The Cochiti Mining District, New Mexico

A Low-grade Gold-silver Camp Which Has a Reputation for Failure, but Which Possesses Many Promising Though Unexplored Veins

BY PERCY E. BARBOUR*

In certain quarters renewed interest has recently been shown in the old Cochiti mining district in New Mexico and some effort to revive mining operations there has been made. The town of Bland, the center of the district, is about 30 miles west of Santa Fé and about 50 miles north of Albuquerque. It is reached by a 25-mile stage ride from Domingo (formerly Thornton), a station on the main line of the Santa Fé railroad, 37 miles northeast from Alhuquerque. A railroad was projected when this camp had its boom and the grade was surveyed and staked the entire distance from Thornton to the camp, but no work on it other than this was ever done.

Leaving Thornton, the stage road runs along the sandy river bottom of the Rio Grande, for 10 miles, to the Mexican adobe town of Peña Blanca, thence across the river by ford, the bridges having been washed away; then through the Cochiti Indian Pueblo and then across the foothills to the mouth of Piño cañon. These foothills are the result of erosion on a low flat mesa of volcanic ash and the total rise in elevation is only about 500 ft. From the mouth of the cañon to Bland, about seven miles, the rise in elevation is about 1200 ft., Bland being 7500 ft. above sea level.

THE TOWN OF BLAND, N. M.

Nature of the Country

There is a series of nearly parallel cañons, running from the northwest to southeast toward the Rio Grande river, which are from 800 to 1000 ft. deep and are generally very narrow. They were eroded from a mesa formed by successive flows of lava, volcanic ash, and volcanic tuff, superimposed, which made a broad, nearly level table-land. The cañons are separated by narrow mesas about half a mile wide called *potreros*. Beginning on the west these cañons are called Peralta, Colla, Piño, Media Dia, Cañada de Cochiti, etc. Of these cañons Peralta and Media Dia have creeks which run water all the year; the other three have water only during the winter and spring. All these cañons and mesas were very well timbered, but Colla and Piño have been heavily drawn upon for mining operations.

At the head of these cañons (Piño is about 10 miles long) the country rises into an irregular series of mountain peaks attaining hights of 10,000 and 11,000 ft. above sea level. All these mountains are well timbered and some are now within the Government forest reserve.

The Cochiti mining district is a volcanic country and has recently been the scene of active volcanism, evidenced by flows of pure lava, now existing in black porous

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sheets, and volcanic ash, cinder and pumice. A great variety of both crystalline and non-crystalline igneous rocks occur, but there are no sedimentary rocks in the district. In Peralta cañon is a natural park of several acres containing many pinnacles and monuments showing some of the most beautiful results of weather erosion to be seen in the United States. The formation here is a white volcanic tuff filled with particles and fragments of pumice of varying size. The pinnacles are of all sizes and some of very fantastic shapes, several of them being nearly 100 ft. high.

In Calla cañon is a very interesting belt of opal formation in which a show tunnel has been run. Some few very fine specimens of opals have been obtained there.

Mines of the District

The district is divided into two distinct sections. The western section contains the Albemarle mine of the old Cochiti Gold Mining Company, which was exploited in Boston about 12 years ago, and after a more or less meteoric career ended in bankruptcy. This mine, situated in Calla cañon, was opened up by a two-compartment shaft to a depth of 800 ft., and during its operation produced more than $1,000,000. It was equipped with steam and electric double-drum hoists, air drills and the finest of mining machinery. The gallows frame was a very elaborate one of steel.

A cyanide mill of 250 tons capacity was erected wholly of structural steel, and while the judgment shown in this was perhaps questionable, the engineering required to transport and install this plant under the then existing conditions was deserving of great credit.

A high-tension power plant was erected at Madrid, 40 miles away, at a cost of about $250,000, and the power transmitted to the mine at 10,000 volts. The enterprise was a colossal failure, said to be due to the diminishing value of the ore at depth. The mine is now caved and the old records burned, so this statement cannot be gainsaid, but the geological and underground conditions of the rest of the camp seem to cast a reasonable doubt on the statement.

Eastern Section

That part of the district now under notice is the eastern half in or contiguous to Piño cañon. Here a series of porphyry dikes has intruded the overlying volcanic flows and is first seen when coming up the cañon about two miles below Bland, where they outcrop in the roadbed. They become more marked farther up the cañon until at the town of Bland, the west mesa is entirely dike mass, the overlying tuff having been wholly removed by erosion. On the crest of this outcrop is located a U. S. mineral monument."

The east mesa just above the town has been forced into an anticline with a very thin capping of tuff still present over the main dike. This dike has a general north and south strike and a nearly vertical dip, and seems to be the eastern boundary of the mineral zone of the district. The dike rocks are various forms of diorite varying from the coarse-grained, granitoid texture of the green-speckled white variety to the compact, fine-grained dark greenish-gray type.

The geologic age of this section is not great. The volcanic flows are considered to be of late Tertiary age, the dikes are more recent and the ore deposits still more recent, so that geologically they are rather young.

