AN OCCURRENCE OF BARITE IN THE RED BEDS OF COLORADO

ARTHUR L. HOWLAND,
Northwestern University, Evanston, Illinois.

During the summer of 1934, in the course of field studies conducted in South Park, Colorado, by Northwestern University, an interesting deposit of barite was examined. A claim had been staked in 1932 and some 15 pits of various sizes, the deepest about 10 feet, had been dug and a quantity of barite taken out. Further development work was done in the winter of 1934–1935 and a revisit to the locality the following summer permitted a fuller examination of the occurrence.

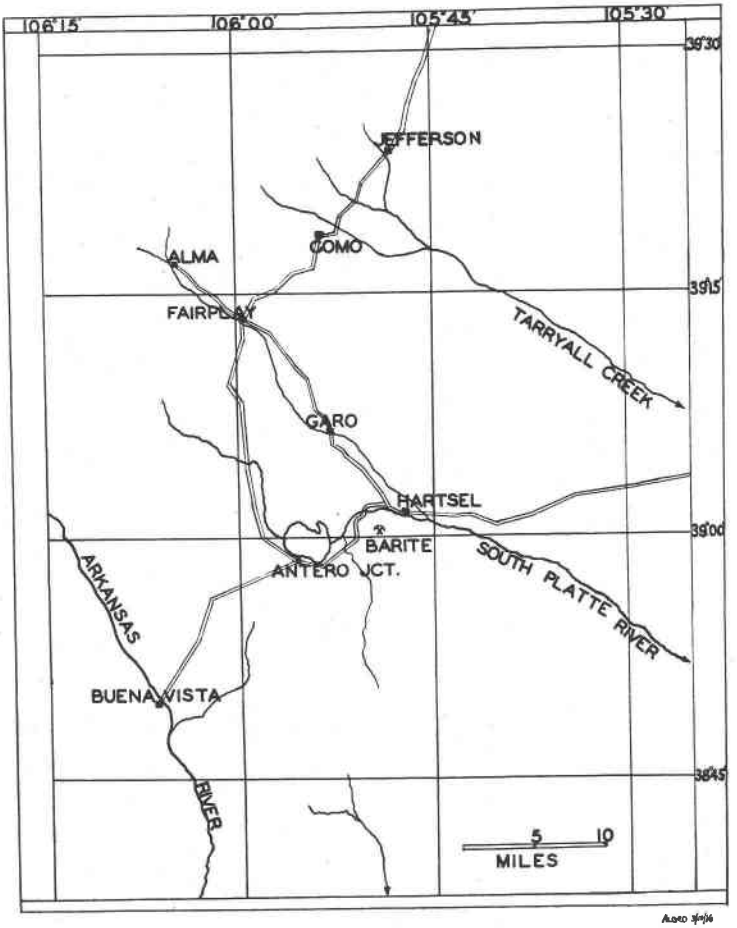

FIG. 1. Index map of South Park, Colorado, showing the location of the barite deposit.

The barite deposit lies about 2 miles southwest of the town of Hartsel in the SE. $\frac{1}{4}$ sec. 18, T. 12 S., R. 75 W. It may be reached by a dirt road which leads southward from the bridge on highway U. S. 40 S, about 2 miles west of Hartsel (Fig. 1).

The stratigraphic horizon of the deposit is a limestone member of the Maroon formation (Permian). Because of rapid thinning of the formation by overlap toward the east, its exact position in the Maroon is unknown, but it is probably in the upper part of the section, and itself overlaps on to the granite about a mile farther east. At the barite locality the limestone dips northeastward from 5–12° and forms the southwestern side of a small structural basin, the northeastern side of which flanks a granite knob south of Hartsel. The surface of the ground is approximately a dip slope and the thickness of the limestone horizon is not determinable, but more than 9 feet is exposed in the deepest of the pits. The red soil and red staining of the limestone suggest that the more typical red shales and sandstones of the Maroon formation formerly lay stratigraphically above this horizon. The limestone is white and fine-grained. Examination of thin sections and insoluble residues discloses a small amount of gypsum. A limestone on the northeast side of the basin which is apparently a nearly equivalent horizon is gypsiferous enough so that it may be scratched readily with the fingernail.

The barite occurs in two ways, (1) as vertical veins from 1 to 2 feet thick, cutting across the beds, and (2) as irregular layers 6 inches to 3 feet thick, roughly parallel to the bedding. The borders of the barite bodies are sharp, but their replacing nature is well shown by a combination of the two types, in which a vein-like mass is enlarged along certain beds through selective replacement (Fig. 2). The barite is a porous aggregate of crystals intermixed with limonite-stained clay, which is probably residual from the weathering and perhaps in part from the replacement of the limestone. In some places there are a few inches of porous brown limonite bordering the under side of the barite layers. Thin coatings of calcium carbonate encrust some of the crystals. No sulphides could be found.

Many masses of the barite have a branching structure, but the ends of the masses, some of which are more than a foot long, show characteristic tabular crystals. Other groups of crystals do not show the branching development (Fig. 3). The well-developed forms are *c* (001), *m* (110), and *d* (102). Measurements of several crystals on the reflecting goniometer showed the presence of the unit pyramid *z* (111) as a very narrow face. Crystals attain a maximum size of more than 1.5 inches in the direction of *c* and 5 inches along the *b* axis. The indices of refraction are $\alpha = 1.635 \pm .001$, $\beta = 1.637 \pm .001$, $\gamma = 1.646 \pm .001$. The specific gravity is 4.45.

