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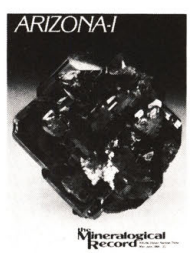

COVER: WULFENITE from the Red Cloud mine (see p. 141). This crystal, 5 cm across and nearly 1 cm thick, was part of the famous 1938 discovery of Ed Over. Richard Bideaux specimen; Wendell Wilson photo.

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the Hamburg mine
and vicinity, yuma county, arizona

by
David M. Shannon
1727 West Drake Circle
Mesa, Arizona 85202

Brilliant, transparent crystals of vanadinite with an unsurpassed, deep red color have been found since the late 1800's at the Hamburg mine, Yuma County, Arizona. Although sometimes overshadowed by the nearby Red Cloud mine, this old Dana locality still produces some of Arizona's finest vanadinite in crystals from micromount size to more than a centimeter.

LOCATION

The Hamburg mine is located about 1 mile northeast of the Red Cloud mine in the Trigo Mountains, Yuma County, Arizona (T4S R23W, Sec 1 center). The area is included on the U.S.G.S. 7½-minute quadrangle *Picacho, Arizona/California.* About 30 meters north of the Hamburg mine is the Princess mine. Because of their close proximity, the true identity of these two mines has caused collectors much confusion. Further similarities between the two mines include identical geology, workings of similar extent, and the occurrence of at least micromount vanadinite.

The dirt access road is usually passable by virtually any vehicle as far as the Red Cloud mine. The jeep trail extending the remaining 1 mile to the Hamburg mine ranges from difficult, even for four-wheel drive, to a two-hour road-building adventure.

HISTORY

The Hamburg mine, as with most of the mines in the Silver district of Yuma County, was first located in the 1860's as a silver lode deposit. During 1880 and 1881, William P. Blake and others sank an 18-meter shaft inclined at an angle of about 45° (Wilson, 1933). At the base of the incline a horizontal drift was run for about 12 meters, exiting on the eastern base of the hill. So far as is known, no ore was ever mined from the Hamburg mine and it has lain idle since these early prospecting days except for the periodic visits of mineral collectors.

GEOLOGY AND TOPOGRAPHY

The elevation of the Hamburg mine is only 277 meters (900 feet) above sea level, but this low height should not be construed as gentle terrain. The Trigo Mountains reach an elevation of over 900 meters (3000 feet) and are extremely rugged for their height, consisting of a series of sawtooth ridges and steep-sided canyons. Most of the rock surfaces are black with desert varnish and pitted with small cavities.

The Hamburg mine, and the adjacent Princess mine, consist of veins of brecciated, silicified andesite emplaced along a fault in Precambrian schist, granite and Tertiary volcanic rocks (Wilson, 1933). A clearly defined hanging wall of polished slickensides extends the entire length of the incline and forms the roof of the mine workings. This fault, though offset by another, unmineralized fault, appears to be the same fault on which is situated the Red Cloud mine.

Vanadinite occurs in brecciated andesite and quartz seams, and is apparently restricted to a small stope at about the 12-meter (40-foot) level. The zone is bordered above and below by iron-stained andesite.

CLIMATE

Temperatures in this remote area of the low desert are almost continuously above 100°F from late May through September, and it is not unusual for the temperature to reach 125°F. There is no

Figure 5. **Two gemmy crystals of vanadinite on matrix from the Hamburg mine; the left crystal is 2.5 mm. Collection of the author.**

Figure 6. **Vanadinite crystals from the Hamburg mine, with typical proportions and cavernous terminations. The large crystal is 6 mm. Collection of the author.**

all sides by vanadinite crystals are found within these seams. The size of the crystals ranges from a few tenths of a mm to 1.5 cm or more. Crystals as large as 2 or 3 mm commonly have flat, pinacoidal terminations and brilliantly smooth, lustrous faces. The larger crystals tend to exhibit hopper growth, some being no more than a hexagonal skeleton. Typically the color is a vibrant red like the color of an automobile taillight lens. Rarely the color grades into orange-red and lemon-yellow. The combination of bright red, hexagonal prisms, often 2 or 3 times longer than wide, commonly with hopper terminations, on gray matrix is characteristic of Hamburg mine specimens. On the largest crystals the prism faces also show hopper growth.

