

BARITE DEPOSITS OF ARIZONA

By L. A. Stewart and A. J. Pfister

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BARITE DEPOSITS OF ARIZONA^{1/}

by

L. A. Stewart^{2/} and A. J. Pfister^{3/}

SUMMARY

This paper describes all occurrences of barite in Arizona that were known or reported to the authors. The history, ownership, production, and geologic setting are discussed for most of the deposits. The uses and specifications of product grades are briefly discussed.

Seventy-five deposits were examined in 9 of the 14 counties of the State. The descriptions are given under county headings. No occurrences were reported in the four northeastern counties of Coconino, Navajo, Apache, and Greenlee, nor in Santa Cruz in the southern part of the State.

From about half of the deposits examined, 55 samples were taken; of these, 45 were for chemical analysis, and 8 larger samples, ranging from 100 to 350 pounds, for beneficiation tests. A 30-ton bulk sample was taken for pilot-plant tests. Bench-scale flotation tests of the eight samples employing several different procedures and reagent combinations yielded marketable-grade barite products with barite recoveries ranging from 60 to 97 percent. Five of the samples contained enough fluorspar to warrant its recovery. Acid-grade concentrates, which accounted for fluorspar recoveries of 45 to 70 percent, were obtained from three of these ores. Batch laboratory tests of a representative portion of the 30-ton bulk sample revealed that acid-grade fluorspar and high-grade barite concentrates could be recovered. Results of the laboratory and continuous pilot-plant tests of this ore will be presented in a separate report.

In virtually all the deposits the barite mineralization was confined to faults or fracture zones, most in igneous, some in sedimentary, and a few in metamorphic rocks. In about half the occurrences, fluorspar was associated with the barite in quantities varying from a few tenths to as much as 30 percent.

^{1/} Work on this manuscript completed November 1959.

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Barite production in Arizona first was recorded in 1925. The total production of barite from Arizona has been more than 300,000 tons; about 98 percent was from the Granite Reef deposit in Maricopa County from 1931 to 1955. Eight other deposits are credited with the remainder of the production in intermittent, relatively small tonnages from 1929 to 1955. There has been no production since the latter date, but in 1958 several large companies optioned promising properties.

INTRODUCTION

This report is one of a series covering the mineral resources of the Nation. Mapping was done where necessary, and numerous samples were taken for chemical analysis or beneficiation tests.

The barite in many of the deposits is complexly associated with fluorspar, calcite, silica, or various combinations of these minerals. As the demand for barite and fluorspar is expanding on the west coast and in Texas, metallurgists of the Bureau of Mines conducted beneficiation tests of some samples to determine the grade and recovery of barite and fluorspar obtainable by gravity concentration and flotation. Principal attention was focused on flotation, as the barite and fluorspar in most ores are intimately associated with each other or with the gangue and require fine grinding for liberation.

The history, ownership, production, and geologic setting are discussed for most of the deposits visited. Some deposits may have been overlooked, but all known deposits were examined. None were reported in the four northeastern counties of Coconino, Navajo, Apache, and Greenlee, nor in Santa Cruz in the southern part of the State.

Production of barite in Arizona has been handicapped by adverse freight rates and distances from consuming centers. A barite processing plant near Mesa was operated from 1946 to 1955, after which the mill was dismantled.

Interest in barite has been revived, and early in 1958 several large companies optioned promising properties in the State.

An effort has been made to determine the positions of the various deposits by section, township, and range. All available maps were used, but in unsurveyed areas it was necessary to make approximate projections of these subdivisions. The township and range numbers refer to the Gila and Salt River base and meridian.

ACKNOWLEDGMENTS

Owners of the barite properties were very cooperative in furnishing information concerning their claims, and many accompanied the writer to the deposits. Special acknowledgment is due William F. Paine, former general manager of the Arizona Barite Co. and more lately of the Macco Corp. (Barite Division) for help in finding deposits that had come to his attention.

The Bureau of Mines has secured permission to publish information concerning their properties from all owners with known addresses.

HISTORY AND PRODUCTION

Barite production in Arizona first was recorded by the Bureau of Mines in Mineral Resources of the United States for 1925, which states "An initial shipment of ore was reported from Cochise County." During the field investigation the source of this barite was not determined.

The next known production was during 1929 to 1938, when some 3,800 tons of barite ore was shipped from four localities in Yuma County.

The first shipment from Maricopa County seems to have been about 1930, when the Fay L property south of Aguila produced 100 tons. In 1950 this same property produced 800 tons of crude ore. The Granite Reef property near Mesa started operations in 1931, and to 1945 W. F. Christman produced 100,000 tons of sorted ore. In 1945 the Arizona Barite Co. (a subsidiary of the Houston Oil Field Materials Co.) took over the property and shipped 12,000 tons of sorted ore while constructing a barite processing plant. The mill, consisting of a grinding circuit, was placed in operation in April 1946; a flotation circuit was added in June 1948. The Macco Corp. bought the mine and mill in 1952 and continued production up to July 1955, when mining was suspended and the mill dismantled. The total production of the mill exceeded 200,000 tons of concentrates.

Small shipments were made from Cochise, Mohave, and Gila Counties.

A compilation of barite production by counties and years, based on the best field information available, is given in table 1. The production record is approximate, as few definite figures were obtainable.

MINERALOGY AND MODE OF OCCURRENCE

Barite and witherite are the two mineral sources of commercial barium and barium compounds. Of these, barite (BaSO_4) is the principal mineral of commerce. It theoretically contains 65.7 percent BaO and 34.3 percent SO_3 . Having a specific gravity of 4.5, it is one of the heaviest nonmetallic minerals. Its average hardness is 3, or about the same as that of calcite (CaCO_3). Chemical inertness and high specific gravity give barite its major use as a weighting agent in well-drilling muds.

The following graph (fig. 1) shows the correlation of specific gravity to percent barite in relation to volume of ore per short ton. The graph is designed for an ore having a siliceous gangue.

Witherite (BaCO_3) contains 77.7 percent BaO and 22.3 percent CO_2 and has a specific gravity of 4.3. As it occurs infrequently in Arizona, it will not be discussed further.

TABLE 1. - Estimated production of barite in Arizona.

County	Approx. Date	Property	Short tons		
			Crude ore	Concentrate	Total
Yuma.....	1929-30.....	Renner.....	1/900		
	Late 1930's.....	Keiser.....	2/100		
	1937.....	Ernest Hall.....	3/300		
	1938.....	Black Mountain.....	2,500		3,800
Maricopa.....	1930.....	Fay L.....	100		
	1950.....	..do.....	800		
	1931-45.....	Granite Reef.....	100,000		
	1945.....	..do.....	12,000		
	1946-55.....	..do.....		200,000	312,900
Mohave.....	1953.....	Rucker.....	90		90
Gila.....	1954.....	Near Payson.....	112		112
Cochise.....	1932.....	Johnnie Boy No. 1.....	75		75
			116,977	200,000	316,977

1/ Tonnage estimated; reported as 18 carloads.

2/ Tonnage estimated; reported as 2 carloads.

3/ Tonnage estimated; reported as several carloads.

In virtually all Arizona deposits, barite mineralization occurs as veins in faults, fractures, or as irregular multiple veins in fracture zones. Of the deposits examined, most occurred in various types of igneous, some in sedimentary, and a few in metamorphic rocks. In a few occurrences barite was an associated mineral in metalliferous deposits, and in one instance is thought to have been deposited by meteoric waters.

In about half the deposits investigated, fluorspar (CaF_2) was associated with the barite in quantities varying from a few tenths to as much as 30 percent.

USES^{4/}

The largest use of barite ... is as a weighting agent in rotary well-drilling fluids. Such fluids serve several purposes - lubricating and cooling the bit, plastering the walls to prevent caving, carrying the cuttings up the well to the surface, and the purpose for which barite is used, restraining abnormally high gas and oil pressures to their formation levels....

Barite crushed to about 16- to 20-mesh and added to a glass melt serves several purposes; it fluxes the heat-insulating froth that tends to form on the surface of the melt, thus saving fuel. It makes the glass more workable and increases brilliance. When crushed material is not available the industry can use ground barite.

4/ Arundale, Joseph C., Barium, ch. in Mineral Facts and Problems: Bureau of Mines Bull. 556, 1956, pp. 88-93.

Barite is the raw material used in lithopone, an intimate mixture of two precipitated salts - zinc sulfide and barium sulfate. Lithopone is used as a white pigment, principally in paints.

Another important use for barite is as a raw material in manufacturing various barium compounds, such as barium carbonate, precipitated barium sulfate, barium chloride, barium oxide, barium peroxide, barium hydroxide, barium nitrate, and others.

Precipitated barium sulfate, or blanc fixe as it is commonly called, is used as an extender and as a pigment in paint. Blanc fixe is used as a paper filler and in paints, printing ink, rubber, linoleum, oilcloth, and leather.

Within recent years, barite mixed with cement has been used as a pipe-coating material in underwater transmission lines, and "heavy" concrete is finding uses.

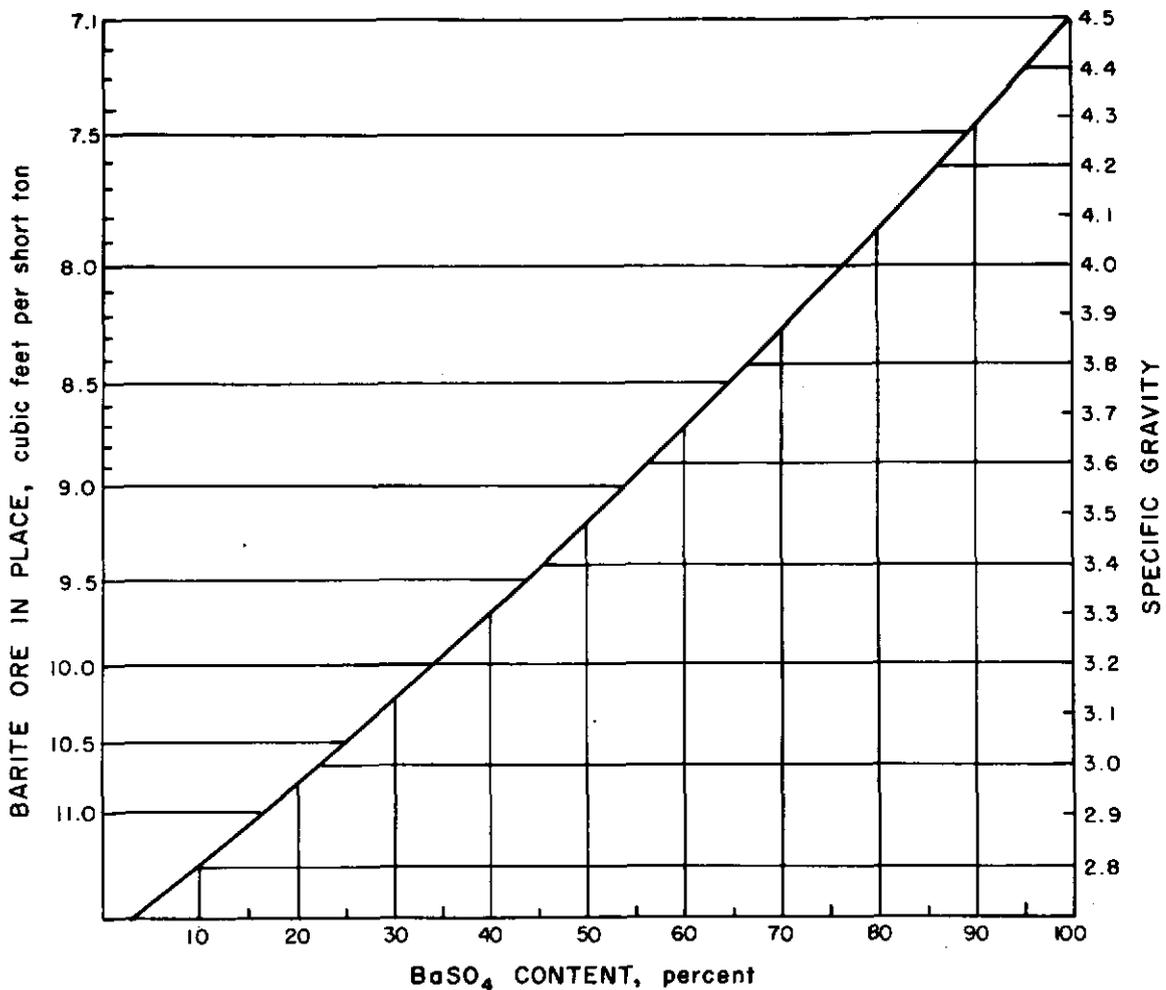


FIGURE 1. - Graph Showing Relation of Specific Gravity, Percent BaSO₄ and Volume of Ore.

A new use for barite^{5/} is as a mixture, finely ground, with synthetic rubber powder, which is added to asphalt and used in road, airstrip, and parking-lot construction.

Although there are many other uses for barite and barium chemicals, the industry depends on the well-drilling market for over 95 percent of its sales volume.

Specifications

The physical and chemical specifications for barite vary according to the end uses.

Well-Drilling Muds

In well-drilling muds the material must be heavy and inert. Grinders attempt to produce a material of minimum 92 percent BaSO_4 , free of soluble salts, such as calcium sulfate. Most grinders of well-drilling barite guarantee 90 to 95 percent passing 325-mesh and a specific gravity of not less than 4.2. Several percent of iron is not objectionable.

Barium Chemical Manufacturing

For chemical purposes, a minimum of 94 percent BaSO_4 is generally specified with a maximum of 1 percent Fe_2O_3 ; a maximum of 1 percent strontium sulfate, with only a trace of fluorine permissible. Strontium sulfate in material intended for lithopone use might be somewhat higher. Mesh size is important to most consumers for chemical purposes.... Most consumers specify a material in the range of 4- to 20-mesh; however, some consumers grind lump to this specification.

Glass

Glassmakers have a specification usually requiring a minimum of 98 percent BaSO_4 , maximum SiO_2 1.5, Al_2O_3 15, and Fe_2O_3 0.15 percent. In mesh size they prefer a mixture ranging from 30-mesh down through 140.... The most objectionable impurity is iron.

Filler and Aggregate Use

Specifications of barite used for filler and aggregate are not so strict, and in most instances mesh size is most important.

^{5/} Schreck, Albert E., and Foley, James M., Barite: Bureau of Mines Minerals Yearbook, 1955, pp. 197-198.

DESCRIPTION OF DEPOSITS

Cochise County

The few barite deposits known in Cochise County occur within a radius of 12 miles of Tombstone (fig. 2). One deposit northeast of the town is reported to have shipped two carloads of barite ore. Another deposit southeast of Tombstone produced several hundred tons of silver-bearing lead ore; the principal gangue mineral was barite.

Ramirez Property

The Ramirez property consists of two unpatented claims (Gila Monster and Corrine), contiguous end to end, in the foothills at the north end of the Mule Mountains on the west side of sec. 30, T. 21 S., R. 24 E. The deposit is on the north side of Gadwell Canyon at an altitude of approximately 5,100 feet.

Claims covering the deposit originally were located in 1927 by Harry Hughes, who apparently produced several hundred tons of silver-bearing lead ore from part of the vein. Later, the property reverted to public domain, and the two claims were relocated in March 1957 by Cecil Ramirez and associates of Tombstone.

The property is accessible from Tombstone by the following mileage log:

- 0.0 Travel south from Tombstone on U.S. Highway No. 80.
- 3.8 Turn left on graded road signed Cowan Ranch.
- 9.3 Turn right on desert road signed Southwest Oil Co.
- 12.2 Turn left on dim trail.
- 12.9 Bear left through fence.
- 15.4 Take left fork, pass windmill at 17.4, and enter Gadwell Canyon.
- 18.8 Workings are on hillside to northwest.

The barite occurs in a fault fracture in the Morita member of the Cretaceous Bisbee group.^{6/} The throw of the fault is not great; the hanging wall is maroon mudstone, and the foot wall is an impure sandstone containing lime and feldspar. The strike of the fault on the northeast claim (Gila Monster) is N. 45° E., with a vertical dip, where visible, near the center of the claim. This dip changes to 65° S. in the east part of the southwest claim (Corrine), and farther to the southwest the fault shows a strike of N. 65° E. and a dip of 75° S.

^{6/} Gilluly, James, General Geology of Central Cochise County, Ariz.: Geol. Survey Prof. Paper 281, 1956, pl. 5.

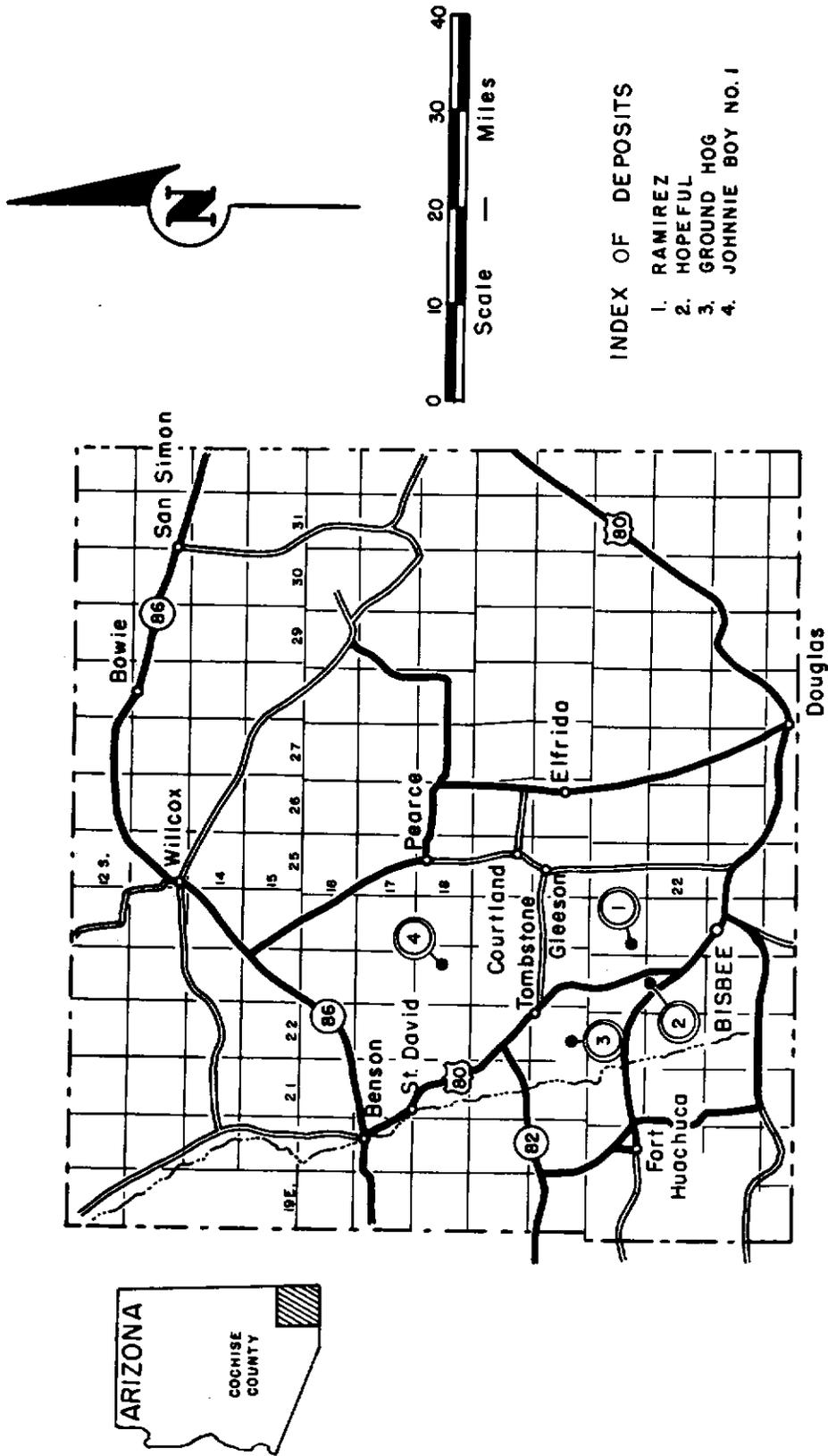


FIGURE 2. - Barite Deposits of Cochise County.

On the Corrine claim, west of a small arroyo, the vein has been prospected some 50 feet up from the arroyo bottom by a 15-foot adit at the end of a 40-foot cut. The mineralized zone is 4 feet wide, showing a 2-foot band of good barite against the hanging wall. The remaining width on the foot-wall side consists of barite stringers in shattered rock. A sample chipped across the 2-foot barite vein assayed 87.6 percent BaSO_4 and had a specific gravity of 4.16. A caved trench showing barite in the dump extends for 40 feet along the strike above the adit. An outcrop 200 feet farther to the southwest and 100 feet higher on the hill showed fair barite 4 feet wide.

Farther up the slope a hillside cut 20 feet wide exposed a vein 2 feet wide of virtually pure barite containing some galena. A short distance beyond this cut, an open stope with a strike length of about 100 feet has been worked partly by underhand stoping but mainly by stoping from the end of a crosscutting 125-foot adit some 50 feet below the outcrop. At the face of this adit the vein was intersected in a pinch. The barite band lying against the hanging wall is 12 inches wide at the top of the drift but increases to 18 inches at floor level. The work above the drift is inaccessible because of material against the gate of the chute, which opens into the stoped area on the west side of the drift. This deposit was mined for the lead-silver values.

The vein can be traced several hundred feet farther southwest by occasional outcrops and considerable float. A sample from an outcropping ledge about 200 feet southwest of the stope assayed the following: 67.5 percent BaSO_4 , 4.6 percent lead, and 0.05 ounces silver per ton.

The Gila Monster claim, abutting the Corrine on the northeast and east of the arroyo, is in relatively flat alluvium-covered terrain. About 200 feet northeast of the first-mentioned 15-foot adit, an outcrop in a small wash exposes the fault zone, showing several narrow barite stringers across a 10-foot section. Workings 200 feet farther eastward show a compound vein system. A shallow cut exposes a 5-foot zone, which has 1-foot bands of good barite on each wall. A parallel, benched trench, 10 feet to the south, shows a 3-foot vein of virtually pure barite. A sample cut across this latter exposure assayed 90.7 percent BaSO_4 and had a specific gravity of 4.21.

Old caved trenches, in intermittent segments, followed the south vein for about 200 feet. Although the vein cannot be seen, the excavated material contains quantities of barite. No prospecting has been done farther to the northeast.

The various workings and outcrops indicate a vein length of nearly 2,000 feet; associated lead mineralization seems to be confined to the southwest part of the vein. The barite generally is massive or coarsely crystalline, and below the surface weathering shows little or no iron staining.

Hopeful Claim

The Hopeful Claim is in low topography north of the Mule Mountains, about 15 road miles south of Tombstone in the NW 1/4 sec. 4, T. 22 S., R. 23 E., at an altitude of approximately 4,600 feet. Specifically, it is 0.3 mile

northwest from U.S. Highway No. 80 (Tombstone-Bisbee road) on a dim trail 4.8 miles south of the bridge signed Government Draw. The claim is immediately west of the highway on a low limestone knoll. It is a 1957 relocation of an old claim by Cecil Ramirez.

The exposure of limestone, about 1,000 feet in diameter, is surrounded by alluvium. The limestone is fairly massive, marbleized, and somewhat cherty. It has been identified by Gilluly^{7/} as the Horquilla member of the Naco group.

The old 30-foot vertical shaft, now inaccessible, was sunk on a gash vein containing barite from 12 to 18 inches wide. The vein strikes N. 70° W. and is essentially vertical. Along the strike to the northwest, several shallow cuts have exposed the vein for about 100 feet from the shaft. Alluvium covers the limestone at about 50 feet southeast of the shaft, so no vein outcrop was noted in this direction.

The barite, gray to white, is coarsely plated and contains minor amounts of galena and local copper-oxide staining.

Johnnie Boy No. 1 Claim

The Johnnie Boy No. 1 claim is on the west slope of the Dragoon Mountains in the Coronado National Forest at an altitude of 5,700 feet. The corner common to sections 13, 14, 23, and 24, T. 18 S., R. 23 E., is within the claim boundaries. This claim is the westernmost one of an unpatented group owned by John F. Kreis, of Warren, Ariz., and is the only one that shows barite mineralization.

The property is accessible from Tombstone as follows: Travel north 1.6 miles on U.S. Highway No. 80 to the junction signed Pearce via Middlemarch Canyon. From this junction go northeast on the Pearce road for 12.8 miles. The barite working is about 200 yards to the north and 100 feet above the road.

The deposit originally was located in January 1937 as the Head Center claim by E. B. Escapule. It is reported that sometime later a lessee mined and shipped 75 tons of sorted barite to a west-coast firm. In 1953 the Standard Tungsten Corp., S. C. Hu, president, leased the group from Kreis and produced tungsten from claims to the east.

This area is underlain by complexly thrust-faulted Cambrian to Permian sediments and Tertiary intrusives.^{8/}

North of and above the road on claim 1, two limestone members are separated by a sill-like, fine-grained igneous rock 100 to 150 feet thick. The limestone units strike northwest and dip southeast. Barite occurs in a stratum of the lower limestone some 50 feet down the hill slope from the lower igneous contact. At the deposit the limestone bedding exhibits a moderate curving dip to the southeast and is overlain by bedding-fault gouge, thin

^{7/} Work cited in footnote 6, p. 7.

^{8/} Work cited in footnote 6, (p. 7), pls. 5 and 6.

remnants of an overlying bed, and several feet of cemented overburden and caliche. Consequently no outcrops are visible other than at the place the work was done in the bottom of a small southerly trending gulch. The exploration consists of a 40-foot adit driven N. 60° E. under shallow cover.

Although the adit originally had a full face of barite, the dip of the limestone carried the barite to floor level at 25 feet from the face. The north (up-dip) side of the adit was widened into a small stope 20 feet long by 10 feet wide, but as this had been backfilled, the wall could not be observed. Opencut work 30 feet west of the portal exposes barite 18 feet wide. A sample cut assayed 56.6 percent BaSO₄.

Mineralization consists of an intergrowth of granular barite and silica in which pods of virtually pure barite occur. Sporadic small bunches of pyrite were observed on fractures. Not enough work done has been done to determine the extent of mineralization. Although the deposit appears to be bedded, strong vertical fractures trending N. 55° W. within the mineralized zone suggest that it may be of the vein type, with an expanded area in the limestone under the impervious gouge capping.

The next good exposure of the limestone bed is in a deep draw about 1,000 feet northwest of the workings. No barite was observed at this outcrop.

Ground Hog Mine

The Ground Hog is one of the old mines of the Tombstone district, dating back to the early 1890's. The workings now are caved and inaccessible, but the size of the dumps indicate that they were extensive. Papers dated in December 1956 show that at least two relocations, covering much of the mineralized zone, have been made by Wallace S. Eavenson and associates.

The property is accessible from Tombstone by traveling 3 miles southwest on the Charleston road, then on a left fork 1.8 miles to the mine workings. The claims are near the west base of Ajax Hill in the south part of sec. 22, T. 20 S., R. 22 E., at an altitude of approximately 4,550 feet.

Numerous old workings extend along a fault zone for more than 1,000 feet. The fault strikes northeast and dips steeply southeast with Naco limestone east and the Bisbee sedimentary group west of the fault contact.

Inspection of the dump material shows that barite was one of the gangue minerals throughout the workings. Near the southwest end of the mineralized zone, a barite vein 1 to 3 feet wide is exposed in pits and shaft collars. The barite is white and relatively pure. Because of the caved condition of the old workings, it was impossible to determine the downward extent of the barite mineralization, which reportedly extends below the 200-foot level.

According to Rasor^{9/} barite is sparse or lacking in most of the ore deposits of the district. He further states that one other occurrence of

^{9/} Rasor, Charles A., Mineralogy and Petrography of the Tombstone Mining District, Ariz.: Univ. of Arizona, doctorate thesis, 1937, p. 53.

barite was noted: "White crystalline barite is present with quartz and manganese oxides in a vein exposed in a prospect pit about one-half mile west of the Lucky Cuss mine." This occurrence could not be found.

Gila County

All known barite deposits are in the northern part of Gila County--two in the vicinity of the Tonto Basin, and the others near Payson (fig. 3).

South of the latter town barite mineralization occurs sporadically in more or less parallel fractures for about 15 miles along an east-west zone in granitic rocks. About 1950 over 100 tons of sorted ore from some outcrops was trucked to the barite grinding plant at Mesa. There probably are several prospects along this zone that were not investigated.

Top Hat Group

The Top Hat group, consisting of five unpatented claims, is in approximate secs. 31 and 32, T. 8 N., R. 12 E., unsurveyed, of the Tonto National Forest. This locality is in the Sierra Ancha Mountains on the north slope of Chalk Mountain at an approximate altitude of 5,450 feet. The claims were located in 1956 by E. W. Grimes, Flora Massingale, and Gale Passey.

The property is accessible from Tonto by the following road mileage log:

- 0.0 Tonto Basin. Travel east on Greenback road.
- 6.6 Turn left on road signed J/X Ranch.
- 13.3 Take left fork, signed J/X Ranch.
- 16.5 Take left fork, signed Del Shay.
- 17.5 Arrive at west end of Top Hat group.

