

## THE GOLD ZONE OF COPALQUIN, MEXICO.—II. COPALQUIN.\*

Written for the Engineering and Mining Journal by Frank B. Fowler.

Copalquin takes its name from the abundance of "copalquin" or quinine trees found there, this tree, or rather bush, being none other than that of Peru. The natives, as well as foreigners, resort to an infusion of its bark for all the ills that quinine cures or remedies, and thus save drug bills. The town of Copalquin lies to the northeast of San Fernando, about 15 miles as the crow flies, but it is a day's hard riding, or a day and a half ordinary travelling from the latter place owing to the broken, rugged condition of the country. Its geological peculiarities are similar to those of San Fernando, its physical ones being, however, more pronounced as to general roughness.

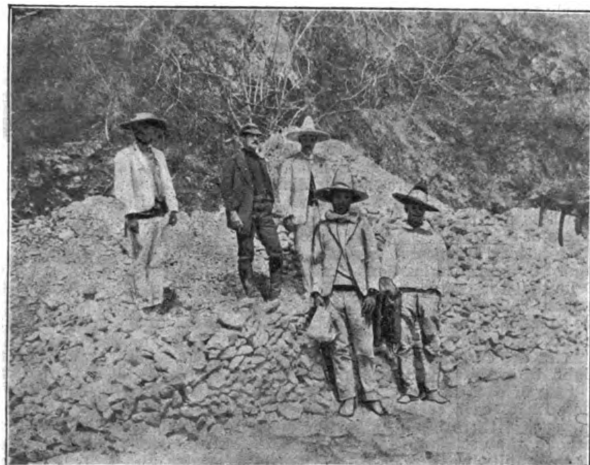
For a very complete description of the geological features of this region, reference is here made to the elaborate report made to the Mexican Government in 1896 by Mr. Ramon Felix y Buelna, a Mexican mining engineer, metallurgist and geologist, and member of the Geological Commission of the Republic of Mexico. He was so

la Rocha, and which is now in bonanza, being one of the richest producers at present worked in this district.

The Refugio Mine was discovered in 1849, one year after the camp was discovered, and is celebrated as having been the largest producer in this section. The output has been a phenomenal amount of bullion produced during the bonanza period of our own California, and is currently reported to have exceeded \$1,000,000 in auroche, or alloy of gold and silver. It is impossible to give the exact figures, as some of the mint records are lost, and some of the bullion stolen and "dissipated."

The principal values extracted were in gold, notwithstanding the then high price of silver in the market. The ore was free milling, and was treated in "tajonas" (arrastras moved by horizontal water wheels of primitive construction), and by this crude method yielded (according to data) as high as 720 lbs. avoirdupois of "auroche" during two months' run, which is said to have been for a time the average output, the richest ore yielding 2,000 oz. per ton, and the lowest grade milled 4 oz. silver and 1 oz. gold per "carga" (300 lbs.).

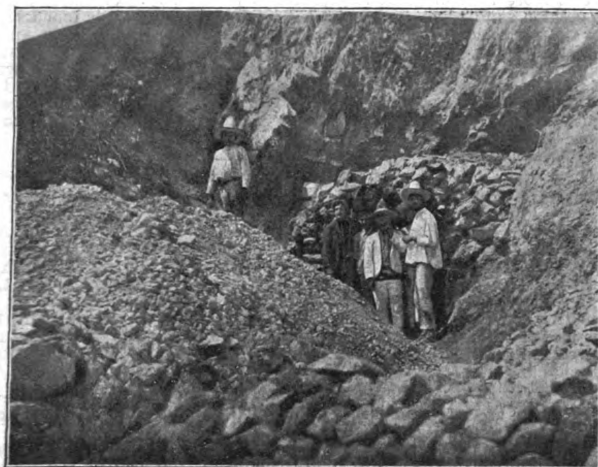
In March, 1897, Copalquin was visited by the Messrs. Alfredo B. Adams and G. Byron Daniels of Chicago, Ill., which visit resulted in the organization in July of that year of the Copalquin Consolidated Mines Company, Limited, under the laws of the State of New Jersey, and the acquirement of its present consolidated interests. In October,



ORE DUMP, EL REFUGIO MINE, MEXICO.



A GROUP AT COPALQUIN, MEXICO.



