

Albuquerque, New Mexico, March 5, 1909

No. 6

General Geology of New Mexico

By FAYETTE A. JONES*

Physiographic Features

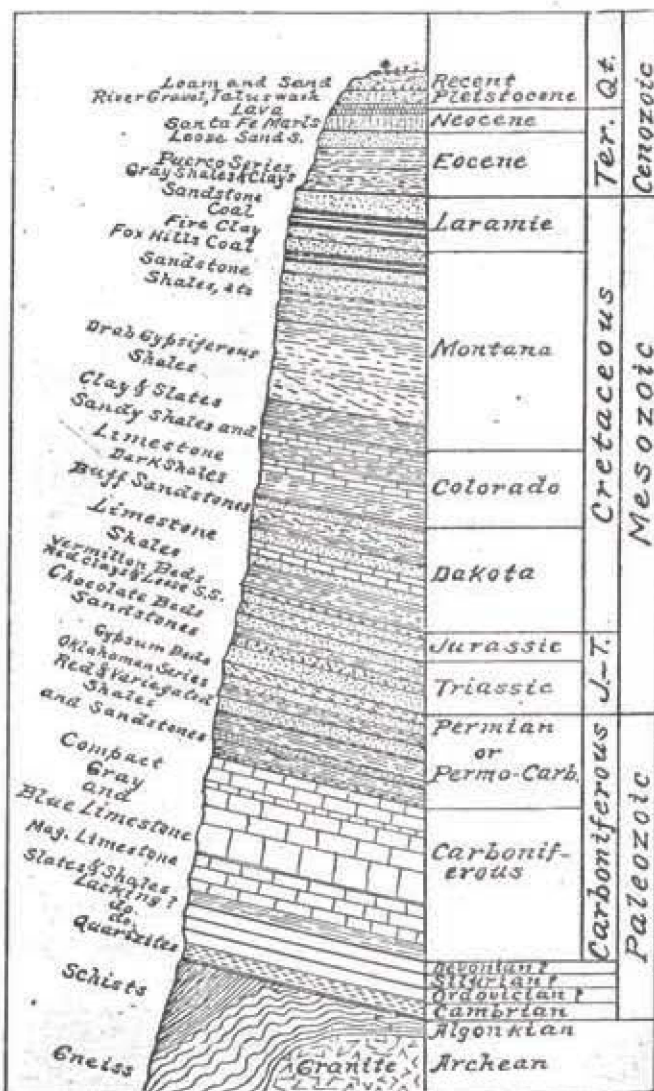
The whole of New Mexico may be regarded as a vast plateau region, averaging 5,000 feet in elevation, and dissected by numerous streams, forming narrow valleys and deep gorges.

The southwest portion of the Territory is characterized by vast stretches of Quaternary plains, embracing the desert ranges of mountains common to central Arizona and the Basin region of Nevada and southern California. The drainage of the Territory is to the south and west.

Rock Formations

Practically the complete geological column is represented in New Mexico, extending from the pre-Cambrian complex to the most recent sedimentary

Geological
Column
of
New
Mexico



deposits. Varying types of metamorphic, sedimentary and igneous rocks, comprising the three fundamental classifications are abundantly represented.

Metamorphic or Pre-Cambrian Rocks

The basal crystalline rocks found in all the principal mountain ranges in the north-central part of the Territory are unquestionably pre-Cambrian. Rocks of the pre-Cambrian complex constitute the core of the various ranges bordering on either side of the Rio Grande from Albuquerque to El Paso; such rocks also comprise the core of the Sierra Blanca, Mogollon, Datil, Mimbres and Black Range. Passing to the desert ranges pre-Cambrian rocks, in the Floridas, Tres Hermanas, Granite Gap and Burro Mountains constitute the basal complex.

These types of rocks are readily recognizable and consist of gray and red gneisses, quartz-schists, pegmatite dikes, etc. The gneisses represent sheared granites and the schists result from extreme foliation of the gneisses and other rock aggregations.

Sedimentary Rocks

Sedimentation, as implied here, is due to the cumulative process of deposition through the action of water.

The thick beds of sediment laid down on the pre-Cambrian sea floor have been deposited by the slow cumulative process of untold ages, and built up, as it were, the geological column of the terrane.

Until recently it was thought that the Ordovician, Silurian and Devon-

*From Epitome of the Economic Geology of New Mexico.
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THE COCHITI MINING DISTRICT OF NEW MEXICO

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 Eland, the center of the district, is about 30 miles west of Santa Fe and about 50 miles north of Albuquerque. It is reached by a twenty-five mile stage ride from Domingo (formerly Thornton), a station on the main line of the Santa Fe railroad 37 miles northeast from Albuquerque. 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 ten miles, to the Mexican adobe town of Pena 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 Pino Canyon. 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 feet. From the mouth of the canyon to Eland, about seven miles, the rise in elevation is about 1,200 feet, Eland being 7,500 feet above sea level.

Nature of the Country.

There is a series of nearly parallel canyons, running from the northwest to southeast toward the Rio Grande which are from 800 to 1,000 feet 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 canyons are separated by narrow mesas about half a mile wide called potreros. Beginning on the west these canyons are called Peralta, Colla, Pino, Media Dia, Canada de Cochiti, etc. Of these canyons 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 canyons and mesas were very well timbered, but Colla and Pino have been heavily drawn upon for mining operations.

