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Barite in the White Sands Missile Range

by Thomas J. Smith, Washington State University, Pullman, WA

This study of the barite occurrences within the confines of the U.S. Army White Sands Missile Range (WSMR) is essentially part of a larger work concerning barite in New Mexico and is intended to provide a preliminary report on the subject for an isolated section of the state. Only limited field time was allotted for the range project because of Department of the Army restrictions; therefore, some occurrences could not be visited. As a result, descriptions by other authors have been included as noted in the text.

The missile range encompasses about 3,000 sq mi of south-central New Mexico (fig. 1) and includes within its boundaries the San Andres and Sierra Oscura mountain ranges and parts of the Tularosa Basin and Jornada del Muerto. Mineral exploration and development in the area began in the late 1800's and was confined principally to the San Andres Mountains. Most of the initial interest was in precious metals; not until after the turn of the century did much activity begin on other commodities. The first important discovery of a barite deposit probably was made around 1900 by J. Bennett. He located a number of claims—primarily for lead—in the Bear Canyon district of the southern San Andres Mountains. Talmage and Wootton (1937) noted that a carload of barite was shipped from the Stevens mine in the Organ Mountains in 1932. A survey of the Organ district revealed no mines with appreciable barite nor any mine called the Stevens; therefore, the mine referred to probably is the one at Bear Canyon. If so, this location would be the source for the only reported barite production from any property within the range boundaries. Production from active mines ceased when the federal government withdrew the area for a missile testing facility in the late 1940's and early 1950's.

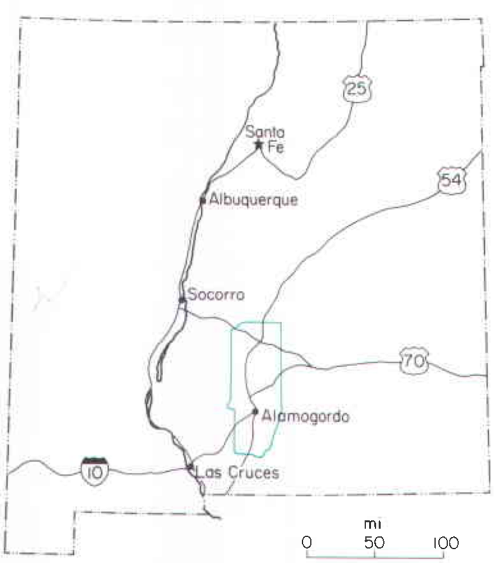

FIGURE 1—LOCATION AND EXTENT OF WHITE SANDS MISSILE RANGE.

Barite is reported at 14 localities within the range, including one in the Sierra Oscura and 13 in the San Andres Mountains (fig. 2). All the occurrences are hydrothermal-type deposits and are mostly replacement deposits in limestone or dolomite or associated with fault or shear zones. No residual or sedimentary-type deposits have been observed. A summary of the locations and geology of the occurrences is provided in table 1.

Sierra Oscura

The only known barite occurrence in the Sierra Oscura that lies on the missile range is the Miera prospect (locality 1, fig. 2). Although the property was not visited during the course of this investigation, the Miera prospect is probably located in limestones of the Magdalena Group (Pennsylvanian), high atop a north-south-trending ridge that forms the west wall of a narrow canyon. Williams and others (1964) describe the deposit as fissure filling in a fault zone; the barite occurs with quartz and minor fluorspar in massive siliceous rock. Apparently, the mineralization is similar in character to that in the Hansonburg district, which is approximately 1 mi to the north, just off the range.

The property consists of two unpatented claims, the Sixty-six and the Santa Rita, which were located in 1939 and 1941 by J. Miera. Workings consist of a 20- by 30- by 10-ft open cut on the Sixty-six and a small prospect pit on the Santa Rita. No production from either claim has been reported.

San Andres Mountains

The San Andres Mountains extend north from San Agustin Pass for about 85 mi to Mockingbird Gap. The east side of the ridge is a steep escarpment that exposes Precambrian rocks overlain by westward-dipping Paleozoic sediments. The crest averages between 7,000 and 8,000 ft in elevation and towers more than 3,000 ft above the Tularosa Basin to the east (fig. 3). Barite occurrences in the range are clustered at the northern and southern extremities and are generally sparse throughout the central area. The northern deposits exhibit a close association with fault or shear zones, but toward the south the mineralization tends to be in the form of replacement deposits in limestone or dolomite. Associated minerals almost always include galena and fluorite in at least minor amounts. Toward the north copper minerals are occasionally present.