ENTRANCE TO UPPER TUNNEL, EL REFUGIO MINE.



PART OF COPALQUIN CAMP, MEXICO.

favorably impressed with Copalquin as a mineral region that he has located there, and engaged in mining on his own account.

Within the limits of the territory which may be denominated the Copalquin Mining Camp, and embracing the village of Limon, are located the three groups of mining properties owned by the Consolidated Copalquin Mines Company, Limited, or its principals in interest. These groups, the Copalquin, Limon and Soledad, comprising at present 14 different properties, lie within an area of 7 by 2 miles, and in close proximity to the Copalquin Creek and Limon River, which water the camp.

Development work by this company has been mainly confined to El Refugio Mine, although more or less prospect work has been done on some of its other properties, and on others there are old workings of considerable extent, made in former years by native owners in their search for and extraction of bonanza ores.

The Refugio property consists of 150,000 sq. meters, situated in the center of the group of mines owned by the company. It is joined by La Lena Mine, also belonging to the company, which, in turn, adjoins La Soledad Mine, which latter is the property of Mr. Remedios de

1897, the work of systematic development upon the Refugio Mine was begun by the company, and prosecuted up to the present time.

The mine is located 350 m. above the Copalquin Creek and 1,130 m. above sea level, and its plan of development is that of self-draining tunnels.

The workings of El Refugio consist of 534 ft. of tunnels, 139 ft. cross-cuts, 746 ft. levels, 218 ft. drifts, 562 ft. winzes, and 400 ft. old drifts, etc., besides a large amount of irregular workings where rich pockets of ore have been taken out by previous owners. There is about 50,000 tons of ore in sight in this mine, which, according to exhaustive milling tests, show 12½ oz. silver and 1 oz. gold per ton.

The process of treatment provided for is continuous, and consists in wet crushing, amalgamation in the batteries by means of chuck-block plates, and concentration of the pyrites and silver sulphides upon Frue vanners and Wilfley tables.

The plant now being installed comprises 20 stamps in four batteries, 2 crushers, 7 vanners, and Pelton water wheels. Its capacity will be about 75 tons per day. It was supplied complete by the Gates Iron Works, of Chicago, and is of the most modern and approved type in every detail.

\*See "Engineering and Mining Journal," February 24th, 1900, page 225.

The location of the plant as to its natural advantages of space, configuration of ground, etc., both for present and future operations on an enlarged scale, seems to leave nothing to be desired, the site being formed by a bench lying along the hill point which divides the Copalquin and Limon streams.

The company controls the water rights for adequate distances from this point on both these streams, and is thus assured of an ample water supply for all future requirements of power, milling, etc., while an unlimited supply of pine, oak and other woods is found in the surrounding mountains, much nearer and less difficult to obtain than in San Fernando, and abundant pasturage for animals. Oranges, lemons, bananas, peaches and apples grow here, in the order indicated as one ascends.

The present plans of the company include the development of the water power on the Copalquin Creek, where, within a distance of 3,000 meters, a head of 200 meters is obtainable with water at a minimum, to supply 300 H. P. On the Limon River may be developed a still greater power, which, however, will not be needed for the present.

Also, there is included the construction of an automatic cableway  $2\frac{1}{2}$  miles in length, for the transmission of the ore from the mines to mill. This gravity cableway is designed to handle not only the present and future output of El Refugio, but also that of the company's other mines, which may be connected with it as desired, in future operations.

The mine is also being prepared for the introduction of tram cars, which will deliver the ore by an easy down grade to the cableway at the main tunnel entrance, and apparently for years to come this mine may be worked by self-draining tunnels, without any necessity for the use of pumping or hoisting machinery.

The company is registered with the New Jersey Registration & Trust Company of East Orange, N. J., which is also the transfer agent for its shares. The capitalization is \$1,000,000, divided into 2,000,000 full paid and non-assessable shares, which are not listed by any stock exchange nor placed upon the market.

The officers are: Mr. Alfredo B. Adams of Chicago, Ill., president and general manager; Sr. Atanasio de la Rocha of Copalquin, Durango, Mexico, vice-president; and Mr. G. Byron Daniels of Chicago, Ill., secretary and treasurer; these gentlemen, with two others, constituting the board of directors.

