,955	50,077,777
X	124,657,709	66,359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII	117,828,655	69,519,501	59,546,570
Year	1,405,403,056	705,051,591	680,942,620
I, 1910.	116,547,287	78,158,387	81,691,672
II	112,712,493	66,618,322	37,369,518
III	120,067,467	62,844,818	40,585,767
IV	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780

	VISIBLE STOCKS.		
	United States.	Europe.	Total.
IX, 1909.	135,196,930	197,993,600	333,190,530
X	151,472,772	210,224,000	361,696,772
XI	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127
I, 1910.	141,766,111	244,204,800	385,970,911
II	98,463,339	248,236,800	346,700,139
III	107,187,992	254,150,400	361,338,392
IV	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160 425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,817
VIII	170,640,678	222,320,000	392,960,678
IX	168,881,245	218,444,800	387,326,045

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

it was purely a market demonstration and did not hold. U. S. Coal and Oil and American Zinc have been the active features. An early resumption of dividend payments is expected in the former, which has caused an advance to above $40. The stock is largely held by insiders and talk is that dividends will be resumed in December at the rate of 5 per cent. Zinc's advance is due to strength of spelter and the fact that there is a pool in the issue. This stock has a fair distribution.

Trading on the Curb has been of fair volume with Chino the active and strong feature. Nevada-Utah had a spasm of strength in anticipation of some sort of a forthcoming reorganization. Rhode Island Coal begins to show signs of strength.

Assessments

Company.	Delinq.	Sale.	Amt.
American, Ida	Sept. 22	Oct. 15	$0.002
Blackhawk M. & D., Ida	Sept. 26	Oct. 24	0.005
Black Jack Utah	Oct. 17		0.01
Champion Copper, Ida	Sept. 25	Oct. 26	0.002
Columbus Ext., Utah	Oct. 8		0.01
Colusa, Ida	Aug. 27	Oct. 10	0.002
Dalmatia, Ida	Sept. 12	Oct. 4	0.001
Ely Con., Nev		Oct. 10	0.05
Hancock Con., Mich	Oct. 10		1.00
Hypothek, Ida	Sept. 12	Oct. 8	0.005
Little Butte, Ida	Sept. 15	Oct. 13	0.002
Ojibway, Mich	Oct. 1		1.00
Phedora S.-L., Ida	Sept. 15	Oct. 14	*
Reindeer C. & G., Ida	Sept. 9	Oct. 15	0.005
Rhode Island, Ida	Sept. 14	Oct. 14	0.001
Saltese Con., Ida	Sept. 26	Nov. 23	0.001
Savage, Nev	Sept. 21	Oct. 13	0.10
Silver Cliff G. & C., Ida	Sept. 14	Oct. 6	0.002*
Snow Shoe, Ida	Sept. 30	Oct. 31	0.01
Sonora M. & M., Ida	Sept. 5	Oct. 15	0.001*
Union, Nev	Sept. 19	Oct. 19	0.10
Yellow Jacket, Nev	Sept. 15	Oct. 20	0.15

*One-half mill.

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	51.534	23.706	23.794
March	50.468	51.454	23.227	23.690
April	51.428	53.221	23.708	24.483
May	52.905	53.870	24.343	24.797
June	52.538	53.462	24.166	24.651
July	51.043	54.150	23.519	25.034
August	51.125	52.912	23.588	24.428
September	51.440	.....	23.743	.....
October	50.923	.....	23.502	.....
November	50.703	.....	23.351	.....
December	52.226	.....	24.030	.....
Total	51.502	.....	23.706	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER.

	New York.				London.	
	Electrolytic		Lake.			
	1909.	1910.	1909.	1910.	1909.	1910.
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	13.332	13.295	13.719	57.688	59.388
March	12.387	13.255	12.826	13.586	56.231	59.214
April	12.56¼	12.733	12.93¾	13.091	57.363	57.238
May	12.893	12.550	13.238	12.885	59.338	56.313
June	13.214	12.404	13.548	12.798	59.627	55.310
July	12.880	12.215	13.363	12.570	58.556	54.194
August	13.007	12.490	13.296	12.715	59.393	55.733
September	12.870	.....	13.210	.....	59.021	.....
October	12.700	.....	13.030	.....	57.551	.....
November	13.125	.....	13.354	.....	58.917	.....
December	13.298	.....	13.647	.....	59.906	.....
Year	12.982	.....	13.335	.....	58.732	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	28.060	32.700	July	29.125	32.695
February	28.290	32.920	August	29.966	33.972
March	28.727	32.463	September	30.293	.....
April	29.445	32.976	October	30.475	.....
May	29.225	33.125	November	30.859	.....
June	29.322	32.769	December	32.913	.....
			Av. Year	29.725	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	4.613	3.868	4.445	13.313	13.328
March	3.986	4.459	3.835	4.307	13.438	13.063
April	4.168	4.376	4.051	4.225	13.297	12.641
May	4.287	4.315	4.214	4.164	13.225	12.550
June	4.350	4.343	4.291	4.207	13.031	12.688
July	4.321	4.404	4.188	4.291	12.563	12.531
August	4.363	4.400	4.227	4.290	12.475	12.513
September	4.342	.....	4.215	.....	12.781	.....
October	4.341	.....	4.215	.....	13.175	.....
November	4.370	.....	4.252	.....	13.047	.....
December	4.560	.....	4.459	.....	13.125	.....
Year	4.273	.....	4.153	.....	13.049	.....