The northernmost of the San Andres deposits is the Independence mine (locality 2, fig. 2), located in a small north-south-trending canyon at Mockingbird Gap. The property is composed of six patented claims originally located by J. B. Leasure. Development of the property includes a timbered 114-ft two-compartment shaft, an 80-ft untimbered shaft approximately 300 ft south of the first, and several prospect pits.

Barite occurs as minor gangue in lead-zinc ores in a silicified and brecciated fault zone that strikes nearly due north and dips 60° east. Mineralization is confined to limestone that is probably part of the El Paso Formation (Ordovician). As of 1941, the property had produced 60 tons of lead concentrates (Walter, 1941); however, a 20-ft chip sample taken across the fault zone by the U.S. Bureau of Mines assayed only 7.0 percent $BaSO_4$ (Williams and others, 1964).

In the Lava Gap area, approximately 10 mi south of the Independence group, barite was observed in a number of small deposits. The less important occurrences, located high on the west slope of Capitol Peak, are associated with copper mineralization related to a north-south-trending fault system. Two fluorspar deposits contain the more substantial quantities of barite in the area. Both are situated on low ridges within a wide valley and are associated with faults in the Panther Seep Formation (Pennsylvanian).

The Baso Four mine (locality 3, fig. 2) consists of two claims originally located in 1925 as the Lava Gap Nos. 1 and 2. Mineralization occurs in a single vein that strikes N. 20° E. and is exposed for a few thousand feet by numerous prospect pits. A 60-ft shaft sunk toward ☞

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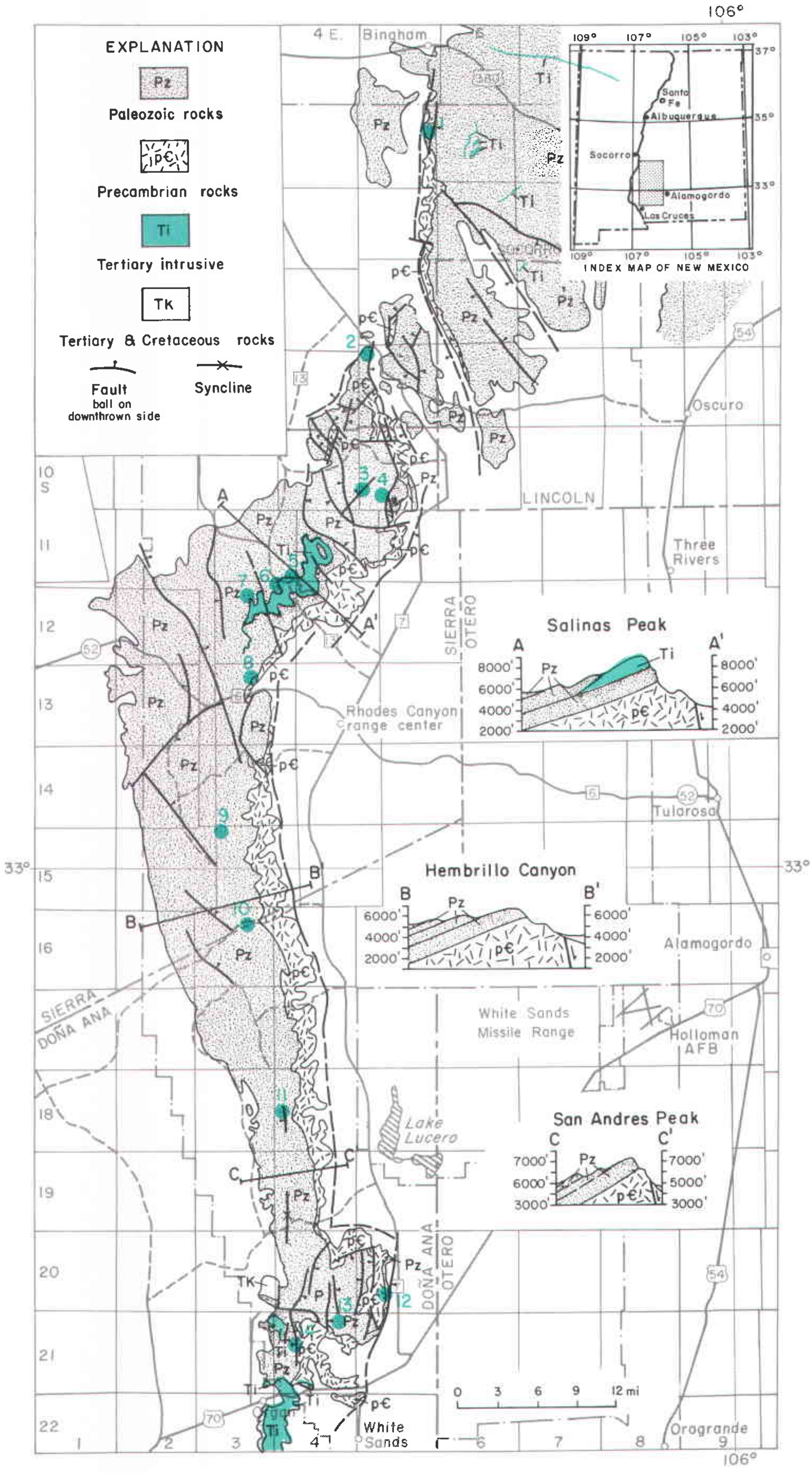