Wulfenite $PbMoO_4$

Orange-red crystals of wulfenite to 1.5 cm in size and similar to Red Cloud mine specimens have been found just above the vanadinite area.

Mimetite $Pb_5(AsO_4)_3Cl$

Microscopic yellow tufts of mimetite crystals occur in association with wulfenite just above the vanadinite zone.

Anglesite $PbSO_4$ and **Cerussite** $PbCO_3$

Anglesite and cerussite are found sparingly as pods completely replacing galena.

Lead oxides

Traces of lead oxides, probably minium (red), litharge (red) and massicot (yellow) are found intermixed in the altered galena pods.

Other minerals

Galena, smithsonite, argentite (acanthite) and cerargyrite were reported by early writers (Emmons, 1885, Wilson, 1933). Quartz (some amethystine), barite, hematite, fluorite, calcite and aragonite also occur as gangue minerals.

DISCUSSION

Many references list "deep red, brilliant crystals of vanadinite from the Red Cloud mine" (e.g. Palache, 1944, Anthony, *et al.*, 1977, Ford, 1949). A review of the original reference cited for this occurrence (Silliman, 1881) indicates that the statement was taken out of context and probably refers instead to the Hamburg mine. Silliman was referring in general to the Silver district rather than specifically to the Red Cloud mine. In his words:

> *Vanadinite occurs in three mines, near together, the "Hamburg," the "Princess," and the "Red Cloud." The crystals of vanadinite are extremely beautiful, alike for brilliancy of color, luster, and perfection of form. . . . The Hamburg Mine has fur-*

Figure 9. **A multiple crystal of fine red vanadinite from the Romaldo Pachecos mine, donated to the Smithsonian Institution by W. F. Hillebrand in 1894. The crystal is 1.5 cm across.**

"Romaldo Pachecos mine, Silver district, Yuma County, Arizona," particularly two in the Smithsonian Institution. Catalog and label data indicate that the specimens were transferred to the Smithsonian from the U.S. Geological Survey collection by the mineralogist W. F. Hillebrand in 1894, but Hillebrand (who most likely collected them personally) gave no further location data either. Some people feel the Hamburg mine and the Pachecos mine are one and the same; others disagree, and place the Pachecos mine somewhere over near the Black Rock mine, perhaps as just a cut instead of a shaft or adit. Chances are we will never know for certain.

ACKNOWLEDGMENTS

The author is indebted to Wendell E. Wilson for help in the preparation of this article and the accompanying photos, and particularly for his research on the Romaldo Pachecos mine.

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the RED CLOUD mine
yuma county, arizona

by
Gary M. Edson
U.S. Geological Survey
Denver Federal Center
Denver, Colorado 80225

The story of the Red Cloud mine began over 100 years ago in one of the oldest mining districts in Arizona. Since that time the mine has regularly produced specimens of red wulfenite which, in form, color, luster and esthetics, are universally acknowledged as the finest in the world. The locality is still producing such specimens.

LOCATION

The Red Cloud mine is in the southern part of the Trigo Mountains, 80 km by road north of the city of Yuma, in Yuma County, Arizona (Fig. 5). The U.S. Geological Survey 7½-minute topographic map of the Picacho quadrangle shows the location of the mine (Sec 2, T4S, R23W).

HISTORY

The history of the Red Cloud mine can be divided into two general periods: before 1890, when the mine was a financial success; and since 1890, when most of the activity was promotion and exploration.