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

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	5.569	4.739	5.419	21.562	23.188
March	4.757	5.637	4.607	5.487	21.438	23.031
April	4.965	5.439	4.815	5.289	21.531	22.469
May	5.124	5.191	4.974	5.041	21.975	22.100
June	5.402	5.128	5.252	4.978	22.000	22.094
July	5.402	5.152	5.252	5.002	21.969	22.406
August	5.729	5.279	5.579	5.129	22.125	22.800
September	5.796	.....	5.646	.....	22.906	.....
October	6.199	.....	6.043	.....	23.200	.....
November	6.381	.....	6.231	.....	23.188	.....
December	6.249	.....	6.099	.....	23.094	.....
Year	5.503	.....	5.352	.....	22.201	.....

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

PRICES OF PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$17.18	$19.90	$16.40	$17.96	$16.26	$17.94
February	16.73	18.96	16.09	17.21	15.90	17.38
March	16.40	18.53	15.84	16.93	15.62	17.00
April	15.79	18.28	15.05	16.84	15.06	16.75
May	15.77	17.10	15.02	15.94	15.08	16.18
June	16.13	16.52	15.84	15.60	15.63	15.53
July	16.40	16.40	15.90	15.40	15.96	15.40
August	17.16	16.09	16.17	14.89	16.20	15.16
September	18.44	.....	16.80	.....	17.03	.....
October	19.75	.....	17.84	.....	18.02	.....
November	19.90	.....	18.37	.....	18.09	.....
December	19.90	.....	18.15	.....	17.90	.....
Year	$17.46	.....	$16.46	.....	$16.40	.....

STOCK QUOTATIONS

COLO. SPRINGS Sept. 27

Name of Comp.	Bid.
Acacia	.05⅞
Cripple Cr'k Con.	.02⅝
C. K. & N.	.17¼
Doctor Jack Pot	.10
Elkton Con	.74½
El Paso	.85
Fannie Rawlins	‡.05½
Findlay	.08
Gold Dollar	.14¼
Gold Sovereign	.03⅜
Isabella	.18½
Jennie Semple	.10½
Lexington	.01½
Moon Anchor	.03⅜
Old Gold	.04⅞
Mary McKinney	‡.53
Pharmacist	‡.02⅝
Portland	1.05
Vindicator	.92
Work	.04

SALT LAKE Sept. 27

Name of Comp.	Bid.
Bingham Copper	.15
Carisa	.15
Colorado Mining	.32
Columbus Con	.39½
Daly Judge	4.25
Grand Central	1.05
Iron Blossom	.71
Little Bell	‡1.10
Little Chief	‡.22
Lower Mammoth	.11
Mason Valley	8.25
Maj. Mines	‡.53
May Day	.05½
Nevada Hills	2.40
New York	‡.13
Prince Con	.59
Silver King Coal'n	2.10
Sioux Con	.26
Uncle Sam	.22
Victoria	‡1.07½

SAN FRANCISCO. Sept. 27.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	‡.10
Belcher	.55
Best & Belcher	.35
Caledonia	.30
Challenge Con	.20
Chollar	.12
Confidence	.50
Con. Cal. & Va	1.00
Crown Point	.60
Gould & Curry	.11
Hale & Norcross	.25
Mexican	1.02½
Occidental	.42
Ophir	1.07½
Overman	.50
Potosi	‡.40
Savage	.20
Sierra Nevada	.16
Union Con	.34
Yellow Jacket	.50

Name of Comp.	Bid.
MISC. NEV. & CAL.	
Belmont	4.30
Daisy	.03
Jim Butler	.27
MacNamara	.27
Midway	.20
North Star	.05
West End Con	.54
Atlanta	.11
Booth	‡.10
C.O.D. Con	‡.17
Comb. Frac	.38
Jumbo Extension	.63
Oro	.06
Red Hill	.03
Silver Pick	.09
St. Ives	‡.16
Tramps Con	.04
Argonaut	‡1.00
Cent. Eureka	‡.97
So. Eureka	‡7.00

