ADMMR

Arizona Department of Mines and Mineral Resources
1502 West Washington, Phoenix, AZ 85007 Phone (602) 255-3795
1-800-446-4259 in Arizona FAX (602) 255-3777 www.admmr.state.az.us

Prospecting for Barite

Circular No. 4, February, 1981, revised 2001

by Ken A. Phillips, Mineral Resource Engineer & Clifford J. Hicks, Field Engineer

The mineral barite, barium sulfate, $BaSO_4$, is unusually heavy with a specific gravity of 4.2 - 4.6. This means it is that many times as heavy as an equal volume of water and that it is over half again as heavy as most common rocks such as granite, lava, sandstone, and limestone. This heft is most noticeable in a fist-sized specimen. The mineral is moderately soft. A fingernail cannot scratch it, a copper penny may or may not, but a knife blade will.

A few other minerals may be mistakenly identified as barite: Witherite (another barium mineral), celestite and strontianite (both strontium minerals), cerussite and anglesite (both lead minerals) and hydrozincite (a zinc mineral) also have a high specific gravity, similar color (colorless, white, yellow, gray, green, blue and red) and a nonmetallic appearance. They are rare and also of potentially greater value than barite. In fact, the identity of any heavy mineral should be determined. No prospector should ignore any other potentially valuable mineral deposit by searching only for barite.

A specific chemical test for the element barium is given in *Field Tests for The Common Mineral Elements*, Arizona Bureau of Geology and Mineral Technology, Bulletin 175, by George H. Roseveare. The test is not simple or specific for barite, as it will indicate the presence of barium in any mineral or rock. A note of caution, barium typically occurs as a constituent of light colored igneous rocks at a concentration of 0.07% to 0.50%. The semi quantitative spectrographic analysis often purchased by prospectors will nearly always show a concentration of 0.50% barium. This may be expected, has little significance to the barite prospector, nor does such a low value have any economic significance.

There are two tests for barite that are simple and usually specific, though not always:

1. The first test requires an ultra-violet (mineral) light and an alcohol lamp with a blow pipe or a propane torch. Frederick H. Pough describes the test in his *A Field Guide To Rocks and Minerals*. "Barite is only occasionally fluorescent, but all barite samples tested were found to be fluorescent yellow orange after roasting. Hence, with two similar minerals (celestite and barite) we have only to roast an edge intensely in the flame (to red heat, briefly), allow them to cool, and examine them with our ultra-violet light. The orange one will be barite, the yellow green one, celestite."

2. The second method requires only a steel prospector's pick. When a barite sample is scratched across the head of the pick it adheres to the steel leaving a distinctive white streak. Other white rocks usually leave only a scratch or nothing.

Field prospecting for barite, like any other mineral, should be preceded by a study of typical types of occurrences and areas of past discoveries. Commonly white to gray, barite occurs in veins, replacements or residual deposits commonly associated with quartz, fluorspar and calcite. Deposits may be sought in highly weathered (rather crumbly or fractured) rocks especially those of Cambrian or Ordovician age, which overlay carbonate rich rocks such as limestone. Nearly all the barite deposits in Arizona, however, occur in veins associated with faults, breccias and fracture zones. Most of these are in igneous rocks, some are in sedimentary and a few are in metamorphic rocks. The veins are typically a few feet wide and usually have been traced for only a few hundred feet in outcrop. Even less is known about the extent of the veins at depth.

The geochemistry of barium in the earth's surface environment is complex and not fully understood. Under some conditions, barium is released from weathered igneous rocks, carried to the sea and precipitated as barite. Some deposits in sedimentary rocks may form in this manner. Prospecting for this type of barite occurrence first requires a determination of the location of marine sediments. The regional delineation of barite beds may be best determined by panning. Most extensive areas of sedimentary rocks contain very limited heavy minerals. Check any panned "heavies" with the ultraviolet light.

Barite's specific gravity is only 13% lower than the mineral magnetite, which is the magnetic constituent of the placer miners familiar "black sand." Fragments of barite in a stream, wash or crushed outcrop will concentrate with the black sand in a pan. Unlike gold, however, barite will not travel far from its outcrop before it is crushed to slime size particles by tumbling action. The other heavy minerals mentioned previously (witherite, celestite, cerussite, anglesite, hydrozincite) can also be concentrated by panning. Any barite found in the pan should then be traced upstream until an outcropping or residual hillside source is found. However, as barite is a common gangue mineral in vein deposits, many occurrences found in this manner will be too low grade or too small. The barite must occur in such a mode as to either be of a minimum specific gravity of 4.25 or is amenable to simple concentration.

Principal uses for barite are as a weighting agent in oil well drilling mud, which accounts for about 90% of consumption, in barium compounds, in paints, in glass, in paper fillers, and in refining sugar. Freight rates are high and barite being a dense, heavy mineral of relatively low unit value, the distance from producer to consumer is economically critical. For current prices contact the Arizona Department of Mines and Mineral Resources.

Arizona has produced approximately 1% of the over 30 million tons of barite mined in the United States since 1882. The first commercial barite productions came from Cochise County in 1925. From available records it is estimated that Arizona's barite production between 1929 and 1955 was about 317,000 tons. Close to 312,000 tons came from the veins of the Granite Reef (aka Arizona Barite or Macco) mine, Maricopa County between 1931 and 1955. Eight other mines in five counties yielded the other 5,000 tons. Since 1986 there is no record of barite production in Arizona.

The standards of quality vary by use. A barite product for drilling mud must have a minimum specific gravity of 4.25 (about 92% $BaSO_4$) and at least 90% of the product must be ground to minus 325 mesh. Many other uses require a product that is 95-98% $BaSO_4$ with no more than minor amounts of iron oxides, silica and alumina.

In 1979 Nevada continued to be the largest producer with 82.5% of the total, followed by Missouri with 7.4%. Other producing states were Arkansas, Georgia, Idaho, Illinois, Montana, and Tennessee. The average price per ton, f.o.b. mine in 1979 was $22.93. This is over $2.00/st higher than the 1978 average.

In 1999 well drilling consumed over 94% of the barite used in the United States. Imports and domestic production for the year totaled 1.4 million tons. Nevada remains the largest U.S. producer but production is about one third of the 1979 level due largely to low-priced imports of barite. China supplies most of the imported barite; domestic production was only 33% of the total. The average price per ton was $25.58.

The Arizona Department of Mines and Mineral Resources has numerous reference works on the geology, mineralogy, mining and processing of barite, and, in the museum, specimens for examination.