FIGURE 2—Location of barite occurrences in White Sands Missile Range (after Fitzsimmons and Kelley, 1980). Numbers refer to table 1.

the middle of a 300-ft open cut constitutes the main workings. Although the vein is predominantly fluorspar, considerable barite occurs at the northern end of the open cut.

A prospect of unknown name or history, which Williams and others (1964) refer to as the Section 29 prospect (locality 4, fig. 2), contains barite as minor gangue in a vein of purple and green fluorite. Mineralization occurs in a brecciated zone along a fault contact between gray shale and limestone. The vein strikes N. 20° E. across a saddle and dips 55° NW. The workings on the west side consist of a 150-ft open cut with a shaft of unknown depth sunk at the southern end. A small prospect pit on the east flank shows massive white barite associated with minor amounts of malachite.

Salinas Peak, rising to nearly 9,000 ft, is the most prominent feature of the northern San Andres Mountains. The uppermost 1,000 ft are composed of an extensive Tertiary rhyolite sill that weathers into characteristic talus slopes (fig. 4) and exhibits columnar jointing in many localities. On the eastern flank of the mountain, the sill overlies the Lead Camp Limestone (Pennsylvanian); while to the west, the units intertongue and are overlain by the Panther Seep Formation. The three most significant barite deposits in the area occur along the Panther Seep–rhyolite sill contact.

The Salinas mine (locality 6, fig. 2), which is noted on the U.S. Geological Survey topographic quadrangle, and a mine referred to as the Unnamed mine (locality 5, fig. 2) by Williams and others (1964) are approximately 4,500 ft apart and are separated by a shallow drainage. Structural relationships and min-

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TABLE 1—BARITE DEPOSITS OF WHITE SANDS MISSILE RANGE. See fig. 2 for locations.

Locality and deposit	Location (sec., T., R.)	Quadrangle	Type of deposit
1–Miera prospect	12, 6S., 5E.	Bingham (15′)	vein; Magdalena limestone
2–Independence mine	5 & 6, 9S., 5E.	Mockingbird Gap (15′)	vein; El Paso (?) Limestone (fault zone)
3–Baso Four mine	30, 10S., 5E.	Capitol Peak (15′)	vein; Panther Seep Formation (fault zone)
4–Section 29 prospect	29, 10S., 5E.	Capitol Peak (15′)	vein; Panther Seep Formation (fault zone)
5–Unnamed mine	36, 11S., 4E.	Salinas Peak (15′)	vein; Panther Seep Formation (shear zone)
6–Salinas mine	1, 12S., 4E.	Salinas Peak (15′)	vein; Tertiary rhyolite sill and Panther Seep Formation (shear zone)
7–Section 9 prospect	9, 12S., 4E.	Salinas Peak (15′)	vein; Tertiary rhyolite sill and Panther Seep Formation (fault zone)
8–Gem group	32, 12S., 4E. & 4, 5, 9, 13S., 4E.	Black Top Mtn. (15′)	vein; Precambrian granite (fault zone)
9–American Fluorspar group	11, 15S., 3E.	Black Top Mtn. (15′)	vein; Madera Limestone (fault zone)
10–Lot OM-69 prospect	10, 16S., 3E.	Kaylor Mtn. (15′)	vein; limestone
11–San Andres lead mine	18, 18S., 4E.	Bear Peak (15′)	replacement; Fusselman Dolomite (fault zone)
12–Stevens mine	28 & 33, 20S., 5E.	Lake Lucero SW (7½′)	replacement; Fusselman Dolomite and El Paso Limestone
13–Black Mountain district	21S., 4 & 5E.	Lake Lucero SW (7½′) & White Sands (7½′)	replacement; Fusselman Dolomite
14–Black Prince mine	20, 21S., 4E.	Organ (7½′)	vein; Precambrian diorite dike

