Fluorspar

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FLUORSPAR

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PURPOSE

The purpose of this article is to emphasize the importance of fluorspar in our economy, the contribution southwestern New Mexico has made in this field, and the possibility of further development. The known occurrences are located on the accompanying map but the reader is referred to the literature for detailed descriptions of these deposits.

USES

The use of fluorspar, the ore of the mineral fluorite (CaF_2), in this country has increased notably during the past few decades, averaging 40,000 tons per year during 1900-09, 323,000 tons per year during 1940-49 and 959,400 tons per year during the period 1960-67. The total consumption during 1967, the last year that has been summarized in the Minerals Yearbook of the U. S. Bureau of Mines, was 1,091,159 tons of which 56% was used by the chemical industries, 36% in metallurgical processes, 5% for ceramics and 3% for miscellaneous uses.

Chemical industries use the highly refined acid grade (97+% effective CaF_2), whereas the ferrous industries can use the more easily produced metallurgical grade (70% effective CaF_2). Other industries have standards generally ranging between these two and all industries have special requirements regarding contaminates.

The chemical use of fluorspar, which usually involves its conversion to hydrofluoric acid, is related to the production of aluminum, high octane gasoline, refrigerants, insecticides, preservatives, dyestuffs, propellants, the separation of uranium isotopes and many other processes.

The principal metallurgical use is as a flux in the reduction of steel and to a lesser extent in the refining of aluminum, nickel, magnesium, copper, lead, and silver.

In the field of ceramics fluorspar is used to produce opalescent, milk glass, and colored glass. It is an ingredient of flint glass, brick mix, and in the manufacture of fiber glass. It is finding increasing use in the manufacture of enamels for metal surfaces.

Fluorspar was classified as critical during World War II because a large percentage of United States consumption was satisfied by imports. This is still true as indicated by the fact that only $26^1/_2$% of the 1963 consumption of 754,966 tons was supplied from domestic sources (Ambrose, 1965, p. 345), a situation that has not improved since then.

FLUORSPAR MINING IN NEW MEXICO

The earliest reported shipments of fluorspar in New Mexico were from Grant County in 1880 when ore from the Foster mine, 6 miles northeast of Gila, was sold to the silver smelters in Silver City. During World War II New Mexico ranked fourth among the fluorspar-producing states, marketing 9.1% of the total United States output in 1943 (Rothrock, 1946, p. 14, 15). The last significant shipments were in 1954. Except for a single small operation in Dona Ana County, the fluorspar resources of New Mexico are not now being utilized.

Although the most obvious ore bodies have been extensively mined, the potential of southwestern New Mexico has not been fully developed, as suggested by the fact that approximately 60% of the fluorspar shipments from the State during the period 1909-1962 came from mines in its southwestern part (Williams, 1966, p. 4).

The locations of the principal mines in this area are shown by appropriate symbols on the accompanying map.