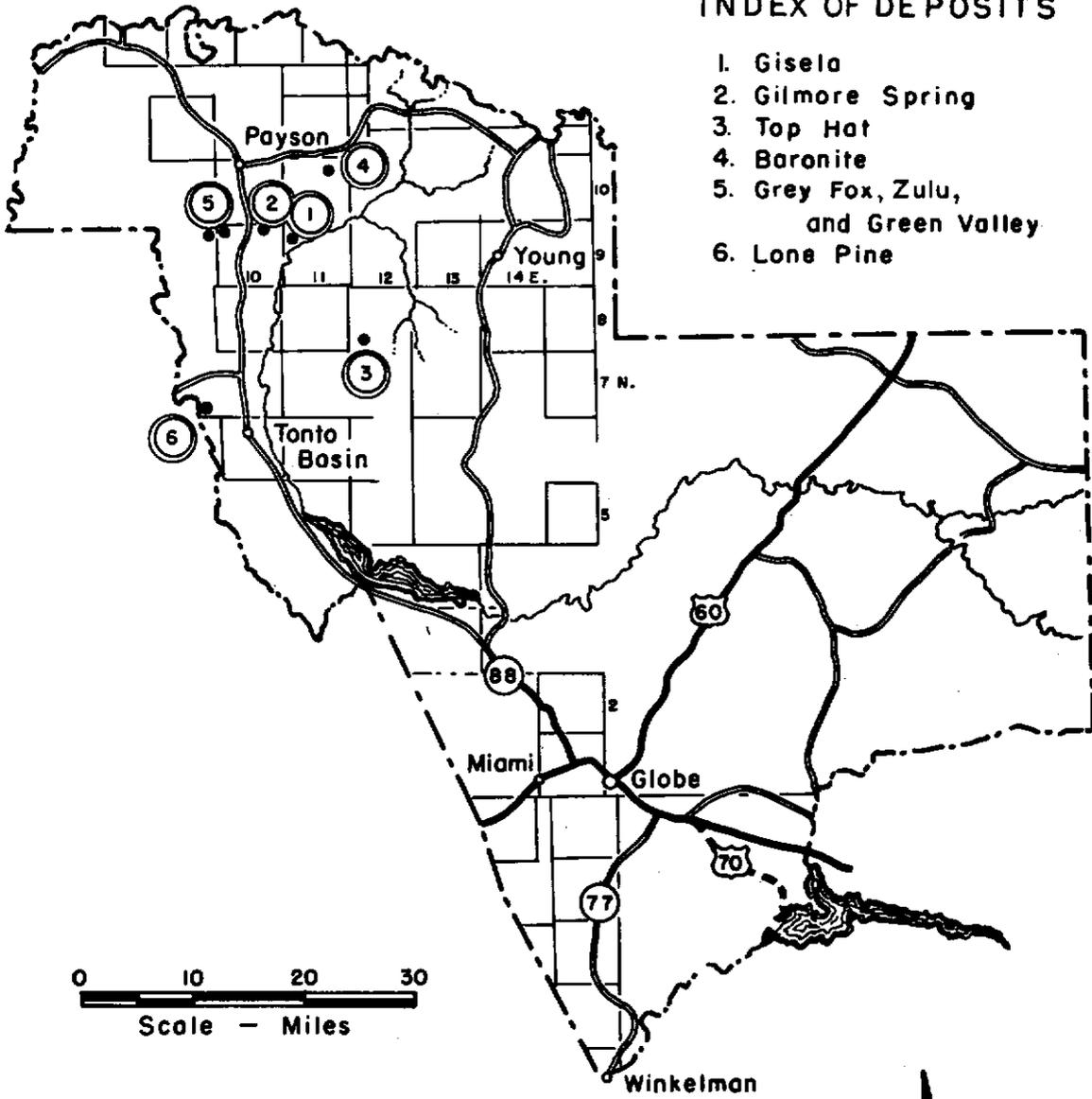
The claims are laid out end to end, consecutively numbered 1 to 5 from west to east. The road crosses the claims near the end line common to claims 1 and 2.

The deposits consist of discontinuous lenticular bodies of barite, occurring as fissure filling along a vertical fault zone having a general strike of N. 75° W.

When examined in late July 1957, the location and exploratory work consisted of dozer cuts along the lower side of the vein on each claim to a depth of 6 to 10 feet. Immediately west of the road, the dozer cut exposes a 75-foot lens with a maximum width of 2 feet. A lens up to 8 feet wide was partially uncovered 600 feet farther west. At this end of the property arkosic quartzite lies south and limestone north of the fault.

INDEX OF DEPOSITS

- 1. Gisela
- 2. Gilmore Spring
- 3. Top Hat
- 4. Baronite
- 5. Grey Fox, Zulu,
and Green Valley
- 6. Lone Pine



0 10 20 30
Scale - Miles



FIGURE 3. - Barite Deposits of Gila County.

A short distance east of the road on claim 2, a 100-foot lens varies from 1 to 3 feet in width. A lens about 1 foot wide is partially exposed in a parallel fissure 15 feet to the south. The country rock on this side is fine-grained rhyolite. Bedrock was not exposed on the opposite side. Farther east, the dozer cut on claim 3 exposed a 100-foot lens having a maximum width of 4 feet, and on claim 4 the lens exposed is 75 feet long and 1.0 to 2.5 feet wide.

Each previously mentioned lens attains its greatest width about midway of the length and gradually decreases in width to the east and west. Beyond the stated length, the barite tends to feather out into smaller stringers containing rock fragments. Where the deposits attain a width of a foot or more, the lenses were composed of relatively pure, thick-plated, or massive barite. A composite sample of all deposits on the four claims assayed 95.7 percent BaSO_4 , 0.5 percent CaF_2 , and 0.1 percent CaCO_3 and had a specific gravity of 4.38.

On the most easterly claim (No. 5), considerable dozing was required to find the mineralized zone, which appeared to be in quartzite. The barite exposed in the 150-foot cut occurred in numerous fractures in a zone several feet wide. Barite float was noted up the hill to the south of this cut and probably was derived from other parallel mineralized fractures.

These deposits are in a heavily wooded area, covered with a thick mantle of soil and virtually devoid of rock outcrops. It is likely that other unexposed deposits are present along the strike of this mineralized zone between the widely spaced cuts on the five claims.

Lone Pine Claim

The Lone Pine claim was located by Gus P. Packard and Tom Soder in July 1955. The claim is on the northeast slope of Mt. Ord at an altitude of 6,450 feet, or about 700 feet below the summit. It is in unsurveyed sec. 35, T. 7 N., R. 9 E., of the Tonto National Forest.

The property is accessible by traveling up the Mt. Ord Forest Service Road, which branches south from the paved Bee Line Highway just above the Ord mercury reduction plant. The junction of this road is 10.3 miles north of the Sunflower store and 22 miles south of Payson. From this turnoff go 5.6 miles; the workings are along the hillside about 900 feet to the northwest.

Barite mineralization occurs within a wide belt of metavolcanic rock, classified by Wilson^{10/} as pyroxenite. The mineralized zone is exposed intermittently for a length of approximately 200 feet by a series of five shallow pits and a 25-foot trench along the strike. Not enough work has been done to definitely delineate the strike or width of the zone. Two of the pits show what may be the foot wall, which in these exposures strikes N. 30° W. and dips 70° SW. The hanging wall has not been exposed, but barite appears to be present in a zone at least 15 feet wide.

^{10/} Wilson, E. D., Precambrian Mazatzal Revolution in Central Arizona: Geol. Soc. of America Bull., vol. 50, No. 7, July 1, 1939, p. 1128 and pl. 11.

In the trench a sample cut across a 4-foot width of solid barite assayed 93.5 percent BaSO_4 and had a specific gravity of 4.28. North of this band there was about 3 feet of barren material, against which another band of barite was barely uncovered in a side opening. To the south the sampled band continued into the trench wall, and its total width was not exposed.

Selected pieces from various places in the trench were assayed to determine if chemical-grade barite could be hand-sorted. The samples had a specific gravity of 4.35, and assayed 96.0 percent BaSO_4 , 0.1 percent CaF_2 , 1.3 percent SiO_2 , 0.11 percent Al_2O_3 , and 0.26 percent Fe_2O_3 . Although the selected material would be acceptable for chemical use, the iron oxide content was too high and barium sulfate analysis too low for glass manufacturing.

Flotation tests were made of the sample to determine if a glass-grade product could be recovered. A barite concentrate having a specific gravity of 4.4 and assaying 98.2 percent BaSO_4 , 0.04 percent Fe_2O_3 , 0.5 percent SiO_2 , and 0.05 percent Al_2O_3 was obtained by flotation with oleic acid. The barite recovery was 97.2 percent. This product met specifications for either chemical- or glass-grade barite.

Judging from the limited exposure, it appears that barite bands several feet wide alternate with narrower runs of barren material, across a zone that may be 20 or more feet wide. Float along the hillside at either end of the prospected area indicates that the zone may extend for a considerable distance along the strike.

Rock fragments within the barite-rich zone usually are confined to the borders of the bands, and elsewhere only narrow strands of siliceous material traverse the compact massive barite, which on broken surfaces resembles gray marble. The platy structure usually observed in barite deposits is almost entirely lacking in this deposit.

Gisela (Spook) Deposit

The Gisela deposit, covered by three unpatented claims, is in sec. 7, T. 9 N., R. 11 E., of the Tonto National Forest about 2 air miles northeast of the settlement of Gisela. The claims were located in mid-1956 as Spook Nos. 1 to 3 by E. G. Sorensen and M. E. Flack, the present owners. Apparently the claims have been located and abandoned several times.

The property can be reached by traveling 11.7 miles south from Payson on the Bee Line Highway, 6.4 miles northeast to the Barkley Ranch, and 2.8 miles northeast to the end of a primitive truck trail; the claims are one-half mile farther northeast.

Near the top of a ridge a bench cut about 60 feet long exposes a barite vein 2 to 4 feet wide. It follows a fracture plane in granitic rock, striking northwest and dipping steeply northeast. The vein can be traced over the ridge and down the slope for about 2,000 feet. Mineralization is within the vertical range of 200 feet. The projected strike crosses a canyon, but no outcrops could be observed in the creek bottom. Shallow cuts along the course of the

vein suggest that the average width at the surface is 2 to 3 feet, but at one point the barite was 10 feet wide.

The barite is massive and remarkably pure, except that the surface of crystal plates was stained pink by iron oxide. A sample assayed the following percentages: 93.6 BaSO₄, 3.7 SiO₂, and 0.5 FeO₃; specific gravity was 4.29.

Gilmore Spring Prospect

The Gilmore Spring prospect is on minor barite-bearing veins immediately south of the Bee Line Highway 7.3 miles south of Payson. The original locator is unknown. The prospect is in the north central part of sec. 4, T. 9 N., R. 10 E., just west of the windmill at Gilmore Spring, at an altitude of 4,250 feet.

The only work done on the claim was in 1953, when two short trenches were dozed across the vein. One trench, some 700 feet west of the windmill, is about 5 feet deep and shows a vein 8 inches wide at the surface and 14 inches on the bottom. The vein strikes S. 80° E. and dips 75° N. The second trench, about 1,000 feet west of the windmill, shows the same vein to be only a few inches wide, but 30 feet to the south exposes an offshoot vein 6 inches wide, essentially vertical, and striking S. 50° E.

Both veins are exposed in a 30-foot roadcut a short distance west of the second trench. The S. 80° E. vein is 2 inches wide; the other vein is 14 inches wide at the top and pinches to 2 inches at the bottom of the cut.

Sparse float fragments were found on a knoll east of the windmill, but the vein was not observed. The country rock is quartz diorite.

The barite within the veins contained no fluorite and was virtually pure; a character sample had a specific gravity of 4.39 and assayed 97.8 percent BaSO₄, 1.0 percent SiO₂, and 0.3 percent Fe₂O₃.

As it had been reported that this zone of barite mineralization extended for 2 or 3 miles westward, a cursory investigation was made along a ridge about a mile west of the Gilmore Spring occurrence. Approximately a mile south of the old Ox Bow gold mine, three narrow barite veinlets were found in the old highway cut near the center of sec. 5. These were within a few hundred feet of each other. Two were vertical, striking S. 40° E.; the third had a strike of S. 60° E. and a dip of 70° SW.

Grey Fox Group

The Grey Fox group of two contiguous unpatented claims is in the south part of sec. 6, T. 9 N., R. 10 E., of the Tonto National Forest, at an altitude of 3,600 feet. The claims were located in September 1956 by Earl Russell. The property is accessible from the Rye Creek store 10 miles south of Payson on the Bee Line Highway (Mesa to Payson), according to the following mileages: Travel north on the highway, at 0.5 turn west on a dirt road; at 1.5 take right fork; at 4.0 take left fork; at 4.4 turn sharp left on a dim trail up

and around a hill; at 5.5 the barite occurrences are visible on both banks of a wash or arroyo.

On the west bank, about 50 feet above the wash, a nearly vertical barite vein as much as 2 feet wide, striking S. 55° E., is exposed by a 150-foot dozer cut across the top of a ridge. The bedrock is fractured and altered diorite. About 100 yards farther to the west, dozer stripping exposed continuation of the vein on the south side of a 4-foot fracture zone, which also contains several minor stringers. The major vein ranges in width from a maximum of 18 inches to local pinches of only a few inches.

A second vein, 10 to 18 inches wide, appears in the west bank 100 feet to the north, where about 50 feet of exposure shows a strike of S. 40° E. and an essentially vertical dip. In contrast to the first-mentioned vein the latter has irregular walls with stringers and pods extending into the wallrock. At the top of the bank the vein is covered with overburden and could not be traced farther to the west.

Generally the barite of both veins is in compact coarse plates with sporadic inclusions of wallrock. No fluorspar was noted in the barite, which has a pinkish tinge at the surface due to iron-oxide staining.

Across the wash on the east side, a barite stringer a few inches wide traverses up the hillside for several hundred feet. This vein strikes N. 80° W. and dips 75° N.

Zulu and Green Valley Prospects

The Zulu mining property, owned by William E. Jackson and Walter Lovelady, is in unsurveyed sec. 1, T. 9 N., R. 9 E., of the Tonto National Forest. This property is accessible from the Rye Creek store, 10 miles south of Payson on the Bee Line Highway, according to the following mileages: Travel north on the highway, at 0.5 turn west on a dirt road; at 2.5 turn right and arrive at the Zulu camp cabin at 4.3.

In this immediate area barite mineralization occurs in several parallel vertical fractures, which strike S. 70° E. in a somewhat altered quartz diorite.

About 650 feet S. 30° E. from the Zulu shaft, the outcrop of a 12-inch vein is exposed for a length of 50 feet. Mineralization appears to fray into numerous stringers in the bottom of the draw to the east, but a narrow and short outcrop some 300 feet to the southeast may represent an extension of the same zone. Any westward extension is completely masked by overburden. It is reported that Lovelady produced two truckloads of ore from this deposit-- probably as part of the 112-ton shipment to the Mesa mill of the Macco Corp. in 1954.

A parallel vein 100 feet to the northeast crops out on the east side of the draw. It is 8 to 10 inches wide and can be traced southeast for about 200 feet up the slope, where it becomes obscured by overburden. It reappears in

the west bank of the next wash, where it contains up to 12 inches of high-grade barite. This and the previously mentioned deposit are on the Zulu No. 1 claim owned by Jackson and Lovelady.

Across the wash on the same vein is the discovery cut of Green Valley No. 2 claim, located by William R. Dudley in mid-1957. This cut exposes a 9-inch width of high-grade barite. Any extension to the southeast is covered by alluvium and has not been prospected.

On the adjacent Green Valley No. 1 claim, a location pit has been excavated on a narrow barite stringer, which has an outcrop length of 100 feet. This locality is about 2,000 feet S. 15° E. from the Zulu shaft.

The barite of all these occurrences is relatively pure, compact, coarse crystal plates, which are almost massive in appearance and only slightly stained with red iron oxide. No fluorite was observed in the mineralization.

Baronite Group

The Baronite group, consisting of two unpatented claims, was located early in 1957 by Clifford L. Martin and W. H. Farrell. The claims are in sec. 15, T. 10 N., R. 11 E., of the Tonto National Forest, on the east side of Dry Pocket Wash near its headwaters.

To reach the property, take the Kohl Ranch Road about one-half mile north of Payson, travel 4 miles northeast, turn south at the Tonto Lumber Co. mill, and go 1 mile to the Martin Ranch. From here, go southeasterly for 3.5 miles to the claims, which are in the canyon about one-quarter mile west at an altitude of approximately 4,500 feet. On a relatively flat area above cliffs, and in the upper part of the cliff face, numerous barite stringers occur in fractures in coarse-grained granite. The general fracture pattern is northwesterly with dips of 20° to 30° northeasterly, and individual mineralized fractures are separated by several feet of barren material. The barite mineralization varies in width from a few inches to a maximum of 1 foot. In the cliffs a fracture also was observed striking N. 80° W. and dipping 80° N., containing discontinuous barite disseminations ranging from a few inches to pods 2 feet wide.

In a lower tributary wash 100 feet north of the cliffs, a vein striking N. 20° E., dipping 15° S., contained a width of 2 to 3 feet of barite mineralization for a visible strike length of 30 feet. Several minor parallel stringers were in the formation above.

In all the above-mentioned occurrences the narrower barite stringers usually are of solid, slightly iron-stained barite, but the wider veins contain rock inclusions.

Somewhat lower on the slope and some 250 feet west of the cliffs, a 2- to 4-foot thickness of barite crops out in the bottom of Dry Pocket Wash. This barite band is overlain by coarse-grained granite and underlain by an iron-stained, brecciated, fine-grained siliceous formation, the top of which forms

the wash bottom and coincides with the stream gradient. The barite zone itself forms the dip slope for some distance up the east bank. As elsewhere on the property, the wider portions of the vein contained rock fragments. Barite mineralization, in small disseminations and stringers, penetrated into both the hanging- and foot-wall formations. A sample cut across the vein where it was 2 feet wide assayed 92.8 percent BaSO_4 , and had a specific gravity of 4.26. The sample contained no fluorspar.

This deposit apparently is cut off to the south but extends northerly for about 200 feet, where a segment has been eroded away. Mineralization appears again in the west bank 100 feet to the north and can be traced by intermittent and thinning exposures for some distance up a steepening grade.

About midway of this latter exposure and on the hillside to the west, a vein dipping steeply northward, striking N. 60° W., contained barite for a length of 50 feet. This was 18 inches wide at the best exposure. A second vein, somewhat higher on the hillside, could be traced southward for about 200 feet, and its best exposures were 6 to 18 inches wide.

Graham County

The few known barite deposits of Graham County are in the west central part (fig. 4). Of the occurrences examined, one was in limestone, and the remainder were in volcanic rocks.

Small production was rumored from one of the properties, but this could be substantiated.

Barite has been reported in the gangue minerals of the old Starlight copper mine, in Kelly Canyon some 2 miles northwest of the Barium King property.

Marcotte Group

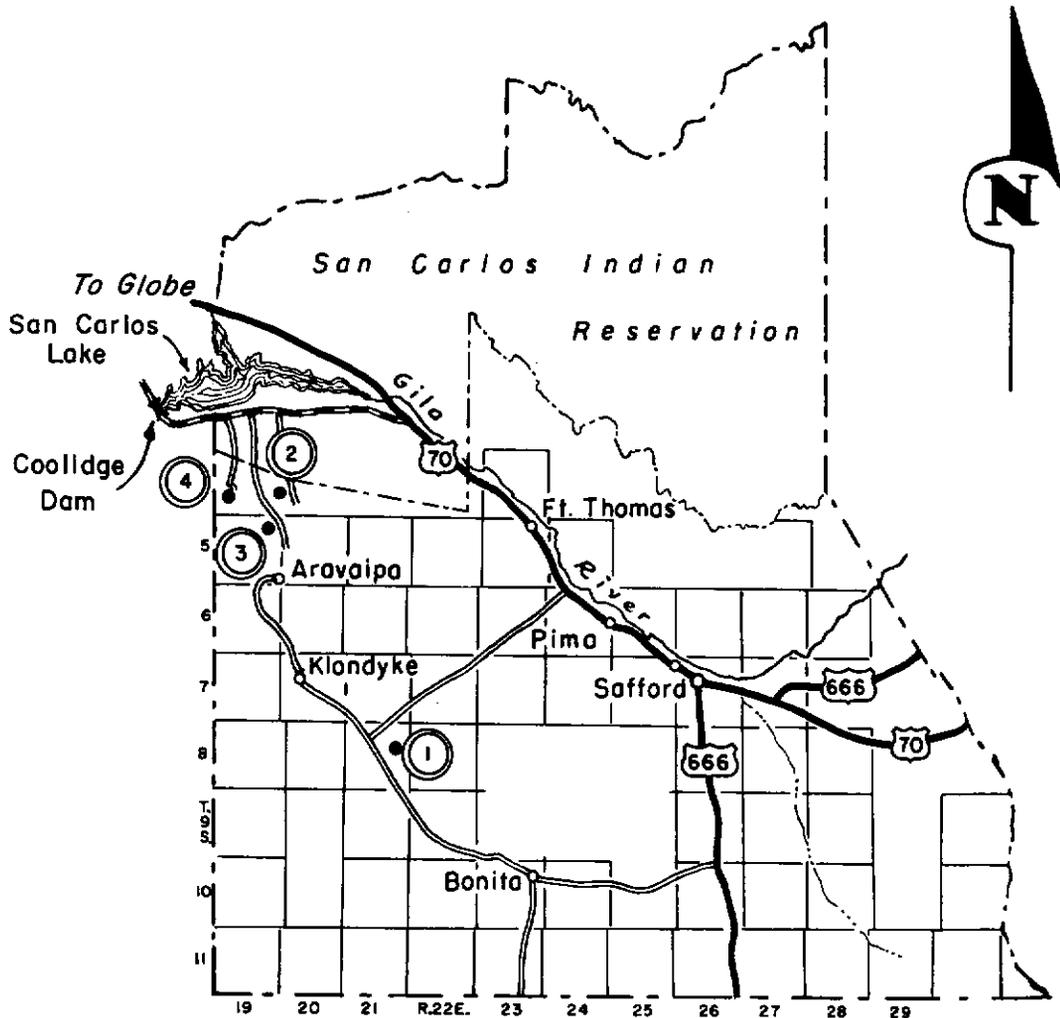
This group, consisting of 12 contiguous unpatented claims (Marcotte Nos. 1 through 12), was located by A. J. Marcotte in December 1956. The claims are largely in sec. 13, T. 8 S., R. 21 E., with slight overlaps into secs. 11, 12 and 14, all on State land (fig. 5). The property is accessible from U.S. Highway No. 70 by the following log:

0.0 Turn southward onto Klondyke-Bonita Road at 6.4 miles west of Pima.

17.6 Turn left on Cedar Camp Road.

19.5 Pass through gate and turn left.

(For an alternate road, keep straight ahead at the gate. This road is about a mile shorter to Cedar Camp, but was badly eroded at the time of the examination in March 1957.)



INDEX OF DEPOSITS

- 1. Marcotte,
Graham
- 2. Barium King
- 3. Little Mule
- 4. Coronado

FIGURE 4. - Barite Deposits of Graham County.

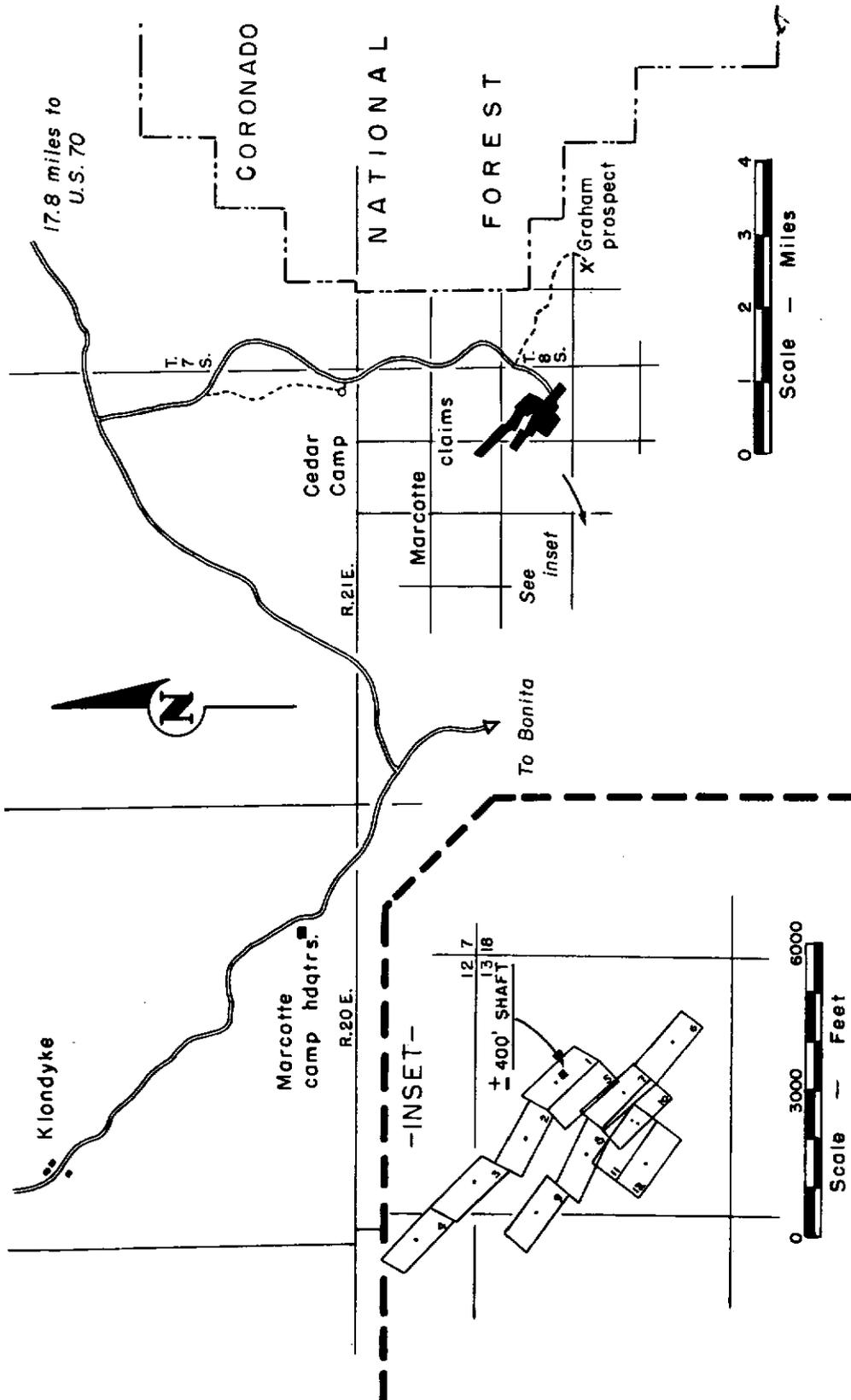


FIGURE 5. - Location and Claim Map, Marcotte Group.

25.8 Keep straight ahead.

26.0 Turn right (left fork goes to Graham prospect).

26.6 Arrive at claim No. 1.

Part of the property, at least, originally was located about 1900, and soon thereafter considerable work was done on what is now claim 1. J. D. Mathews, of Thatcher, Ariz., relocated the group about 1934 and sometime later allowed it to revert to public domain. It has been reported that a shaft, said to be 300 feet or more deep, was sunk in 1904 by Eastern capital and that some barite was shipped to an eastern market.

In this area several barite-bearing veins occur in relatively parallel fault fractures traversing a volcanic agglomerate formation. The claims are arranged in a pattern five tiers wide, covering two major and several minor veins. The courses of the outcrops of both major veins are remarkably persistent, and except for occasional patches of overburden, each can be traced for a length of four claims. Two northeasterly trending, postmineral faults have offset the veins. The relative movement of the central segment is reflected in alinement of the claims. The strike of the veins varies locally from approximately N. 45°-65° W.; they are either vertical or dip steeply to the northeast.

The barite veins usually contain various-sized fragments of wallrock. A small amount of green fluorspar and copper oxide staining was noted locally. Lead did not appear to be associated with the mineralization. Location cuts or shafts were relatively near the center of each claim.

Typical samples of each exposure examined were composited into one sample, which assayed the following percentages: 71.1 BaSO₄, 6.4 CaF₂, and 1.3 CaCO₃. As it had been reported that the deposit had a slight gold content, this combined sample was assayed; its content was 0.80 ounce silver and 0.08 ounce gold per ton.

The collar timbers of the old shaft on claim 1 have caved for about 30 feet down, exposing the shaft walls, but below this point timbering appears to be in fair condition. The vein, exposed on the northwest side of the shaft, dips 85° NE. At the surface veins 14 and 30 inches wide are separated by 18 inches of waste (fig. 6) but join together about 30 feet down the shaft to form a 4-foot vein. On the opposite side there is less barite, distributed in thinner zones across an 8-foot face.