Mines of the Eastern Section

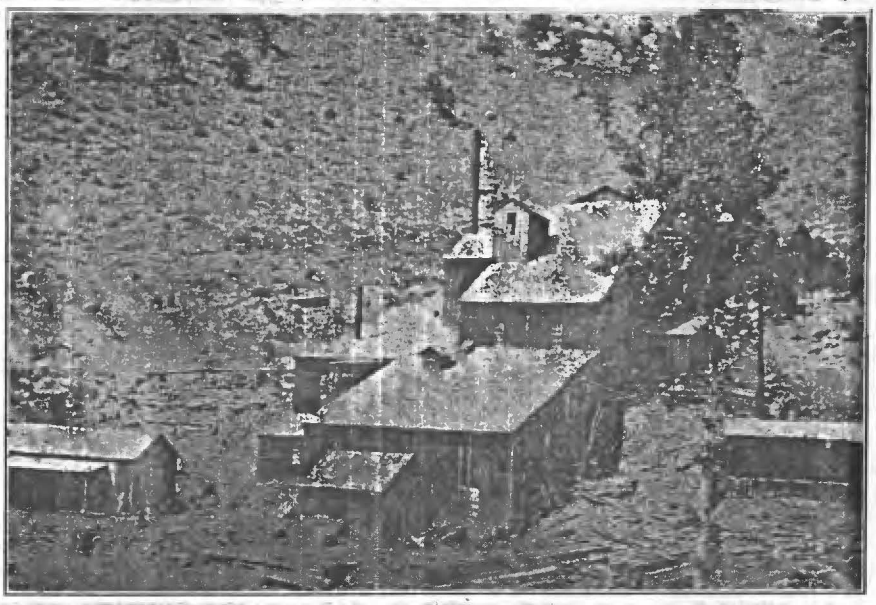
There are four well defined independent veins, practically parallel, which define the vein system as generally north and south. Beginning on the east these veins are the Washington, the Iron King, the Lone Star and the Crown Point. Each vein has been opened up more or less by a mine of the same name, and from each considerable ore has been shipped to the smelters at Pueblo. The Washington vein dips west; the Iron King is nearly vertical; the Lone Star dips east; and the Crown Point dips west.

The Iron King is opened up by a single adit with a 100-ft. winze on the vein which shows a width of 8 ft. throughout the workings and underhand stopes. The Crown Point is opened up in a similar manner, but the workings are in bad shape for examination. It was recently bonded to an English syndicate. The Washington group is next to the Lone Star in importance, but it has been tied up by litigation which has been continuous for nearly 13 years. The difficulty has recently been reported settled.

The most important group in the district is the Lone Star group. This property is opened up by six adits all in one, which are connected by raises. Lower down on the other side of the mountain a working adit was driven to tap these workings. This adit for an expected output of but 100 tons per day was driven with a cross-section of 10x10 ft. in the clear and double-tracked with 56-lb. rails. The Lone Star vein in some places attains a width of 70 ft. and will average 25 ft. An analysis of the ore gave the following results:

	Per Cent.
Gold	0.00062
Silver	0.04200
Iron sulphide	0.09000
Antimony	0.19000
Tellurium	0.24200
Sulphur	0.61020
Silica	98.10300
Copper	Trace
Total	99.27782

This district received such an unenviable reputation through the failure of the Cochiti and Navaho undertakings that it has been very difficult to reopen the camp.



STAMP MILL AND CYANIDE PLANT, BLAND, N. M.

The Question of Value and Depth

The assertion that the value did not continue with depth was made to account for these failures. The theory was advanced that the ores were the result of deposition by descending hot waters and that therefore the value grew less with depth. That this theory is without foundation is evident from even a casual examination of the facts. The Iron King mine which adjoins the Lone Star has the deeper workings by 100 ft. or more, and had good ore in the deepest winze. The workings in the Star ran off the pay shoot. Furthermore, the mineral-bearing zone, as previously stated, is formed by a series of porphyry dikes intruding the overlying volcanic tuffs. Descending

waters would have had to traverse this tuff capping to reach the fissures in the porphyry. No traces of water courses exist in the tuff and there were no subsequent igneous rocks laid on top of it and no trace of any mineral has ever been discovered in this tuff formation.

On the other hand, one kind of the porphyry forming the country rock is mineralized. The source of the magma was below, as evidenced by the dike itself, and it unquestionably provided the course for "ascending" waters carrying mineral.

Therefore, if time and development should prove that the ores do not continue with depth, some other reason than descending waters must be found to account for it. Bland is a low-grade camp, the ores averaging $10 to $15 with the value about evenly divided between silver and gold, but the district has a great deal of merit and it is to be hoped that this renewal of interest in it will be productive of results.

