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GEOLOGY OF THE 21 AND 27 FLUORSPAR MINES, ZUNI MOUNTAINS, VALENCIA COUNTY, NEW MEXICO

The 21 and 27 mines, near the southeastern end of the Zuni Mountains and about 14 miles southwest of Grants, Valencia County, N. Mex., are in one of the most productive fluorspar areas in the West. A detailed study of the fluorspar deposits in the area is being undertaken by E. N. Goddard, of the Geological Survey, and a preliminary geologic and topographic map showing the results of the work done during 1944 has been prepared. This map, accompanied by longitudinal sections of the mine workings and a short descriptive text, has been released for public inspection in open files of the Geological Survey in Washington, D. C., and the regional office in Rolla, Mo., according to an announcement by Survey Director W. E. Wrather to Secretary of the Interior Harold L. Ickes. A copy of this material is also available for consultation at the New Mexico School of Mines Library, Socorro, N. Mex.

The mines are now being operated by the Zuni Milling Co. Since the opening of the deposits in December 1940, about 120,000 tons of crude fluorspar has been produced. The ore is treated in a flotation mill at Los Lunas, N. Mex.

The 21 and 27 veins cut the coarse-grained gneissic granite, of pre-Cambrian age, which forms the core of the Zuni Mountains. The coarsely crystalline green fluorspar of the veins has been strongly brecciated and in some places cemented by fine-grained purple fluorspar. The main impurities are calcite, wall rock fragments, and gouge. Abrupt change in strike of the vein fissures is apparently the principal controlling factor in the distribution of the fluorspar. The 21 vein ranges from a few inches to 3½ feet in width and can be traced for about 3,000 feet; the 27 vein is as much as 15 feet wide in some places and can be traced for nearly 5,000 feet.

Each vein is developed by a shaft about 300 feet deep and several thousand feet of workings. Ore bodies are of about the same size and grade in the lower levels as they are in the upper workings. It is therefore reasonable to expect that fairly large tonnages of fluorspar may be found at greater depths.

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FLUORSPAR INVESTIGATIONS

THE 21 AND 27 FLUORSPAR MINES, ZUNI MOUNTAINS, VALENCIA COUNTY, NEW MEXICO*/

By E. N. Goddard
January 1945

INTRODUCTION

The 21 and 27 mines, 1/ near the southeastern end of the Zuni Mountains and about 14 miles southwest of Grants, Valencia County, N. Mex., are in one of the most productive fluorspar areas in the West. They were named after sections 21 and 27, respectively, of T. 9 N., R. 11 W., in which they are located. The veins were discovered in December 1940 by James Mallery, and since then the two mines have produced about 120,000 tons of crude ore. Each mine has a shaft about 300 feet deep and several thousands of feet of workings. Both mines are operated by the Zuni Milling Co., and the ore is treated in a flotation mill at Los Lunas, N. Mex.

GEOLOGY

The 21 and 27 veins are in coarse-grained gneissic granite, of pre-Cambrian age, which forms the core of the northwestward-trending Zuni Mountains. The granite core is flanked by red sandstones and gray limestones of late Paleozoic age. These sedimentary rocks dip away from the range at low angles and form prominent hog backs on both sides of the granite area. Extensive flows of basalt lava of Quaternary age sweep around the southeastern end of the Zuni Mountains

*/ Accompanied by one sheet of illustrations:
Geologic map and longitudinal sections of the 21 and 27 fluorspar mines and vicinity, Zuni Mountains, Valencia County, New Mexico.

1/ Geologic maps of the underground workings of these mines and a descriptive text entitled "Ore reserves at the Navajo fluorspar mines near Grants, Valencia County, New Mexico," by A. E. Weissenborn, were released April 4, 1944, in open files of the Geological Survey.

NOTE: The plates to this report are missing. We have been unable to obtain them.

and largely cover the sedimentary rocks in the area south of the mines. The 21 and 27 veins are about 1½ miles from the nearest sedimentary rocks and about half a mile from the nearest lava flows.

In the vicinity of the mines (see accompanying map), the granite is cut by scattered dikes of quartz monzonite gneiss, gneissic aplite, diorite, hornblendite, and granite porphyry. In these dikes the gneissic structure or foliation does not follow the walls of the dikes but is parallel to the foliation of the gneissic granite, which strikes N. 35°-70° E. and dips 55°-85° SE. All these dikes, therefore, were intruded before the gneissic structure of the granite was developed, and they are believed to be of pre-Cambrian age. Very small dikes of basalt, only a few inches wide, found along a strong fault near the 27 vein, show no evidence of shearing and are believed to be much younger, possibly of Tertiary age.

The dominant structural feature of the area is a strong fault, which strikes N. 40°-80° W., dips steeply, and cuts diagonally across the two fluorspar veins. This fault is marked in most places by red strongly silicified breccia or sheared rock and closely resembles the breccia reefs [2/] of the Colorado Front Range, which are of late Cretaceous age. The red color is due to the very fine intergrowth of hematite with quartz. In some places small irregular veinlets of milky quartz are found in the fault zone, and small veins of fluorspar are locally present. There are several irregular bodies of red silicified breccia along offshoots of this fault. The largest of these forms a prominent hill just northeast of the 27 shaft. In parts of the Front Range, the ore deposits bear a close structural relationship to the breccia reefs, and there is evidence to suggest that these faults served as trunk channels along which the mineralizing solutions made their way upward from depth. It is therefore suggested that the fluorspar of the 21 and 27 veins may have been deposited from solutions that rose from depth along the strong northwestward-trending fault.