N. Y. EXCH. Sept. 27

Name of Comp.	Clg.
Amalgamated	61⅝
Am. Agri. Chem	‡44
Am.Sm.&Ref.,com	66¼
Am. Sm. & Ref., pf.	‡103⅞
Anaconda	‡39
BethlehemSteel pf	‡58
Col. & Hock. C. & I.	‡3¼
Federal M. & S.	‡56
Coldfield Con.	8⅞
Great Nor., orectf.	55¾
Homestake	86½
Nat'nalLead,com.	52
National Lead, pf.	‡103
Nev. Consol.	19⅝
Pittsburg Coal	17
Republic I&S,com.	31½
Republic I & S, pf.	92⅝
SlossSheffi'd,com.	55¼
Sloss Sheffield, pf.	‡116
Tennessee Copper	31½
Utah Copper	45⅛
U. S. Steel, com	67⅞
U. S. Steel, pf.	116¾
Va. Car. Chem	58¼

N. Y. CURB Sept. 27

Name of Comp.	Clg.
Ariz.-Cananea	4⅛
Barnes King	‡⅛
Bonanza Creek	‡3
Braden Copper	3⅛
B. C. Copper	5⅜
Buffalo Mines	2⅛
Butte Coalition	18⅜
Caledonia	⅝
Calumet & Mont.	.89
Canadian Mines	6¾
Chino	18⅛
Cobalt Central	6
Con. Ariz. Sm.	1⅛
Davis-Daly	2⅛
Dolores	5⅛
Dominion Cop	7
Ely Con	.30
El Rayo	3⅛
Florence	2⅞
Giroux	6⅛
Greene Cananea	6⅞
Guanajuato	‡1⅛
Guerrero	1⅛
Guggen. Exp	180
Kerr Lake	6¼
La Rose	3⅛
McKinley-Dar-Sa.	.97
Miami Copper	19⅜
Mines Co. of Am.	57
Mont. Shoshone	‡.37⅛
Mont.-Tonopah	‡.92
Nev. Utah M. & S.	⅞
Nipissing Mines	11
Ohio Copper	1⅛
Pacific Sm. & M.	⅛
Precious Metals	1⅞
Ray Central	2⅛
Ray Con	18⅛
South Utah M.&S.	1⅞
Standard Oil	600
Stewart	⅛
Tonopah	⅛
Tonopah Ex	1.05
Tri-Bullion	⅛
Union Mines	⅛
Yukon Gold	3⅛

LONDON Sept. 28

Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	1 12 6
Esperanza	2 10 0
Tomboy	0 16 3
El Oro	1 7 0
Oroville	0 7 0
Mexico Mines	8 0 0

BOSTON EXCH. Sept. 27

Name of Comp.	Bid.
Adventure	5
Allouez	‡40
Am. Zinc	27½
Arcadian	5
Arizona Com	16¾
Atlantic	‡6
Boston Con	‡18
Bonanza	.50
Boston & Corbin	13¾
Butte & Balak	5¾
Calumet & Ariz	57¼
Calumet & Hecla	543
Centennial	‡15¾
Con. Mercur	6
Copper Range	65
Daly-West	3
East Butte	7
Franklin	10¼
Granby	31
Hancock	19½
Helvetia	2⅜
Indiana	14
Isle Royale	20¾
Keweenaw	3½
Lake	33½
La Salle	9½
Mass	7½
Michigan	4
Mohawk	46½
Nevada	19⅝
North Butte	25½
North Lake	‡8½
Ojibway	‡5
Old Dominion	35½
Osceola	125
Parrot	12½
Quincy	70
Shannon	9⅝
Superior	48½
Superior & Bost	7⅞
Superior & Pitts	11
Tamarack	58
Trinity	5¼
U. S. Mining	‡38
U. S. Mining, pf	48½
Utah Apex	‡3¼
Utah Con	22½
Victoria	2½
Winona	7
Wolverine	115
Wyandot	1½

BOSTON CURB Sept. 27

Name of Comp.	Last.
Ahmeek	185
Bingham Mines	‡2½
Boston Ely	1⅜
Boswyocolo	‡.08½
Cactus	1½
Calaveras	10¾
Champion	.09
Chemung	‡8½
Chief Cons	1¾
Cons. Ariz	1⅛
Corbin	5
Crown Reserve	2¾
First Nat. Cop	3¾
Inspiration	7⅞
Mackinaw	.42
Majestic	.52
Nat'l Mine	.06
Nevada-Douglas	2
Oneco	2⅛
Raven Copper	.35
Rhode Island Coal	6¾
San Antonio	‡6
Shattuck-Ariz	‡21
South Lake	7¾
Superior & Globe	‡.15
Trethewey	‡1⅜
Tuolumne Copper	3⅛
Vulture	9⅝
Yuma	.37

‡Last quotation.