The first prospectors began working claims in the area in the

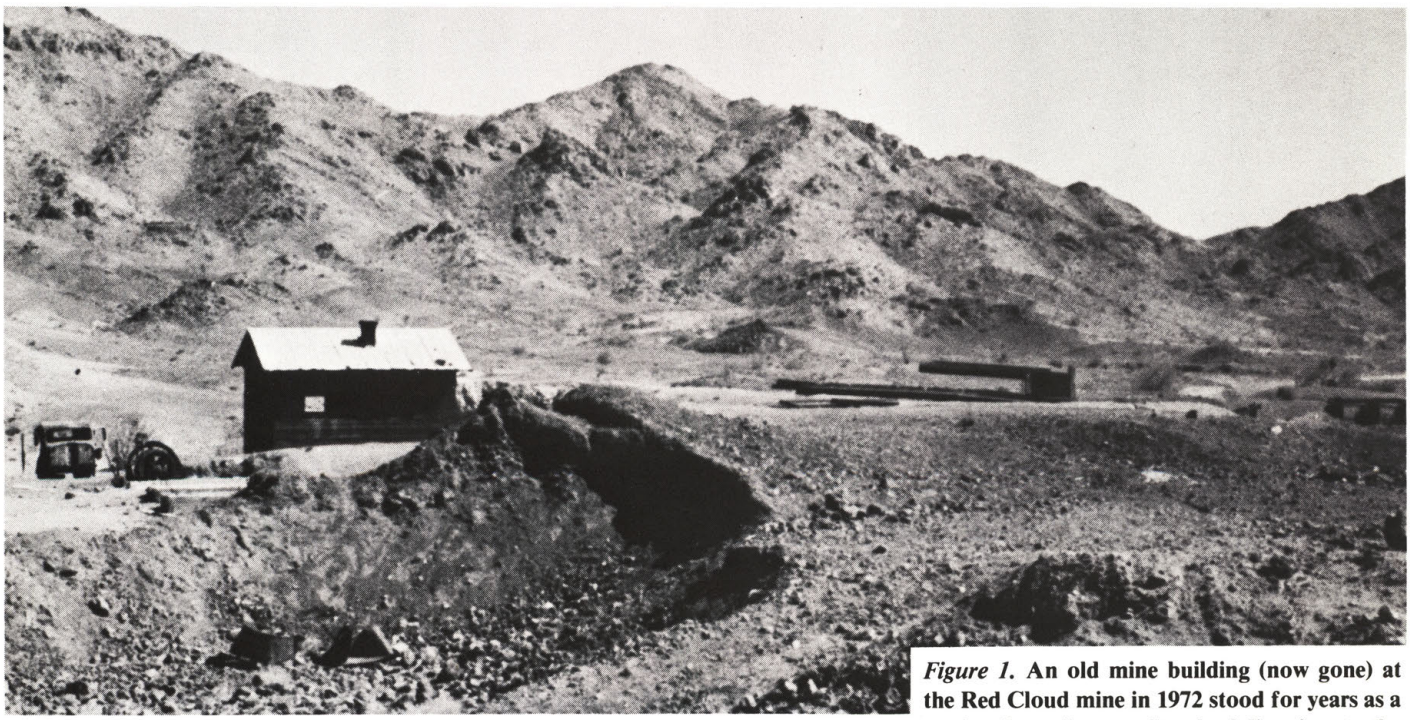


Figure 1. **An old mine building (now gone) at the Red Cloud mine in 1972 stood for years as a marker for collectors. Standard directions to the mine included, "look for the shack with 'WULFENITE IS LOVE' written on the side." In the distance, across Yuma Wash, are part of the Trigo Mountains.**

Figure 2. **A fine crystal of wulfenite 2 cm across, on matrix. Smithsonian specimen.**

Figure 3. **Red mimetite from the Red Cloud mine; the group is about 3 cm across, and was found in a long channel lined with such specimens but devoid of wulfenite. Grant Richards specimen.**

1860's and the Silver mining district came into being in the 1870's. Until about 1880 the Red Cloud mine, named after the nearby Red Cloud trail used by early Spanish explorers, consisted only of a small open cut. Silver-lead worth more than $30,000 was taken from the outcrop (Hamilton, 1884), and freighted by wagon down the Red Cloud wash to Norton's Landing on the Colorado River, for shipment by boat to the Selby smelter (Keith, 1978). The present upper workings, including the inclined shaft, wide stopes, and passageways joining them, were made by the Red Cloud Mining Company of New York in about 1880 (Hamilton, 1881). Production in silver and lead until 1890 was not recorded, but a consulting mining engineer, Elgin Bryce Holt (1942), believed that it may have been over $1 million. Keith (1978) estimates a total closer to $500,000 (21,000 tons of ore at 18 oz. of silver/ton).