eralogy of the mines are remarkably similar, suggesting a genetic as well as spatial relationship. In both cases, the mineralized zone strikes N. 80° E. and dips about 40° SE. The hanging wall consists of gray Panther Seep limestone; the footwall is the rhyolite sill. The contact is characterized by severe shearing and brecciation.

At the Unnamed mine the breccia zone is about 7 ft thick and contains barite associated with minor fluorite and galena. A significant amount of copper mineralization is also present. Chalcocite, chalcopyrite, azurite, and malachite were identified in the mine and on the dumps; in addition, a small amount of elemental sulfur was observed as a coating on some of the fragments.

The workings consist of two adits that intersect the ore zone at different elevations. Some stoping of high-grade areas has been done, as well as some exploratory drifting and crosscutting. Substantial ore is still exposed in the ribs. Although indications within the mine suggest a lateral continuation of the mineralization, tracing of the zone outside of the immediate area of the workings is impossible because of soil cover. The sill is not exposed in the mine.

The description of the workings at the Salinas mine is virtually identical to that of the Unnamed mine. Two adits with a total of approximately 500–600 ft of drifting intersect the ore zone at different elevations (figs. 5 and 6); however, a greater area of stoping is present at the Salinas mine.

Mineralogically, the Salinas mine differs from the Unnamed mine in that copper minerals are rare and galena and fluorite are major ore constituents. At one area in the upper workings, the ore zone is about 8 ft thick and contains 4–4½ ft of relatively pure barite in the center. The remainder of the ore zone is composed of massive blue and green fluorite and galena on either side of the central barite deposit. Fragments of the sill wholly included within the outer edges of the ore material indicate an age of mineralization somewhat later than the intrusion.

The extent of the Salinas deposit is difficult to determine. Near the upper adit a 4-ft thickness of barite outcrops along the hillside (fig. 7), but soil cover prevents tracing the zone more than a few feet. Within the mine exposures imply that significant mineralization may continue both laterally and at greater depth. The ore zone may possibly extend to the Unnamed mine to the east; in that case, the deposit as a whole would be quite noteworthy.

The Section 9 prospect (locality 7, fig. 2) is located about 3 mi southwest of the Salinas mine, near the head of Goodfortune Canyon. Here, a north-south-trending fault has dropped the Panther Seep–rhyolite sill contact to the east. Mineralization is limited almost totally to barite, with only traces of galena or fluorite.

The northernmost workings consist of a series of shallow pits and trenches following the strike of the fault northward, culminating in an 80-ft vertical shaft that exposes a 3-ft thickness of barite (fig. 8). This thickness is maintained as far down into the shaft as can be seen. In this area, only the Panther Seep Formation is exposed; as a result, the relationship of the mineralization to the intrusive body is not readily apparent. However, a few hundred feet to the south around a bend in the canyon, a narrow strip of the sill is exposed along with mineralization at the contact with the Panther Seep. Two inclined shafts of unknown depth have been sunk at the contact, and the material on the dumps indicates that barite is the dominant mineral. Galena and green fluorite are somewhat plentiful relative to the northern workings. As in the Salinas mine, the ore zone contains breccia fragments of the sill.

Originally, Williams and others (1964) thought that the Section 9 prospect might be the Valle Vista mine described by Lasky (1932); however, the workings observed did not agree with Laksy's description. At the Valle Vista the main tunnel was near the contact between the Precambrian and the overlying Paleozoic sediments. Lasky also mentions that the vein may be traced to the top of the range and that a deposit occurs approximately 125 ft below the crest containing minor chalcopyrite in a gangue of barite and fluorite. Trace amounts of galena, bornite, and chalcocite were also noted. Although no copper minerals were observed on the dumps at the southern workings of the Section 9 prospect, the two inclined shafts which appear to be rather older than the northern workings may represent the prospecting of Lasky's upper deposit. Williams and others (1964) do not mention the old shafts in their report, and the shafts are not visible from the other workings.