At the head of these canyons (Pino is about ten miles long) the country rises into an irregular series of mountain peaks attaining heights of 10,000 and 11,000 feet 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 vulcanism, evidenced by flows of pure lava, now existing in black porous 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 canyon 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

*Engineering and Mining Journal.

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 them being nearly 100 feet high.

In Calla canyon 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 Canyon, was opened up by a two-compartment shaft to a depth of 800 feet, and during its operation produced more than \$1,000,000. It was equipped with steam and electric double-drum hoists, all drills and the finest of mining machin-

posits 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-foot winze on the vein which shows a width of eight feet 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

tuff capping to reach the fissures in porphyry. No traces of water could exist in the tuff and there were no subsequent igneous rocks laid on top and no trace of any mineral has been discovered in this tuff formation.

On the other hand, one kind of porphyry forming the country rock mineralized. The source of the magma was below, as evidenced by the 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 high grade camp, the ores averaging \$10 \$15 with the value about evenly divided between silver and gold, but the district has a great deal of merit. It is to be hoped that this renewal interest in it will be productive of suits.

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ian strata were lacking, but now the supposed gaps have been filled in discoveries made in the southwest part of the Territory.

In the northern part of New Mexico it is observed that the Carboniferous rocks seem to rest unconformably on the pre-Cambrian complex.

Igneous Rocks

Aside from the primordial granite it is observed that post-Paleozoic rocks of igneous character are abundant throughout the mountainous region. Post-paleozoic igneous rocks may with propriety be divided into two separate groups—intrusive and effusives. The intrusives embrace the porphyries, which are readily distinguished by their dark to light-gray and pinkish tint containing white phenocrysts of feldspar. Porphyries have a wide range in variation as necessitate an extensive nomenclature to specify them. They pass gradually from one to another, due to a variation in their composition, as from granite-porphyry through syenite-porphyry, quartz-monzonite-porphyry, monzonite-porphyry to diorite-porphyry.

Certain porphyritic intrusives and dikes have an intimate relation with ore deposits; especially those of Tertiary age.

The effusive or flow-rocks are recognized by their extensive surface distribution, covering the older rocks frequently to profound depths. The flow-rocks found in various parts of New Mexico comprise rhyolites, andesites, dacites and basalts. The most recent of these lavas is basalt or what is locally termed malpais; it belongs to the Tertiary and in many instances appears to have reached into the late Pleistocene. Many thousands of square miles of the surface of New Mexico are covered with this comparatively recent lava, especially in the north central portion.

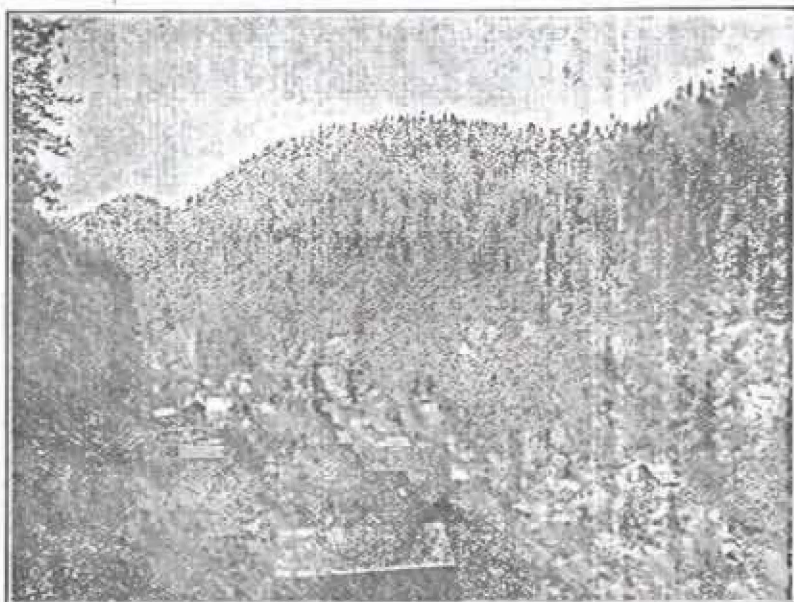
Ore Deposits.

Concerning the mineral deposits of New Mexico and elsewhere, it is important to be able to recognize and differentiate the ore-bearing formations and rocks from those that are destitute of economic value.

The uneducated prospector has now begun to realize the important relation existing between certain kinds of minerals and their allied formations. He is thus able to prosecute his work and apply his energy in fields especially favorable for success.

In prospecting for gold one should seek a region with abundance of porphyry and quartz, iron stained dikes.

Copper ores in many instances are found among limestone and porphyry contacts, and disseminated as sulphides through porphyritic masses of large extent. Certain strata of the Jur-



The Town of Bland, New Mexico.

ery. 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 Pino canyon. Here a series of porphyry dikes has intruded the overlying volcanic flows and is first seen when coming up the canyon about two miles below Bland, where they outcrop in the roadbed. They become more marked farther up the canyon 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

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 feet in the clear and double-tracked with 50-pound rails. The Lone Star vein in some places attains a width of 70 feet and will average 25 feet. 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.

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 ore 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