The efforts of Messrs. Adams and Daniels have been continuously devoted to the interests of the company from the start, and to these, and especially to Mr. Adams' intelligent management in the Republic, are due the present success and very satisfactory status of its affairs.

In addition to the improvements above mentioned as being made by this company, is the erection of substantial buildings for business offices, assaying, storage and living quarters for accommodation of its officers and expert employees; also the construction of over 5 miles of good roads.

The present force consists of about 150 natives employed in both mining and construction departments, under the direction of Sr. R. Felix y Buelna, above mentioned, who also acts as the company's consulting engineer and superintendent, assisted by a corps of 5 experts in mining, milling and mill construction, the whole having the personal supervision of the general manager, Mr. Adams.

Besides the properties enumerated above, there are many others, being worked, however, in a most primitive way, and only the rich pockets being exploited.

Ten years ago an American company was in possession of all these properties, but did not seem to appreciate the value of its possessions, allowing them to go by the board, and fall into the hands of the Messrs. Rocha, who have made themselves wealthy thereby. Sr. Remedios de la Rocha is one of the few millionaires in the State of Durango. Atanasio de la Rocha, his son, and vice-president of the above-mentioned Consolidated Company, is also quite wealthy. Another son, Erasmo de la Rocha, is owner of a rich silver and gold mine between San Fernando and Copalquin. A brother of Remedios—Jose Maria de la Rocha—sold to its present owners the fine San Fernando property. Some of this wealth was inherited, but most of it was derived from the mines of this zone.

#### THE ELECTROLYTIC DETERMINATION OF COPPER.\*

By William E. Grainger.

The methods here described are those used in the laboratory of the Ducktown Sulphur, Copper and Iron Company, Limited. In this laboratory there are used three of the best known methods for estimating copper—the electrolytic, the colorimetric and the cyanide, the former being used in all important cases; the others, merely in furnace control work.

There is apparatus for making 10 electrolytic determinations at one time. This apparatus is very simple, consisting of 10 coils of platinum wire, as anodes, and 10 platinum cylinders, as cathodes, supported by an insulated rack in such a way that one cathode and one anode may be placed in each solution to be electrolyzed. As the copper in the solution is to be deposited on the cathodes, they should be perfectly clean and bright and the weight of each should be carefully ascertained before each determination. The weight of the cathode subtracted from the weight of the cathode plus the copper, will give the amount of copper deposited, and from this is calculated the percentage.

In the preparation of samples, different methods are used. Mattes and unroasted (or green) ores are ground and passed through a 60-mesh sieve, while in the case of roasted ores and slags an 80-mesh sieve is used. In many cases the dissolving of the sample is by far the most difficult part of the operation. Samples of matte, green ore and chilled slag are very readily attacked by acid, but with roasted ores the task is not so easy, from the fact that some of the oxides formed during the roasting are almost insoluble in acids. However, experience has shown that, if the samples are put through an 80-mesh sieve and then given a long treatment with aqua regia, all the copper will be dissolved out. We have tested this point time and again by fusion of the insoluble residue and testing for copper, very seldom even a trace being found.

\*Abstract of paper in the "Record" of the University of Tennessee.

As samples, one-half gramme matte and one gramme of slag and ores are used—the treatment in all cases being nearly alike, excepting the amount of acids and the order in which they are added. One very important point in all electrolytic work is to keep the volume of the solution small. For instance, the following directions are observed in the case of mattes: After weighing the sample into a small beaker, slightly dampen it with distilled water; cover the beaker with a watch glass and add 7 c. c. of nitric acid. When the violent action has ceased, add 3 c. c. of hydrochloric acid and boil down nearly to dryness. Cool, add 7 c. c. of sulphuric acid and again heat carefully, with occasional shaking, until choking white fumes appear, indicating that all the nitric and hydrochloric acids have been expelled and the sulphuric acid is being driven off. Cool, add about 20 c. c. of water and heat again to dissolve the soluble sulphates. The solution, still hot, is now filtered to remove all sulphur, silica and insoluble residue, the filtrate being retained in a No. 2 beaker, its volume being from 100 to 150 c. c.

