

THE COCHITI DISTRICT, NEW MEXICO.

Written for the Engineering and Mining Journal by W. C. Wynkoop.

The Cochiti District, New Mexico, is a comparatively new mining district, situated in a direct line 35 miles due west from Santa Fe, in the Jemez range of mountains. The mines are located on the eastern slope, at an elevation ranging from 7,500 to 8,000 ft. The known good-ore bearing veins are confined to an area about 3 by 4 miles in extent, though veins, which, so far as known, are barren of good ore, are found on every side outside of the small producing area. Three parallel canyons about $1\frac{1}{2}$ miles apart, having a general range slightly west of north, extend through the district. They are from 500 to 800 ft. in depth, and are bounded by vertical cliffs or precipitous sides. The topography gives good opportunities to study the geology of the region. All the country is volcanic, and the prevailing rock is porphyritic andesite. In few places is it undisturbed; generally it is brecciated or a conglomerate. Nowhere in the region are the underlying rocks visible; local authorities say the overflow took place at about the close of the Jura-Trias; Bandler says the underlying rocks are Cretaceous, but I am inclined to think, without any other basis for the opinion than their correspondence with the similar and near-by rocks of the San Juan Region in Colorado,

The dikes are generally of a soft, gray acid porphyry, with occasionally one of diorite or trachite. Following the first period of dike formation there was a second one, the dikes of that period following the first and adjoining or cutting them. The second series are smaller than the first, and are composed, so far as I have seen, of basalt, or phonolite. Running parallel to and within a few feet of the main dikes are many small veins of white quartz, barren of ore. The largest dikes are about 100 ft. in width, narrowing in places to a few feet and again widening to more than 100 ft. All of them throw off spurs running at acute angles to the main dike and extending hundreds or even thousands of feet. The ore is entirely a replacement of the dike material. In some places the replacement has been complete, and in others partial; in the latter the replacement may have been all adjoining one wall, or in streaks or pockets or bodies anywhere in the vein. Porphyry "horses" are found in all the workings, and frequently chunks of quartz will be found to have a core of porphyry around which the ore is deposited in streaks, forming handsome samples of banded structure.

The quartz deposits are peculiarly characterized by fracture planes (having no better name for them) parallel and from a few inches to a couple of feet apart, which run almost at right angles to the strike of



PERALTA CANYON, COCHITI DISTRICT, N. M.



COLLA CANYON, COCHITI DISTRICT, N. M.

that they are Tertiary; this, too, is the age ascribed to them by the ethnologists, who are just now deep in a discussion trying to demonstrate that man lived on earth during the Tertiary age, basing their claims on evidence of human work found in volcanic rock in this region.

There are at least two volcanic overflows here; the older one is the andesitic, and it is in this only that the veins are found. The younger one, covering the andesite, is tufa, and is very modern. It is in this that evidences of human life are claimed to have been found. The ethnologists, I think, have made an error by ascribing this later rock to the wrong age. Among other evidences of the late deposition of the tufa is the fact that it is found covering old water channels, filled with water-worn boulders and ore float, clearly derived from the disintegration of the andesites and their accompanying rocks.

In the upper, or portion of the district nearest the range, the tufa has been mostly eroded, but in lower portions it still caps some of the mountains, covering the veins which outcrop on the mountain sides below. After the deposition of the andesite the country was faulted and fractured, and dykes were formed, and there were considerable changes of elevation, while denudation formed deep sedimentary deposits, which extend easterly to the Rio Grande River, 15 miles distant. The periods of elevation were gradual and extended over long periods of time, until a late one, which was probably contemporaneous with the tufa overflow, which was rapid, as geological time is measured.

the veins. Sometimes these planes form very distinct boundaries to the ore. Rich or pay ore will be cut off by them, the rock adjoining being barren; at the next, or some other plane, the ore may reappear as suddenly as it disappeared. These barren spots sometimes extend for a 100 ft. or more. Practically all of the ore of the district carries from 85 to 95 per cent. silica. Silicious rocks characterize the entire region. Opals (mostly wood, but occasionally a precious one), chalcedony and brilliant but small quartz crystals are abundant.