The history of the mines and prospects in the Salinas Peak area is rather perplexing because of the dearth of information concerning exact locations and descriptions of the deposits. Both Lasky (1932) and Anderson (1955, 1957) mention the district in general works, noting certain claims and mines by name; however, no details are provided. Unpublished reports on the Gwin–Short property disclose the general location and geology of a deposit that may be the Unnamed mine; if so, interest in the district would date back as early as 1926. Indications are, however, that mining activity has been much more recent. None of the three properties has been fully developed and the overall area is apparently poorly explored.

Williams and others (1964) describe a minor deposit located near the mouth of Rhodes Canyon, about 6 mi south of the Section 9 prospect. The Gem group (locality 8, fig. 2) consists of eight unpatented claims laid end to end. Barite, along with quartz and calcite, occurs with minor galena and fluorite in a fault in Precambrian granite. Mineralization is narrow, shallow, and sporadic along the fault. Because of its relative insignificance, the property was not visited during the course of this study.

Between Rhodes Canyon and Bear Canyon, a distance of over 40 mi through the central part of the San Andres Mountains, only three occurrences of barite are known. All are small and none have reported production. Only one ☞

of the deposits was visited as a result of time limitations; consequently, reliance on the observations of other investigators is necessary.

The American Fluorspar group (locality 9, fig. 2) consists of nine claims located on the south side of Sulphur Canyon, approximately ¼ mi southwest of the old Frank Crockett Ranch headquarters. Clippinger (1949) describes the deposit as a broken and mineralized zone 10–30 ft wide along a fault in Madera limestones (Pennsylvanian). Barite occurs with galena, calcite, quartz, and fluorite; occasionally lenses of relatively pure barite occur. A 20-ft drift constitutes the workings on the main prospect. Clippinger's evaluation of the property concluded that inferred ore at the time of his visit was insufficient to warrant the expense of mining and transportation.

From William and others' (1964) location, the Lot OM-69 prospect (locality 10, fig. 2) is probably on the south side of Hembrillo Canyon near the Henderson Ranch; however, a reconnaissance on foot failed to reveal any workings. Apparently the prospect is either quite small or well hidden. According to Williams and others (1964) the deposit is a vein of unknown dimensions in limestone (a sample contained 77.8 percent $BaSO_4$).

An inspection of the San Andres lead mine (locality 11, fig. 2), located on the north slope of San Andres Canyon, disclosed that K. C. Dunham's (1935) description of the deposit is undisputedly correct. Barite, with quartz and minor galena, occurs as an irregular replacement in Fusselman Dolomite (Silurian), and is associated with a pronounced normal fault that strikes N. 15° W. and dips steeply to the west. The deposit is only about 200 ft long and a maximum of 20 ft wide. Much of the ore in the mineralized zone is diluted with large amounts of quartz.

The principal workings are composed of a 100-ft open cut that exposes the ore body, a shaft at the center of the open cut, and an adit located about 100 ft below. The adit intersects the shaft about 400 ft from the portal and continues another 50 ft before splitting into two drifts of 100 and 130 ft, respectively. A winze of unknown depth has been sunk near the bottom of the shaft. Throughout the adit there is no evidence of mineralization. Several tons of ore are stockpiled near the foundations of the old mill and smelter, but it is doubtful that any production ever came from the mining effort.

Barite deposits of the southern San Andres Mountains occur in two distinct groups. The Black Mountain district (locality 13, fig. 2) encompasses numerous irregular replacement deposits in Fusselman Dolomite (Silurian) along the contact with the Percha Shale (Devonian). Apparently barite is the most abundant mineral, but the mineralized zones are too small and localized to be of interest; consequently, the area was not visited during this investigation.

The Stevens mine (locality 12, fig. 2) in the Bear Canyon district constitutes a significant occurrence of barite. Dunham (1935) has divided the deposits into two groups: the first group of deposits, like those of Black Mountain, consists of replacements in Fusselman Dolomite; the second group is related to a low-angle fault contact between El Paso Limestone and Precambrian granite.

The Fusselman deposits are situated near the crest of the range and are rather small, having inspired only minor exploitation because of their size and inaccessibility. Conversely, the lower deposits are located in the eastern foothills of the mountains and have been worked relatively intensively. A number of open cuts, prospect pits, adits, and shafts have been used to explore and exploit the ore zones. Barite mineralization occurs as replacement of limestone beds and breccia fragments. Minor amounts of fluorite and galena, as well as traces of cerrusite, anglesite, wulfenite, and vanadinite are present. Zoning of the minerals is similar to that at the Salinas mine in that the galena and fluorite occur toward the outer edges of the ore zone and were deposited before the barite.