In the case of slags, after weighing the sample, cover it in the beaker with about 10 c. c. of water, and boil vigorously for 3 or 4 minutes. This treatment aids very materially in obtaining a clean, white silica. Add 10 c. c. of nitric acid and 7 of hydrochloric acid, in the order given, boil nearly to dryness, and add 7 c. c. of sulphuric acid. Complete the treatment as given for mattes.

With roasted ores a long treatment is necessary, from 10 to 15 c. c. each of nitric and hydrochloric acid being added, and slowly boiled down nearly to dryness before the sulphuric acid is added. The treatment for green ores is exactly like that for slags, except that the hydrochloric acid is added first, thus getting rid of much of the sulphur as hydrogen sulphide.

As has been before emphasized, in filtering the solutions great care should be taken in keeping the volume of the filtrates small and still washing the filter papers thoroughly. The larger the solution the longer the current of electricity must pass to do its work. After filtration, the solutions are made neutral with ammonia in order to get rid of the excess of acid. When 2 c. c. each of nitric and sulphuric acid are added, the solutions are thoroughly mixed and are ready for electrolysis. In regard to the neutralization of the solutions with ammonia, some writers claim that the presence of ammonium salt retards the deposition of the copper. This may or may not be the case. However, results at Ducktown are so much more satisfactory that we can afford to waste a little time in this way.

After the current has been passing through the solutions during the night, in order to find whether or not the copper is all deposited, the volume of each is increased slightly, thus exposing a fresh portion of the stem of each cathode to the action of the current. At the end of an hour, if there is no deposit of copper on the bright portion of the cathode, the deposition may be considered complete. The cathodes are now carefully washed in three changes of water and two of alcohol, the last being quickly burned off in the flame of a spirit lamp, in order to dry them thoroughly. When they have cooled to the temperature of the room, they are weighed.

One more item of great importance is the battery. Chemists differ in opinion as to which is the best one to use. However, it is found that for regular service (from 3 to 5 nights out of the week) the Bunsen is by far the most satisfactory. It is a little more expensive and, perhaps, more troublesome than some others, yet it has advantages in the way of rapidity and economy of space which amply compensate for the extra expense and trouble. Two Bunsen cells will complete a set of 10 determinations in from 16 to 18 hours, where each sample does not contain more than 5 grms. of copper.

**THE ONTARIO GOVERNMENT ASSAY OFFICE.**—The statement of laboratory work done at the Ontario Government assay office, located at Belleville, which is conducted by the Bureau of Mines as an aid to discovery and development of mineral lands in Northern Ontario, shows a total receipt of 60 samples sent in for examination during the month of April. The laboratory made 91 determinations during the month for the public, consisting of 40 for gold, 14 silver, 12 copper, 3 nickel, 3 lead, 3 zinc, etc. Seven iron ores for partial or complete analysis as to smelting quality were received from Eastern Ontario. Four samples for identification or report as to probable commercial value were received and reported on at a nominal charge.

**RUSSIAN OIL IN GERMANY.**—The London "Petroleum Review" says: "We are informed that the firm of Nobel has lately entered into arrangements with Rothschilds for the joint distribution of their oil in Germany. From statistics given we have seen that whereas the import of American oil into the United Kingdom has considerably decreased, the import of the same oil into Germany shows an increase. The reason for this is that during the last few years the Americans have practically monopolized the German market, in spite of the competition which has existed. Now, however, that the German Government has shown a desire to break down this monopoly and has offered various facilities to Russian producers in the way of reduction of railway rates, etc., it may be expected that in the near future Russian oil trade will make considerable progress in Germany."

**GOLD IN QUANTUNG, CHINA.**—United States Commercial Agent R. T. Greener writes from Vladivostok that the reports that an engineer had discovered unusually rich gold mines in the Quantung Peninsula, and that Port Arthur itself stood on ground unusually rich in auriferous deposits are greatly exaggerated. The mining engineer, Bagdanovich, sent to Quantung by the Ministry of Government Land and Property, has prospected in that region, but the results are not as yet officially published. It is known here, however, that he proved the presence of gold in the sea beach, placer land, and in quartz veins. Mr. Greener thinks that "it is rather early to say anything definite, but there is no doubt that there is gold in the Quantung, for the administration has taken the precaution to establish a strict guard, and has prohibited mining until further orders are received from the Ministry of Agriculture and Government Property."