Mr. Marcotte was told that the shaft, known as the Kinney Kye mine some 50 years ago, was 420 feet deep with two drifts at unknown depths and that there is barite 4 to 6 feet wide all the way down the shaft. Across the gulch to the southeast, a shallow cut shows an 8-inch vein of relatively pure barite and numerous smaller stringers across a 4-foot zone. This zone continues to the southeast but was not investigated. Following the vein to the northwest, 200 feet from the shaft, two pits show a single vein 6 to 8 inches wide. The 10-foot-deep location cut on claim 2 exposed 4 feet of barite at the surface,

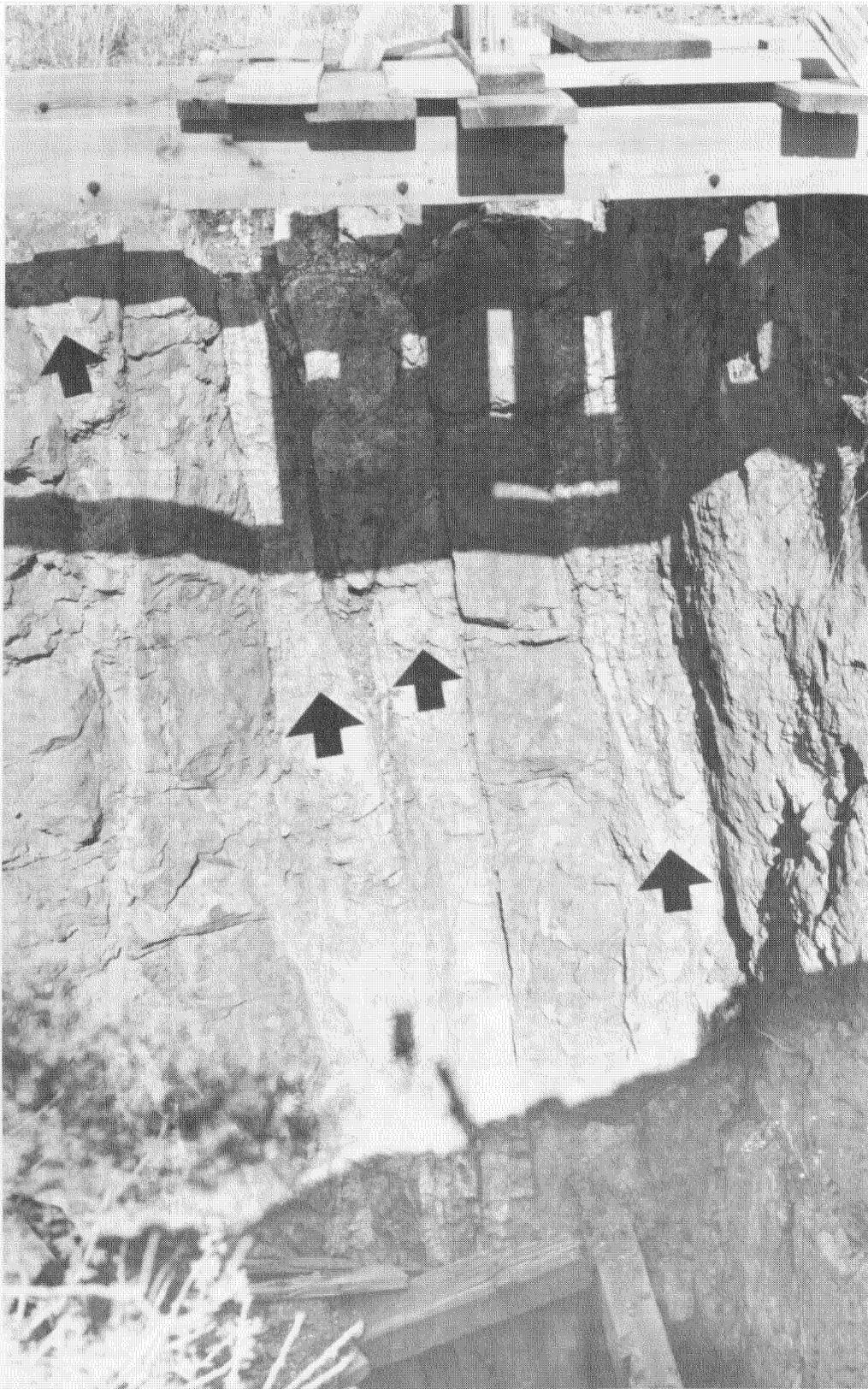


FIGURE 6. - Arrows Point to Barite Veins in Northwest Side of Marcotte Shaft.

increasing to 5 feet at the bottom. In a draw about 75 feet northwest of the No. 2 location cut, the vein is 20 inches wide. The work on claim 3 exposed 3 feet of solid barite with few rock inclusions; on claim 4 the vein is 2 feet wide.

The other major occurrence, extending the length of four claims, shows the vein trending through claims 6, 7, and 8 varying from 8 inches to 2 feet wide. The cut on claim 9, which is about 20 feet long, crosses several irregular veins 12 to 18 inches wide and a 6-foot mass of barite, which decreases to 3 feet at floor level. The barite in this cut occurs in large plates, with included rock fragments of several inches in size. Immediately ahead of the face, several additional 1-foot veins appear in surface outcrops. On the crest of the hill on claim 10 the cut shows a 3-foot vein, and near the top of a knoll at the southeast end of claim 11 a similar vein is exposed.

In the cut on claim 12, two narrow veins separated by a 15-inch rock band at the surface, join together near the bottom of the cut to form 14 inches of solid barite.

Claim 5 was not investigated, as it was located to consolidate contiguous claims.

The property is at an average altitude of 4,500 feet. The nearest rail point is Cork, a siding on the Southern Pacific Railway, one-half mile north of the junction of the Klondyke-Bonita Road with U.S. Highway No. 70.

Metallurgical Tests

A 175-pound grab sample was taken from an ore pile at the deep shaft for metallurgical testing. This sample assayed 69.6 percent BaSO_4 , 11.7 percent CaF_2 and 0.6 percent CaCO_3 . Tests employing the lignin-fluoride method of flotation yielded a fluorspar product assaying 99.7 percent CaF_2 . Fluorspar recovery was 50.3 percent. The lignin-fluoride method of flotation consisted of wet-grinding the ore to pass a 200-mesh sieve in the presence of soda ash, sodium fluoride, and lignin sulfonate at a pH of about 9. The fluorspar then was floated selectively with a minimum amount of oleic acid collector and cleaned four times with small quantities of lignin sulfonate to depress the barite activated during the rougher flotation step. Subsequent flotation of the barite from the fluorspar tailing at a pH of about 10, using oleic acid collector, also was successful. Seventy-five percent of the barite was recovered in a product that assayed 94.0 percent BaSO_4 and had a specific gravity of 4.40.

Graham Prospect

The Graham claim, about 2 miles southeast of the Marcotte property (fig. 5), is in sec. 20, T. 8 S., R. 22 E., at an altitude of 4,900 feet. It was located in late 1955 by John East and associates. In January 1958 it was owned by Elton Kidd, of Klondyke. The property is accessible by taking the left fork at the 26-mile junction of the Marcotte road log, traveling 2.4 miles southeast, then turning right and going down a wash for 0.6 mile--passing a windmill on the east bank.

The barite vein, striking N. 30° W. and dipping 75° NE., occurs in a fracture in coarse-grained granite. The location pit, 12 by 6 by 10 feet deep, exposes mineralization 12 inches wide at the surface and increasing to 16 inches at the bottom. Contact between the barite and the wallrock is irregular, with barite stringers running into the granite. The vein is composed partly of tabular crystal aggregates, fine to coarsely bladed, and partly of massive barite. Fluorspar occurs sparingly in the angular interstices between the barite crystals, which are stained with iron oxide. A representative sample assayed 77.8 percent BaSO₄ and 4.9 percent CaF₂.

Because of alluvial cover, the vein cannot be traced uphill to the northwest, but down the slope to the southeast occasional patches of the vein are exposed. A quartz dike, striking northeast along the north bank of the wash, is 50 feet wide. A prospect cut in the dike, some 200 feet southeast of the location pit, shows the barite-bearing fracture to be about 8 inches wide.

A 6-inch width of barite was observed across the wash in the south bank. At this place the barite vein lies on the contact of coarse-grained granite on the hanging wall and a foot wall of highly altered, fine-grained intrusive dike. The dike is about 30 feet wide and contains traces of barite in fracture planes throughout this width. Overburden covers any extension of the vein to the southeast.

Although the strike of the Graham vein is somewhat more northerly than that of the Marcotte zones, it is likely an extension of the same fracture system. Mr. Marcotte states that there are numerous places between the two properties where barite outcrops can be observed.

Barium King Group

The Barium King group, comprising four unpatented claims, is in sec. 19, T. 4 S., R. 20 E., and sec. 24, T. 4 S., R. 19 E., 5 miles west of Turnbull Mountain. The claims are 9 miles south of San Carlos Reservoir. This deposit was known before 1925--as Ross^{11/} states "Near Kelly Canyon, somewhat less than 2 miles southeast of the Starlight mine, is a vein containing barite, which has been prospected with a view to mining that material." At about this time Charles Ireland, of Globe, owned these claims but allowed them to lapse.

The claims, now known as Barium King Nos. 1 to 4, were located in April 1954 by Ralph Castenada and J. E. Boatwright. At the time of the examination in April 1957 the ownership included Urbane House, of Globe, on whose cattle range the claims were situated.

The property is accessible from old U.S. Highway No. 70 by turning south on a dirt road at 13 miles east of Coolidge Dam, traveling about 9 miles to the House Ranch buildings, just outside the Reservation boundary. From the house, a 2.8-mile truck trail leads west to the claims, which are on the west

^{11/} Ross, Clyde P., Geology and Ore Deposits of the Aravaipa and Stanley Mining Districts, Graham County, Ariz.: U.S. Geol. Survey Bull. 763, 1925, p. 144.

bank of Mitchell Canyon. The deposit is 24 miles from Calva, a station on the Southern Pacific Railway, which is the nearest rail shipping point (fig. 7).

Three separate deposits occur on the property, but not enough work has been done to definitely delineate either the width or lateral extent of any of the deposits. Mineralization of all the occurrences is similar--brecciated barite and rock fragments, cemented with iron-stained, fine-grained barite. The host rock generally is trachyte.

The deposit at the end of the road is on claim 4 at an altitude of approximately 4,200 feet. A shallow cut, a dozed bench above, and outcrops on the hillside have exposed barite in a vertical range of about 60 feet. The west side of the mineralized zone is against a southerly striking fault that dips 55° E. The width of mineralization, as indicated by surface exposures, is at least 50 feet, and parts of this exposure can be traced for about 200 feet southward up the hillside.

The deposit on claim 3 is about 1,000 feet to the southeast at approximately the same elevation. Mineralization is fairly well exposed along the hillside by dozer stripping and by outcrops over an area of 50 by 150 feet in a vertical range of some 30 feet. A 10-foot shaft was excavated in barite near the east side of the exposure.

On claim 2 there is an unprospected zone of barite. It is west of the road end and at least 150 feet higher on the ridge. In noncontinuous patches where there is no soil barite can be observed in an area of 60 feet along the hillside by 20 feet up the steep slope. About half of the longer dimension is obscured by a rock slide, so the continuity of mineralization in this direction is in doubt.

Except for the deposit on claim 4, where the hanging wall can be observed, information on the strike and dip of the ore zones was unavailable at the time of the examination. Considerable exploratory work would be required to determine these data. The deposits on claims 3 and 4 appear to be overlain by capping formations.

A sample typical of deposit 3 assayed 62.2 percent BaSO_4 and 10.6 percent CaF_2 and had a specific gravity of 3.64. A 150-pound sample of deposit 4 assayed the following percentages: 64.8 BaSO_4 , 11.5 CaF_2 , and 0.5 CaCO_3 ; specific gravity was 3.71.

Metallurgical Tests

Bench-scale flotation tests were made on the latter sample to determine the grade of barite and fluorspar products obtainable. Two methods of selective flotation were tried. In one the barite was floated first, and in the other the reverse process was followed. Both methods yielded a good grade of barite products, but neither gave satisfactory recovery of fluorspar.

A barite concentrate assaying 92.5 percent BaSO_4 and having a specific gravity of 4.31 was obtained by flotation of minus-200-mesh ore with petroleum

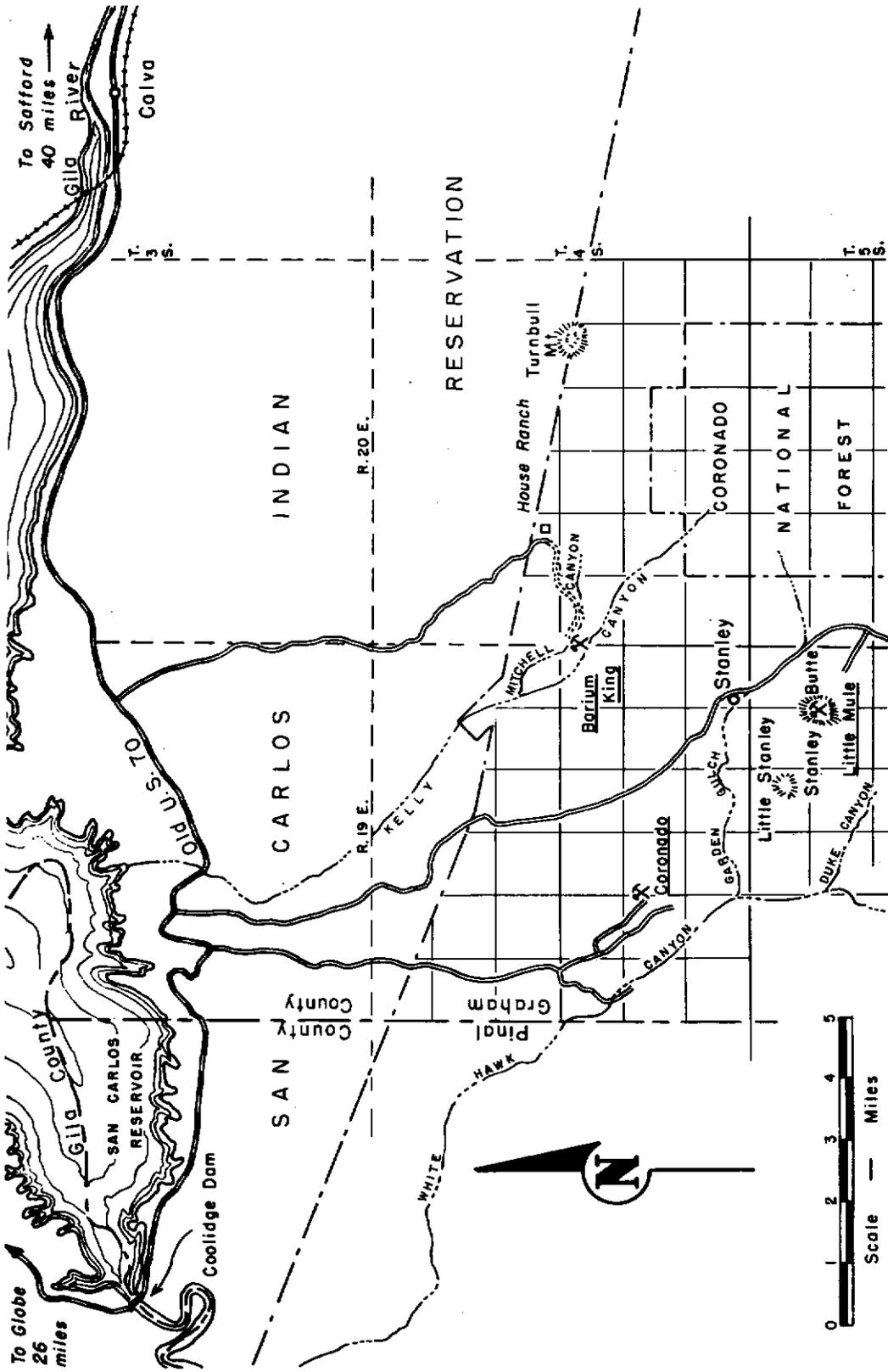


FIGURE 7. - Location Map of Barite Deposits South of San Carlos Reservoir, Graham County.

sulfonate collector. The concentrate accounted for a barite recovery of 76.9 percent. Subsequent flotation of the fluorspar with oleic acid yielded a fluorspar product assaying 96.7 percent CaF_2 and accounting for 31.1 percent of the fluorspar. The above method of flotation comprised grinding the ore with caustic soda at a pH of about 10.5, followed by conditioning the pulp with sodium silicate and floating the barite with petroleum sulfonate. The rougher froth was cleaned three times. Middlings from the first two cleaning operations were added to the barite tailings; the pH then was adjusted to 10.5 with caustic soda and sodium fluoride, and calcium lignin sulfonate was added. The fluorspar was floated with oleic acid, and the resultant froth cleaned five times, using small amounts of calcium lignin sulfonate in each cleaner to depress the activated gangue. Treated water was used throughout the test, and the flotation pulps were maintained at a temperature of 30° C. Reagent consumption was as follows: 2.0 pounds of caustic soda, 5.0 pounds of sodium silicate, 1.0 pound of petroleum sulfonate, 4.0 pounds of sodium fluoride, 6.0 pounds of calcium lignin sulfonate, and 0.16 pound of oleic acid per ton of ore feed.

Treating the ore by the lignin-fluoride flotation method yielded a concentrate assaying 96.1 percent CaF_2 with a fluorspar recovery of 38 percent. Flotation of the barite from fluorspar rougher tailing gave a concentrate assaying 92.5 percent BaSO_4 . The barite product had a specific gravity of 4.30, which accounted for a barite recovery of 27 percent. Recovery was low, owing to distribution of the mineral throughout the fluorspar middlings. The lignin-fluoride method comprised grinding the ore charge with sodium fluoride and lignin sulfonate at a pH of about 9.5 to 10, followed by recovery of the fluorspar with a small quantity of oleic acid. The addition of more oleic acid to the fluorspar rougher tailing promoted flotation of the barite. Reagent consumption was as follows: 4.0 pounds of sodium fluoride, 4.0 pounds of lignin sulfonate, and 1.0 pound of caustic soda per ton of ore in the grind; 0.16 pound per ton of oleic acid in the fluorspar rougher and 1.6 pounds per ton of lignin sulfonate in the fluorspar cleaners; and 0.96 pound per ton of oleic acid in the barite rougher. Research is being continued in an effort to develop a reagent combination that will permit recovery of acid grade fluorspar products and improve recovery of the barite.

Little Mule Group

The Little Mule group, comprising six contiguous, unpatented claims, in secs. 2, 11, and 12, T. 5 S., R. 19 E. (fig. 7), lies atop Stanley Butte at an average altitude of 6,700 feet (fig. 8). This mountain is composed of volcanic rocks. In the area investigated the predominant rock visually has been classified as diorite porphyry. Barite occurs in fractures at several places on or near the top of the mountain, in an area of steep terrain and difficult access.

The claims originally were located by Bob Knowles about 1907. Knowles is said to have worked some of the claims intermittently for several years for the silver values in the barite. Reed R. Crunk and associates relocated the claims in 1955 and 1956.

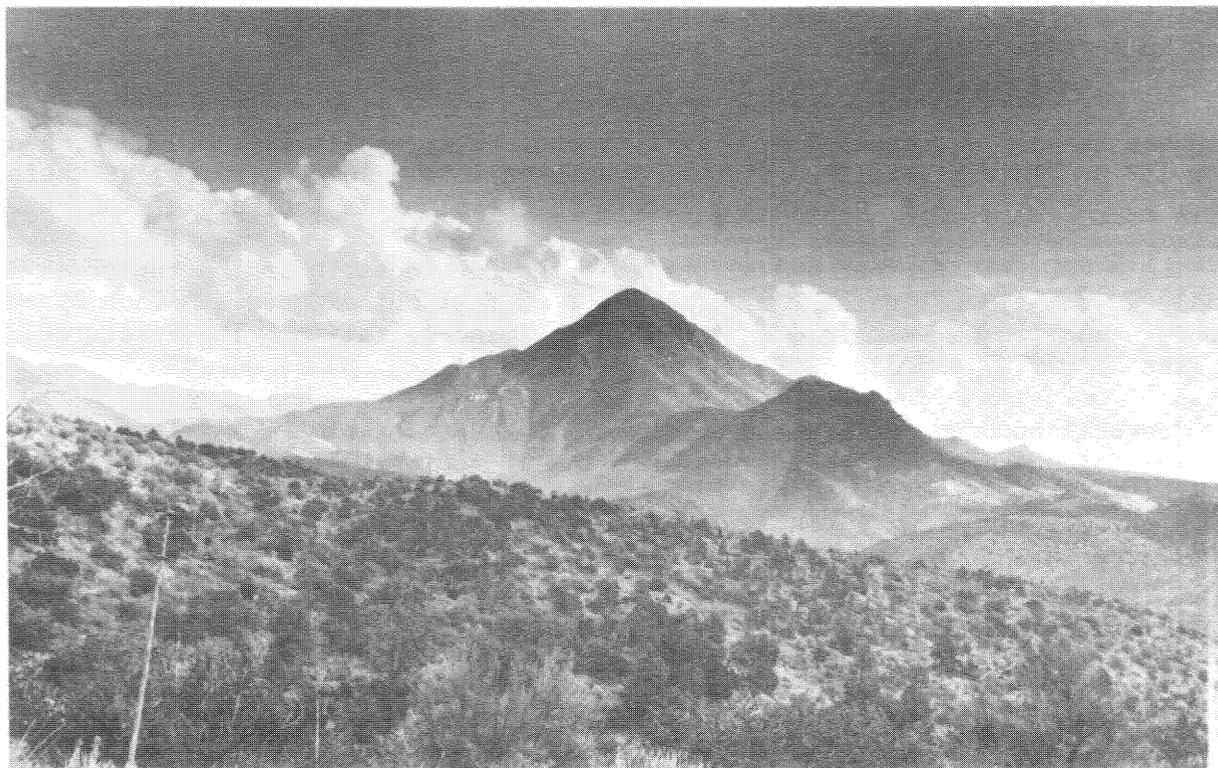


FIGURE 8. - View of Stanley Butte and Little Stanley Butte From Coronado Deposit.

The property is accessible from old U.S. Highway No. 70 by a dirt road branching south at 8 miles east of Coolidge Dam (mile post 285). This point is 33.5 miles from Globe (junction of U.S. Highways Nos. 60 and 70); travel southward from the paved highway 12.9 miles to the old settlement of Stanley; continue southeastward up the road toward the Princess Pat mine, turning right on a pilot road at 3.5 miles from Stanley. This trail has been dozed up the southeast side of Stanley Butte for a distance of about 1 mile. From the end of the road it is necessary to climb the steep mountain slope to a grass-covered hanging valley just below and north of the summit. Locally, it is known as the Potato Patch.

A few hundred yards north of this area, just below the outlet of the valley, are three old workings where Knowles did most of his mining. The center working consists of an inclined shaft bearing S. 20° E., which is reported to be somewhat more than 100 feet deep. It was sunk on a barite vein, which, at the shaft collar, was 12 to 15 inches wide, striking S. 70° W. and dipping 40° SE. As far as could be seen, the incline appeared to be open, but no examination was made down the incline because the timbers were badly rotted.

About 40 feet eastward, a 30-foot cut, apparently on the same vein, was caved so that the vein could not be seen in place; however, barite was noted in the dump. An adit somewhat lower on the hillside west of the inclined shaft had been driven on a second barite-bearing fracture 12 to 18 inches wide, striking S. 40° W. and dipping 60° SE. Because of a caved portal, the adit

was inaccessible, but Reed Crunk stated it to be 170 feet long, with some side stopping to a maximum width of 20 feet.

On the hillside south of and 50 feet above the valley floor, a 6- to 8-inch barite vein was exposed by a 20-foot cut. The vein strikes N. 75° E. and dips 45° S. This mineralized fissure must open into a lower crevice, as there was a downdraft of air through the rubble on the floor at the face of the cut.

Some 700 feet farther and slightly to the southwest, near the top of a saddle in the ridge line of the mountain, a 20-foot cut exposed a 6-inch barite vein containing rock fragments within the mineralization. The fracture strikes N. 55° W. and dips 35° SW.

Several hundred feet to the southeast and over the ridge, a 2-foot vertical vein of massive barite is exposed in the 10-foot face of a N. 10° W. cut. Mineralization can be traced northward for a short distance up the hill. A few hundred feet to the south, a second cut about 75 feet lower on the outcrop exposes an 18-inch band of barite at the surface, pinching to 6 inches at floor level. Wherever this vein is exposed, it contains virtually pure, massive barite.

Small samples, considered representative of the previously mentioned occurrences, were combined and assayed 74 percent BaSO₄ and 14 ounces silver per ton.

About one-half mile to the northwest and just below the top of the ridge forming the curving backbone of Stanley Butte, a mineralized fracture has been prospected. This fracture strikes northwest and dips steeply northeast. A cut in the cliff face on the east side of the ridge exposes 2 feet of mineralization containing barite in segregations, stringers, and rosettes, with many inclusions of rock fragments. Copper-oxide staining is prevalent. The mineralized zone can be traced over the top of the ridge to the west and into the cliffs also forming that side of the mountain.

On the south side of the mountain, some 1,500 feet horizontally southeast of the highest peak, and several hundred feet lower, barite occurs in a fault zone striking N. 50° W. and dipping 60° NE. In a 20-foot inclined shaft under a cliff outlier mineralization is 3 to 5 feet wide and consists of aggregates of relatively small barite crystals associated with wallrock fragments. The footwall section of the vein contains the greatest concentration of barite. Slide rock on either side of the little cliff covers any extension of the vein.

Fluorite was not associated with the barite in any of the deposits.

Carl Roberts of Mesa, Ariz., reported that there were noncommercial barite occurrences in the area between Little Stanley Butte and Duke Canyon, but these were not investigated.

Coronado Group (Copper Reef Deposits)

There are several minor barite deposits in the vicinity of the old Copper Reef mine property in secs. 28 and 29, T. 4 S., R. 19 E. (fig. 7). This area

is accessible from old U.S. Highway No. 70 by a graded road, signed Hawk Canyon, branching south at 6.8 miles east of Coolidge Dam. This point is 32.2 miles from the junction of U.S. Highways Nos. 60 and 70 at Globe. Travel southward from the paved highway, keep right at 4.1 miles, take the left fork onto a poor dirt road at 6.9 miles, and again take the left fork at 7.7 miles. The old North Star shaft is at the end of the road at 9.5 miles.

A large number of claims were located in this area about 1910 by the Copper Reef Consolidated Mines, and intermittent mining for lead and copper was conducted for 10 or 12 years. The North Star inclined shaft is reported^{12/} to be 735 feet deep, and the California tunnel, some 4,000 feet to the southwest and 600 feet lower is said to have at least 2,500 feet of drifts. A considerable quantity of barite can be observed in the dump material of these and other shallower workings.

In the vicinity of the North Star shaft, a group of Coronado claims was located in 1954 by the Coronado Development Co., of Farmington, N. Mex., Gilbert S. Maxwell, agent. This area is on the southwest slope of Copper Reef Mountain, where the formation is composed of tilted Carboniferous Tornado limestone, which has a general strike of N. 50° W., dipping 25°-35° SW.

About 2,000 feet east of the shaft, across a gulch and approximately 300 feet higher, a small pile of cleavage fragments of high-grade, usually clear barite had accumulated on the dump of a shallow cut. As no mineralization could be observed in the pit sides or adjacent rocks, it is likely that this material was taken from a pocket in the face, somewhere below the caved portion of the cut.

At about the same altitude on the opposite side of the gulch, some 1,200 feet to the northwest, material containing barite intermixed with rock was piled on the dump of a shallow inclined shaft. The working was inaccessible because of water a few feet below the shaft collar. This ore appeared to have come from a vein along a bedding plane of limestone. Between these two occurrences and near the bottom of the gulch, a small segregation of barite was observed in a shallow trench.

At 0.6 mile northwest of the North Star shaft, on the northwest side of a precipitous southwest-trending gulch, several small workings immediately below the road exposed small amounts of barite. The barite mineralization occurred as disseminations, stringers, and sporadic rosettes in narrow quartz zones, which were stained with iron, manganese, and copper oxides. Mineralization generally was along bedding planes of the limestone.

All the barite noted contained small amounts of fluorspar. There doubtless are many more small occurrences of barite mineralization in this area.

^{12/} Work cited in footnote 11 (p. 25), pp. 111-112.

Maricopa County

The three localities in which the known barite deposits occur in Maricopa County are widely separated (fig. 9). Of the five deposits investigated one is in schist, and the remainder in volcanic rocks.

According to the best records available, barite production of the county totaled 313,000 tons, or 99 percent of the entire Arizona production. One deposit south of Aguila produced less than 1,000 tons, and the remainder was from the deposit near Mesa.

The deposit near Gila Bend shipped copper-lead ore; its principal gangue mineral was barite.

Granite Reef (Arizona Barite) Mine

The Granite Reef mine is about 14 air miles northeast of Mesa in secs. 4 and 5, T. 2 N., R. 7 E., Tonto National Forest, at an altitude of 1,550 feet. The property consists of 10 contiguous, unpatented claims (Phoenix Nos. 1 - 10) covering an area in which numerous barite veins occur (fig. 10).

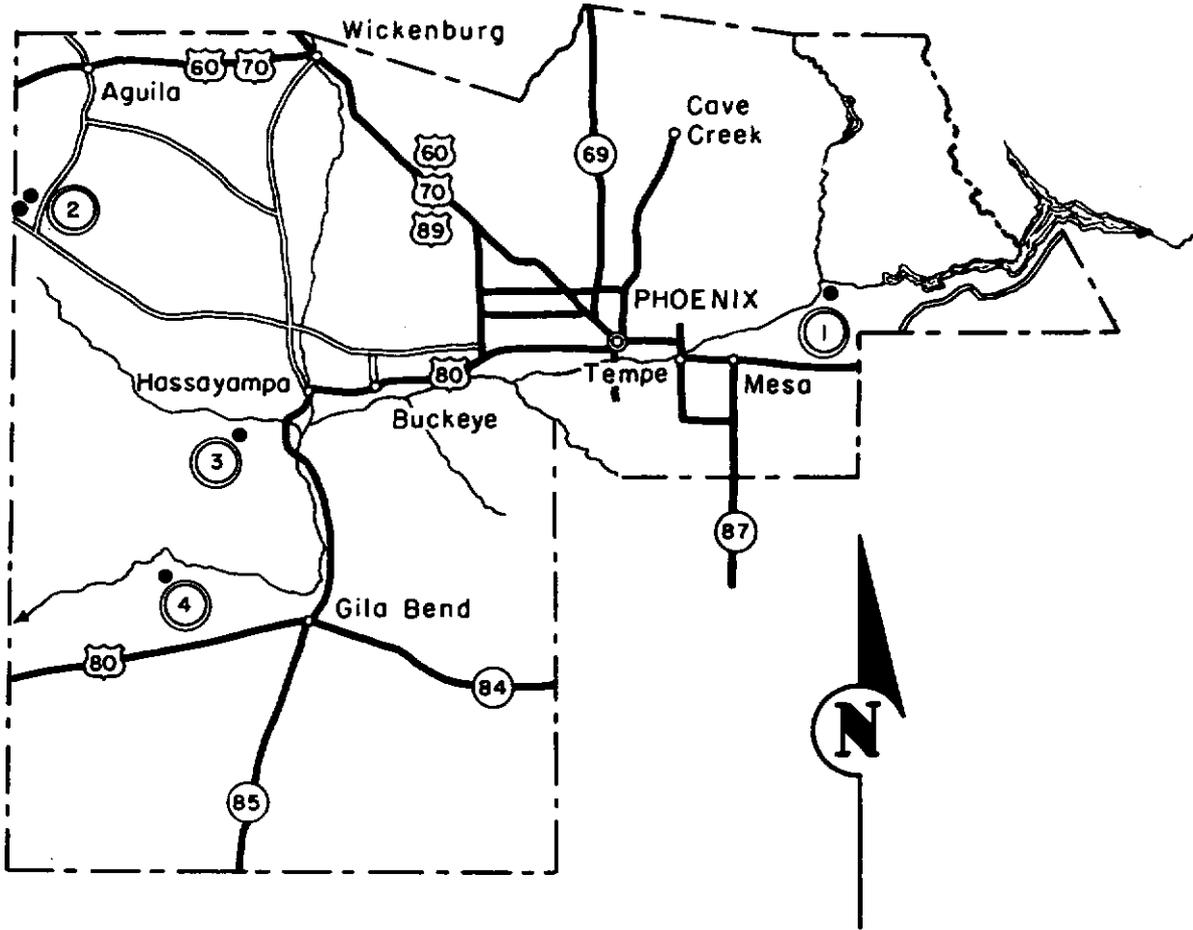
The claims are accessible from the junction of State Highway No. 87 and U.S. Highway Nos. 60-70 in Mesa by traveling east on the latter; at 9.0 miles turn north onto the Bush Highway and at 19.0 turn left; the mine is at 19.5 miles.