The Development of the Delprat and Potter Flotation Processes

By W. R. Ingalls

Among the recent methods introduced for the separation of the mineral components of mixed sulphide ores—magnetic processes, electrostatic processes, pneumatic processes and flotation processes—the last mentioned occupies the premier place in point of commercial application up to the present time. I feel justified in making this statement in view of the fact that the greatest recent addition to the world's supply of zinc ore has come from Broken Hill, New South Wales, and the largest producer in that district has been the Broken Hill Proprietary Company, using a flotation process. The success of the Borken Hill Proprietary Company in this direction led many investigators to study the theory of ore flotation, which is now generally believed to be a function of surface tension, and the results of their investigations have created surprise that the bearing of well known phenomena had been so long overlooked. Every chemist is acquainted with the tendency of mineral particles, put into a breaker for digestion, to float upon the surface; and everyone who has walked on the seashore has observed the flotation of particles of mica when the incoming tide wets the sand. Yet thousands of scientists failed to draw any useful conclusion from these well known facts.

It was natural that in the introduction of these new processes there should be disputes as to priority of invention. This appears to be inevitable when an invention is sufficiently valuable to be worth a contest. It is one of the curiosities of economic history that most of the important inventions have been the result of study wherein two or more persons have approached success at about the same time. The flotation processes were no exception to this experience. The process originally introduced by the Broken Hill Proprietary Company was patented by G. D. Delprat, the general manager of that company. However, a similar process had previously been patented by C. V. Potter, of Australia, who died a few weeks ago. Potter claimed that the Proprietary Company was infringing his process, and a long litigation ensued, which was settled, in 1907, by the Broken Hill Proprietary Company recognizing the Potter patents, paying the owners thereof a large sum for the use of them in lieu of any further royalties and assigning the Delprat and other patents to the company owning the Potter patents.

In an article published in *The Mineral Industry*, Vol. XV, I said, "the Potter process was the original flotation process. The Delprat process is a slight modification of the Potter, being designed to evade the patents on the former." Mr. Delprat took some umbrage at this statement, which he considered to be a reflection upon him, although I did not intend to imply any illegality, wrong or impropriety. The evasion of a patent implies legality, else there would be no evasion; and a design to evade a patent does not imply anything illegal, wrong or improper. The only implication in my remark was that Mr. Delprat did not originate the acid-flotation process. In this it appears that I was wrong, inasmuch as it appears that he did originate it independently of Potter.

In a letter lately received from Mr. Delprat, he communicates some very interesting history respecting the origin of his patents, and I think that I am justified in quoting some paragraphs from his letter, although he has not specifically authorized me to do so. Mr. Delprat says:

"I quite admit that Potter's patent was taken out six or 12 months before mine, but my point is that I did not know anything of Potter's existence until my patents were applied for, and that consequently my patents could not have been designed so as to evade Potter's. This has clearly come out in the evidence given at the trial, and is public property. To say, therefore, that my patents were designed with a view of evading Potter's patent, is not only an inaccuracy, but furthermore puts me in a very unfavorable light with any right-thinking men.

"Although not affecting the point at issue, I may add that my invention was purely accidental; that in fact I was experimenting in quite a different direction at the time, and that during these experiments, in boiling tailings in a solution of acid saltcake, one of my assistants drew my attention to the fact that a heavy scum formed on the top of the solution, which could not be kept down. After repeated trials to sink this scum, it was given up as hopeless, the scum was decanted and then it struck us that the separation thus unexpectedly effected was all we were really in search of, and appliances were designed to carry the idea into practice; and it was only after applying for the patents that the existence of Mr. Potter was revealed to me.

"I am not writing to you to claim any credit for my process; I am quite willing to give all the credit to my able assistants, without whose help the process would never have reached its present state of efficiency. What I do most strongly object to is that anyone should have a right to say that I designed my process in order to evade another man's process; in other words to reap the benefit of another man's work without adequate remuneration. Such a proceeding, is in my opinion mean and contemptible and is an action I hope never to be guilty of."

It is, of course, a pleasure to me to correct an unintentional and involuntary error, and also to make it a matter of authoritative record how the flotation process was first introduced at Broken Hill. No one should desire to do any injustice, least of all to so distinguished an engineer as Mr. Delprat, to whom no one has ever denied the credit of developing the acid-flotation process into a great commercial success. I was not previously aware of the early history of Mr. Delprat's discovery, as to which I am now informed, and accepting his statement, as I am bound to do, I freely admit the error in my remark in *The Mineral Industry*, Vol. XV, and tender him my apology.

The Hancock Jig at Palmerton, Penn.

The New Jersey Zinc Company, at its smeltery at Palmerton, Penn., is using a Hancock jig to treat the residue from the oxide furnaces. From this material the jig yields a zinc ore containing 16 to 18 per cent. zinc oxide, which is sent back to the oxide furnaces; iron-manganese clinker, containing 40 per cent. iron and 14 per cent. manganese, which goes to the spiegeleisen furnaces; and unburned coal containing 65 per cent. carbon, which is used in the charge for oxide furnaces. The only waste is 2 per cent. of ash. The jig handles 15 tons per hour, but can do more.

At Creede, Colo., strong fissure veins, occurring in igneous rocks, carry galena and blende with a quartz gangue, the minerals being separated by jigging. The ore is easily milled, affording a high-grade lead, and a high-grade zinc product. This district was discovered in 1892, since which time it has been worked continuously.