From 1890 to 1917 the Red Cloud lay idle, owing to depressed silver prices. It was then bought by a syndicate, headed by Holt, which leased the property to a succession of operators. One of these lessees was the Primos Chemical Company, which drove a 102-m crosscut into the hanging wall on the 500 level for diamond drilling to intersect the vein at greater depth. A disagreement arose between the owners and the Primos people, which resulted in abandonment of the project (Holt, 1942).

In 1941 Penn Metals Inc., of Pennsylvania, operated a small flotation plant on dump material. However, this undertaking was not a financial success, so they hired Holt to make an evaluation and submit a report. The development program he outlined in-

TIGER
ARIZONA

by
Richard A. Bideaux
1144 West Miracle Mile
Tucson, Arizona 85705

From the initial discovery in 1879, over 100 years ago, until the time of their closing in 1953, the Mammoth and Collins mines were producers of spectacular mineral specimens for the collector. Many of the mineral specimens recovered from this deeply oxidized, base and precious metal vein deposit were exceptional examples compared to those found in the numerous similar deposits in Arizona, New Mexico and Sonora. Additionally, the superimposed wulfenite and vanadinite mineralization was outstanding both in quality and volume. Special conditions which obtained in these veins led to a suite of highly unusual copper-lead minerals unmatched in richness and beauty from any other deposit. The nearly 100 species recognized to date seem to occur in endless combinations; while outstanding cabinet specimens of some of the minerals were produced, the full impact and range of the mineralogy can only be appreciated in micromount-size crystals.

LOCATION

The mines are located about 80 km north-northeast of Tucson, near the present town of Mammoth, Pinal County, Arizona, and are today owned by the Magma Copper Company. Access to the grounds is prohibited except by prior arrangement.

MINING HISTORY

Frank Schultz located claims on the Collins vein in 1879, the Mohawk vein in 1881, and the Mammoth vein in 1882. Original workings were an open cut atop a hill on the Collins vein. Mineral specimens from this cut bearing labels with the locality "Schultz gold mine" are still to be seen.

The town of Mammoth, about 5 km northeast of the mine, was established to mill the gold ore. By 1889, the property was in operation by the Mammoth Gold Mines, Ltd., an English company, in turn succeeded in 1896 by the Mammoth Gold Mining Company. At first ore was hauled by 20-mule teams; later connection was made to the town of Mammoth by an aerial tramway, traces of which can still be seen.

In 1901 the workings caved from the 750-foot level to the surface. For this reason and litigation, the mine was not reopened until 1913, by the Great Western Copper Company. Before 1914, the mine was worked for gold alone, but demand for molybdenum during World War I created interest in the mines' wulfenite reserves. The extensive tailings dump was worked for discarded wulfenite, the first of several reworkings by the Arizona Rare Metals Company.