The claims originally were located for silver by David and Herman Crisman in 1897. They later were acquired by W. F. Christman, who started mining in 1931 and produced a total of 100,000 tons of selected ore, which was shipped to Texas consumers. In April 1945 the property was purchased by the Houston Oil Field Materials Co. The Arizona Barite Co., a wholly owned subsidiary, was formed to exploit the property.

The following year a total of 12,000 tons of crude ore of plus-4.0 gravity was mined and shipped, and construction of the processing mill near Mesa was completed. The plant consisted only of a grinding circuit, which produced plus-4.2 gravity-ground barite from ore that had been selectively mined and sorted. A flotation circuit was added in June 1948, and thereafter ore containing 50 percent barite (approximately 3.5 gravity) could be processed.

About 1952 the entire property was sold to the Macco Corp., which continued production until July 1955, when mining was suspended and the mill was dismantled. By this time the shaft had been sunk to 320 feet, and mining was being conducted on the 300-foot level. The tenor of ore had decreased on this level, and when a heavy flow of water was encountered at the west end of the mine, operations were suspended.

A total of more than 200,000 tons of ground barite was produced by the Mesa mill during its operation by the two companies.



INDEX OF DEPOSITS

- 1. Granite Reef
- 2. Princess Ann,
White Rock
- 3. B & H No. 6
- 4. Rowley



FIGURE 9. - Barite Deposits of Maricopa County.

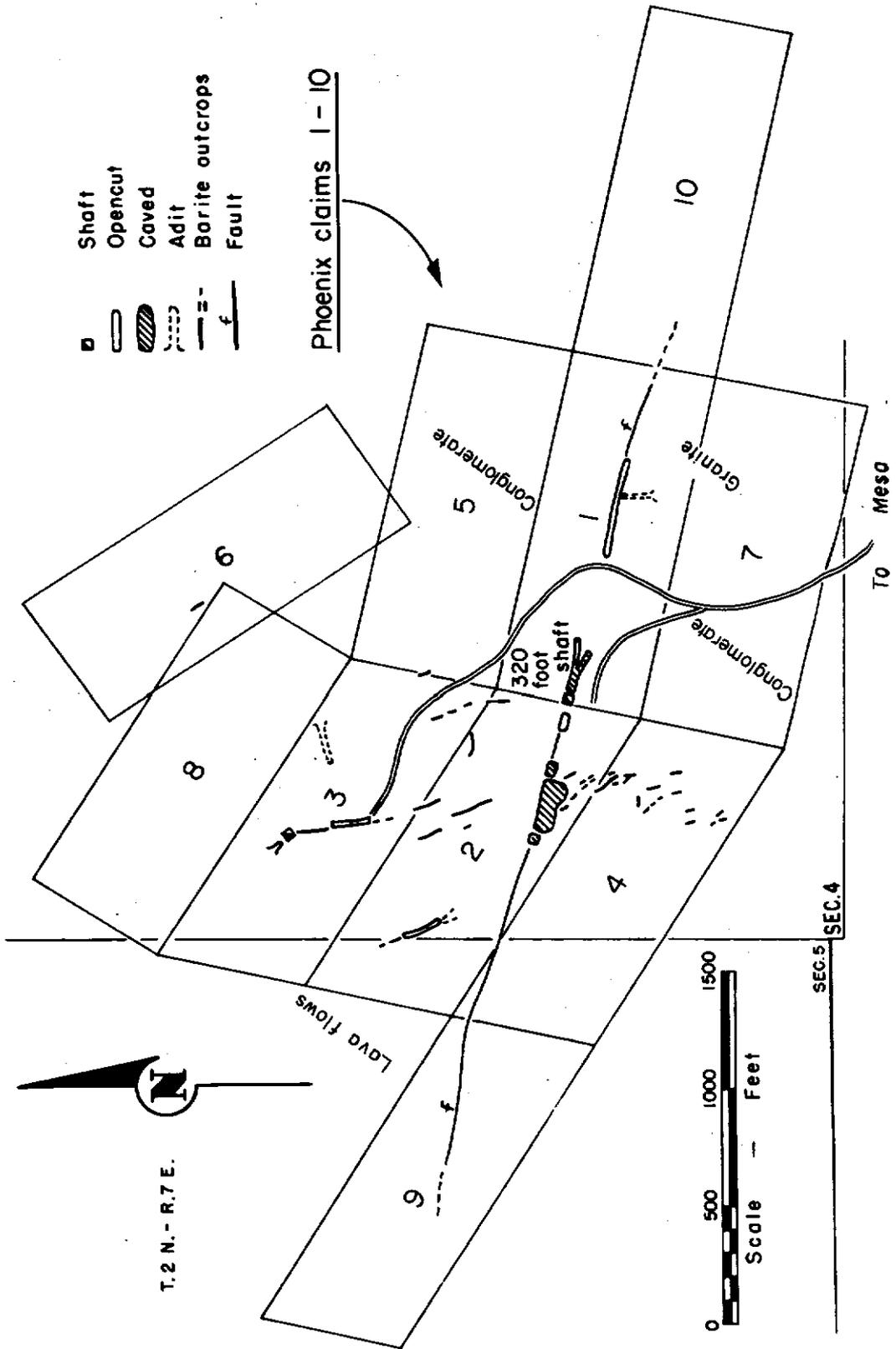


FIGURE 10. - Sketch Map of Granite Reef Property.

The claims were relocated in late 1957 by William F. Paine, former general manager of the Arizona Barite Co. and of the Macco operation.

Barite mineralization occurs in fault and fracture zones in Cretaceous, conglomerate red beds. A relatively small area of granite is in fault contact with the conglomerate at the southeast corner of the property. The claims on the northwest side border against lava hills.

The major deposit occurs along a strong fault, which strikes N. 75° W. and dips 65° to 70° SW. The following mine description has been furnished by Paine. The 320-foot shaft was sunk on the footwall, which is a relatively smooth, slickensided fault plane with a uniform dip of 68° SW. There is no definite hanging wall. Mining was conducted by shrinkage stoping, and very little timber was required. Drifts on the 60-foot level extended 200 feet east and 800 feet west from the shaft. On the 200-foot level drifting followed the vein for 1,200 feet in each direction. Except for pillars the vein was stoped between the two levels and upward from the 60-foot level to near the surface.

On the 300-foot level the drifts had been driven 100 feet east and 1,385 feet west. Above the latter drift the stope was 20 to 30 feet high. The average overall width of vein mined was 20 feet; the maximum stope width was 35 feet, and the minimum width 6 to 8 feet. When operations were suspended, the corporation bulkheaded the shaft below the collar and backfilled to the surface. Since that time, the thinner stope tops have caved (fig. 11). The extremities of the caved area are 900 feet apart; only a length of 300 feet west of the shaft has not subsided. The width of the caved portions varies 30 to 80 feet at the surface.

The vein splits 100 feet east of the shaft; the width of the barite in the main course of the fault became too narrow to mine, but in the converging fault was enough to mine for an additional 100 feet eastward, where mineralization was cut off by a basalt dike. In this intersecting fault zone the hanging wall was smooth and slickensided, striking N. 60° W. and dipping 75° SW.

The fault reappears farther east, and barite was mined from an open cut about 450 feet long, up to a depth of 30 feet. Where it can be seen on the floor of the cut, the principal barite vein in the zone is 1 to 2 feet wide, with several feet of lower grade material to the south. This cut was the source of most of the Christman production. Mineralization along the west end of the cut is on the fault contact between granite on the south and conglomerate on the north. Farther east the granite contact is a few feet south of the fault. Barite mineralization virtually ceases at the east end of the cut, although the fault continues.

A 150-foot adit, bearing N. 10° W., intersects the fault about 40 feet below the floor midpoint of the cut. A raise to the surface now is inaccessible. The footwall of the fault has virtually the same strike and dip as in the mine workings and is similarly slickensided. Against the footwall, the

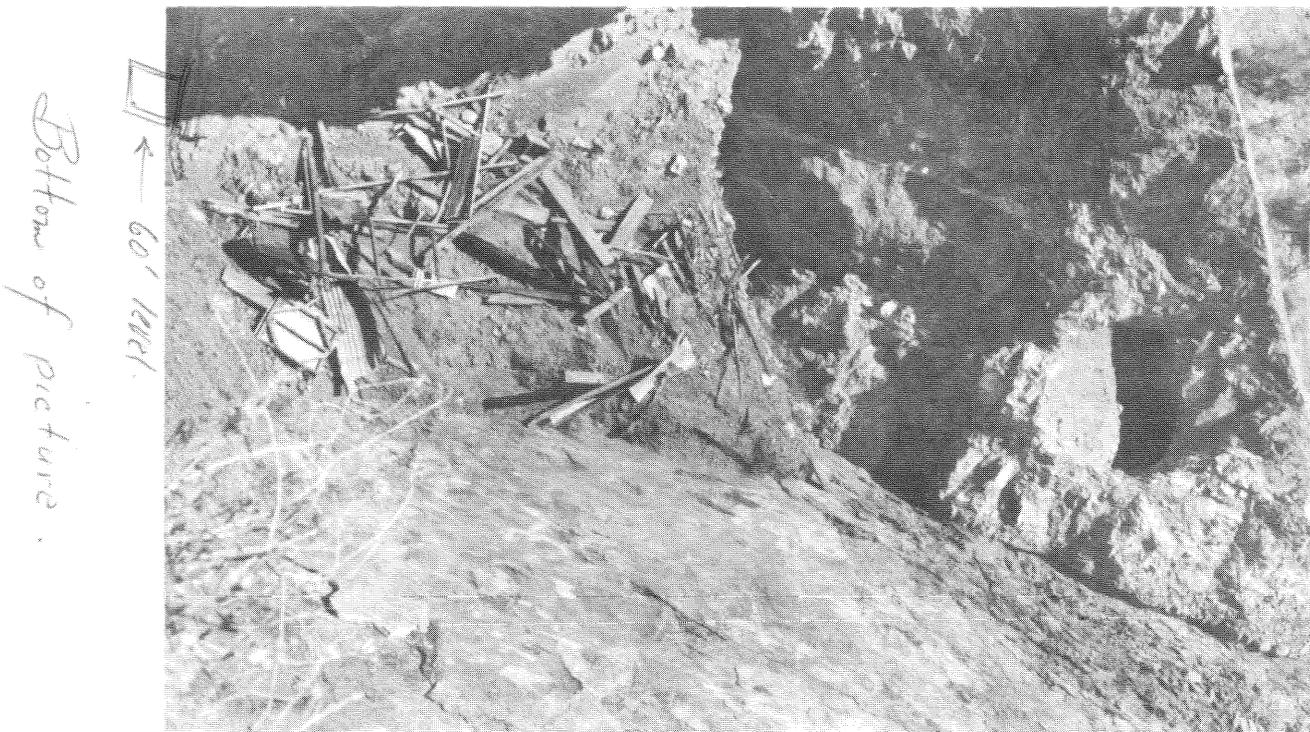


FIGURE 11. - View of Portion of Caved Workings of Granite Reef Mine, Looking West at Shaft Pillar (60-foot level at bottom of picture).

mineralized zone, which consists of barite and brecciated wallrock, is 4 feet wide and has been stoped for 35 feet west of the adit to a maximum height of 20 feet. The ore is entirely within conglomerate; the hanging-wall granite contact parallels and is 10 feet south of the footwall of the fault.

Near the west end of Phoenix No. 2 claim, a 160-foot opencut has been dozed to a maximum depth of 20 feet on mineralization that appears to have been localized in the vicinity of the junction of three northwest-trending fractures, which dip steeply southwest. The floor of the cut generally is covered with debris, but occasional open patches indicate that the mineralized zone may have had a maximum width of 4 feet. Part of the Christman production reportedly was mined here before the dozer work was done.

About 500 feet east of the last-mentioned cut, the shallow alluvial cover had been stripped by a bulldozer, discontinuously exposing the top of a mineralized zone up to 3 feet wide for a length of nearly 200 feet. The apparent strike is slightly east of south, and the dip probably is steeply westward. The barite and included rock fragments are lightly stained with azurite and malachite.

Near the middle of claim 3, barite mineralization averaging 2 feet wide has been exposed in a shallow 100-foot dozer cut. The vein strikes N. 5° W. and dips steeply west. The outcrop can be traced for about 200 feet north of the cut. The last exposure observed was a 25-foot adit driven southward from a 25-foot opencut. The barite zone, 4 feet wide at the portal, pinched to 1 foot at the face. This work is about 50 feet lower than the highest point in the dozer cut.

An adit near the bottom of the draw, some 450 feet to the east, is 150 feet lower than the dozer cut and apparently was intended to intersect the vein. It was driven S. 80° W. for a distance of 165 feet. The only mineralization encountered were two minor barite stringers near the face of the adit.

On the hillside southwest of the mine shaft are a multitude of mineralized fractures in an area about 600 feet long by a maximum of 200 feet wide. Some of these were prospected by shallow shafts, pits, and opencuts; and a considerable amount of dozer stripping was done later. The fractures trend northwest and contain barite mineralization varying from 8 inches to 2 feet in width.

These occurrences and a few others at various places on other claims were not investigated in detail; their locations are generalized in figure 10.

Princess Ann (Fay L) Deposit

The Princess Ann group of four contiguous claims is on the northwest tip of the Big Horn Mountains in sec. 34, T. 5 N., R. 10 W., at an altitude of approximately 1,900 feet. Papers indicate that the claims were filed last in January 1958 by William F. Paine and Harold Bogan, of Scottsdale, Ariz.

The property is reached from Aguila by traveling south on the main manganese-area access road; take right fork at 14.2 miles, turn sharp right at the tank and windmill at 14.6 miles, continue down the valley and turn left on a dim road at 19.4 miles, and arrive at the property at 20.0 miles.

Claims were located in this area as early as 1906, but the names of the original owners are unknown. The major deposit crops out on the east bank of a large dry wash. About 1930 George Ballam and Louie DeLisle sank an 8- by 8-foot shaft here to a depth of 40 feet, with barite on all four sides, and reportedly made a 100-ton shipment. A heavy flash flood completely filled the shaft and washed away all equipment. In 1949, William F. Paine and associates purchased this and two adjacent claims from Rogers and Lemmon, when they were known as the Fay L group. The Arizona Barite Co. took over the claims, did some exploratory work, but later allowed the claims to expire.

Barite mineralization associated with fluorite, occurs as fracture filling in an igneous-flow conglomerate, only the top of which has been exposed by erosion in a relatively narrow zone along the northeast side of the valley. Overlying this formation, somewhat higher on the hill, is a basaltic flow through which the barite mineralization does not penetrate, except as occasional narrow stringers. Consequently, prospecting has been limited to a zone along the bank of the dry wash.

There are numerous stringers and occasional veins of barite exposed in the wash bank for nearly 2,000 feet upstream from the major workings. The general strike of these mineralized fractures is southeastward, but the dips are variable.

The major deposit on claim 1 is a vein 10 to 20 feet wide, which has been opened by a cut from the edge of the wash southeasterly for a distance of 250 feet. The maximum depth of the cut originally was 30 feet, but at least 10 feet of stream debris has been washed in by floods. From this cut the Arizona Barite Co. shipped six carloads (300 tons) of hard-sorted crude ore, used for grouting oil pipe lines in Texas. The specific gravity of these shipments reportedly averaged 4.0, which indicates a content of approximately 75 percent barite. Other shipments, totaling 500 tons of unsorted ore, were trucked to the Mesa plant for milling tests.

The barite ore of this and other veins in the vicinity contains various sizes of inclusions of wallrock fragments.

A shallow dozer trench 50 feet long from the upper end of the main cut and another 150-foot dozer trench 100 feet to the southeast crosscut the overlying fractured and shattered basalt formation. These trenches exposed more or less parallel fractures containing stringers of barite 2 to 12 inches wide, spaced from 2 to more than 10 feet apart. Not enough work was done on the strike of the main vein to determine its extension to the southeast. It is likely that this vein extends for some distance to the northwest under the valley fill.

Upstream from the major work, the location pit on claim 2 shows a 6-foot vein with a low-angle dip to northeast. A shallow dozer cut above the pit shows similar mineralization, but the barite ore contains more and larger rock fragments.

On claim 3 a vertical vein striking S. 60° E. has been prospected by a dozer cut 125 feet long to a maximum depth of 15 feet. The vein (4 to 8 feet wide) on the west side of the cut passes under overburden on the upper end. An inaccessible adit at stream level and a caved shaft at the upper end of the cut appear to be the work of early prospectors.

Metallurgical Tests

A representative 350-pound sample of the material obtained from the major cut assayed 53.0 percent BaSO_4 , 15.6 percent CaF_2 , and 1.7 percent CaCO_3 . Bench-scale flotation tests were made on the sample to determine the grade of barite and fluorspar products obtainable. In a typical test employing the lignin-fluoride method of flotation, 45 percent of the fluorspar was recovered in a concentrate assaying 98.8 percent CaF_2 . The lignin-fluoride method of flotation comprised wet-grinding the ore to pass 200-mesh, using sodium fluoride and lignin sulfonate as the barite depressants and oleic acid as the fluorspar collector. The fluorspar rougher froth was cleaned four times, using lignin sulfonate to depress the barite. Flotation of the barite from the fluorspar tailing at a pH of 10, using oleic acid collector, yielded a barite product that had a specific gravity of 4.23 and assayed 87.9 percent BaSO_4 . Barite recovery was 76.6 percent. Reagent consumption in the test was as follows: 4.0 pounds of sodium fluoride, 9.6 pounds of calcium lignin sulfonate and 0.32 pound of oleic acid per ton of ore feed in the fluorspar float; 6.0 pounds of soda ash, 0.96 pound of oleic acid, and 0.1 pound of sodium silicate per ton of feed in the barite float. Treated water was used in the test, and the flotation pulps were maintained at a temperature of 30° C.

White Rock (Blue Bird) Claims

The four contiguous unpatented White Rock claims are in the northwest end of the Big Horn Mountains in sec. 35, T. 5 N., R. 10 W., at an altitude of approximately 2,000 feet. These claims cover essentially the same area as the original group of Blue Bird claims located about 1950 by William F. Paine of Scottsdale, Ariz., for the Arizona Barite Co. Title later passed to the Macco Corp., and in 1955 the claims were relinquished when the corporation ceased mining and milling barite in Arizona. The White Rock claims were relocated in January 1958 by Paine.

The property is accessible from U.S. Highway Nos. 60-70 at Aguila by traveling south on the Buckeye road; keep right on the main road at all forks; at 14.6 miles turn sharp right at the windmill and tank and continue down the valley; turn left at 18.2 miles, and go up a canyon to 19.0 miles--the end of the road.

Barite mineralization occurs in numerous fracture zones in basalt and is concentrated along an east-trending ridge, which rises steeply to the south of

the road. Generally the barite is massive in character, with few rock inclusions.

The face of a 25-foot trench near the top of the ridge exposes a 4-foot vein striking N. 80° W. and dipping 50° N. A sample cut across the vein assayed 85.0 percent BaSO₄ and 8.1 percent CaF₂. To the east the vein narrows; at 75 feet it is 2 feet wide. It is covered by alluvium to the west, and the zone appears only as stringers on a knoll 100 feet away.

Dozer stripping over the top of the saddle about 100 feet to the east exposes half a dozen east-west veinlets up to 10 inches wide within a length of 80 feet.

Just over the saddle to the south, this dozer cut has exposed a 2-foot vein, which strikes S. 65° W. It has been prospected by a shallow cut 50 feet to the west, where the vein dips 40° N. In a second cut 50 feet farther west the vein is 4 feet wide. Samples cut across the vein at both these exposures were combined and assayed 86.7 percent BaSO₄ and 10.4 percent CaF₂. Over the hill to the west, this vein splits and persists as two veins, with a maximum width of 2 feet for at least 100 feet. Numerous 1- to 6-inch stringers appear in the cliff face above.

None of these veins can be seen traversing the low hill immediately east of the saddle, but in the next depression some 200 feet eastward and along the same general strike, a group of veinlets 2 to 10 inches wide appear in a 40-foot zone.

Southward from the first-mentioned saddle and a short distance down the slope, an east-west zone about 100 feet wide contains a myriad of mineralized stringers and veins varying in width from 1 inch to 2 feet. The individual veinlets vary widely in strike and dip and form a network of mineralization extending several hundred feet westward and at least 1,000 feet eastward to the end of the ridge.

In the valley southeast of the ridge, random dozer cuts expose minor stringers of barite.

At the end of the access road a prospect adit had been driven S. 20° W. for a distance of 215 feet. It was intended to intersect the downward extension of the mineralized zones, some 200 feet below their outcrops in the saddle, but had not been driven far enough.

A character sample from the several veins on the claims, somewhat representative of the entire deposit, had a specific gravity of 4.15. It assayed 86.5 percent BaSO₄, 7.7 percent CaF₂, and 3.4 percent CaCO₃.

B & H Claim No. 6

The B & H claim No. 6 is one of a large group of claims located by A. C. Bourbonnais and associates. It is the only claim of the group on which the presence of barite has been noted. The claim is approximately at the center

of unsurveyed T. 2 S., R. 6 W., 25 road miles southwest of Buckeye, in rolling country on the north side of the Gila Bend Mountains at an approximate altitude of 950 feet.

The claim is accessible by traveling southwesterly on a desert road for 7 miles from the El Paso Natural Gas Co. pumping station on the Arlington-Gila Bend Road.

As the presence of barite had been recognized only recently, no exploration had been done up to the time of the visit in October 1957, and the following discussion is based merely on examination of the few definite exposures and by following float material.

Sporadic mineralization occurs along fracture planes in biotite schist over an exposed area of bedrock for several hundred feet west and north of the location monument of claim 6. Generally the mineralized fractures strike northwest along the plane of schistosity, but at several places they were seen to crosscut the schist. Some of the veins can be traced by float for 30 or 40 feet but may extend to greater lengths under the shallow alluvium cover. The maximum observed width was about 2 feet, and it is likely that the veins are nearly vertical.

The barite of the wider surface exposures appears to be of good quality.

Rowley Mine

The Rowley property, consisting of six patented claims, is on the west flank of the Painted Rock Mountains, in the NE 1/4 sec. 25, T. 4 S., R. 8 W., with a slight overlap into the SE 1/4 sec. 24.

The claims are accessible from Gila Bend as follows: From the junction of State Highway No. 85 and U.S. Highway No. 80, travel west on the latter; at 14.5 miles turn right on the Painted Rock Dam Road; at 27.1 miles turn right (east) onto a desert road; and at 28.0 miles arrive at the mine.

The six claims were bought by the Rowley Copper Mines Co., which was incorporated in 1909. About 1917 wulfenite had been found, and a 75-ton concentrator was built to treat it. In 1922 the Rowley Co. was succeeded by the Reliance Copper Co. Operations by the latter company were suspended later, and at a foreclosure sale in 1926 the bondholders secured title to the property. Charles A. Rowley in 1927 became the majority owner and president of the Rowley Mines, Inc. The mine was exploited intermittently from 1909 to 1923 for ore that contained values in copper, lead, molybdenum, and gold.

A report dated November 1933, by Walter X. Osborn, former manager of the Rowley Copper Mines Co., describes the workings as follows: One inclined shaft extended to the 160-foot level (225 feet on the incline) and another to the 100-foot level (150 feet on the incline). A vertical shaft was 280 feet deep with more than 300 feet of workings on the 160-foot level. There was 1,462 feet of total development work, and ore was shipped to a value of \$10,000; all except the wulfenite ore came from development work. There was a

heavy flow of water on the 160-foot level, and more water was encountered at 280 feet in the vertical shaft.

During the present investigation, the first or 100-foot level was examined and mapped in March 1958 (fig. 12). Water stands at about 15 feet below the drift.

The basic formation of the area is andesite. The two inclined shafts are on the outcrop of the mineralized fault zone where it was exposed over the top of a low knoll at an altitude of 600 feet. Because of extensive dumps, the outcrop is not visible. On either side of the knoll alluvium masks any surface extensions of the vein. Underground operations indicate that the fault zone has an average strike of N. 25° W. and a dip 45° E. The main four-compartment shaft and a two-compartment inclined shaft are 100 feet apart. The vertical shaft was sunk in the hanging wall about 200 feet to the east. Barite mineralization is the chief gangue constituent of the hanging-wall portion of the fault zone. Usually the footwall segment is composed of siliceous material containing random bands of chrysocolla up to 6 inches wide. Both the barite and the silicified portion of the vein contain varying amounts of wulfenite, minor vanadinite, and copper oxide staining. The wulfenite occurs as aggregates of small crystals and as druses of minute prismatic needles.

The main shaft, consisting of two hoisting and two manway compartments is well timbered down the incline to 107 feet. From there to the level at 150 feet (inclined distance) only a few posts are present. The shaft is sunk on or near the footwall. Below the 100-foot level the shaft narrows to two compartments.

From the surface to 75 feet down the incline, the barite is against the footwall, and its upper limit somewhere above the back of the shaft. Below this point siliceous material gradually wedges in against the footwall, and the bottom of the barite band becomes the back of the shaft. At the drift level a crosscut to the east exposes the full width of the vein. A 28-foot sample, cut horizontally across the barite zone, represents 20 feet of normal width. This sample, shown as No. 2 on section A-A (fig. 12), assayed 70.0 percent BaSO₄ and had a specific gravity of 3.83. Some 10 feet of siliceous material on the footwall side of the vein was not included in the sample.

A stope drift above the first chute north of the shaft was oblique to the structure. Sample 1, cut across a normal width of 14 feet, assayed 79.2 percent BaSO₄ and had a specific gravity of 3.91. The full normal width of the barite zone was not exposed here.

Enough lateral work has been done to indicate a 20-foot normal width of baritic material between the main incline and the crosscut to the vertical shaft. Fifty feet north of the latter, the barite band against the hanging wall pinches to 3 feet, and at the end of the drift the zone is composed entirely of siliceous material.

The alinement of the drift southward from the main shaft trends into the siliceous footwall zone of the vein and passes out of the barite zone at about

60 feet from the shaft. Judging by the strength of the barite zone in the crosscut east of the main shaft it is likely that there is barite mineralization in the east wall and possibly extending beyond the end of the present workings.

The smaller inclined shaft was sunk vertically for about 30 feet, beyond which it is inclined down the footwall of the vein. The vertical segment is solidly lagged so that the width of the vein cannot be seen. The stopes north and south of the smaller inclined shaft have full faces in barite but have not exposed the upper limit of the zone. These workings were mined for the wulfenite content. Barite is exposed in the back of this shaft to water level.

Osborn's report, previously mentioned, states that at 180 feet in the vertical shaft the ore contained galena and copper. By projection this would indicate mineralization to at least 300 feet down the incline. The vertical shaft, which is untimbered, is tightly bulkheaded at the 100-foot level.

Metallurgical Tests

Bench-scale flotation tests were made on a 165-pound sample of ore from the mine to determine the feasibility of selectively concentrating the barite and lead minerals. The sample consisted of random pieces of ore taken from various points underground. The sample had a specific gravity of 3.75 and assayed the following percentages: 64.0 BaSO₄, 3.60 Pb, 0.16 MoO₃, less than 0.01 V₂O₅, 0.08 Cu, 3.8 CaF₂, and 0.8 ounce per ton Ag. The lead was present as cerrusite, and the molybdenum occurred as wulfenite.

The sample was wet-ground to pass a 270-mesh sieve for the tests. A lead concentrate, which assayed 39.3 percent Pb and accounted for a lead recovery of 62.3 percent, was obtained by sulfidizing the pulp with sodium sulfide followed by xanthate flotation. The lead rougher tailing was thickened and the barite floated by means of oleic acid collector at a pH of about 11. The barite concentrate obtained by this procedure assayed 92.2 percent BaSO₄ and had a specific gravity of 4.3; recovery was 76.2 percent. Treated water was used in both the lead and barite flotation steps. Reagent consumption in a typical test was as follows: 8 pounds sodium sulfide, 0.4 pound amyl xanthate, and 0.05 pound methyl isobutyl carbinol per ton of ore feed for lead flotation; 2 pounds caustic soda, 2 pounds soda ash, 7 pounds sodium silicate and 0.72 pound of oleic acid per ton of ore in the barite flotation step. The high sodium sulfide consumption is attributed to the altered and weathered condition of the lead minerals present in the ore.

Mohave County

Examination was made of the only barite deposit known to the writer in Mohave County (fig. 13). This deposit, near Kingman, produced 90 tons of crude ore, which was shipped to a California user.

A second deposit was rumored to exist on the south side of Lake Mead in the vicinity of Bonelli Lodge, but its exact location could not be determined.