FIELD IDENTIFICATION

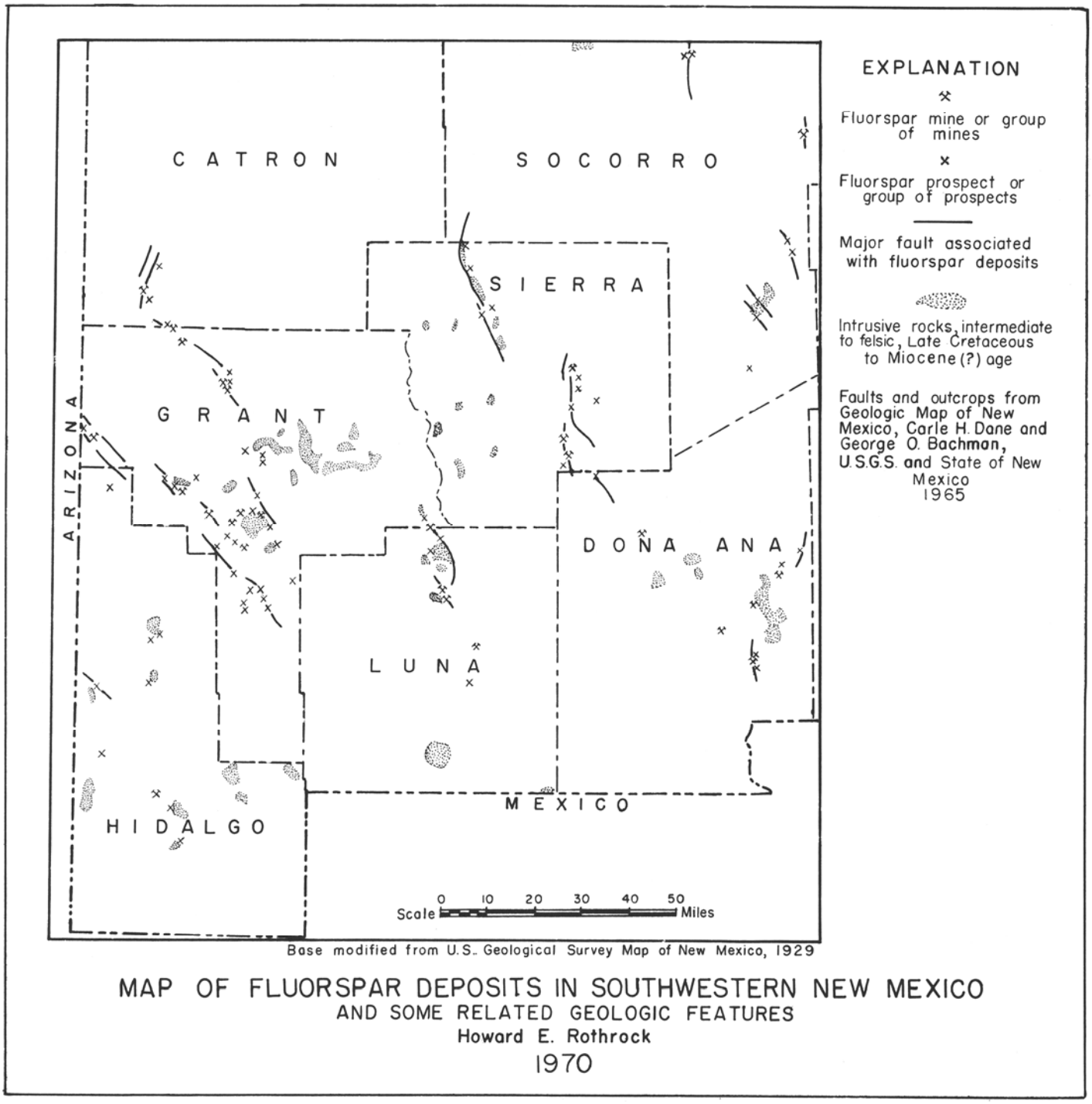
Those who are interested in fluorspar from either the collectors' or the developers' viewpoint may find the following information to be helpful. Fluorspar generally can be readily identified in the field by its color, specific gravity, hardness, crystal form, cleavage and luster, characteristics that are summarized below:

Crystal Form.—The most commonly recognized occurrences of fluorspar have been those that are megascopically crystalline. In these the cubic form is generally conspicuous although twinning and secondary growth forms may tend to obliterate the simple isometric form. Tetrahexahedrons and hexoctahedrons occur but are rare.

Cleavage.—The perfect octahedral cleavage is a very useful and obvious identification in the coarsely crystalline varieties. It produces triangular lineation on crystal faces and four-sided pyramids bounded by equilateral triangular faces in crushed samples. Such tetrahedrons may be found in colorful piles in the shops of industrious rock dealers.

Luster.—The vitreous luster is especially useful in field determination of microcrystalline fluorspar, because it produces a glittery surface.

Color.—The color that is considered to be typical is purple but this may range from a deep rich shade to pale suggestions of the hue. Green, red, brown, or colorless fluorspar is quite common, but yellow, called "honey ore," is rare. The colors are especially attractive in the transparent varieties. The importance of color, however, should not be overemphasized, because colors fade when weathered and a weathered ore can be easily overlooked.



MAP OF FLUORSPAR DEPOSITS IN SOUTHWESTERN NEW MEXICO
AND SOME RELATED GEOLOGIC FEATURES
Howard E. Rothrock
1970

Specific Gravity.—The moderately high specific gravity of fluorite, 3.183 (3.017-3.357), is a useful aid to field identification. A heavy, nonmetallic specimen that is not barite should be carefully examined.

Some fluorspar deposits do not exhibit these physical characteristics so plainly and escaped detection until recently. These occurrences are generally of the cryptocrystalline, granular, fibrous of stony types. Simple tests that may be made on such fluorspar involve its characteristic of decrepitating at temperatures from 550° to 650°F. and its usual fluorescence under ultraviolet light. Striking fluorspar a glancing blow with a pick often produces a momentary blue glow, an indication of its thermoluminescent property, or this property can be utilized by sprinkling the powdered ore onto a hot plate.