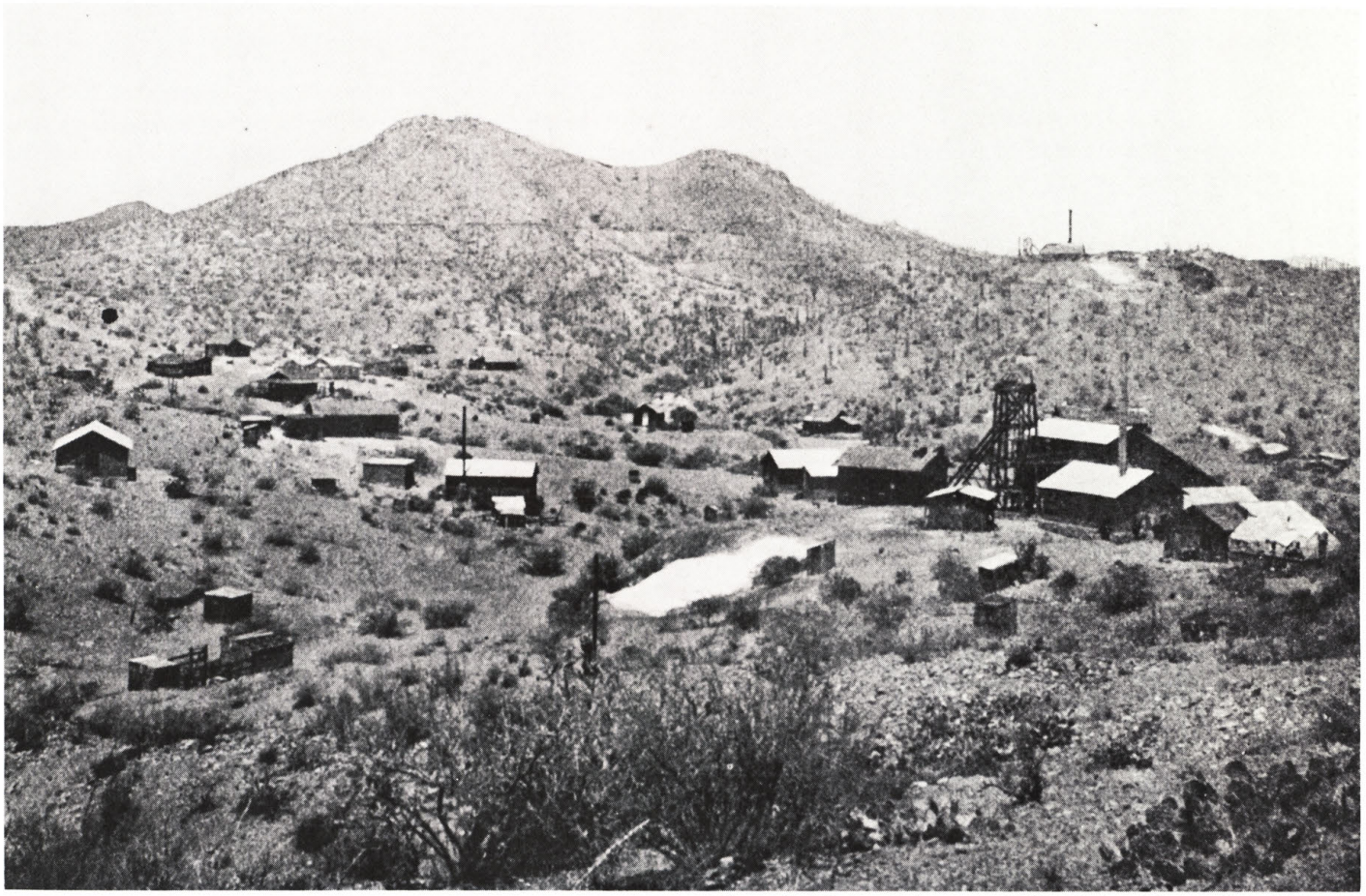


Figure 2. **Schultz, Arizona, in 1903. The headframe of the Mohawk mine is in the foreground, and the Mammoth mine workings are in the saddle of the hills and to the right on the horizon (photo courtesy of the Arizona Historical Society).**