Analysis of the ore shows it to be an arsenical pyrite, though the amount of sulphur and arsenic present is very small, generally 1 to 2 per cent. of the former, and from a trace to 0.5 per cent. of the latter. Copper and lead are found only in traces. Manganese is occasionally plentiful, but does not appear to be a constituent of the good ore. Antimony is more rarely found, and is always an accompaniment of high values. The ore of smelting grade, ranging in value from \$30 to \$50 or more per ton, is generally found in lenticular bodies, extending longitudinally from a few to 100 ft. or more, and vertically the same distances. These pay streaks vary in thickness from a few inches to 10 ft., and are often so solid that the ore requires no sorting. Generally the low grades are formed by the dissemination of specks of high grade through an otherwise practically barren quartz.

All of the ores carry gold and silver, the relative proportions varying in different properties. On the vein which I have been developing the values are 60 per cent. silver (valuing it at 60c. per oz.), and 40 per cent.

gold, though it is not unusual to find places where the value is almost entirely gold. In a few properties gold largely predominates. The quartz, as might be expected from its composition, is exceedingly hard and costly to drill, but as a rule it breaks big, and the deposits are so large that it can be mined cheaply, notwithstanding the difficulty in drilling. Its hardness is less of a difficulty in mining than in milling, where, in crushing, it becomes a great consumer of steel. Most of the veins outcrop prominently, occasionally forming cliffs of quartz from 20 to 50 ft. high.

The Albemarle Mine, belonging to the Cochiti Gold Mining Company, is the best developed mine in the camp. It has reached a depth of little less than 700 ft., and is opened by seven levels extending and opening the vein for 1,000 ft. The width of the vein above the sixth level varies from 40 to 65 ft. Almost the entire dike material for about 800 ft. longitudinally and from the third to the sixth level is replaced with quartz, averaging about 40 ft. wide. I am told by the manager at the mine that it will average \$7.50 per ton. On the seventh level the vein has narrowed to from 10 to 20 ft. between walls, and it is said the ore has increased in richness. The company has a cyanide mill erected at the mine with a daily capacity of 300 tons. It is constructed entirely of steel and iron, and was erected by the Gillet-Herzog Manufacturing Company, of Minneapolis, Minn. The sizes of the buildings are: Crushing building, 76 by 100 ft.; engine and boiler room, 40 by 62 ft.; one leaching room, 68 by 112 ft., one 60 by 174 ft., and one 42 by 70 ft. The ore, when dumped into the mill passes over grizzlies, the fine stuff being crushed in Huntingtons to 50 mesh and treated in Pelatan-Clerici pans. There are three 6-ft. Huntingtons and eight Pelatan-Clerici pans in use. The crushing machinery consists of two Blake 9 by 15-in. rock breakers, four sets of rolls 16 by 36 in., four sets 12 by 20, furnished by the E. P. Allis Company, of Milwaukee, and two sets 16 by 36 in., furnished by the F. M. Davis Iron Works, of Denver. The ore is screened to 24 mesh. In the leaching rooms there are 12 round iron tanks, 25 ft. diameter, with capacity of 120 tons each; 8 rectangular tanks, 25 by 30 ft., with a capacity of 200 tons each; 6 round wooden tanks, 18 ft. diameter, with a capacity of 70 tons each. The depth of each of the tanks is 6½ ft. The saving is reported to be about 80 per cent. of the total values.

The mine is equipped with an electric plant, both mill and hoisting works being operated by electric motors. The dynamos are located at the Madrid coal banks, 31 miles distant. The plant does not work well, giving almost daily trouble; this is the common report. Water power in abundance is found on the Rio Grande River, 11 miles distant in a direct line, but after investigating it Mr. F. W. Hart, the engineer who erected the plant, decided to use steam instead of water to furnish the initial power.

The Lone Star, at Bland, is the next best developed mine in the district. It is opened by adit levels for about 1,000 ft., and to a depth of 800 ft. below the highest outcrop. A cross-cut tunnel, 1,000 ft. long, has just been completed to the vein. The mine has blocked out approximately 150,000 tons of ore, having an average value of about \$8 per ton. This property has shipped about \$60,000 worth of ore carrying \$40 per ton. The vein varies in width from 50 to 100 ft.