OCCURRENCE

Fluorite generally occurs as a primary mineral deposit where it is formed by fluorine-bearing solutions that appear to represent a late phase of predominantly acidic volcanic activity. The solutions may be of high, medium, or low temperature.

The presence of rocks from which calcium can be extracted by the fluorine-bearing solutions is essential to the formation of fluorite, but the mineral may be deposited in some other type of host rock and at a considerable distance from the source of this constituent element.

These factors extend the petrographic range of host rocks from Precambrian to late Cenozoic and the geographic range to any area influenced by either extrusive or shallow intrusive volcanic activity that is not of the basic type.

The primary factor in the localization of fluorspar deposits is preparation of the ground, as a result of which structural and textural controls are established. The structural features that exert noteworthy control are faults, breccia zones, fractures, and to a lesser extent folds. Of these features, faults are by far the most influential, and the largest fluorspar bodies generally are deposited where breccia zones are present. Fractures commonly influence the details in the form of the deposits that have been localized by faults. Control imposed by folds appears to be less common than that established by faults and fractures.

Secondary control may be imposed by the host rock which may exhibit differences in solubility or permeability. Differential solubility is well illustrated by the Burro Mountain deposits in which the ore bodies tend to be enlarged in the Precambrian granite rather than in the adjoining rhyolite (Gillerman, 1952, p. 278) . Permeability as a limiting factor in fluorspar ore bodies is well illustrated in the Huckleberry mine (Rothrock, 1946, p. 44-46) where fault gouge along a low-angle fault restricts the vertical development of the ore and in the Nakaye mine where the ore is impounded beneath a shaly limestone (Johnston, 1928, p. 49-57).

Most of the known fluorspar deposits in southwestern New Mexico are of the fissure-vein type. They range from low-temperature deposits in simple fractures and in voids left by incomplete pre-fluorite mineralization as in the Hansonburg mine (Kottlowski, 1953, p. 8) to deposition by more active solutions in wide brecciated zones as in the Burro Chief and Shrine mines in the Big Burro Mountains (Rothrock, 1946, p. 69-73) .

The only reported deposits that were favorably affected by anticlinal structure are veins of the "White Star, Oakland, and Universal mines near Truth or Consequences, where ore bodies were largest along the axis of a transversely faulted anticline (Rothrock, 1945, p. 2).

Bedded replacement deposits such as those in the prolific Kentucky-Illinois deposits have not been discovered in New Mexico. Fluorspar in New Mexico has not been reported in unconsolidated deposits such as detritus, nor does it occur as substantial placer deposits, because of its friable character. It is not restricted to any specific type or age of consolidated rock except that it has not been found in New Mexico in rocks or deposits of late Cenozoic age.

FUTURE POSSIBILITIES

Prospects for developing new fluorspar ore bodies in southwestern New Mexico are much the same as for the metals: the obvious, high-grade, readily accessible ore above mine water level has been extensively mined.

The fluorspar resources, however, have not been exhausted. Deeper deposits must be available, because fluorspar does not occur in as definite zonation as the metals and because it has been deposited over a wide range of geologic time, type of host rock, ground preparation, and depth. Any area in which there has been igneous activity of an acidic type, intrusive or extrusive, may contain fluorspar. Most of the deposits in southwestern New Mexico represent a late phase of mineralization from such activity, but some, as those in the Gallinas Mountains in Lincoln County, east of the subject area, may represent an earlier deposit, almost syngenetic with the period of ground preparation (Kelley and others, 1946) .

Optimism in the matter of reserves is also supported by the fact that relatively little exploratory core drilling has been done even where geologic mapping suggests favorable areas. This type of exploration, preceded by detailed geologic analysis, therefore, offers the greatest assurance of success.

Another promising approach would be an active search in domed and faulted areas for the types of fluorspar that are not generally recognized, such as the stony textured, fine-grained, drab ore that is associated with some replacement deposits. Furthermore, the possibility should not be overlooked of finding sedimentary fluorite deposited during the evaporation of fluorine-bearing water. Such fluorite has been reported to have been deposited from sea water at a stage of concentration intermediate between that producing dolomite and that producing gypsum (Florenski, 1941).

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