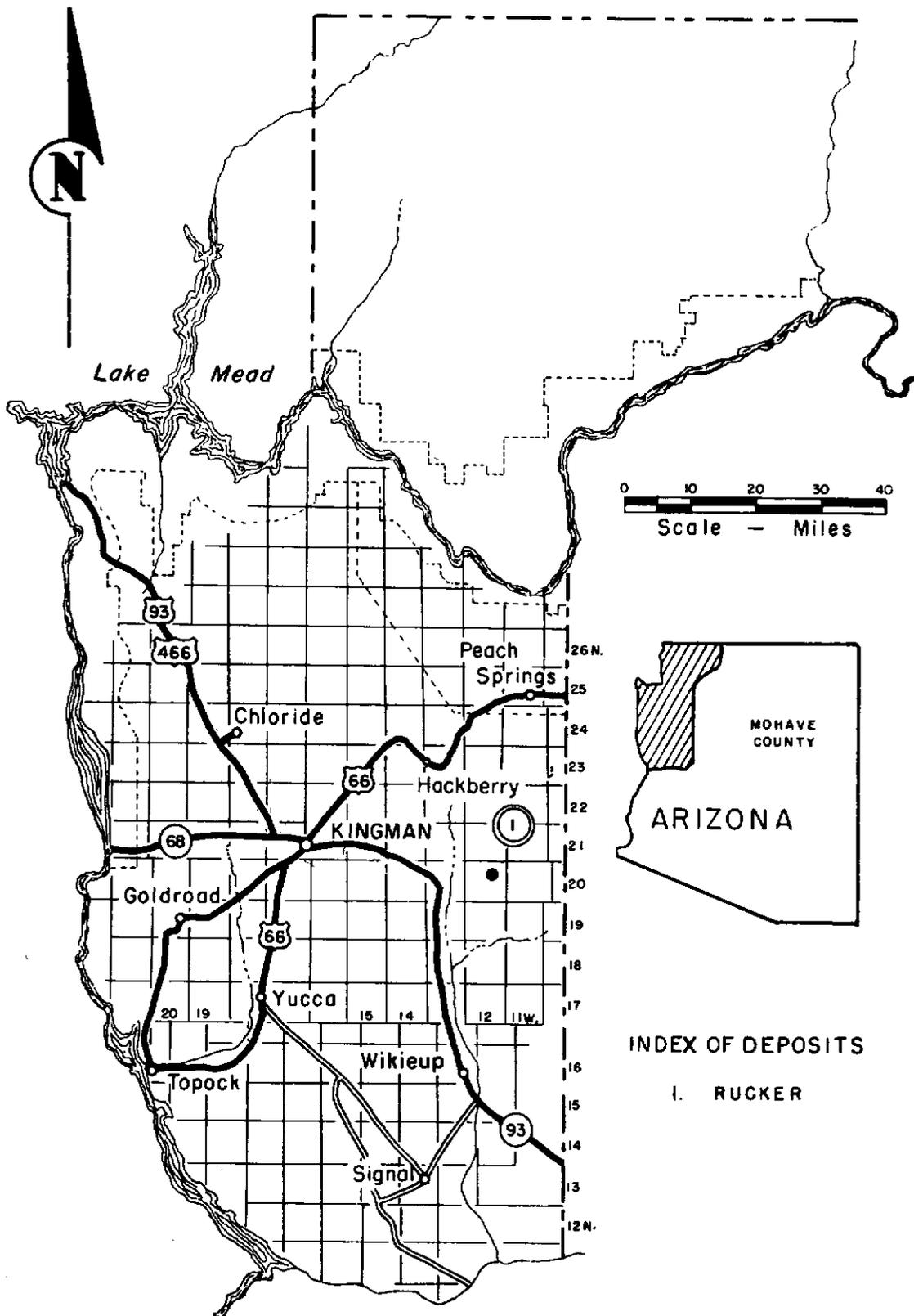


FIGURE 13. - Barite Deposits of Mohave County.

Barite occurs as a gangue mineral in the McCracken silver-lead mine some 8 miles west of Signal. Bancroft^{13/} states "Barite is the principal sulfate present and this occurs in large quantities, usually showing a banded structure which is prevalent in the gangue minerals in this mine." This occurrence was not investigated in 1957 because the mine is old and largely inaccessible. Shafts are as much as 600 feet deep, with extensive lateral workings and many stoped areas.

Rucker Group

The Rucker group, consisting of five unpatented claims, is about 30 air miles east of Kingman in sec. 2, T. 20 N., R. 12 W., at an approximate altitude of 4,150 feet. Most of the area covered by the property originally was located in 1942 by J. L. Hillton as the Barite Nos. 1 to 4 claims. The present Rucker group was relocated in August 1954 by Emery Blevins. The claims lie along Rucker Canyon, a tributary of Cottonwood Wash. The nearest railway shipping point is at Hackberry (26 miles).

The property is accessible from Kingman according to the following road log:

- 0.0 Junction of State Highway 93 and U.S. Highway No. 66. Travel east on 93.
- 23.4 Turn left (north) on Hackberry cutoff.
- 28.3 Turn right (east) on road signed Miller Ranch and follow road by the side of the El Paso Natural Gas Co. pipe line.
- 32.3 Turn right (south) on dim truck trail. This point is about 0.2 mile west of the gas-line bypass station. Follow this trail to Cottonwood Wash, thence easterly up the canyon.
- 36.4 Arrive at camp house on the east end of the claims.

A road has been dozed westward up the south side of Rucker Canyon from the house to the deposits. It passes two shallow inclined shafts and several pits excavated along a copper-bearing vein.

West Deposit

Barite is exposed 0.4 mile from the house on the south side of the east-west road cut. The barite occurs in sporadic pods or segregations up to 2 feet or more in cross section and in random stringers and usually is relatively pure and coarsely plated. The sides and face of a 12-foot cut into the south bank expose similar mineralization. The barite content is estimated at 10 to 15 percent of the rock mass.

^{13/} Bancroft, Howland, Reconnaissance of the Ore Deposits in Northern Yuma County, Ariz.: Geol. Survey Bull. 451, 1911, p. 126.

The barite mineralization appears to be confined to a width of 40 feet within a pink, coarse-grained granite and is limited on the north and east by zones of black chlorite-rich granite. Hillside alluvium masks any extension of the deposit to the south.

East Deposit

A wide and topographically prominent quartz dike has been exposed by erosion of the granite host rock on the north side of the canyon, about 1,000 feet east of the previously mentioned area. The trend of the south side of the dike is S. 80° W., and conforms to a fault contact between the quartz mass and the relatively soft, coarse-grained granite.

A barite vein is exposed in the cliff face of the dike and can be traced for some distance up and into the jumble of loose rock that caps the dike. The vein is along a zone of shear planes striking N. 60° W.; thus to the east mineralization wedges out at the fault. The dip of the fault and of the shears is nearly vertical.

Barite previously had been mined from an opencut for about 30 feet westward from the fault. At the time of the examination (October 1957) the lower part of the cut was filled with debris, but elsewhere the floor was visible. The exposed vein was 6 to 8 feet wide consisting of relatively pure, coarsely plated barite. An 8-foot stub adit at the west end of the opencut exposes similar mineralization in the back and face, except that fragments of siliceous gangue are present in the upper parts.

A few feet above the adit, the bottom of a shallow shaft shows fair mineralization, but the vein outcrop above the shaft, which contains increasingly more waste material, has not been prospected. It appears that the upper limit of minable ore is about at the top of the adit, and any future exploitation would be westward on that level and downward on the vein.

A 6.5-foot sample chipped across the vein at a bench near the adit portal assayed 92.0 percent BaSO₄ and had a specific gravity of 4.3.

It is reported that 90 tons of crude ore was shipped to the Macco Corp., Rosamond, Calif., about 1953.

The two deposits are unrelated structurally, but the barite of each is freely cleavable and varies in color from milky white to light pink; the pink is due to minute particles of hematite along the cleavage planes. Selected specimens of this barite had an average specific gravity of 4.4. Minor amounts of green copper oxide stains were noted on fracture planes of the barite of both deposits.

Pima County

Of the three barite occurrences known in Pima County, two are on the Papago Indian Reservation; one is in limestone, and the other in andesite. The third deposit, southeast of Tucson, is in limestone.

There has been no production from the deposits, the locations of which are shown in figure 14.

White Prince Claim

The White Prince claim is on the west flank of the Quijotoa Mountains in approximate sec. 17, T. 15 S., R. 2 E., unsurveyed, of the Papago Indian Reservation, at an approximate altitude of 3,300 feet. It was located by William H. Coplen in October 1954.

The property is accessible by traveling west on State Highway No. 86 for 77.8 miles from its junction with U.S. Highway No. 89 in South Tucson. Turn west on a semigraded dirt road and go 3.5 miles to the end of the road at a windmill and tank; then go south on a foot trail for about 2 miles, cross over the saddle, and go down the southwest side of the mountain. The altitude of the deposit is approximately 3,300 feet, and the saddle is 300 feet higher.

A wedge of limestone is in fault contact with andesitic rock. The limestone has been metamorphosed to coarsely crystalline, manganese-stained calcite and mineralized with barite and minor amounts of fluorspar. A wash courses southwest across the deposit near its midpoint.

South of the wash the outcrop is exposed for more than 100 feet in a vertical rise of about 60 feet. The east contact is well exposed, striking N.-S. and dipping 75° W. The south and west extremities of the block are not well exposed but strike approximately N. 60° E. and N. 20° E., respectively. The limestone is 30 to 40 feet wide in the wash, and the southern end is about 70 feet wide. In the east half of the limestone barite occurs as crystals in disseminations as much as 1 foot or more in diameter and in veinlets along fractures. A character sample taken across 12 feet assayed 60.6 percent BaSO₄, 2.6 percent CaF₂, and 24.3 percent CaCO₃--probably representing better material than could be mined. The west half of the outcrop contains less barite but proportionately more fluorspar.

Exposures of the apex of the block north of the wash are poor, because of alluvial cover and a calichelike surface crust, but barite-bearing limestone can be seen in occasional narrow patches for more than 100 feet from the wash. The caliche crust is composed essentially of fine-grained calcite, granular quartz, and feldspars.

Another deposit, in which the barite occurs in a vertical fracture zone in andesite, is present on the hillside north of the wash and some 400 feet northeast of the major limestone outcrop. The barite occurs in irregular and discontinuous nearly parallel veins up to 2 feet wide, separated by rock bands. At places the barite is solid and elsewhere contains rock inclusions. The rock bands contain sporadic disseminations and minute crystals of barite dispersed throughout the rock mass.

The outcrop is partially covered throughout its visible length of 250 feet. The southern 50 feet is at least 10 feet and may be as much as 20 feet wide. The remaining 200 feet to the north appears to be 6 to 8 feet wide. A

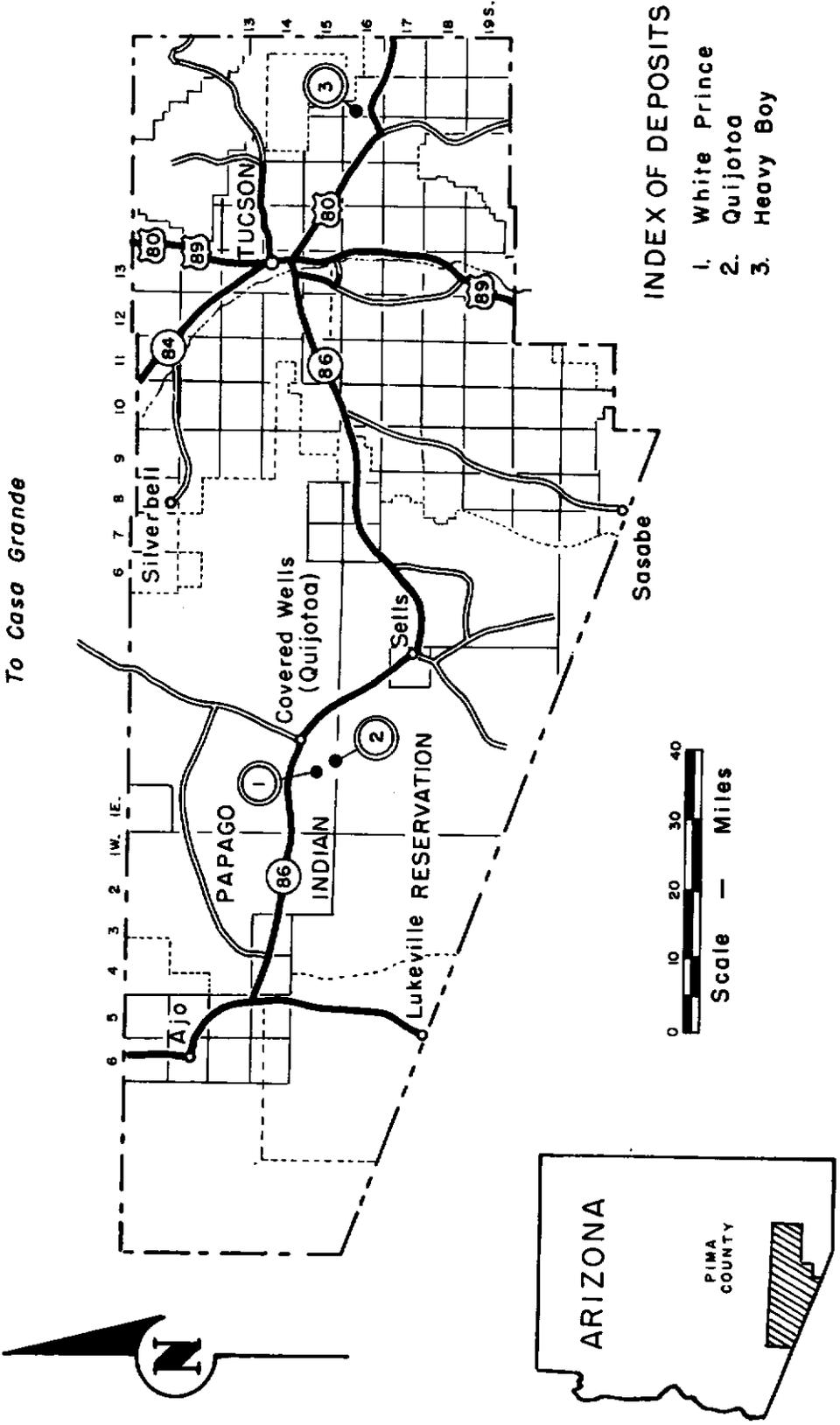


FIGURE 14. - Barite Deposits of Pima County.

character sample of the better mineralization, excluding barren bands, assayed 69.0 percent BaSO_4 , 0.2 percent CaF_2 , and 7.4 percent CaCO_3 .

Metallurgical Tests

A 100-pound grab sample was taken from the location pit for bench-scale flotation tests. The sample assayed 66.3 percent BaSO_4 , 26.2 percent CaCO_3 , and only a trace of CaF_2 . The sample was ground to minus-200-mesh, using soda ash to establish a pH of 10, and the barite was floated with petroleum sulfonate collector while retarding the calcite with sodium silicate. Three-stage cleaning of the barite rougher froth yielded a product assaying 95.9 percent BaSO_4 and having a specific gravity of 4.36; barite recovery was 71.9 percent. Soft water was used in the test with the following reagent consumption: 2.0 pounds of soda ash, 7.0 pounds sodium silicate, and 1.25 pounds of petroleum sulfonate per ton of ore treated. The White Prince ore is readily amenable to flotation.

Quijotoa Mine

This old mine was operated in the 1880's by Comstock Lode financiers as a silver producer. It is on Ben Nevis Mountain of Quijotoa Range, some 5 miles west of State Highway No. 86 (Tucson-Ajo Road), in approximate sec. 33, T. 15 S., R. 2 E., unsurveyed, on the Papago Indian Reservation. Several mines on Ben Nevis Mountain were involved in an ephemeral silver-mining boom at that time, but it is likely that the following discussion relates to the Peerless workings. The title to the claims probably reverted to the Reservation many years ago.

The mine is accessible from the old Quijotoa Road, which branches west from State Highway No. 86 at 76 miles west of the junction of U.S. Highway No. 89 and State Highway No. 86 in Tucson, or 2 miles east of the junction of the Casa Grande (Santa Rosa) Road. Travel west from Highway No. 86 on the Quijotoa Road to 0.7 mile, turn south on a dim truck trail, and keep left at 4.0; bear right at 4.9, turn left across a wash at 5.6, and reach the road end at 6.7 miles. A now-impassable wagon road goes up the hillside about one-quarter mile farther to a large cut and dump, which was the site of the milling and powerplant. This dump is plainly visible from the highway because of a large accumulation of white ash produced by the old wood-burning steamplant.

Of interest to this report is a barite-lined fissure cavity occurring in the workings. No investigation was made of the silver-bearing quartz vein mined elsewhere. The mine portal is in the cliff face west of the dump, some 700 feet higher on the mountain (altitude 3,350), and accessible by about one-half mile of steep, narrow trail.

Drifts extend north and south from the end of the westerly bearing 350-foot adit in andesite. At about 300 feet in the south drift a crosscut to the east breaks into an open cavity with a northerly course. It is as much as 10 feet wide and 20 to 30 feet long, with a maximum height of 30 feet. A second crosscut 100 feet farther south in the drift opens into another lenticular cavity on the extension of the same fissure zone. This cavity is about 200

feet long, up to 20 feet wide, and averaged about 20 feet high. From about midpoint the rubble-covered floor slopes downward to the south and terminates where the walls close together.

The following description of the mineralization applies to both cavities: 1 to 2 feet of bladed compact barite lines most of the walls of the cavity. The barite is of high purity, white and translucent. Over much of these surfaces is a thin coating of coral pink, finer laminated barite, exposing crest-like surface forms. Deposited over the barite is calcite, mostly in acute scalenohedral (dogtooth spar) forms. It sometimes is white but usually is manganese-stained. Occasional wall areas show gypsum, generally granular but sometimes of the selenite variety. All these minerals appear to have been deposited from meteoric waters.

Enclosed within the barite and calcite are cubes of galena, probably deposited on the open-fissure walls before formation of the barite and calcite crusts. There is some alteration of lead to anglesite and to a red material containing lead and iron.

Heavy Boy Group

The Heavy Boy group, consisting of four contiguous unpatented claims, is leased from the State of Arizona by Charles W. Hopkins and James I. Stevens. The property is in the NE 1/4 sec. 8, T. 16 S., R. 17 E., on the east side of Mountain Spring Canyon, about one-half mile east of Colossal Cave, at an approximate altitude of 3,500 feet. The claims are accessible from Tucson by traveling approximately 30 miles southeast to Colossal Cave, either by U.S. Highway No. 80 or the Sahuaro National Monument Road. One-half mile south of the Cave entrance take the picnic-area road to the west, keep to the signed La Selvilla Barbeque Road for 0.8 mile. The property is on the hillside across the wash.

The claims originally were owned by the late W. E. Johnson during the latter 1940's. The property was relocated by the present owners in May 1955.

Major exploration work has been confined to claim 3 on a brecciated, barite-bearing fault zone with indefinite walls, cutting massive, somewhat cherty, Paleozoic limestone. The zone strikes N. 30° E. and is essentially vertical. From a bench cut about 80 feet long, a crosscutting 35-foot adit has been driven S. 65° E. The interior is caved but appears to have been opened to a width of about 25 feet. Occasional nodules or disseminations up to 1 foot or more in diameter are present in the walls and can be inspected.

A pit excavated in the floor of the cut just north of the adit exposes a 10-foot face, which appears to be a fault plane. The upper part consists of weathered and fragmental material containing nodules and broken masses of barite; the lower, more solid portion of the face exposes several irregular disseminations of barite. Clusters of replacement barite crystals occur in the adjacent massive limestone. Two lots of handsorted ore of milling grade, estimated to contain about 50 tons, are piled on the dump.

Local concentrations of barite ranging from a few inches to 2 feet in width, occur above the workings to the east and along the hillside to the northeast for hundreds of feet. These concentrations occur in fractures of various attitudes or as unrelated replacement masses. A shallow cut approximately 500 feet N. 80° E. of and about 150 feet higher than the adit exposes a zone of mineralization dipping with the hillside slope. A thickness of at least 4 feet of barite containing occasional large inclusions of rock fragments is disclosed, but the extent of the body has not been determined.

Pinal County

Only one barite occurrence is known in Pinal County (fig. 15). The deposit, from which no production has been reported, is in schist.

Gonzales Pass Deposit

The Gonzales Pass property reportedly consists of five unpatented claims located in the early 1950's by J. W. Barnett. Presumably, the claims are in secs. 16 and 17, T. 2 S., R. 11 E., less than 1-1/2 miles south of Gonzales Pass. The property is accessible by a 2.2-mile truck trail, which branches southeasterly from U.S. Highway, Nos. 60-70 at 4.9 miles east of Florence Junction.

The major work has been confined to a vein that strikes S. 30° E. and dips 75° NE., following a fault fracture in Pinal schist. The outcrop of the vein is well exposed by some 300 feet of dozer stripping up the hillside. The barite, with some rock inclusions, is 3 feet wide at the bottom of the cut; 20 feet farther up, the vein is 2 feet wide and contains more waste inclusions and considerable manganese-oxide staining. In the next 200 feet the vein decreases in width, contains pods of barite deposited in a serrated pattern, and finally splits into several stringers only a few inches in width.

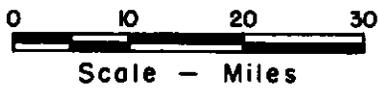
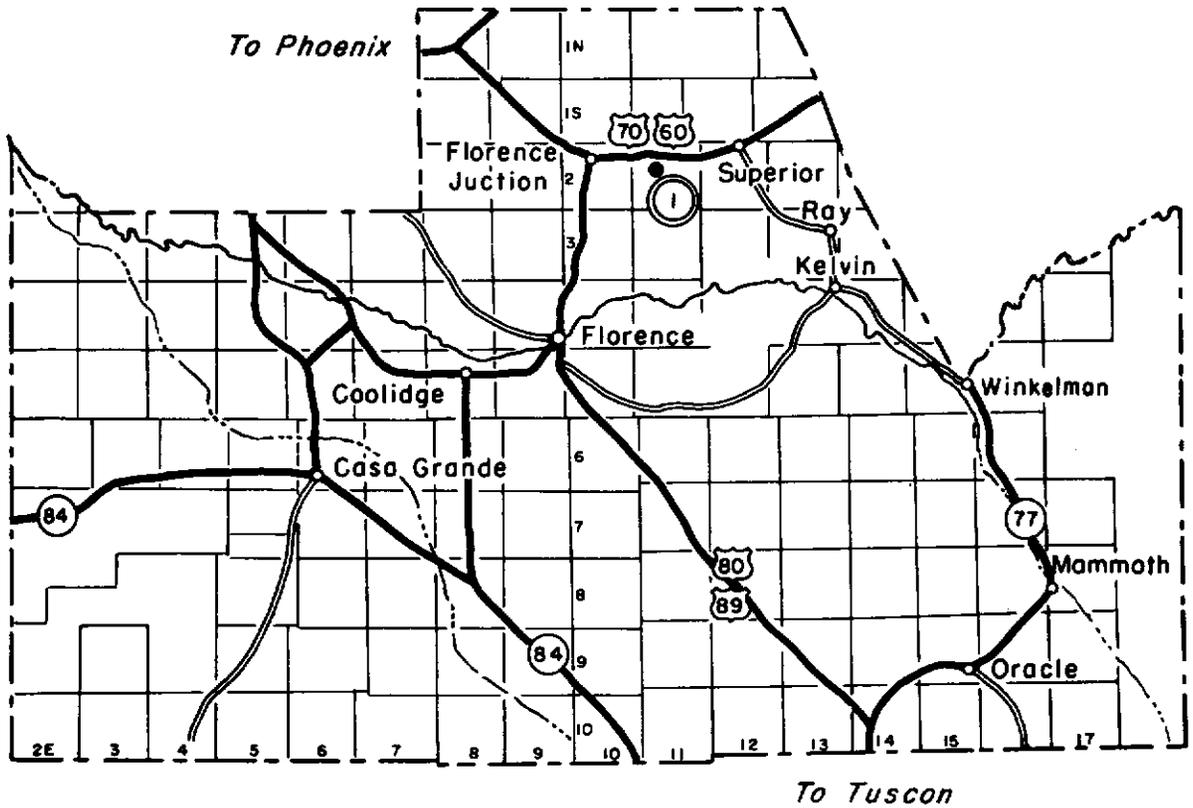
Minor amounts of fluorspar occur in the barite, particularly near the outer edges of mineralization. Dump material at the bottom of the cut has covered any immediate extension of the vein into a wash to the northwest, and heavy alluvium covers the next hill along the projected strike.

A second occurrence was observed south of the road, about 1,000 feet west of the previously mentioned work. The location pit was sunk on a 2-foot zone of barite, which contained waste as fragments and ribbons of rock, all heavily impregnated with manganese-oxide staining. This vein, along a fault in decomposed granitic material, is vertical and strikes S. 50° E.

No mineralization was observed in the roadcut a hundred feet to the northwest on the projected strike.

Yavapai County

The three known barite deposits investigated are in the south central part of Yavapai County (fig. 16). One is in schist, and the other two are in igneous environment.



INDEX OF DEPOSITS

- 1. Gonzales Pass



FIGURE 15. - Barite Deposits of Pinal County.

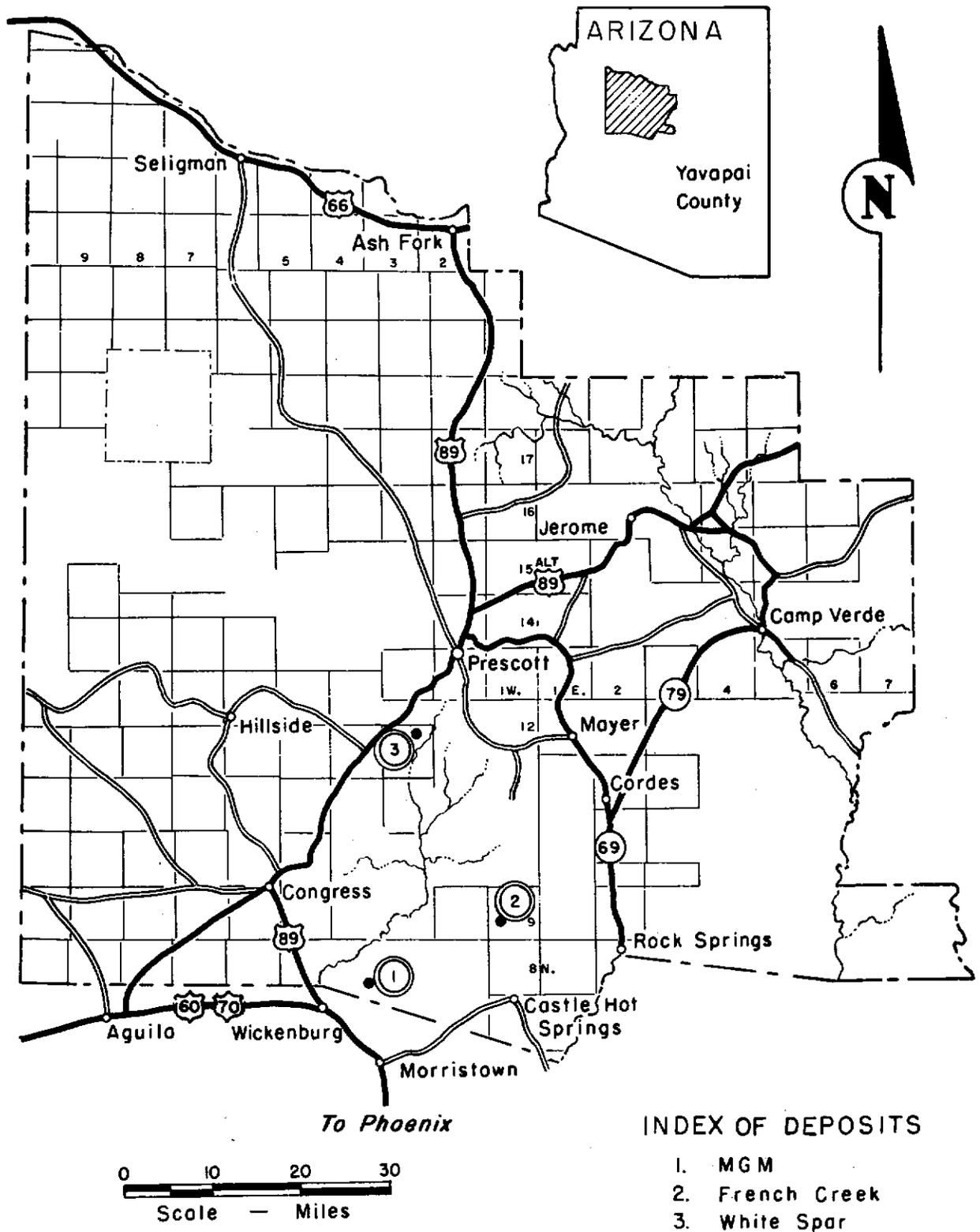


FIGURE 16. - Barite Deposits of Yavapai County.

There has been no barite production from these occurrences, but one of the mines shipped several hundred tons of silver-lead ore with predominantly barite gangue.

Barite also is reported as a gangue mineral at the Arizona National, the Silver Bar, and other mines in the Bradshaw Mountains area.

MGM Claims

The two MGM claims are a few miles northeast of Wickenburg, probably in the southern part of sec. 25, T. 8 N., R. 4 W., at an altitude of approximately 3,000 feet. Papers indicate that they were filed by Robert A. Galloway and Raymond T. Murphy.

The property is accessible according to the following road log:

- 0.0 Junction U.S. Highway Nos. 60-70 and Constellation Road. Travel northeast on the latter road.
- 4.5 Take right fork.
- 5.2 Keep right at forks.
- 6.6 Take right road at steel flag sign.
- 6.7 Turn right on dim trail.
- 6.9 End of trail at workings of MGM No. 1 claim.