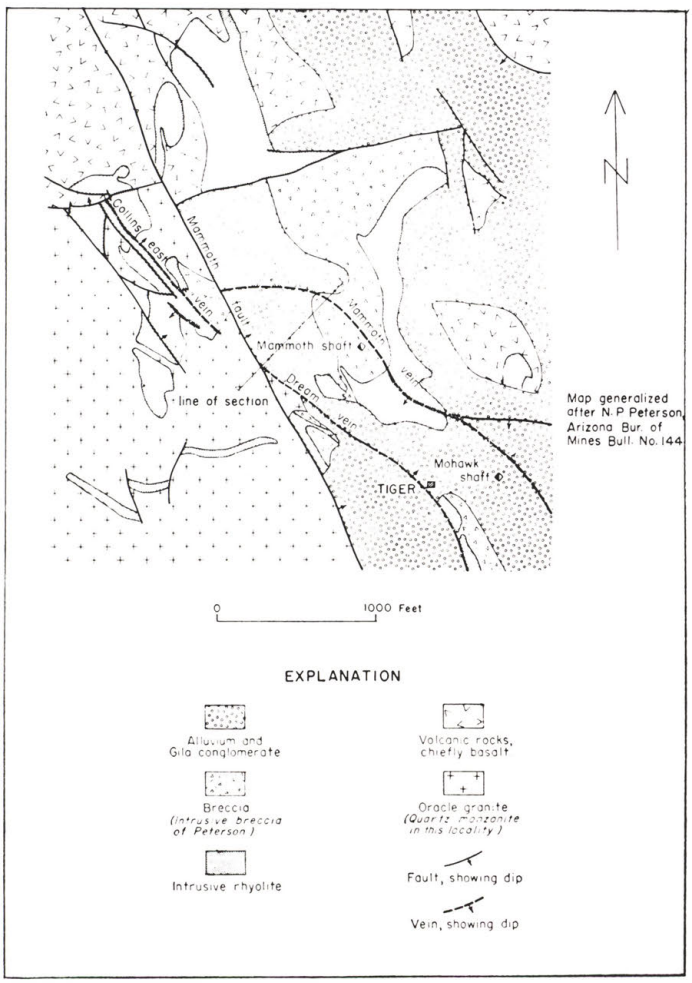


Figure 3. (left) **Generalized geology of the Tiger area (from Creasey (27)).**

Figure 4. (below) **Vertical section through the Collins and Mammoth veins (from Anderson (35)).**

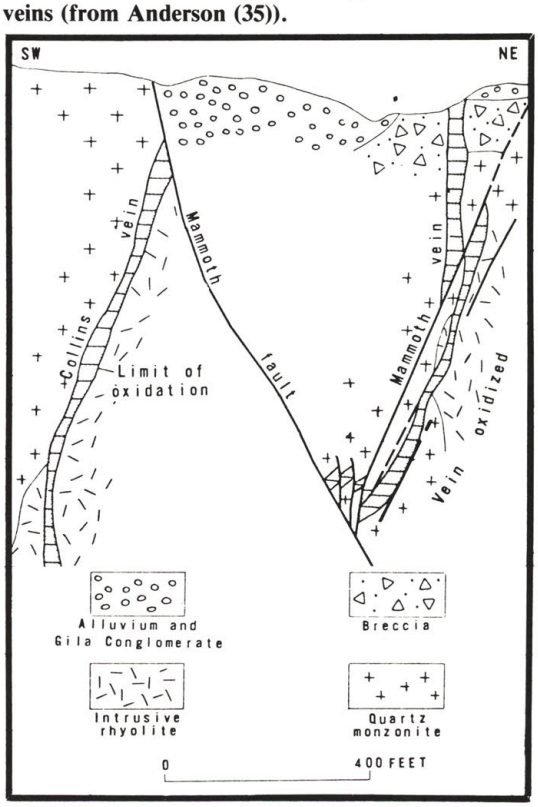


Figure 14. **Wulfenite, 15 cm across, Arizona-Sonora Desert Museum collection. Photo by William Panczner.**

Figure 16. **Pale bideauxite crystals to 4 mm with blue boleite, Arizona-Sonora Desert Museum collection.**

Figure 15. **Spherical aggregate of dioptase crystals 6 mm across, Jelks collection, Arizona-Sonora Desert Museum.**