The shafts are no longer accessible, but the inclines and tunnels remain in good condition and were entered for observation. The principal workings have partially explored a 2- to 4-ft thickness of barite mineralization. Small pits lower in the gulch have exposed another replacement body of similar width. As Dunham (1935) noted, other outcrops of barite in the area remain unprospected. On the whole, the lack of exploitation of barite on the property reflects the fact that lead was the commodity of primary interest.

The San Agustin Mountains represent a topographic separation from the San Andres Mountains rather than a structural division.

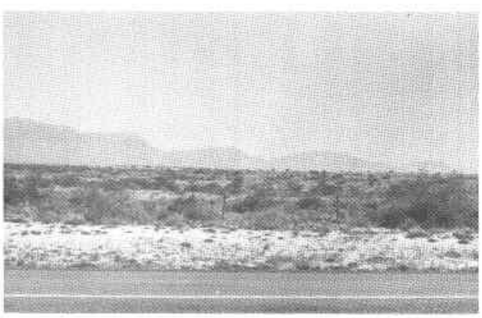

FIGURE 3—Looking northwest across the Tularosa Basin toward the southern San Andres Mountains.

FIGURE 5—View of the workings at the Salinas mine (looking north).

FIGURE 7—Outcrop of barite at upper workings of the Salinas mine; Sam is about 5½ ft tall.

FIGURE 4—View of the talus slopes on the southern side of Salinas Peak; note the fault evidenced by the offset dark beds of Lake Valley Limestone.

FIGURE 6—The upper adit at the Salinas mine; opening is about 4 ft high, with a 3-ft thickness of barite above.

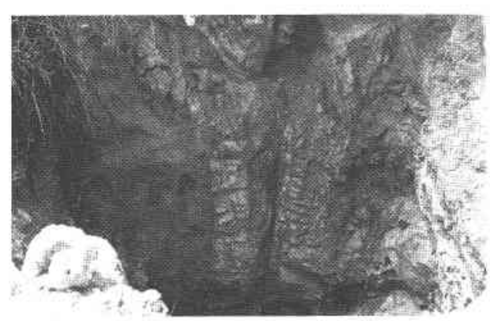

FIGURE 8—View southward at a 3-ft thick barite zone in the shaft at the Section 9 prospect.

The southern limit, San Agustin Pass, is generally taken to be the boundary between the San Andres and Organ Mountains.

Although Dunham (1935) reports barite at the Crested Butte prospect, an inspection of the dumps and workings revealed only two small fragments with coatings of tiny bladed crystals. The only notable occurrence of barite in the area is at the Black Prince mine (locality 14, fig. 2). The main workings, on the west side of a low ridge, exploited oxidized lead-zinc ores associated with a northeast-trending fissure through the contact between Fusselman Dolomite and Percha Shale. A 1-ft-wide zone of barite occurs at the intersection of a northeast extension of the fissure with a Precambrian diorite dike. A shaft approximately 50 ft in depth has exposed the mineralization. The deposit is quite small and pinches out a few feet below the top of the shaft.

Summary

Most of the barite-bearing deposits of the White Sands Missile Range constitute no more than occurrences of the mineral; however, the Bear Canyon and Salinas Peak districts are of some interest, especially in comparison to other significant barite deposits within New Mexico. The major mineral assemblage and sequence of deposition at Salinas Peak and Bear Canyon are remarkably similar to that in the Hansonburg and other districts. Deposits of some consequence also appear to be most prevalent at the linear extremities of fault-block mountain ranges, in areas characterized by profuse normal faulting in Paleozoic rocks. Examples of this relationship include Salinas Peak and Bear Canyon districts (San Andres Mountains), Hansonburg district (Sierra Oscura), Placitas and Tijeras districts (Sandia Mountains), and the Rincon district (Sierra Caballo). In addition, some correlation between barite mineralization and the presence of Precambrian rocks seems to exist (Allmendinger, 1975).

Although the barite deposits of the White Sands Missile Range are no longer open to exploitation and exploration, their stratigraphic and structural relationships can provide a guide for prospecting in other areas of the state.