Barite mineralization occurs as filling and replacement within a 4-foot crushed and brecciated zone of a low-angle fault; the hanging wall is volcanic breccia, and the foot wall altered granite. It strikes N. 40° to 60° W. and dips 20° SW., where exposed by a 60-foot north-trending, shallow dozer cut. The upper half of the zone contains most of the barite, which is intimately mixed with wallrock fragments. Very little barite is exposed in the shallow cut where the lower half of the zone is exposed. It is estimated that about 20 percent of the material in the entire zone is barite, much of which has a reddish tinge from iron-oxide staining. Some of the barite segregations are several inches in cross section and relatively free of rock inclusions.

Up the hillside to the northwest, the mineralized zone appears to decrease in thickness, and any extension to the southeast is masked by debris in the bottom of the wash.

The deposit dips under a low ridge to the west. Dozer stripping over an area about 50 feet wide by 100 feet long has exposed several mineralized hanging-wall fractures. The largest one strikes north and dips 20° W. and contains a barite vein varying in width from 6 inches to 1.5 feet. It can be traced for about 100 feet down the slope. Other minor fractures vary in strike from northeast to northwest.

Minor barite showings also were observed on adjacent claim 2, several hundred feet to the southeast.

French Creek Deposit

The French Creek barite occurrence is so-called for lack of a current owner or claim name. It is on the west flank of Silver Mountain of the Bradshaw Range in the northwest part of sec. 29, T. 9 N., R. 1 W., at an approximate altitude of 4,350 feet.

The only work noted was a 50-foot adit, driven with hand steel, and two shallow, caved pits. It is obvious that this work was performed many years ago, probably for gold. The ruins of a rock hut, probably associated with those operations, further indicates the age of the workings. Two location notices by different persons, dated 1951 and 1956, were found near the adit, but evidently no new location or assessment work was done to hold the claim.

The deposit is accessible from U.S. Highway No. 89 according to the following road log:

- 0.0 From Morrystown travel northeast on the Champie Ranch Road and follow the signed road.
- 26.6 Pass Champie ranch buildings and continue down the bed of French Creek.
- 26.8 Turn left out of the creek bed.
- 27.7 Turn left at road signed Bard Headquarters Ranch.
- 29.6 Turn left at the VX Ranch house.
- 34.5 Road goes over the divide and crosses French Creek. It is necessary to walk from this point.

Follow the bed of French Creek northerly for about 2 miles to a vertical, 15-foot cliff face, which forms a waterfall. The barite occurrence, some 400 feet higher on the hillside, is about one-half mile northerly up a small tributary wash, which joins French Creek immediately above the waterfall. The ruins of the previously mentioned rock house can be seen in the brush on the left bank of this junction.

Barite mineralization is in a 4- to 5-foot fault zone, visible in the wash bottom for a length of about 200 feet, and also exposed in a 30-foot cliff face, which crosses the wash. The fault strikes N. 45° W. and dips 70° NW. across the northeasterly schistosity of the area. At the base of the cliff face and in the center of the wash an old adit has been driven 50 feet northwestward on the fault zone, which here shows slickensided and grooved hanging and foot walls. The material composing the zone is somewhat brec-

ciated and extremely silicious and contains very little barite. Above the cliff, the zone is covered with stream rubble.

Below the cliff several exposures show a considerable barite content on the hanging-wall side of the fault zone, gradually decreasing toward the foot-wall. Barite mineralization occurs as aggregates and rosettes of relatively small tabular crystals within a matrix of manganiferous siderite in which occasional crystals of pyrite and chalcopyrite can be seen. In the outcrops, weathering of the matrix produces limonite, and occasionally hematite, and sparse copper oxide staining. Some of the barite is iron-stained, but most is white. Occasional pods and aggregates of virtually pure barite attain dimensions of several inches in cross section.

The outcrop can be followed for a distance of about 200 feet down the streambed, which has the same course as the vein. It cannot be traced into the bank because of heavy alluvium. No sample was cut, but the barite content in the 3- to 5-foot zone was estimated at not more than 20 percent.

At several places downstream from this occurrence, similar northwest-trending zones as much as 12 inches wide can be observed coursing across the bottom of the wash.

As would be expected, much float can be found in the wash, and occasional pieces were observed in French Creek.

White Spar Claim

The White Spar is one of a group of six adjoining claims patented in 1904. It and two others now are owned by Harold H. Block, of Los Angeles, Calif. The White Spar claim originally was located in 1880 and worked many years ago, probably producing several hundred tons of silver-bearing ore. It is in the Bradshaw Mountains in sec. 2, T. 12 N., R. 3 W., of the Prescott National Forest.

The claim is accessible from U.S. Highway No. 89 by turning south on a dim road signed White Spar Mine at a point 2.4 miles northeast of Wilhoit or 14 miles southwest from the Courthouse at Prescott. From this junction travel down the wash, keep straight ahead at 0.8 mile, turn left out of the wash at 0.9, and go around the hillside and down a ridge to the end of the road at 1.6 miles. The road is in poor condition and has a very steep grade at the mine end, which is at an altitude of approximately 5,000 feet. The area is heavily brush covered, and old trails to the workings are virtually obliterated.

A vein within a fault fracture in dioritic rocks contains barite mineralization and has been prospected by workings at three levels - on the crest of the ridge at the end of the road, midway down the hillside to the south, and near the bottom of the canyon for a vertical range of about 150 feet and a strike length of approximately 500 feet.

The vein strikes N. 5° W. and dips steeply to the west; the lower adit, some 50 feet above the bottom of the canyon, has been driven 250 feet north-erly. The vein at this level is 3 to 5 feet wide and of virtually all siliceous material, with only occasional stringers and small pods of barite. At the face there is a 4-inch veinlet near each wall of the drift. A stope starts about 100 feet from the portal and connects above a pillar with a vertical raise 50 feet farther back in the adit. This work is inaccessible, but as there is an updraft here it probably connects with a caved opencut some 75 feet higher on the hillside.

This cut is about 40 feet long, inclined downward about 10 feet to the caved material constituting the floor, and has exposed the vein in a vertical face for a depth of about 30 feet below the surface. The vein is 3.0 to 3.5 feet wide and composed of fair barite mineralization with some rock ribs and inclusions.

Immediately east of the road end the vein was prospected by a shallow cut about 40 feet long. Because of the caved condition of this old work the only exposure is in a pillar across the cut, where a 2-foot vein contains weathered barite and rock bands. Fifty feet to the south, the dump of a caved pit shows that barite was encountered. The intervening 200 feet between this pit and the stoped opening down the hill to the south has not been prospected.

A second and vertical vein, 30 feet to the west and on a level with the stoped area on the east vein, has a strike of N. 20° W. It has been opened by a 100-foot adit, which connects with a small stope to the surface some 30 feet above. Except for stringers and small lenticular pods, no minable ore was encountered except for the lens mined in the stope. This stope likewise is inaccessible, but no barite could be seen in the vertical face near the surface.

A crosscut drift westward from the interior of the lower adit may have intercepted the west vein, but the drift was caved and inaccessible. It is evident that there has been no mining activity on the claim for many years before examination in February 1958.

A stockpile of several tons of ore from previous operations remains on the dump. The ore, apparently handsorted and obviously prepared for burro packing, is stacked in sacks decaying with age. A grab sample, composited from various sacks, assayed the following percentages: 40.4 barite, 2.2 lead, 1.4 zinc, 26 ounces silver, and a trace of gold per ton. Generally the barite is white, contains blebs and segregations of clear quartz, and shows local copper-oxide staining.

Yuma County

Yuma County contains more individual occurrences of barite than any other county in the State. The Bouse district in the north-central part of the county contains most of the deposits, all within 10 miles of the village of Bouse. Four other deposits lie in the northern part of the county, and three

more are in the south-central part. Locations of the various deposits are shown in figure 17.

Occurrences in the Bouse area are predominantly in volcanic flow rocks (1 and 2, fig. 17). Two of the deposits in the vicinity of Wenden (3 and 5) are in metamorphic rocks, as are the two occurrences (6 and 7) in the south-eastern part of the county. The two remaining localities (4 and 8), respectively northwest of Wenden and north of Yuma, are in igneous rocks.

Shipments of approximately 4,000 tons of barite ore, more than half from the Bouse district, were made from four localities in this county during the 1940's.

Bouse (Plomosa) District

Barite-bearing fractures occur in two areas near Bouse. One area lies along the low, rolling foothills on the eastern flank of the Plomosa Mountains west and southwest of town, and the other is in similar topography at the north end of the Bouse Hills, northeast of town. With few exceptions the veins traverse volcanic-flow rocks, but the fracture pattern does not exhibit a regional trend.

Locations of the occurrences are shown in figure 18. Some are approximate, based on road distances and bearings to Bouse, but others are more exact, as section corners were found nearby. None of the claims examined had been patented.

The only known production of barite was obtained in 1948, when the National Lead Co. shipped 2,500 tons of mine-run ore--most from the Black Mountain claims.

In 1955 the Trans-National Minerals Co., of Albuquerque, N. Mex., George Dailey, agent, optioned several claims and conducted some preliminary exploration work, including wagon drilling of at least one deposit. When the district was examined in May 1957 and June 1958, there was no activity or equipment at any of the properties.

The individual deposits in the vicinity of Bouse are described below.

Black Mountain Group

The Black Mountain group consists of two noncontiguous unpatented claims 5 miles north of Bouse in unsurveyed sec. 34, T. 8 N., R. 17 W. The property is reached by traveling 3.7 miles northeast from Bouse on the Swansea (Planet Ranch) Road, turning northwest at a corral and windmill, and continuing 1.9 miles to the No. 1 deposit. The No. 2 deposit is one-half mile to the southwest. Both deposits are at an altitude of approximately 1,000 feet.

The two claims are part of a group originally located in the early 1930's by F. C. Brewer. In 1938, under a lease agreement, the National Lead Co.

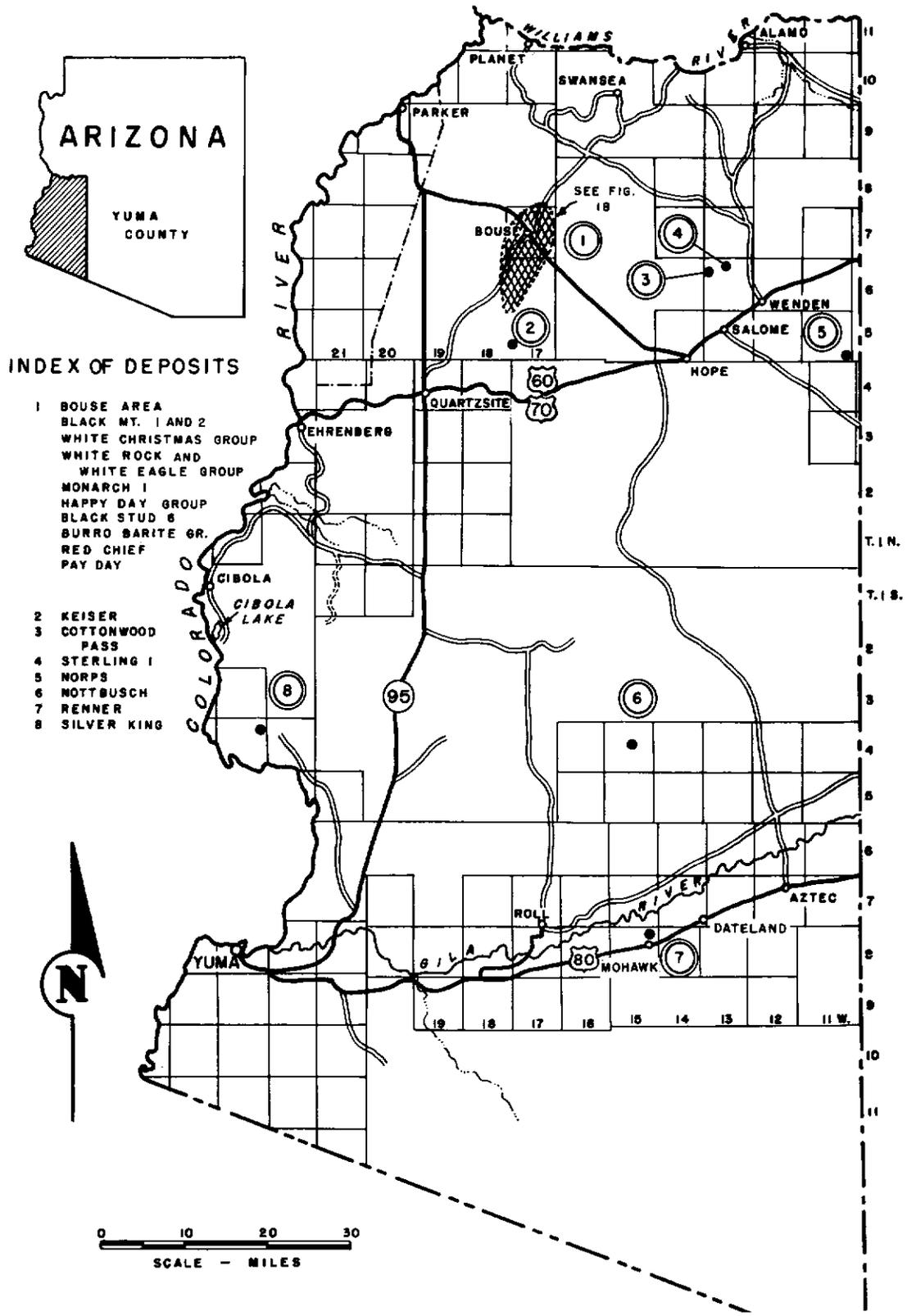


FIGURE 17. - Barite Deposits of Yuma County.

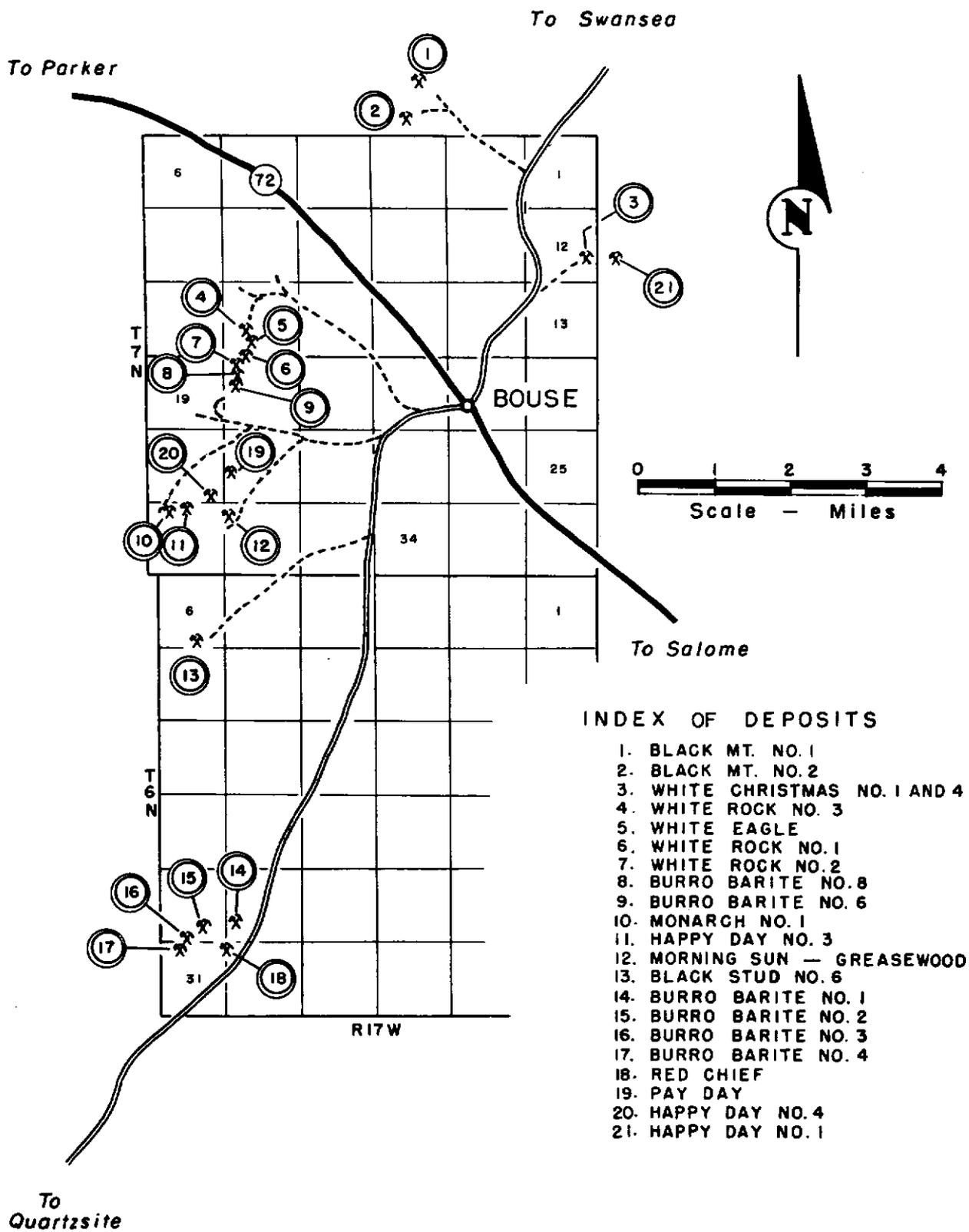


FIGURE 18. - Sketch Map, Barite Deposits in Bouse District, Yuma County.

improved the access road, constructed a loading ramp at the Santa Fe tracks at Bouse, mined and shipped 2,500 tons of barite ore, most from claim 1. The claims were purchased by the present owner, James C. Townsend, and relocated in January 1949.

Black Mountain No. 1

On a low, rounded hill of volcanic agglomerate, three major fissure veins containing barite mineralization have been mined by long opencuts, combined with some underhand stoping. A smaller parallel vein is exposed by a shallow cut (fig. 19).

Two of the major veins intersect near the outer end of the workings. The vertical vein exposed in the floor of the northeast trench ranges from 3 to 5 feet in width. The wider concentrations appear at junctions with acutely diverging minor veins. At the end of the trench an adit driven 10 feet ahead shows a 2-foot barite zone containing minor rock ribs.

The 240 feet of vein exposed in the intersecting trench has an average dip of 75° to 80° NE. and varies from 2 to 6 feet in width. A 30-foot shaft at the entry to the cuts is inclined 45° to the southeast and shows the 2-foot vertical vein at the surface, decreasing to 1 foot at the bottom, with minor stringers to the east. It is apparent that the shaft had not penetrated to the intersection of the two veins, as the plunge carries it southeastward, somewhat ahead of the bottom of the shaft.

The continuation of the east vein to the southeast has been prospected for about 250 feet from the end of the trench. The dozer stripping was not deep enough to expose the vein except at the southeast end. A nearby 16-foot shaft shows a 6-foot zone of barite with included rock bands. Two cuts indicate the vein is 4 feet wide for 40 feet, and farther down the hill the vein narrows to 2 feet. Another parallel 2-foot vein has been exposed by a shallow cut about 40 feet to the east.

The west workings consist of a cut 120 feet long to a maximum depth of 20 feet. Two veins, separated by a couple of feet of barren material, are exposed in the floor. The eastern vein is 2 to 4 feet wide; the other is narrower. Near midpoint of the cut an underhand stope has been worked for 15 feet below floor level. It shows the 2-foot vein at floor level widening to 4 feet at the bottom. At the face of the trench barite mineralization was in numerous veinlets scattered across the entire face. Shallow dozer stripping exposed 2 to 3 feet of barite along the strike of the vein some 60 feet to the southeast.

Continuation of the vein to the northwest had been prospected by a now inaccessible 25-foot steeply inclined shaft. However, the 18-inch vein at the surface appeared to be decreasing in width at depth. The collar of the shaft was about 20 feet below the floor of the cut.

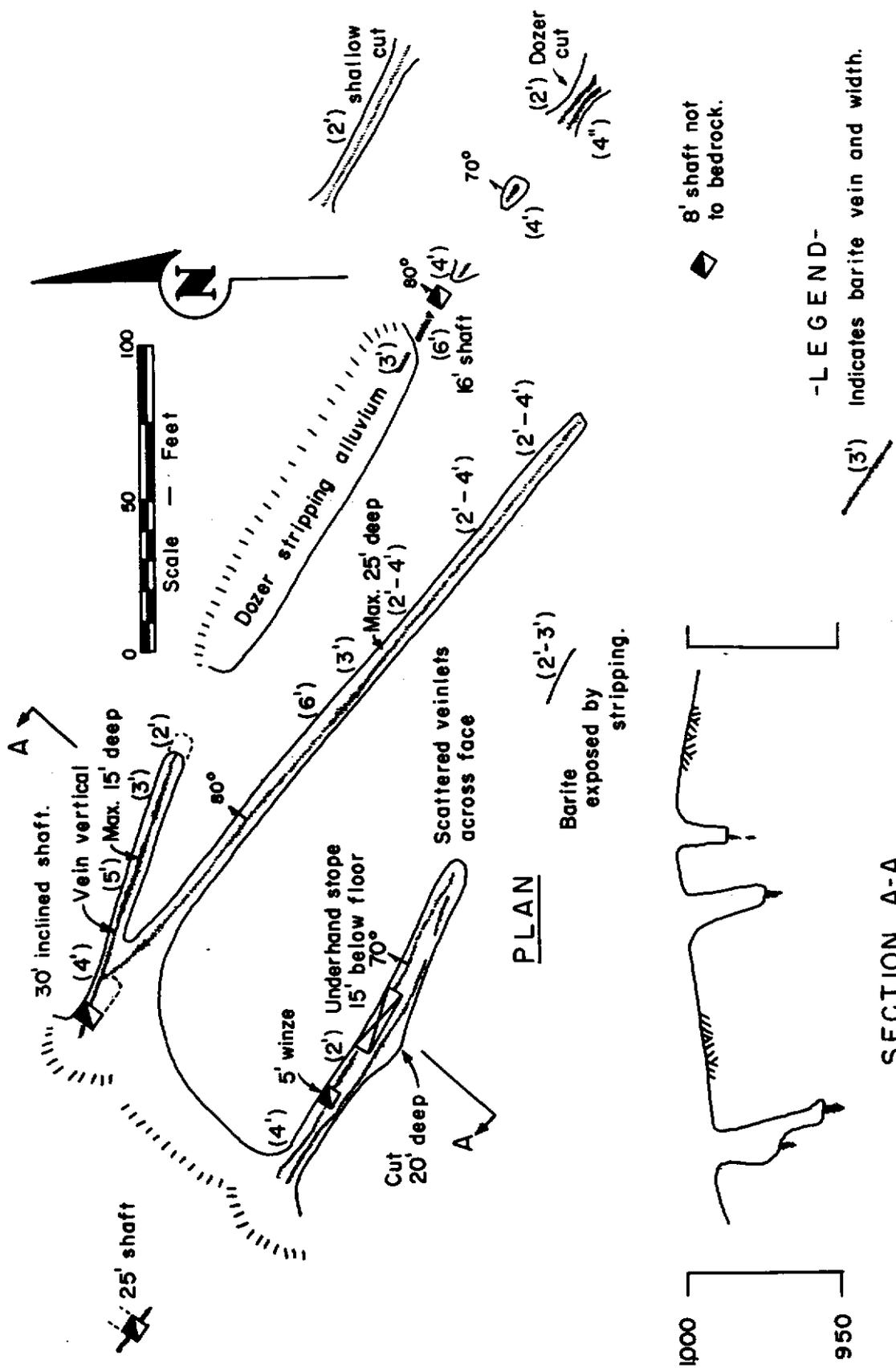


FIGURE 19. - Sketch Map, Black Mountain No. 1 Workings, Yuma County.

The barite of all these occurrences contains some included rock fragments and occasional discontinuous rock bands. Fluorite mineralization is associated with the barite, particularly near the sides of the veins. Copper oxide staining is common. A composite sample of the deposit, assayed the following percentages: 75.3, BaSO₄; 14.1, CaF₂; and 5.2, CaCO₃.

The hill across which these veins trend is approximately 75 feet high, 600 to 700 feet in diameter, and surrounded by alluvium-filled washes. A similar hill about 1,000 feet to the northwest has been prospected with negligible results. An adjacent, lower hill to the southeast is composed of light-colored volcanic rock and seems to be barren of mineralization.

Metallurgical Tests. - Bench-scale flotation tests were made on a 150-pound sample of composite ore to determine the grade of barite and fluorspar products obtainable. The sample assayed 75.3 percent BaSO₄, 14.1 percent CaF₂, and 5.2 percent CaCO₃. Tests in which the barite was recovered before the fluorspar yielded a barite product assaying 95.7 percent BaSO₄ with a specific gravity of 4.37 and a fluorspar concentrate assaying 94.3 percent CaF₂. The products accounted for a barite recovery of 75.5 percent and a fluorspar recovery of 53.5 percent. The method employed in the above test comprised wet-grinding the ore to minus-200 mesh at a pH of 10 with soda ash and sodium silicate. The barite was recovered using petroleum sulfonate as the collector, and the rougher froth was cleaned three times. Cleaner tailings from the first two cleaners were added to the barite tailing, and the pH was adjusted to about 10 with caustic soda. This pulp was then conditioned with sodium fluoride and lignin sulfonate, and the fluorspar was floated with oleic acid. The resultant froth was cleaned five times, using small amounts of lignin sulfonate in each cleaner. Reagent consumption in the test was as follows: 2.0 pounds of soda ash, 7.0 pounds of sodium silicate, 1.0 pound of petroleum sulfonate, 0.5 pound caustic soda, 4.0 pounds of sodium fluoride, 6.0 pounds of lignin sulfonate, and 0.16 pound of oleic acid per ton of ore feed.

In other tests flotation of fluorspar followed by recovery of barite from the fluorspar tailings gave two-mineral separation, but the products were low grade. Fatty acid flotation of the fluorspar from the finely ground feed, using lignin sulfonate and sodium fluoride to retard the barite, recovered 68.8 percent of the fluorspar in a concentrate assaying 94.2 percent CaF₂. Flotation of barite from the fluorspar rougher tailings, using petroleum sulfonate as the collector and sodium silicate as the gangue depressant, yielded a barite product assaying 92.8 percent BaSO₄ and had a specific gravity of 4.37. The concentrate accounted for a barite recovery of 68 percent. The reagents required to float the fluorspar and barite were as follows: 4 pounds of sodium fluoride, 5.6 pounds of calcium lignin sulfonate, and 3.2 pounds of oleic acid per ton of feed in the fluorspar float; 2 pounds of soda ash and 1.28 pounds of oleic acid per ton of ore in the barite flotation step. Treated water was used in both the fluorspar and barite flotation steps. Research is continuing to determine if acid grade fluorspar can be recovered from Black Mountain ore.

Black Mountain No. 2

Black Mountain No. 2 claim covers most of a small, elongated hill trending northwest-southeast. The southern part of the hill is about 100 feet high; it slopes gently downward to the northwest and more steeply around its southern perimeter. The core of the hill appears to be volcanic agglomerate, capped with a veneer of silicified limestone, thinning to the north. The north end of the hill has been intensely shattered and fractured, and extensive barite mineralization occurs as fracture and void filling and as partial replacement of the breccia fragments, which range from small particles to masses a couple of feet in their greatest dimension.

This part of the hill has been well prospected and indicates an area of mineralization about 150 feet wide by 175 feet long. Four of the five cuts or shallow shafts around the perimeter of this part of the hill show varying quantities of barite. Near the center of the area, a surface cut 30 by 12 by 20 feet deep exposes barite on all walls and in the floor. It appears that probably half the material removed was barite ore, which reportedly was shipped by the National Lead Co.

A 100-foot-long dozer stripping across the midsection of the hill about 175 feet from the north end exposes several veins and many barite-bearing stringers. A second wide dozer strip some 200 feet farther southeast (up the hill) shows only a few mineralized stringers; however, a zone of barite 8 feet wide is exposed in a pit 100 feet farther up the hill. The weathered limestone capping obscures any extensions of barite mineralization.

At least 2 dozen wagon drill holes, 14 to 66 feet deep, were observed. It is stated that this work was done by George Dailey in 1955, but neither the assays nor the hole logs were given to the owner.

In the deposit the barite is slightly pink from iron oxide staining, and the larger masses contain included rock fragments. A small amount of fluorite is present, and occasional copper oxide staining is noted.

White Christmas Group

The White Christmas group of five claims was located in 1954 by James B. Simpson, of Bouse, Ariz. The property is in an area of low, rolling hills of volcanic breccia at the north end of the Bouse Hills, in sec. 12, T. 7 N., R. 17 W., at an altitude of 1,000 feet. It is accessible from Bouse by traveling 2.1 miles northeast on the Swansea (Planet Ranch) graded road, then on a dirt truck trail to the right. From a fork at 2.4 miles, the right-hand trail is 0.2 mile to claim 1. Claim 4 is 0.4 mile ahead on the left-hand trail.

As the other claims of the group appeared to contain only minor showings of barite, they were not investigated in detail.

White Christmas No. 1. - This is a July 1954 relocation of an old claim known as the Barium Gold Dollar, originally located by Mrs. E. A. House in April 1935.

A barite-bearing zone striking east and dipping flatly north crosses the apex of a wedge-shaped ridge formed by the right-angled junction of two dry washes. On the west side of the ridge, a cut has been excavated down dip. On the ends of the cut a barite band more than a foot wide is partially exposed, but caved material covers the lower part of the zone.

A shallow cut 50 feet to the east exposes a 3-foot zone, composed of stringers, bands, and nodules of barite mixed with unmineralized rock fragments. Across the wash, the outcrop can be seen trending southeast up the hillside.

The barite of both exposures is platy and associated with considerable fluorspar.

White Christmas No. 4. - White Christmas No. 4 claim is east of claim 1. The vein on which the location was made strikes generally N. 50° E. and dips 50° NW. A 10-foot inclined shaft exposes a 3-foot vein, of which the hanging-wall portion is 12 inches of virtually pure barite in large plates. The remaining width is composed of barite bands alternating with rock ribs. The outcrop can be traced westward for about 100 feet, where it splits into numerous narrow stringers. The barite mineralization is associated with minor amounts of fluorspar.