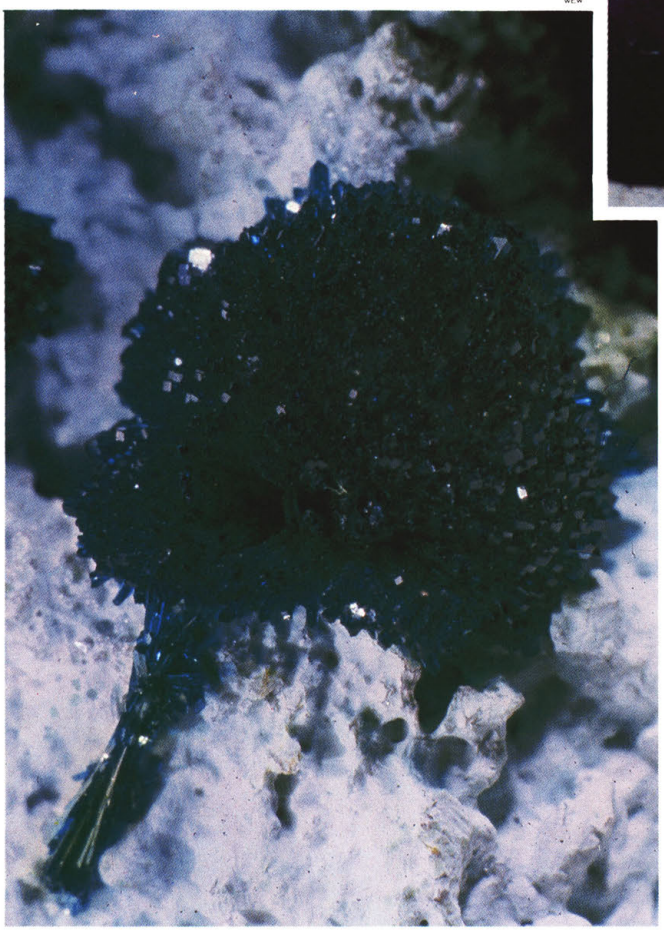
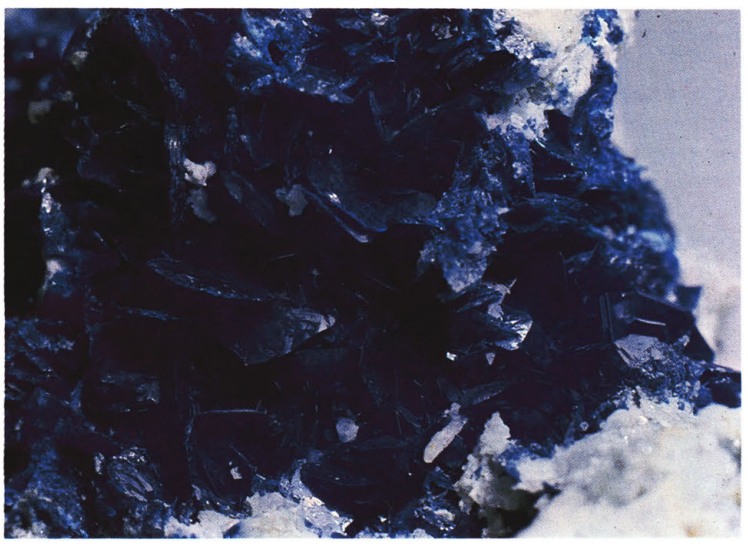


Figure 17. **Diaboleite crystal pocket 3 cm across, University of Arizona collection.**