FLUORSPAR DEPOSITS

The 21 and 27 mines develop two fissure veins, which are roughly parallel and about 1½ miles apart (see accompanying map). The veins strike northeast and dip steeply southeast, and both are very irregular in trend. The 21 vein, which is northwest of the 27, is rather narrow, ranging from a few inches to 3½ feet in width, but can be traced for a distance of about 3,000 feet. The 27 vein is considerably wider, as much as 15 feet across in some places, and can be traced for nearly 5,000 feet. Both veins fork at their northeastern ends and the forks split and die out within short distances.

The veins are filled with coarsely crystalline brilliant green fluorspar that has been strongly brecciated and in some places cemented by fine-grained purple fluorspar. In parts of the 27 vein coarse-grained calcite is abundantly intergrown with the early fluorspar, and small amounts of calcite are found in the 21 vein. Also the fluorspar breccia in parts of the 27 vein is cemented with fine-grained

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2/ Lovering, T. S., and Goddard, E. N., Geologic map of the Front Range mineral belt, Colorado (Explanatory text), Colorado Sci. Soc. Proc., vol. 14, no. 1, pp. 37-42, 1938.

red or yellow calcite that may be of supergene origin. The rest of the gangue in both veins consists of granite and silicified granite wall rock fragments, gouge, and finely crushed granitic material. In the widest part of the 27 vein, 300 to 600 feet northeast of the shaft, so much wall rock breccia is mixed with the fluorspar that the ore is of very low grade. Along the hanging wall of this part of the vein is a wide irregular zone of coarse open breccia resembling stope-fill, which may have been formed as a result of leaching the calcite from the wide part of the vein so that the hanging wall collapsed.

The veins are bordered in some places by red silicified breccia or by red mildly silicified rock. This seems to indicate that the vein fissures were first opened when the strong northwestward-trending fault was formed and were reopened by later movement.

The ore in the veins is mostly of medium to low grade, and very little ore of metallurgical grade could be shipped without treatment or careful sorting. The CaF_2 content of samples taken from the 21 vein has ranged from 56 to 96 percent, but the ore shipped in large tonnages has contained from 55 to 68 percent of CaF_2. Much of the ore in the 27 vein contains from 45 to 65 percent of CaF_2 and averages about 50 percent. The widest part of the vein, however, is of low grade, owing to the admixture of wall rock breccia, and contains from 20 to 35 percent of CaF_2 and a large percentage of lime. Ore treated in the mill at Los Lunas during 1944 ranged in grade from 24 to 60 percent of CaF_2 and averaged about 40 percent. 2/ The silica content of the veins ranges from 5 percent to more than 35 percent. Lime is absent in some parts of the veins but it may constitute as much as 35 percent in parts of the 27 vein.

The distribution of the ore in the veins seems to be controlled chiefly by abrupt changes in strike. Grooves on the walls of the veins and displacement on the dikes indicate that the southeast or hanging wall has moved southwestward and downward at angles of 35° to 45°. Displacement on the 21 vein amounts to only a few feet, and on the 27 vein, to several feet. Those parts of the veins that have a more easterly trend were opened to a greater extent and hence tend to be wider than the segments that have more northerly trends. In other words, the more favorable parts of the veins are those that bend abruptly to the right. In the 21 vein, however, the strike changes abruptly within very short intervals and even the narrower parts of the vein contain fairly good ore. Thus, it is considered economical to mine these short narrow segments of the vein rather than to leave them as pillars. As a result the 21 vein has been mined nearly continuously for a length of about 1,600 feet. In the 27 vein, however, the points where the strike changes abruptly are much farther apart, and fairly large ore bodies are separated by rather long nearly barren segments of the vein. The best ore shoot is in the vicinity of the 27 shaft and appears to pitch steeply northeastward. It measures about 300 feet in stope length, extends from the surface to beneath the 300 foot level, and is from 3 to 8 feet wide. The vein is widest farther east where it bends abruptly and trends nearly eastward. Unfortunately this part of the vein has been greatly diluted with wall rock breccia. A large part of this

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2/ This includes small tonnages of relatively high grade ore from other mines.

zone has been mined above the 100-foot level but much of it at greater depth is of too low grade to constitute ore. If this breccia resulted from the leaching of calcite, as has been suggested, the breccia may give way in depth to a more nearly solid vein of fluorspar and calcite.

In both the 21 and 27 mines, the ore bodies are of about the same size and grade in the bottom levels as they are in the upper workings; and considering the lengths of the veins, it is reasonable to expect a fairly large tonnage of ore at greater depth. Exploration of the veins at greater depth should be confined chiefly to those localities where the veins turn abruptly to more easterly trends.