East of the shaft the vein is exposed for 75 feet by a dozer cut and for an additional 50 feet by an open-cut, in which the vein is offset several feet to the south by a cross fault. The next exposure, probably of the same vein, appears on the east side of an adjacent small knoll and again in the bottom of a draw some 100 feet farther east, where the vein zone is 6 feet wide and composed of alternating bands of barite and rock ribs. This outcrop can be traced eastward for about 50 feet, where it becomes obscured by alluvium.

Shallow dozer stripping near the knoll exposes four narrow veins within a distance of 25 feet south from the major workings. About 250 feet to the north, a parallel, 2-foot barite vein has been exposed for 100 feet by several shallow pits.

Happy Day No. 1

Happy Day No. 1 claim was located in 1954 and now is owned by Bryan Halstead, of Bouse, Ariz. It is 0.3 mile east of White Christmas No. 4 claim and reached by the same road. The claim is in unsurveyed sec. 7, T 7 N., R. 16 W., and covers a small but prominent hill of black volcanic rock.

Near the bottom of the west side of the hill, an 18-inch vein of barite containing some rock inclusions is exposed in a cut 10 feet long. The vein strikes west and dips flatly north. Thirty feet down the hill to the southwest

a 6-inch vein is exposed in a shallow shaft. This vein, striking S. 60° E. and dipping 65° NE., also is exposed in a pit about 20 feet to the southeast, where it joins a 12-inch vein striking S. 40° E. and dipping 80° NE. The vein zone, a maximum of 2 feet wide, continues some 50 feet to the southeast, where it is covered with alluvium.

The flat vein, or one parallel to it, crops out slightly higher on the hillside, but mineralization is weaker than at the first-mentioned occurrence. The barite in these veins consists of whit-to-pink platy crystals, with which fluorspar is associated.

From the first cut described above, a narrow barite vein trends north-eastward for several hundred feet up and over the south flank of the hill. At one place mineralization expands to a width of 2 feet.

On the north side of the hill about a dozen southeastward-trending narrow veins are exposed within the 200-foot length of a shallow dozer-stripped cut. A few minor pits have been excavated on some of these veins higher on the hillside.

White Rock and White Eagle Group

The White Rock group and the White Eagle claim, forming a contiguous group of four claims, is in secs. 17 and 20, T. 7 N., R. 17 W. The claims were located in late 1954--the three White Rock claims by James M. Sprinkle, and the White Eagle claim by Sprinkle and James B. Simpson.

The most northerly claim, White Rock No. 3, is accessible from Bouse according to the following log:

- 0.0 Bouse. Travel west on Quartzsite Road.
- 0.7 Take right fork.
- 3.2 Turn left.
- 3.9 Take left fork.
- 4.1 Take left fork for 0.2 mile to White Rock No. 3 workings; the right fork leads to the remainder of the group to the south.

The claims are in an area of low, rolling hills at an altitude of approximately 1,000 feet.

White Rock No. 3. - The barite mineralization occurs in fractures having various attitudes in a rhyolitic country rock. The location shaft exposes a 2-foot barite vein striking N. 75° E. and dipping 70° SE. The vein has sharp contact on the hanging-wall side, but the foot-wall side is gradational and contains variable amounts of rock inclusions. To the south a short dozer stripping, a shallow shaft at the summit of the knoll, and meager float

indicate several mineralized fractures trending southeast, some with northwesterly dips. The barite zone contains a considerable amount of rock inclusions.

Coursing S. 20° E. down the south side of the knoll, a 2-foot vein of better barite crops out for a length of about 100 feet. Farther down the slope a southeast-trending outcrop of partly marbleized manganiferous limestone contains some barite and fluorite.

White Eagle. - The limestone ledge previously mentioned continues on to the adjacent White Eagle claim, striking S. 20° E. and dipping 75° SW. A cut shows it to be 12 feet wide and to contain a considerable amount of copper-stained barite mineralization throughout. At 100 feet to the southeast on the same zone, a cut shows a 3-foot and a 1-1/2-foot lens of virtually pure barite in large plates and some lower grade barite in the remainder of the limestone ledge. At the top of the knoll, dozer stripping shows irregular masses of fair barite mineralization over an area 50 feet in diameter.

Farther to the southwest, the location work of this claim exposes siliceous barite-bearing material 5 feet wide, which extends S. 20° W. for 100 feet over the knoll. Nearby to the east is work on a 15-foot-wide lens of siliceous material striking N. 70° W., which contains barite impregnations, veinlets, and plates. This mineralization is not traceable into a cut 30 feet northwest, but float indicates it may extend in the opposite direction for 50 feet. A small amount of fluorite is associated with the barite in most of the above occurrences.

White Rock No. 1. - A small knoll approximately 1,000 feet south of the White Eagle location work is composed of siliceous, iron-stained volcanic rock. A dozer cut around the east and south side of the knoll shows a northwesterly trending 50-foot fissure zone, which contains numerous irregular veins and disseminations of barite. The wider veins contain barite, a considerable amount of rock fragments, and some fluorite. Fifty feet to the northeast, a parallel 2-foot barite vein is exposed in an inaccessible northerly inclined 20-foot shaft. About 100 feet to the southeast, a wide 10-foot shaft in this zone contained very little barite.

White Rock No. 2. - White Rock No. 2 claim is adjacent to the south of claim 1. All work seems to have been confined to outcrops near the bottom of a steep-sided dry wash. Near the location monument a mineralized zone crosses the wash bottom on a strike of N. 15° E. with a dip of 75° NW. Cuts have been made in both banks, exposing a zone 5 to 8 feet wide, which contains low-grade material composed of barite in a siliceous gangue.

Farther west in the wash bottom several cuts have prospected minor veins of various attitudes.

Pay Day

The Pay Day claim was located in May 1951 by the present owner, James M. Sprinkle, of Bouse, Ariz. The claim is on the extreme west side of sec. 29,

T. 7 N., R. 17 W., and is accessible from Bouse by taking the Quartzsite Road, turning right at 1.2 miles, and bearing left at 2.7. The workings are immediately on the right at 3.3 miles.

Several nearly parallel barite-bearing fracture zones strike northwest across a low hill composed of volcanic-flow rock. At the side of the road a pit exposes a zone 1 to 2 feet wide, dipping about 50° NE. Bands of relatively pure barite alternate with rock ribs in an irregular pattern. About 100 feet to the northeast, a hillside dozer cut partially exposes the same zone for 75 feet. Where it is seen in the cut, the width of mineralization varies but may average 2 feet. Barite occurs in bunches 1 foot or more in diameter, as smaller disseminations, and in irregular veinlets within a matrix of host rock. The barite is coarsely crystalline, with plates in random orientation; iron- and manganese-oxide staining is prevalent, and some fluor spar was noted between the crystal aggregates.

A 10-foot shaft on a nearby parallel structure exposes a zone 2 feet wide dipping 45° NE. It is similar to the previously mentioned occurrence but contains less barite.

A few hundred feet west of the 10-foot shaft and on the south side of the ridge, a 30-foot cut to a maximum depth of 10 feet has been excavated on a northwest-trending vein, which dips steeply southwest. The hanging wall is a slickensided fault plane, but the foot wall is indefinite. At the southeast end of the cut the vein is 4 feet wide, composed of intermixed barite and wallrock. Thin hematite films occur between the barite crystals and occasionally as irregular nodules.

The vein at the opposite end is 2 feet wide; caved material covers the bottom of the cut, and except for a short distance from each end of the cut, alluvium covers any extension of the vein.

Several minor mineralized fractures elsewhere on the claim exhibit a northwesterly trend.

Happy Day No. 4

The Happy Day No. 4 claim was located in September 1954 and now is owned by Bryan Halstead. It is in the east side of sec. 30, T. 7 N., R. 17 W., at an altitude of approximately 1,100 feet. To reach the property, travel southwest from Bouse on the Quartzsite Road, turn right at 1.2 miles, bear left at 2.7, turn left at 3.5, and arrive at the workings at 3.8 miles.

On the east slope of a hill, just above the road, an open cut, 30 feet long and as much as 10 feet deep, has been excavated on a 3-foot barite-bearing fracture zone striking N. 20° W. and dipping 60° SW. in volcanic-flow rock. The zone is composed of irregular bands of rock and barite, the latter up to a foot in width. Within the barite, the structure often is banded, owing to color variations, usually separated by thin quartz or hematite partings. The barite is in finely bladed crystals, which lie approximately perpendicular to

the vein walls. Bunches of granular barite occur occasionally, and both the bladed and the granular barite are associated with some fluorite.

The barite-bearing fracture can be traced by outcrops for 50 feet or more to the north. Sorted ore, estimated at 50 tons, has been stacked on the dump of the opencut. A grab sample of the pile assayed 71.3 percent BaSO_4 and 4.1 percent CaF_2 .

An area immediately north of the opencut was stripped of surface debris for 100 feet to a wash. A second barite vein can be traced by outcrops from a point 30 feet up the hillside west of the opencut, across the dozed area, and up the next hill slope to the north. The vein strikes N. 15° E., and, where exposed by shallow cuts on the wash bank, appears to dip steeply to the west.

The lower cut exposes a width of 2.5 feet of barite ore, which widens to 4.5 feet for a short distance. Mineralization consists of wavy, crenulated bands of barite, separated by narrow hematite and red jasper or occasional rock bands. The vein can be traced for 100 feet up the hill but gradually narrows and frays out.

About 50 feet west of this point, a 15-foot shallow cut shows a vertical 2-foot mineralized fracture containing a few bands of barite. The strike is N. 70° E., but barite mineralization cannot be traced beyond the limits of the cut.

Monarch No. 1

The Monarch No. 1 claim was located in March 1955 by George E. Dailey and Russell Twistleton and now is owned by Bryan Halstead. The property is in sec. 31, T. 7 N., R. 17 W., and is accessible from Bouse by traveling the Quartzsite Road, turning right at 1.2 miles, left into the bed of a dry wash at 3.1, and left out of the wash at 4.4. The claim is on a hillside to the left at 4.5 miles, at an approximate altitude of 1,250 feet.

A mineralized fracture striking S. 60° E. and dipping 35° NE. is present on the south side of the rhyolite porphyry hill. The vein has been exposed on the west side by an opencut, and the overburden has been stripped from the vein for 40 feet eastward. About 2 feet of relatively pure barite is exposed against the hanging wall, and toward the foot wall barite with waste fragments and rock ribs add another foot or more to the width of the vein. The vein can be traced by float for 100 feet farther eastward.

An outcrop 40 feet to the north shows a parallel vein about 1 foot in width, and numerous other smaller mineralized stringers with random strikes are shown by lines of float elsewhere on the hill. Dozer cuts low down on the north and west sides of the hill do not show significant mineralization.

Happy Day No. 3

Happy Day No. 3 variously was known as Black Mule No. 21 and Barite No. 3. This claim now is owned by Bryan Halstead, who has done the latest assessment

work. The claim is in sec. 31, T. 7 N., R. 17 W., 0.2 mile east of the Monarch claim, at the same altitude (1,250 feet).

Considerable work has been done on a fault vein on the south side of a small rhyolite porphyry hill. Work on this vein, striking east-west and dipping 45° N., consists of a 130-foot opencut, 3 to 8 feet deep, in which an underhand stope at each end extends 10 to 15 feet deeper. The vein has a consistent normal width of 4 feet except near the west end, where it narrows to 2.5 feet. Overburden obscures any extensions of the vein. The National Lead Co. reportedly produced more than 100 tons of ore from the cut in 1938. Samples cut across the 4-foot width of vein in the east and the west underhand stopes assayed, respectively, 71.3 and 87.8 percent BaSO_4 and 5.1 and 2.5 percent CaF_2 .

A small area of dozer stripping some 70 feet south of the opencut exposed a width of 10 feet of barite mixed with rock fragments. This occurrence strikes S. 50° E., but only a length of 20 feet within the stripping can be seen. To the northeast, a dozer trench cuts a zone of mineralization at an acute angle. The zone has indefinite walls, and the material is weathered, but the strike appears to be N. 15° E., and the width about 15 feet. A sample chipped along one wall of the shallow trench assayed 84.5 percent BaSO_4 and 4.9 percent CaF_2 . Like the other occurrences on this claim, the lateral extension cannot be traced through the overburden.

Approximately 150 feet northwest of the west end of the first-mentioned opencut, a 20-foot adit cuts a barite vein 12 feet below its outcrop. The 2-foot vein strikes N. 55° W., dips 65° NE., and, as exposed in a stub drift and small stope to the east, is laminated with narrow rock bands.

Morning Sun and Greasewood No. 1

The Morning Sun claim was located in April 1955 by James B. Simpson and the Greasewood No. 1 claim in September 1955 by Barbara Pfeifer. According to the positions indicated by the location notices, these claims overlap, forming an L-shape. They are in sec. 32, T. 7 N., R. 17 W. The property is accessible from Bouse by traveling the Quartzsite Road, turning right at 1.2 miles and left on a dim trail at 2.4; the location work of the claims is reached at 3.9 miles.

A vein striking N. 15° W., containing barite mineralization apparently 1 to 2 feet wide, can be traced for a considerable distance by the line of float on the relatively flat terrain of volcanic-flow rock. On this vein and near where it crosses the road, several shallow pits have been excavated within a length of about 200 feet. No other work was noted in the vicinity.

Black Stud No. 6

The Black Stud No. 6 claim was located by James F. Hicks in February 1957. It is in sec. 6, T. 6 N., R. 17 W., and is accessible from Bouse by traveling the Quartzsite Road for 2.8 miles and then on a right fork 2.7 miles, using all right-hand road forks.

On and over the top of a small knoll a zone containing dozens of small fractures in volcanic agglomerate trends northeastward. The fractures contain barite in bands and coarse crystal plates, intimately mixed with cherty gangue material. The fracture zone is about 75 feet wide. On top of the knoll the fracture pattern is complicated by crisscrossing veinlets.

The visible strike length is about 125 feet. To the northwest mineralization appears to be cut off, as there is virtually no barite in the cliff face of a wash forming that side of the knoll. Any extension of the zone into the shallow valley to the southeast is covered by alluvium.

Burro Barite Group

The Burro Barite group consists of eight unpatented claims, (Nos. 1 to 8), all located by James F. Hicks and associates. As these claims have been staked recently no development or exploration work, other than location pits, has been done. Claims 5 and 7 were not visited. As the claims are widely separated, road directions for the various locations are given in the individual discussions. Examination was made early in May 1957.

Burro Barite No. 1. - This claim, located in October 1956, is accessible by traveling 8.8 miles southwest from Bouse on the Quartzsite road to the fork signed "Red Chief." It is 0.3 mile west on this road and over the ridge to the north, in sec. 29, T. 6 N., R. 17 W.

The major exposure is on the north side of a low ridge of volcanic agglomerate. The vein here strikes S. 45° E. and has a steep dip to the east. At the best exposure the vein is 4 feet wide, but a cut in the hillside has not reached the vein, so a cross section is not exposed. The vein is irregularly banded with white to red barite, fluorite, crystalline quartz, and irregular segregations of chalcedonic quartz and calcite. The vein can be traced for about 200 feet to the north by poor exposures and float.

To the south over the ridge the vein follows a sinuous course, 1 to 4 feet in width. At the location pit, it is 2.5 feet wide, strikes S. 25° W., and passes into alluvium fill. Near the top of the ridge a split of the vein courses S. 20° E. and is of lower grade; it is brecciated rather than banded. Elsewhere on the claim numerous other narrower stringers can be observed striking in various directions.

Burro Barite No. 2. - This claim is on the south side of the road about one-half mile southwest of claim 1. It is the northeasterly claim of the contiguous group, consisting of Nos. 2 to 4, located in October 1956, and is in sec. 30, T. 6 N., R. 17 W.

The major barite occurrence is in a mineralized fracture 10 to 12 feet wide, striking S. 30° W. and dipping 80° NW. in volcanic agglomerate. The material within the fracture zone is composed of interbanded barite, containing wallrock inclusions, and rock ribs. The barren material and some of the barite is heavily iron stained, and part of the waste material is jasper. Considerable copper oxide staining was noted throughout the occurrence.

A dozer cut, as much as 4 feet in depth, exposed the north wall for 210 feet. A crosscutting pit at the east end of the dozer work exposes 2 feet of solid barite containing some rock inclusions and 7 feet of barite-bearing material. The vein can be traced for about 200 feet to the northeast; at the end of the claim it is covered by valley fill.

About 100 feet southwest of the dozer cut the mineralized fracture zone swings more westerly, and near the southwest end of the claim splits into numerous and divergent small veins. In this area and about 50 feet to the north a parallel 30-foot fractured band contains numerous narrow mineralized veins.

Burro Barite No. 3. - Burro Barite No. 3, which adjoins claim 2 to the southwest with a common end line, is in sec. 30 and probably extends into sec. 31. The claim covers an extension of the same two mineralized fracture zones occurring on claim 2. Although these are continuous, the individual mineralized fractures within each are erratically disposed, splitting and coalescing and occasionally forming a network of veins.

An old inaccessible inclined shaft, which may be more than 50 feet deep and probably unrelated to barite prospecting, is between the mineralized zones. A criss-cross of barite croppings are about 20 feet south of the shaft, and a 2- to 3-foot vein crops out 50 feet to the north.

Approximately 600 feet southwest on the latter vein, a 6-foot shaft exposes 3 feet of heavily iron-stained, barite-bearing material. Farther to the southwest on the southern band of mineralization, the No. 3 location shaft, 8 feet deep, exposes a 6-foot brecciated vein containing barite as fracture and void filling and as partial replacement of the rock fragments. Fluorite, intermixed with crystalline quartz, is present as blebs and discontinuous narrow bands. The entire occurrence also is heavily iron-stained.

A sample chipped across the vein assayed 74.8 percent BaSO_4 and 6.6 percent CaF_2 .

Burro Barite No. 4. - Claim 4 parallels and adjoins the southeast side line of claim 3 but is offset a few hundred feet to the southwest. It probably is entirely within sec. 31, T. 6 N., R. 17 W. Mineralization is confined to two parallel fractures about 40 feet apart, striking S. 30° W. along the top of a low ridge of volcanic agglomerate. On a saddle between two knolls, the veins are connected by an acutely crosscutting stringer.

To the northeast the veins continue to be parallel, but each narrows to 1 foot or less. The outcrops are obscured by hillside talus. To the southwest of the saddle and over the next knoll the veins unite and can be traced as one vein for about 200 feet up the ridge. The widest exposures, which are in the saddle, have been prospected by two pits. The north vein attains a width of 4 feet of interbanded barite and rock ribs. The south vein has a 2-foot width of highly contorted mineralized bands separated by bands of chalcedonic quartz and iron-stained chert.

Burro Barite Nos. 6 and 8. - These claims are contiguous and partly overlapping. They were located in March 1957, are in sec. 20, T. 7 N., R. 17 W., and adjacent to and south of Sprinkle's White Rock No. 2. The property is accessible from Bouse by traveling the Quartzsite Road, turning right at 1.2 miles, and keeping right on the forks; the claims are reached at 3.5 miles.

The claims are in an area of low, rolling hills of volcanic agglomerate. The formation is cut by numerous mineralized fractures, which vary from stringers a few inches wide to veins having a maximum width of 2 feet. The dominant trend of the fracture pattern is northwesterly, but cross fractures and divergent veins strike in various directions. The barite occurs in the fractures as breccia filling and as partial replacement of the rock fragments.

The main zone of claim 8 appears to be continuation of the major zone of White Rock No. 2.

Red Chief Deposit

The Red Chief barite deposit lies within the length of two claims, Barium No. 21 and Red Chief No. 5, which were located in November 1929 by J. J. and A. F. Cavanaugh. In 1956 these and probably adjacent claims were purchased by Olin N. Jaye, of Weatherford, Tex. Later, Jaye performed considerable dozer work along the vein and located several adjacent claims, one of which covers extension of the strike to the southwest. The claims are in secs. 29, 31, and 32, T. 6 N., R. 17 W.

The property is accessible from Bouse by traveling south on the Quartzsite Road, turning right at 8.6 miles, left at 8.7, and arriving at the northeast end of the vein at 9.1 miles. From this point a pilot road follows along the south side of the vein system for its entire length.

The claims are at an altitude of approximately 1,300 feet, in an area of low topographic relief. Barite mineralization occurs in the fissures of a relatively narrow fracture zone in volcanic agglomerate. The essentially vertical, compound-vein system strikes approximately S. 50° W. and is nearly 2,800 feet long (fig. 20). Barite occurs in serrated iron- and manganese-stained bands between which are narrow stringers of chalcedonic quartz and considerable fluorite. Occasional, small copper oxide stains can be observed.

Figure 21 is a view of the outcrop from its midpoint, looking southwest.

Exploration work consists of two crosscutting and two strike trenches; seven shafts, ranging from 6 to 15 feet deep; 600 linear feet of dozer work, which removed the wallrock from one side of the vein to a maximum depth of 12 feet; and a 30-foot open-cut in the vein.

Although barite appears in parallel veins, only one contains most of the mineralization at any one point. Generally the ore is remarkably free from wallrock inclusions, but rock ribs or bands appear in the vein at several places. Several minor faults displace the vein a few feet laterally.

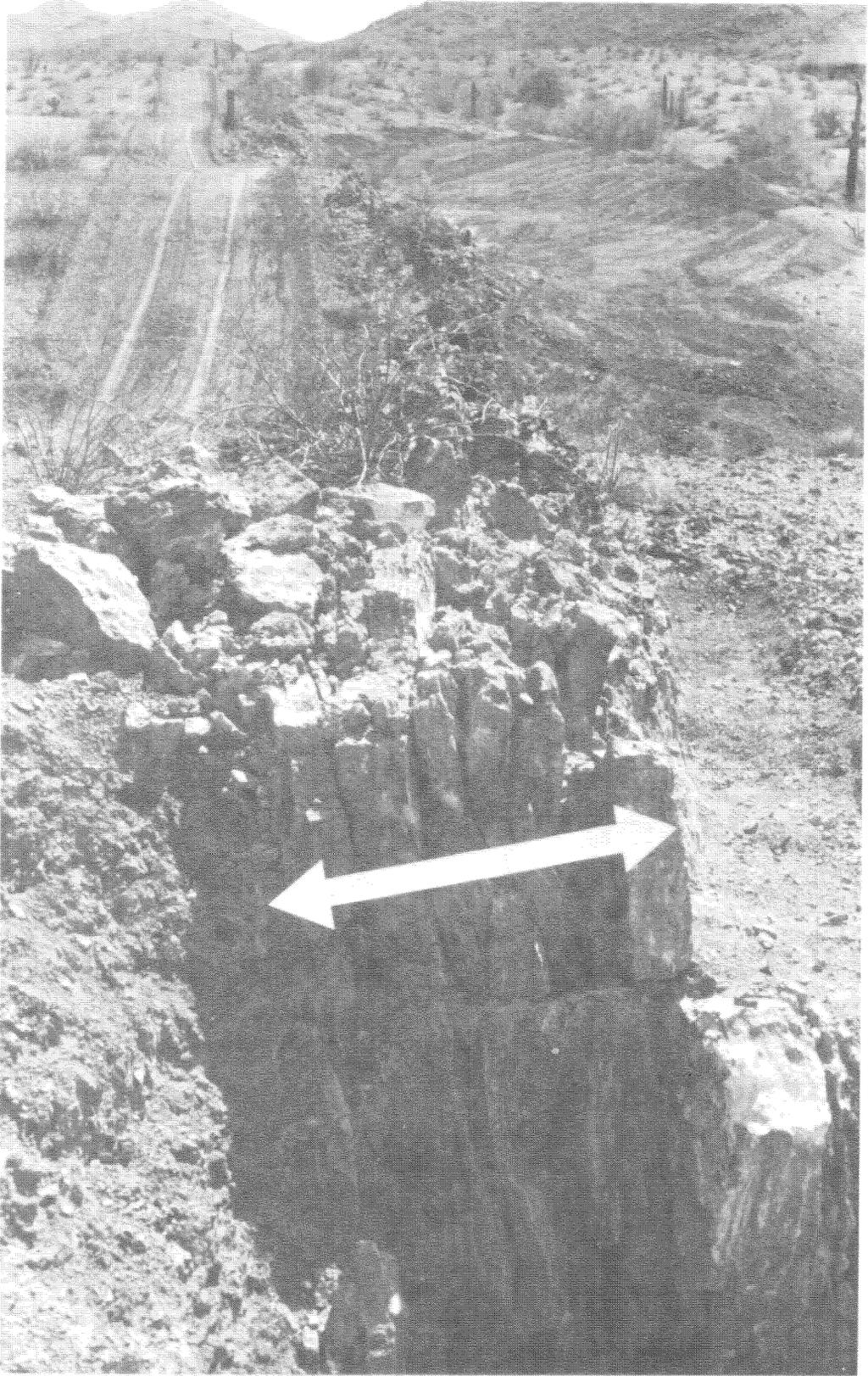


FIGURE 21. - Red Chief Barite Vein (arrow) Looking Southwest From 10-Foot Shaft.

Mineralization definitely pinches out at the northeast end, but at the opposite end the vein is exposed across the bottom of a wide wash, beyond which the southwestward extension is covered by valley fill.

A grab sample of material along the outcrop assayed 46.0 percent BaSO_4 , 28.7 percent CaF_2 , and 4.3 percent CaCO_3 . Later, samples were cut across the major vein at six places. The location, widths, and assays are shown in figure 20.

The property was idle when visited in June 1957, and there was no evidence to indicate production.

Metallurgical Tests. - Bench-scale flotation tests were made on a composite of the six samples shown in figure 20 to determine the grade of barite and fluorspar products obtainable. The composite sample assayed 38.8 percent BaSO_4 , 30.7 percent CaF_2 , and 6.9 percent CaCO_3 . A barite product assaying 95.4 percent BaSO_4 and having a specific gravity of 4.41 was obtained by flotation with petroleum sulfonate collector. Flotation of the fluorspar from the barite tailing with oleic acid yielded a product assaying 97.4 percent CaF_2 . Barite and fluorspar recoveries were 59.7 and 71.4 percent, respectively. The flotation procedure employed for two-mineral separation consisted of wet-grinding the ore to minus-200-mesh, using soda ash to establish a pulp pH of about 10. The barite then was floated with petroleum sulfonate collector while retarding the fluorspar and gangue with sodium silicate. The fluorspar was floated from the barite rougher tailing with oleic acid after addition of sodium fluoride and lignin sulfonate. Then barite and fluorspar rougher froths were cleaned three and five times, respectively, to yield the final products. Treated water was used for both the barite and fluorspar floats. Reagent requirements for the separation were as follows: 2.0 pounds of soda ash, 4.0 pounds of sodium silicate, and 0.5 pound of petroleum sulfonate per ton of ore feed in the barite float; and 4.0 pounds of sodium fluoride, 5.2 pounds of calcium lignin sulfonate, and 0.48 pound of oleic acid per ton of ore feed in the fluorspar float.

The bench-scale tests of the above sample indicated that marketable-grade barite and fluorspar products can be produced from the Red Chief ore. On June 16, 1958, a 30-ton bulk sample was mined from two localities on the outcrop for tests in a small-scale continuous flotation unit of about 1-ton-per-day capacity to verify the results obtained in the batch tests. Preliminary bench-scale tests of a representative portion of this sample gave results similar to those obtained from the composite sample. Results of the tests will be presented in a separate report.

Keiser Deposit (Sierra Blanca Claims)

The Keiser barite deposit is in the Plomosa Mountains, in the southwestern part of unsurveyed T. 5 N., R. 17 W., at an altitude of approximately 1,850 feet. The property is accessible from Quartzsite by the following road log:

0.0 Intersection of paved U.S. Highway Nos. 60-70 and State Highway No. 95. Travel north on Highway No. 95.

0.4 Bear right onto old graded Bouse Road.

8.6 Turn right on desert road going up a long mesalike flat.

13.1 Leave mesa and enter area dissected by numerous washes.

14.6 Turn right and go upstream in wash bottom.

15.2 Road impassable beyond this point.

From here, walk easterly up the wash for about 1 mile, following traces of the old road, which ends at the property.

Claims covering the deposit originally were located by William G. Keiser, of Quartzsite, in 1909. Sometime later Frank B. Knox and J. Q. Little acquired the property and reportedly shipped two carloads of barite--probably in the late 1930's. Some years later Keiser relocated two Sierra Blanca claims covering the barite occurrence.

In an area of rough, sharply dissected volcanic-flow rocks the major barite vein occurs in a fault fissure, trending along the hillside at an average strike of N. 75° E. and dipping 50° to 55° NW. Fifty feet west of a southerly trending gulch, a shaft was sunk 25 feet and the vein stopped eastward for about 20 feet.

The mineralized zone is 4 feet wide and virtually all barite on the east side of the shaft. On the west side a 12-inch rock rib, which occupies the center portion of the vein, gradually wedges out downward as the fault walls converge. The vein is 2 feet wide at the bottom of the workings and consists of brecciated barite, best on the hanging-wall side and grading into iron- and manganese-stained rock fragments on the foot-wall side. Both fault walls show coarse, vertical, slickensided grooving. Post ore movement is indicated by smaller scale striations within the vein.

Eastward from the shaft for about 300 feet, the vein is well exposed up the hillside, where it maintains a width of 3 to 4 feet. Within this distance, lenses of virtually solid barite alternate with areas containing lenses of barren material or a mixture of brecciated barite and rock fragments. Three hundred to four hundred feet from the shaft the vein decreases to a width of 8 inches and frays into stringers, which reunite into a short lens of less-pure barite about 2 feet wide. Farther to the east the mineralized fracture swings to a due-east strike, with a steep dip northerly, and narrows to about 6 inches.

A sample chipped across the 3.5-foot vein 125 feet east of the shaft assayed 93.7 percent barite and 0.9 percent CaF₂ and had a specific gravity of 4.39. Part of the barite in the better portions of the vein is white and glassy, appearing to be pure enough to hand-sort into a chemical grade.