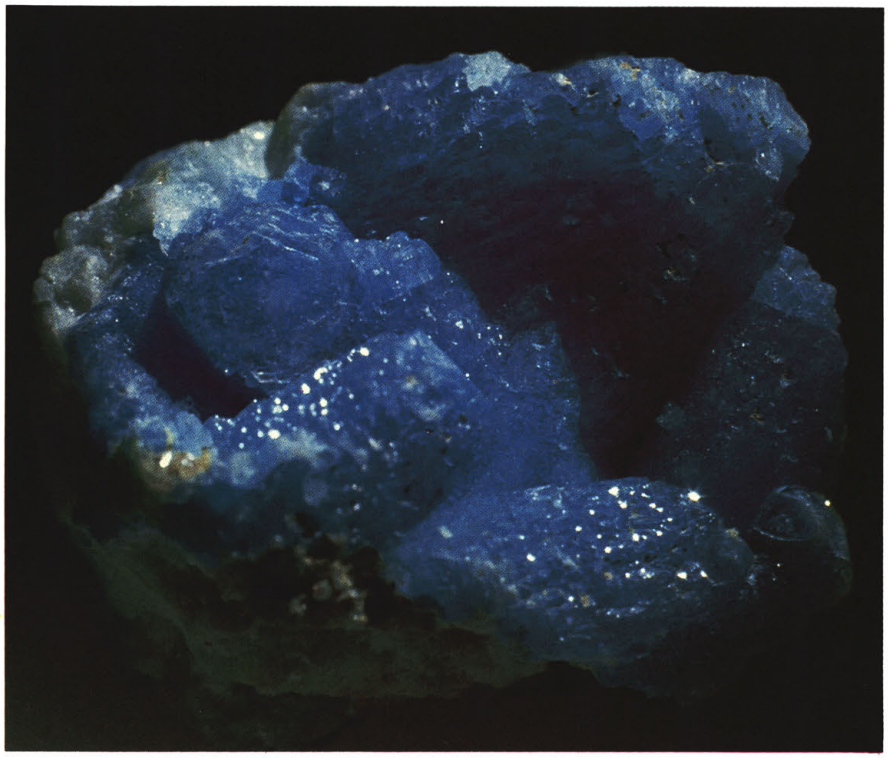


Figure 25. (above) **Leadhillite, 2.3 cm across, Jelks collection, Arizona-Sonora Desert Museum.**

Figure 26. (above) **Wulfenite showing crystal form change from first to second order, 1.6 cm across, Smithsonian Institution collection.**

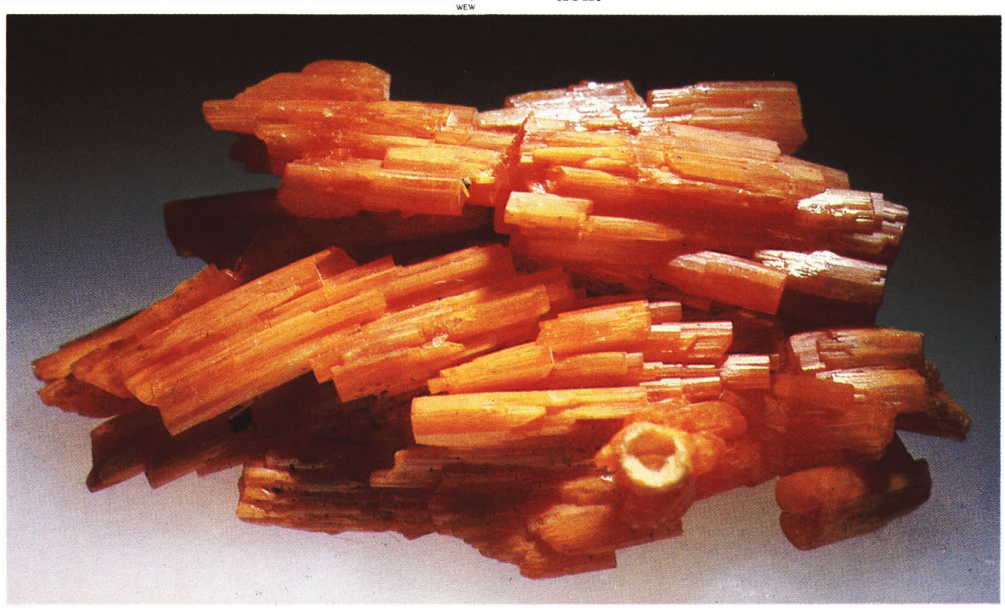


Figure 27. (right) **Vanadinite crystals in sub-parallel group 3.2 cm across, Jelks collection, Arizona-Sonora Desert Museum.**

Figure 28. (lower right) **Smithsonite ball 1.9 cm across on matrix; Jelks collection, Arizona-Sonora Desert Museum collection.**

Figure 29. (below) **Matlockite, one of the largest crystals known, 3.5 cm across; Arizona-Sonora Desert Museum collection.**

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