ACKNOWLEDGMENTS—Special thanks are due Robert Weber, Robert Eveleth, and Robert North—all members of the New Mexico Bureau of Mines and Mineral Resources—who accompanied me in the field and offered their observations and suggestions. Borden Putnam was kind enough to discuss with me findings related to his research in the Hansonburg district. Most important, however, the Facilities Engineering Directorate of the White Sands Missile Range generously allowed our party into the restricted area to perform this investigation.

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New Mexico's minerals

CHALCANTHITE, $CuSO_4 \cdot 5H_2O$. GRAPHIC MINE, MAGDALENA DISTRICT, SOCORRO COUNTY, NEW MEXICO

Crystal system: triclinic — Hardness: 2½
Specific gravity: 2.28 — Fracture: conchoidal
Color: sky blue, sometimes greenish; streak: colorless
Specimen pictured: 5 × 2 cm

Chalcanthite is a secondary mineral found in copper deposits and is often associated with other secondary hydrated sulfates such as melanterite (iron), espsomite (Mg), goslarite (Zn), and gypsum (Ca). Chalcanthite is commonly found on the walls and timber of copper mines where it precipitated from copper- and sulfate-rich waters. In some deposits in Chile, chalcanthite is a major copper ore mineral. Chalcanthite was a minor ore mineral in the oxidized zone of the copper deposits of Butte, Montana. The name is derived from the Greek word "chalcanthum," meaning flowers of copper.

Photo by Mark R. Leo

Call for abstracts

The Second Annual Geoscience Student Research Symposium will be held on the campus of the New Mexico Institute of Mining and Technology at Socorro, New Mexico, on Saturday, April 18, 1981.

Student papers presented can be from any area of geoscience (including geology, geochemistry, geophysics, and hydrology).

Only abstracts received by March 20, 1981, will be included in the program. Abstracts should be submitted to Stephen White, Geoscience Department, New Mexico Institute of Mining and Technology, Socorro, New Mexico 87801. For further information write to the above address.

Geographic names

U.S. Board on Geographic Names

Leon, Cañon del—canyon, 10.3 km (6.4 mi) long, heads at 34°11′55″ N. 108°28′36″ W., trends northwest to open out 8.9 km (5.5 mi) south of Quemado; Spanish name meaning "lion canyon"; Catron County, New Mexico; sec. 33, T. 1 N., R. 16 W., New Mexico Principal Meridian; 34°16′08″ N., 108°30′45″ W.; not Canyon del Leon.

Nester Draw—ravine, 32 km (20 mi) long, heads at 34°03′50″ N., 108°15′22″ W., trends east then southeast to the Plains of San Agustin 58 km (36 mi) southeast of Quemado; reported to be named for early settlers who "nested" along this ravine; Catron County, New Mexico; sec. 12, T. 4 S., R. 12 W., New Mexico Principal Meridian; 33°58′21″ N., 108°02′36″ W.

Paradise Canyon—canyon, 5.6 km (3.5 mi) long, heads at 34°11′17″ N., 108°28′45″ W., trends southwest to Largo Creek 19 km (12 mi) south-southwest of Quemado; Catron County, New Mexico; sec. 32, T. 1 S., R. 16 W., New Mexico Principal Meridian; 34°10′19″ N., 108°32′10″ W.; not Canyon del Leon.

by Stephen J. Frost,
NMBMMR,
Correspondent

Satellite photomap of New Mexico available

(illustrated on p. 11)

RESOURCE MAP 12 (color)—Small 8″ × 10″ continuous tone, full-color print on photographic paper. Scale approximately 56 mi to the inch. Suitable for framing or inserting in reports. Can be examined with 2-power magnifier. Order from New Mexico Bureau of Mines & Mineral Resources, Socorro, NM 87801. $3.00

RESOURCE MAP 12 (black & white)—Large 26″ × 29″ monochrome lithographic print on map paper. Folded. Scale 1:1,000,000 (16 mi to the inch). Principal geographic, geomorphic, and cultural features are labeled. Order from New Mexico Bureau of Mines & Mineral Resources, Socorro, NM 87801. $3.00

RESOURCE MAP 12 (color)—Large 28″ × 31″ continuous tone, full-color print on photographic paper. Rolled. Scale 1:1,000,000 (16 mi to the inch). Suitable for mounting and wall display. Order from Aerial Photography Field Office, U.S. Agricultural Stabilization and Conservation Service, P.O. Box 30010, Salt Lake City, UT 84125. $40.00