West of the shaft, the vein contains either a rock rib or a band of brecciated, stained barite associated with rock fragments, narrowing to 12 inches 50 feet from the shaft; farther up the hillside it frays into narrow stringers.

North of the major fault fissure there are numerous narrow mineralized fractures in a zone nearly 100 feet wide. On the north side of a knoll west of the shaft, a shallow pit on one of these fractures exposes a band of pure white barite several inches wide.

Cottonwood Pass Area

Barite occurs at several places within 1 mile of Cottonwood Pass, which is 8 miles northwest of Wenden. This area, in the Harcuvar Mountains is composed predominantly of granite schist and gneiss. Baritic mineralization occurs in shears, which appear to have a regional trend. Of five occurrences investigated, the strike varied from N. 30° to 50° W. and dipped from 55° NE. to near vertical.

The pass is accessible from Wenden according to the following log:

- 0.0 Junction U.S. Highway Nos. 60-70 and Alamo road. Travel north toward Cunningham Pass.
- 0.3 Turn left after crossing cattle guard.
- 1.1 Turn right on the west side of fence.
- 1.4 Turn left on a desert road.
- 4.5 Keep straight ahead at fork signed "Mickey Doland."
- 7.6 Bear left onto a dim truck trail up a steep grade.
- 8.0 Top of the ridge (Cottonwood Pass summit), altitude approximately 2,750 feet.

Ernest Hall Property

This is an old property, partly patented, but the names of the claims and present status of ownership are unknown to the author. In the 1930's Ernest Hall was the owner, but apparently the property has changed hands several times. According to Wilson^{14/} several carloads of barite were produced in 1938.

The claims, probably in unsurveyed sec. 1, T. 6 N., R. 14 W., are accessible by following the Cottonwood Pass road westward from the summit, bearing left across a small draw at 0.3 and 0.9 mile; there is an opencut and headframe on the north side of the road at an altitude of 2,450 feet.

This cut, 75 feet long by 12 feet wide to a maximum depth of 15 feet, strikes N. 50° W. and dips 70° NE. on the hanging-wall side. Debris covers the floor and east end of the opencut; barite can be seen only on the shear

^{14/} Wilson, E. D., Arizona Nonmetallics: Arizona Bureau of Mines Bull. 155, 1949, p. 11.

west wall--the side of an inclined shaft that probably antedates the opencut work. The bottom of the shaft now is about 15 feet below the floor of the cut, with a 20- to 30-foot drift to the northwest.

The vein is 1 to 2 feet wide and has a banded appearance, due to relatively narrow bands of barite alternating with thin laminations of iron oxide. A similar and parallel vein 8 to 10 inches wide is exposed on the footwall side of the cut under the headframe timbers.

L. C. Huthmacher, of Wenden, states that E. A. Wayahn, under a lease agreement, produced from this and other nearby deposits several carloads of ore, which were shipped to a California talc company in 1937. The ore was hand-sorted and averaged over 4.25 specific gravity. He also stated that when the operation was begun the outcropping vein was 3 to 6 feet wide but pinched laterally and at a depth of about 10 feet below the surface.

About 100 feet east of the opencut, this vein was prospected by a shallow 75-foot trench, which now is caved, but considerable barite can be observed in the excavated material. To the northeast and within 50 feet of the last-mentioned trench, three other narrow parallel veins have been exposed by hill-side cuts.

Extension of the major vein to the northwest is indicated for at least 150 feet by two cuts, one of which exposes a vein 2 feet wide.

Specimens of barite from the various workings show fine- to coarse-bladed barite crystals in random orientation, which produced triangular vugs. Within these vugs are crusts of crystalline quartz, coated with manganese and iron oxide. Much of the iron has been altered to limonite, but some hard hematite remains as incrustations and as filling between the barite plates. A little fluorspar was noted in some vugs. No samples were taken, but it is estimated that the ore would run 50 to 60 percent barite.

About 1,000 feet west of these workings and on the opposite side of the large wash, a 10-foot shaft midpoint of a shallow 60-foot trench exposed 4 feet of barite in a vein striking N. 40° W. and dipping steeply northeast. Mineralization grades irregularly into the hanging wall; the foot wall is not exposed. A shallow crosscutting trench on the footwall side shows decreasing barite mineralization for another 5 feet. As the mineralization is similar to the deposit at the inclined shaft, it is likely that some sorted ore from this work was included in the carload shipments. Extensions of the vein in the immediate area are covered by alluvium, but the same or another nearly parallel vein is exposed over a low ridge about 1,000 feet to the northwest, where two shallow trenches and occasional outcrops show a length of several hundred feet of vein 1 to 2 feet wide.

Deposit Southeast of Cottonwood Pass

A barite vein has been prospected on the south side of the Harcuvar Mountains, immediately above the road about 500 yards southeast of and below the summit of Cottonwood Pass. The names of the original owner and claim are

unknown, but it is reported that a man named Bunker leased the claims and produced one carload of hand-sorted ore--included in the Ernest Hall shipment. This claim is in approximate sec. 7, T. 6 N., R. 13 W., unsurveyed.

A narrow barite vein on a fault contact in schist can be traced along the hillside for 300 feet. It strikes N. 30° W. and dips 60° NE. The vein is cut off to the north by a transverse fault and decreases in width to about 3 inches at the south end.

At the north end, the vein is 12 inches wide and consists mostly of a mass of crystal plates. A sample across the vein assayed 71.7 percent BaSO₄. A short distance to the south, a cut extends along the vein for about 80 feet to a maximum depth of 10 feet. At each end of the cut the barite is 6 inches wide. In the bottom of the cut there is weak barite mineralization across a 2-foot zone. The next opening is a 10-foot shaft, where the barite band is 12 inches wide, and some 30 feet farther down the slope a cut exposes a 14-inch band. The vein here is virtually vertical. Two other pits lower on the slope show only a few inches of barite mineralization.

Associated with all the barite is an iron-stained cherty gangue.

Minor amounts of barite occur in a vein exposed on the south side of the road, a few hundred feet west of the summit of the pass. An open-cut 50 feet long and up to 10 feet deep has been excavated on a vein striking N. 35° W. and dipping 55° NE. The vein, where visible in the cut, is 6 to 8 inches wide and shows minor amounts of copper-oxide minerals in a gangue of quartz and barite.

Sterling No. 1

The Sterling No. 1 is the only claim in a group of three that shows barite mineralization. It is on the south flank of the Harcuvar Mountains in approximate sec. 4, T. 6 N., R. 13 W., unsurveyed, at an approximate altitude of 3,000 feet. The claims were located early in 1956 by A. N. Johnson and Nelson T. Zuver, probably as a copper prospect.

The property is accessible from Wenden by the following road log:

- 0.0 Junction U.S. Highways Nos. 60-70 and Alamo Road. Travel north toward Cunningham pass.
- 0.3 Turn left after crossing cattle guard.
- 2.3 Turn right.
- 2.8 Turn left on a dim trail.
- 7.3 End of road at workings on Sterling No. 1 claim.

The workings are along the faulted zone that strikes S. 45° E. up the hillside slope. Near the road is a 40-foot inclined shaft, several shallow

pits, and an inaccessible adit that prospected a vein within the fault zone. The vein is 3 feet wide and contains low-grade copper mineralization, but no barite was noted in the surface exposures or on the dumps. This work appears to antedate the 1956 location. The dip of the vein is 60° NE. About 1,000 feet farther southeast and 250 feet higher on the outcrop a shallow pit exposes an 18-inch zone of interbedded barite and rock in a zone containing calcite stained by iron and manganese oxide. The hanging wall is quartz diorite, and the footwall appears to be altered quartz diorite.

The fault passes over a saddle some 50 feet higher, where a cut exposes weak barite mineralization in the central portion of a 20-foot zone. Two barite bands, each 6 to 12 inches wide are separated by 6 feet of material containing random disseminations of barite.

The fault had not been prospected below the saddle to the southeast, and no investigation was made as the terrain is steep and rubble-covered.

Norps Group

The Norps group of three unpatented claims, lying end to end, was located in 1957 by B. L. Gary and Porter and Marvin Northrup. The property is on the south side of the Harquahala Mountains in sec. 31, R. 10 W., and sec. 36, R. 11 W., T. 5 N., at an average altitude of 2,000 feet. It is accessible from Salome by traveling southeast on the Buckeye Road for 13.0 miles, left on a dirt road signed Monterey mine, and again left (north) at 18.2 onto a truck trail; the central workings of the property are at 20.5 miles on this trail.

Barite-fluorspar mineralization occurs in a fault fracture vein striking N. 70° W. in granite gneiss. An old inclined shaft, now inaccessible, appears to be about 70 feet deep. It was sunk on the vein, vertical for about 25 feet, then following a northerly dip of about 60° to the bottom. The collar timber set is badly rotted as are the skidway timbers below. Both sides of the shaft are visible to a depth of 15 to 20 feet and appear to be strongly mineralized across a vein 4 or 5 feet wide. In the material composing the dump there is considerable barite and some fluorspar associated with crystalline calcite and silica. The massive ore contains varying amounts of wallrock inclusions. An old cut 20 feet to the west is caved, but its dump likewise shows barite and fluorspar.

Eastward from the shaft, the vein courses into an alluvium-covered flat, and no outcrops are visible. None of the several recent workings were sunk deep enough to expose the solid vein below the iron- and manganese-stained weathered portion.

About 80 feet east of the inclined shaft and on the east-end line of claim 1 (fig. 22) the weathered top of the vein is barely exposed. A 4-foot sample across this exposure assayed 40.8 percent BaSO_4 and 0.5 percent CaF_2 . One hundred feet eastward, on claim 3, another 10-foot shaft exposed the top of the vein under alluvium fill. A chip sample across the 5-foot width of disintegrated vein material assayed 9.3 percent BaSO_4 and 0.5 percent CaF_2 . Neither of the two trenches, dozed 10 to 12 feet deep, had cut through the

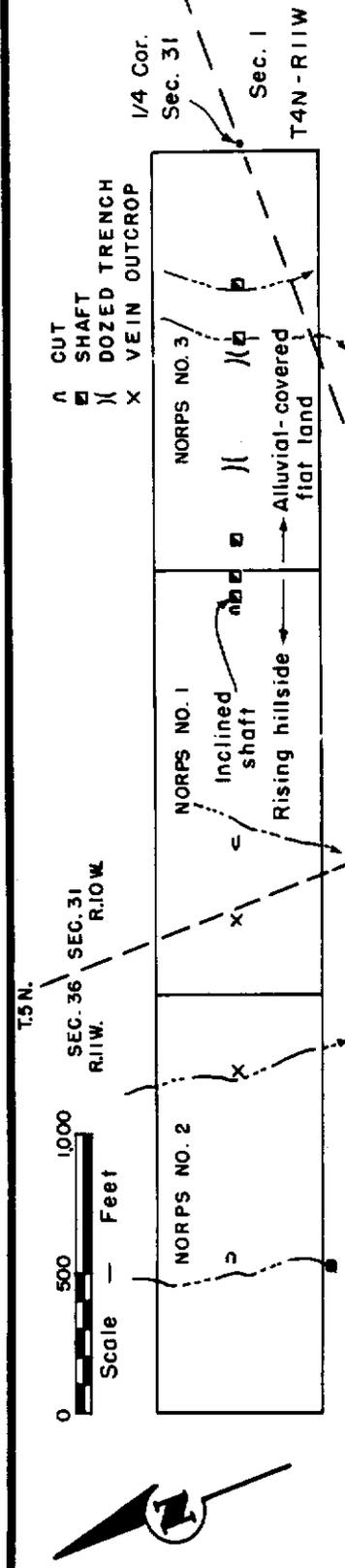
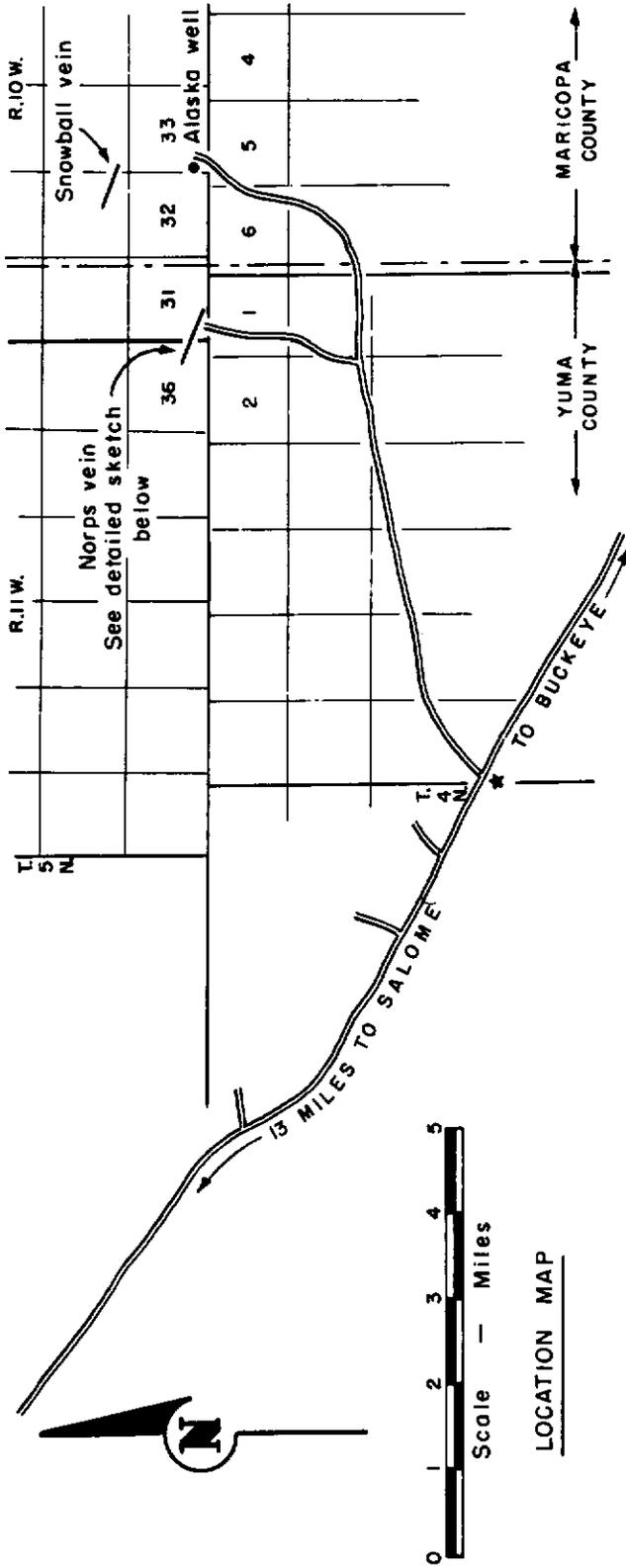


FIGURE 22. - Location and Claim Map, Norps Group, Yuma County.

alluvial cover. A pit in the wash bottom at the center of claim 3 exposed disintegrated, iron-stained material of the vein, which here appeared to dip 60° N. Indications of the vein were present in the next wash east, but a pit in the bank was too shallow to reach bedrock.

West of the inclined shaft the vein could be traced up the hillside and across ridges by occasional outcrops, visible where the surface debris is thin or absent. A peculiarity of this vein is the manner in which the surface outcrop has weathered. It is oxidized to a brown, brecciated mass in which limonite, hematite and manganese oxides are prevalent. In this capping and close to the surface, leaching may have removed much of the barite and fluorspar. This condition may exist for 10 or more feet downward on the vein.

The first outcrop noted west of the inclined shaft was in the next draw over the saddle. A shallow cut showed mineralized material about 6 feet wide. The location cut of claim 2 is about 500 feet from the west-end line and 175 feet higher than the inclined shaft. At this place the iron-stained capping appears to be about 15 feet wide. The cut is not deep enough to expose the solid vein, but weathered barite particles were fairly abundant.

Similarity of the Norps barite-fluorspar occurrence and the Snowball fluorite deposit, some 2 miles to the northeast, is worthy of note. Both are in the same lithological environment, the strike of the mineralized faults are parallel, and both dip northeast. The Snowball property was the site of a Bureau of Mines exploration project in 1944.^{15/} The alluvium-covered vein was traced for more than 2,000 feet by dozer cross-trenching.

Nottbusch (Silver Prince) Mine

The Nottbusch property is near the northern end of Neversweat Ridge in sec. 15, T. 4 S., R. 15 W., in the extreme southeast corner of the Kofa National Wildlife Refuge, at an altitude of approximately 950 feet.

The property originally was located and worked by J. F. Nottbusch in the early 1900's and was known as the Silver Prince mine. Courthouse records indicate that 15 claims were relocated in the early 1930's by Addie S. Nottbusch and held by annual assessment work through 1948. The claims were leased to the California-Arizona Mines Development Co., Paul Pellegrini, agent, from 1949 through 1952. One claim, the Addie, was leased to the Universal Mining and Smelting Co., Walter L. English, agent, during 1953.

The major work, consisting of an inclined shaft, was on the Addie claim. The property appears to have reverted to the public domain and the claim relocated as the Silver King by Walter Parker and associates in June 1956. Intermittent mining operations were conducted for lead and silver values in the ore.

^{15/} Denton, Thomas C. and Kumpke, Charles A., Investigation of Snowball Fluorite Deposit, Maricopa County, Ariz.: Rept. of Investigations 4540, 1949, 15 pp.

The property is accessible from Dateland on U.S. Highway No. 80 according to the following road log:

- 0.0 Travel north from Dateland on a well-graded road.
- 9.3 Turn left at the Southern Pacific Railway.
- 10.9 Turn right and cross the track, taking left hand road past the monument marking the entrance to an old military reservation and follow the old graded streets, that is--,
- 11.4 Turn sharply to the left.
- 12.0 Turn left.
- 13.5 Turn right and follow a road along the southwest base of the Palomas Mountains. This road shows occasional signs of prior grading.
- 27.3 Enter the Kofa Refuge.
- 30.6 Take left fork into a little valley.
- 30.9 Mine shaft.

The prevailing rocks of the area are fine-grained, well-laminated schist, intruded by irregular dikes and bodies varying in composition from rhyolitic to andesitic. At several places on and in the vicinity of the Nottbusch property barite-fluorspar veins occur in the schist, usually on or adjacent to the contact with the intrusive bodies.

The shaft was sunk down dip on the 45° footwall of the mineralized fault, which underground has an average strike of N. 25° W. Mineralization cannot be traced on the surface.

Except for the lenses hereafter described, the walls of the shaft show only minor amounts of barite in the footwall band and in the brecciated material above. From 15 to 33 feet down the incline, the footwall band reaches a maximum width of 3 feet. A lens occurs from 50 to 75 feet on the south side of the shaft. This lens has been stoped, lagged, and backfilled, so that only the top is accessible, where the stope is 20 feet long. The fault zone is about 5 feet wide, composed of a 12- to 16-inch footwall barite band and a zone containing some disseminated barite in 2.5 feet of brecciated schistose material against the slickensided hanging wall. The two zones of mineralization are separated by gouge of secondary faulting.

At 137 feet, another lens has been mined by an irregular drift system (fig. 23). Mineralization extends into a complexly fractured area in the hanging wall; exploration has been confined to about 60 by 100 feet. The character of the barite is varied; it occurs in relatively high-grade bands, as pure white disseminations either crystalline or massive, in a banded

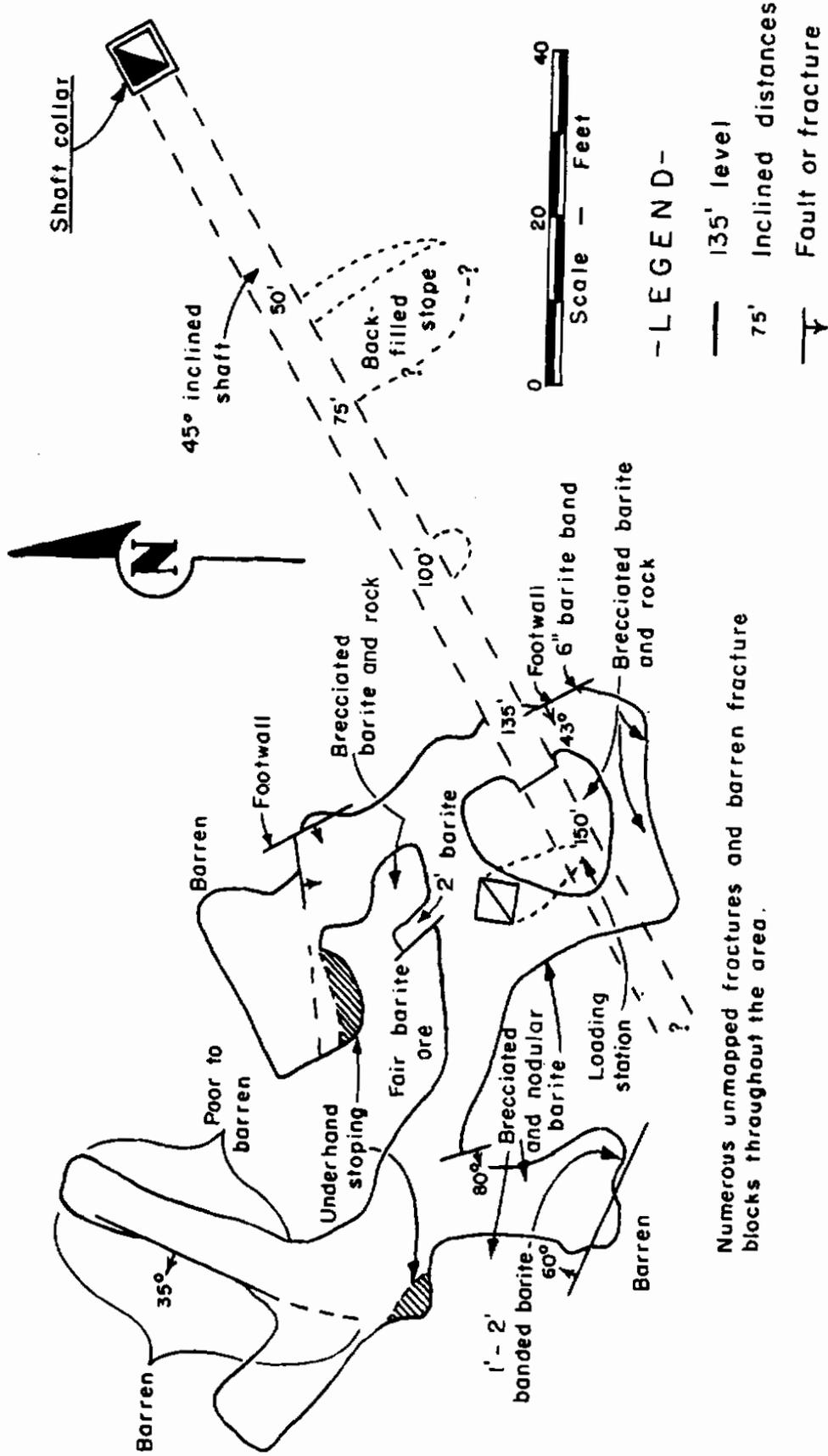


FIGURE 23. - Plan, Nottbusch Mine, Yuma County.

structure, and finely disseminated in brecciated footwall rock. Much of this fractured zone contains irregular blocks of barren rock. The shape of the deposit is roughly triangular, bounded by the footwall and two strong fractures; however, the strike length has been explored for only 60 feet.

The barite is associated with considerable fluorspar, some argentiferous galena, and massive and finely granular gypsum. As galena was the mineral sought, very little of it now can be observed in the exposed surfaces. Because the mineralization is irregular, it was not sampled for assay, but it is likely that the barite content would be on the order of 30 to 35 percent.

An ore pocket in the floor of the 137-foot level leads to a loading chute in the shaft. Shaft timbering and track extend only to this loading station, 150 feet down the incline. The shaft walls at this point do not show continuation of the fractured zone above.

The shaft was not investigated below the chute because of the lack of timbering and the possibility of bad air. It definitely is more than 200 feet and was reported as 300 feet deep. Mr. Nottbusch reportedly shipped two carloads of ore in 1912, containing 35 percent lead and 35 ounces silver per ton.^{16/} Mr. Parker states that he shipped a considerable tonnage of lead ore in 1956. Other operators may have produced a few carloads.

A foot trail from the shaft leads southwest over a low saddle. On the south side of the wash, about 750 feet from the shaft, a 10-foot pit in schist contains irregular and discontinuous stringers, disseminations, and small pods of barite associated with considerable fluorspar. Approximately 200 feet farther southwest and on the opposite side of the wash an inclined 35-foot shaft was sunk on a 4-foot mineralized vein striking S. 70° W. and dipping 65° N. The best mineralization is within a 12-inch band against the footwall; lesser mineralization is present in the remainder of the vein. A shallow pit and considerable float show extension of the vein for 100 feet to the southwest against an andesitic footwall. The barite is associated with fluorspar and contains minor manganiferous calcite strands. No galena was noted in this deposit.

Shallow pits have prospected other minor barite stringers on the hillsides to the east and west of this occurrence.

Some 800 feet to the west across a little valley, a prospect pit exposed a 2- to 3-foot zone containing some barite and honey-colored fluorite; the latter predominates. The mineralized zone is on the hanging wall of a schistose band some 20 feet wide near contact with an intrusive body. Mineralization can be traced for 100 feet around the hillside to the southwest. A monument contains a 1934 location notice by Walter L. English.

^{16/} Wilson, E. D., Geology and Mineral Deposits of Southern Yuma County, Ariz.: Ariz. Bureau of Mines Bull. 134, 1933, p. 128.

Renner Deposit

The Renner deposit is at the western base of the Mohawk Mountains 1 mile N. 30° W. of Mohawk in the SE 1/4 sec. 11 and the SW 1/4 sec. 12, T. 8 S., R. 15 W. The name Renner is used because James Renner originally exploited the property. Claims covering the deposit have been relocated at least twice since that time, but apparently little or no work was done by these later parties.

According to Wilson^{17/} the claims originally were located in 1902 and later were taken over by Mr. Renner, who shipped about 18 carloads of barite from the major workings in 1929 and 1930.

The principal barite vein occurs within a fault zone striking N. 70° W., dipping 80° SW., and traversing low, rounded hills of granitic gneiss. The one productive lens is at the west end of the outcrop just east of a small wash. The extension of the fault west of the wash is concealed by heavy alluvial cover. To the east, the fault can be traced for 500 feet, but the barite band is less than 1 foot wide. Other barite stringers were noticed in fractures having a similar strike for about 1,000 feet farther to the east.

The productive lens was mined in an opencut 40 feet long to a maximum depth of 30 feet, with an underground stope extending 25 feet to the east. In the surface exposures at each end of the cut the barite band on the footwall side of the fault zone is about 1 foot wide. The cut is 4 feet wide at the surface and widens to 7 feet from 10 feet below the surface.

It is likely that much of the fault filling was barite, as the dump is small in comparison with the size of the workings. Debris covers the bottom of the cut, and the width of mineralization could not be determined. At the widest place on the west wall 3 feet of barite is mixed with rock fragments. At the east end of the stope the vein is 12 inches wide. A 75-foot trench along the strike eastward from the opencut is 4 to 8 feet deep and exposes less than 1 foot of barite, as do several shallow cuts to the southeast.

Mineralization of this deposit occurs in brecciated fault material as aggregates of radiating crystals up to 1 foot in diameter, in ribbons of pure barite several inches wide, and as coarse to fine particles within the breccia. The barite is associated with minor amounts of fluorspar, crystalline manganiferous calcite, and crusts of white calcite of a later generation. Most of the barite has a pink tinge.

The altitude of the deposit is approximately 650 feet.

Silver King Claim

The Silver King claim is in the Trigo Mountains in sec. 1, T. 4 S., R. 23 W., unsurveyed, at an altitude of 850 feet. It is in the Silver district, which flourished in the 1880's as a silver-mining area. There have

^{17/} Work cited in footnote 16 (p. 87), p. 152.

been sporadic operations since that time, and according to Wilson^{18/} this claim produced a few tons of silver ore in 1923. The claim now is owned by James Byrom.

The property is accessible from Yuma according to the following road log:

0.0 Junction U.S. Highway No. 80 and State Highway No. 95 in Yuma.
Travel east on Highway No. 95.

24.2 Turn left at windmill.

36.9 Turn right.

51.4 Pass the Red Cloud mine.

52.7 Turn right on a Jeep trail going up a canyon to the east.

53.1 Silver King workings on the right.

At this place a broad, northward-trending, brecciated zone traverses the andesite. The principal vein within this zone strikes S. 25°-35° E. and dips 65° NE.

A crosscutting adit driven about 100 feet westerly intersects the vein at 65 feet. Drifts driven 15 feet northward and 30 feet southward exposed a vein 5 to 7 feet wide. A sample cut across the end of the south drift assayed 11.3 percent BaSO₄ and 48.6 percent CaF₂.

Above the main adit the vein has been stoped about 50 feet to the surface. At its midsection the stope has a maximum length of 50 feet and a width of 10 feet. The vein minerals consist of clear to light-green fluorite, quartz, calcite, minor iron oxides, and white barite. The latter, mostly on the hanging wall, is partly massive and partly in rosettes. Locally on the walls and on the sides of the stope, small nests of orange-red wulfenite can be seen, and small crystals of vanadinite occur in fractures and vugs. Small particles of galena were present, partly altered to cerrusite, and copper-oxide staining was noted.

This stope antedates a visit by the author in 1950, at which time it was stated that about 200 tons of fluorspar ore had been produced.

The vein has been prospected southeastward down the slope by several cuts for a distance of about 400 feet. Barite mineralization favors the hanging-wall side, and at one of the cuts is 2 feet wide. In each cut fluorspar is abundant although less pure than in the stope.

In other mines of the district, particularly in the Red Cloud, barite and fluorite occur in a gangue predominantly manganiferous calcite.

^{18/} Work cited in footnote 16 (p. 87), p. 64.