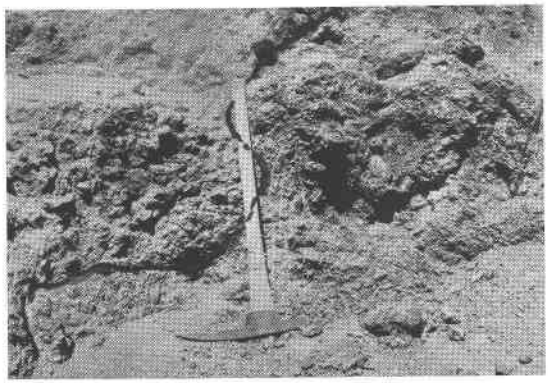

FIG. 2. Barite imbedded in clay cutting irregularly across limestone beds. The barite is below and to the right of the black line.

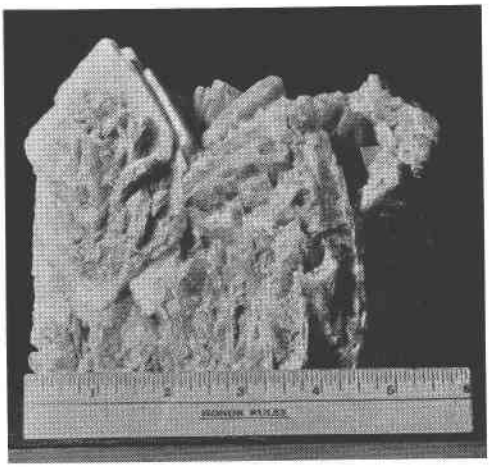

FIG. 3. Group of well terminated barite crystals.

An analysis of the barite is given below. The absence of strontium, though sought for, is noteworthy. A small amount of alkali sulphate may be present.

ANALYSIS OF BARITE FROM SOUTH PARK, COLORADO
R. W. Hunt Company, *analysts*

BaO	64.05
CaO	tr.
SrO	none
SO_3	33.71
CO_2	0.22
Loss on ignition (other than CO_2)	0.14
	98.12

The slightly opaque light blue color is a striking feature of the barite. This color is not uniform, but shades off to white in the interior of the branching masses. Doelter[1] found that an irregular blue coloring could be produced from colorless barite by irradiation with radium chloride. In this connection it may be mentioned that there is a locality about eight miles to the north of the barite occurrence where a concentration of radioactive vanadium minerals has been found. This deposit is in a red sandstone of the Maroon, not far above a white limestone member. A similar concentration in the red beds above or below the barite, may have been the cause for the blue color.

The origin of barite has been attributed both to hot rising solutions of magmatic origin and to concentration from surrounding rocks by the action of ground water. Concentration in residual deposits is common, but most of these have been developed from original fissure fillings or replacements. Sources for the barite in South Park might be found either in the sediments of the Maroon formation, or in rising solutions, such as might originate from the magma chamber that furnished Oligocene trachyte in this area.[2] The chloride waters of red beds are known to contain barium in some cases,[3] and percolation of waters through the red sands and shales of the Maroon might have caused the deposition of barite. Gypsum in the limestone would supply sulphate for the precipitation of the barium which had been in solution in waters bearing chlorides and carbonates. The basin-like structure of the Maroon at this locality, as described above, might have served to concentrate downward percolation. At the town of Hartsel, 2 miles to the northeast, is a hot spring. An analysis of the water stated in milligrams per litre[4] is here recalculated to percentage of ions. To supplement this a careful test was made for barium, but no detectable amount was present in either of two tests, and no barite was found associated with this spring or other mineral springs which rise through the Mesozoic beds farther east in the park. At best, evidence based upon the hot springs would be debatable. The present composition of the spring water suggests that though the heat is probably attributable to hot magmatic waters or to hot rock at depths, the waters are entirely meteoric or, if magmatic, are greatly diluted by meteoric waters, a suggestion borne out by the rather high radioactivity of the water. This is what might be expected if water from the red beds, with their known content of radioactive minerals, contributed to the

[1] Doelter, C., *Handbuch der Mineralchemie*, vol. 4, pt. 2, pp. 234–235, 1929.

[2] Howland, A. L., Harris, D. V., and Stark, J. T., Bedrock geology of southern South Park (abstract): *Proc. Geol. Soc. Am.*, 1934, p. 84, **1935.**

[3] Jones, F. A., New Mexico mines and minerals, p. 309, Santa Fe, New Mexico, **1904.**

[4] George, R. D., and others, Mineral waters of Colorado: *Colorado Geol. Survey, Bull.* **11**, p. 311, 1920.

flow of the spring. Any barium present could therefore be attributed to either source.

ANALYSIS OF HARTSEL HOT SPRING

H. A. Curtis and O. C. Lester, *analysts*

Cl	35.48
SO_4	14.76
CO_3	13.73
Na	27.17
K	1.08
Li	tr.
Ca	4.38
Mg	1.29
Mn	tr.
SiO_2	2.03
$(Fe, Al)_2O_3$	.08
	100.00

Milligrams per litre = 2248.05
Temperature = 56.5°C.
Curies of Ra emanation per litre ..... 15.14×10^{-10}
Permanent activity, grams Ra per litre ..... 0.180×10^{-10}

Concentration of the barite from surrounding sedimentary rocks is here preferred to deposition from rising solutions for the following reasons:

1. A reasonable source of barium is found in the saline waters of the red beds of the Maroon formation.
2. The position of the deposit corresponds with a synclinal structure, such as might control the flow of meteoric waters.
3. A precipitating agent in the form of gypsum is available in the limestone.
4. Sulphides or other minerals common in deposits formed by hypogene solutions and often associated with barite of possible deep seated origin are conspicuously absent.