The Washington adjoins the Lone Star on the south. It has been opened by a shaft to a depth of 300 ft., and has some hundreds of feet of levels. It has shipped several carloads of ore containing over \$100 per ton, and has considerable ore in sight, though not blocked out, which samples from \$10 to \$20 per ton. The mine belongs to an Albuquerque company, and is not worked.

The Crown Point is situated about ½ mile to the north of the Lone Star, and is generally believed to be a spur from the great vein. It is opened by a shaft approximating 300 ft., with several hundred feet of levels. The vein varies in width from 3 or 4 to 10 ft. The ore is found in pockets rather than lenses. The values are mostly gold. It has shipped probably \$75,000 worth of ore, and has considerable in sight which samples from \$8 to \$20 per ton.

The Iron King, adjoining the Lone Star on the north, is the first discovery in the district. From a great cliff, forming a quarry where the discovery was made, 102 tons of ore were shipped which sampled \$14.40 per ton. The mine is developed by some hundreds of feet of adit levels and a shaft 100 ft. deep from which levels are now running.

These are the only developed properties in the district, though there are many prospects having 100 ft. or less development. Some of these show ore samples from \$8 to \$20 per ton. In two of them the values are almost entirely gold, which amalgamates well.

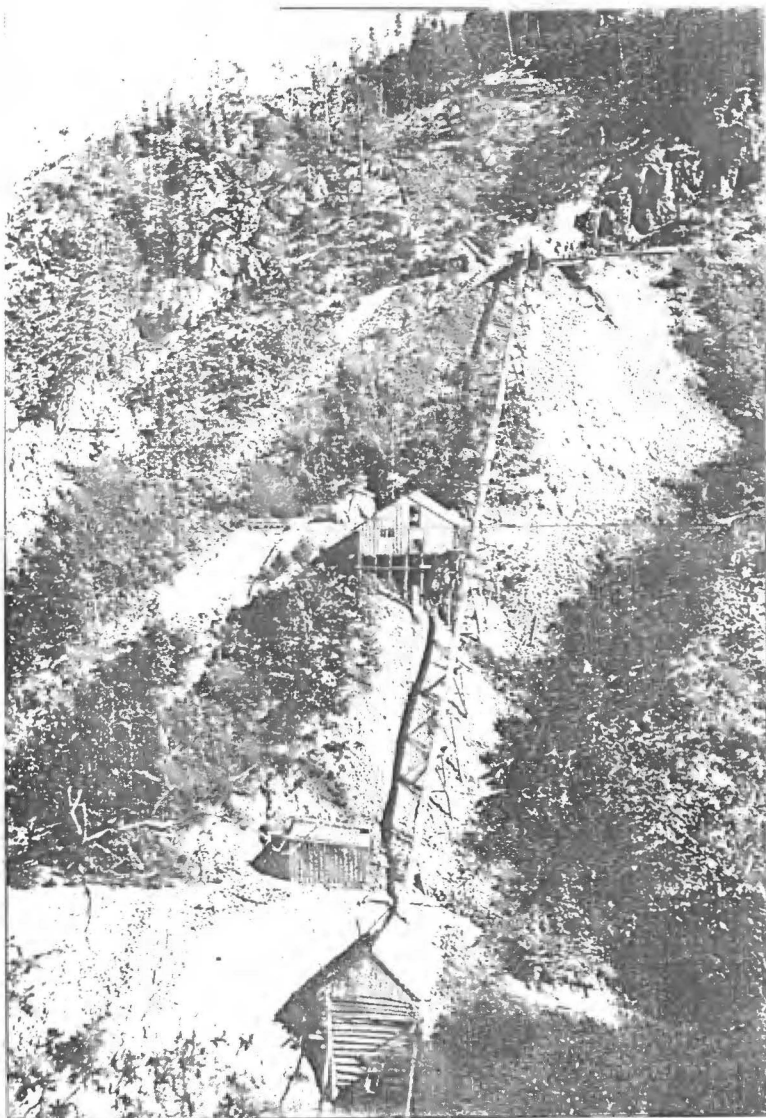
At Bland, the principal town of the district, there is a small mill with 10 stamps, two Pelatan-Clerici pans and a couple of leaching tanks. It was erected and run as a stamp mill some years ago, with poor results, and has passed through various process changes. It has lately been purchased by the Navajoe Mining Company, the owner of the Lone Star, and has been used by it as a test mill to determine the best method of treating the ore. This company announces that it will this year erect a cyanide leaching mill, with a daily capacity of 300 tons, crushing wet with stamps, using the Butters-Mein distributors, following the South African practice. It is claimed that their tests show a saving of 90 per cent.

The Cochiti Reduction and Improvement Company, operating the Iron King, had a mill at Woodbury, 6 miles below Bland, until a few days ago when it was destroyed by fire. It was a pan amalgamation mill, developed from a process plant erected on the ground in 1894, which proved a failure. It fell to my lot to work out a plan for utilizing it, which I did by a plant that, so far as I know, has not been used elsewhere. Treating the ore by raw amalgamation I was able to save upward of 70 per cent., treating it after roasting the saving was considerably better. The plan developed was to crush to 30 mesh in rolls, pulverize in Alsing continuous feed and discharge cylinders to 100 mesh, when it was charged into ordinary 5-ft. combination pans. The charge was 2 tons to the pan. Twelve pounds of sodium chloride were added to the charge, steam turned in and the charge run thick. Caustic soda was added until the reaction was alkaline, when 150 lbs. of quicksilver were added. In a few minutes 2 lbs. of potassium cyanide were added, and an electric current turned on. A low amperage dynamo was used, iron forming the anode and the quicksilver the cathode. All ores were

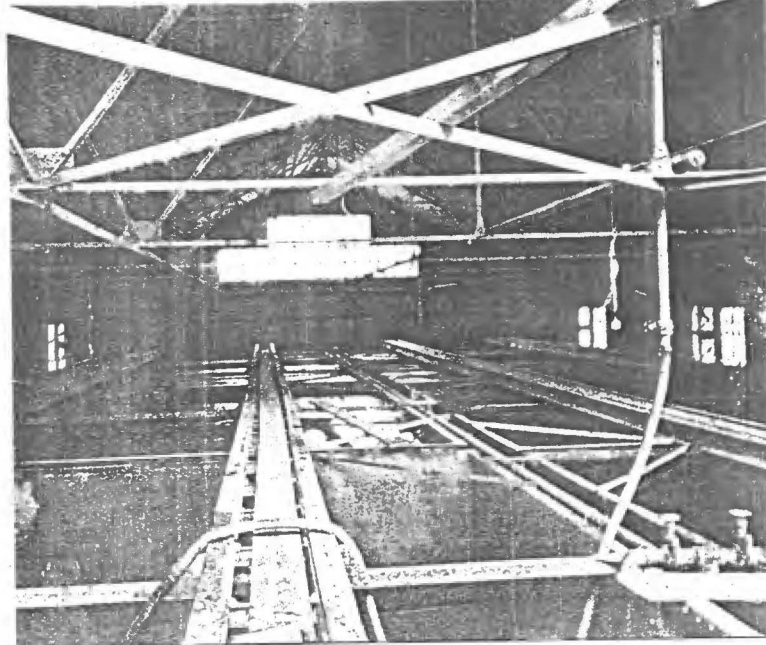
sampled when crushed through the ordinary pipe sampler, and samples were taken from the settler discharge every 15 minutes. The water was decanted from the sample and evaporated to dryness, the residues assayed, 12 half-ton samples being taken for assay. The samples, after decantation, was also assayed; and from other samples the entire water was evaporated without decantation. This was for the purpose of locating the losses, and they were found to be almost entirely in the pulp instead of in solution. The saving varied from 84 to 96 per cent.

The greatest obstacle to the development of the district is scarcity of water for milling purposes. The Cochiti Gold Mining Company's great mill can hardly run to full capacity for more than nine months of the year, on account of scarcity of water during the dry season. There is an abundance of water in the Rio Grande River, 15 miles distant by road, and a railroad would make it practicable to carry the ore to the river. The Cochiti Reduction and Improvement Company has an abundance of water for a large mill, which it controls by prior appropriation.

Pine and spruce timber is fairly abundant, lumber costing \$15 per thousand, wood \$2.50 to \$3.50 per cord, according to place of delivery, and mine timbers for square sets 9c. per running foot. All other supplies are sold at about the same price they bring in favorably located mining camps.



LONE STAR-IRON KING VEIN, COCHITI, N. M.



SQUARE-PAN ROOM, COCHITI MILL, N. M.

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