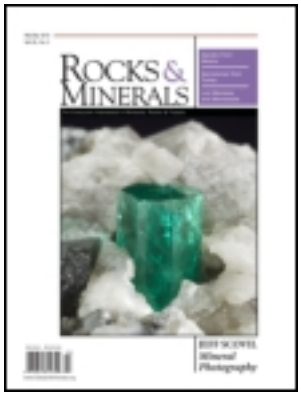

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Connoisseur'S Choice: Alabandite Uchucchacua Mine, Oyon Province Lima Department, Peru

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Alabandite

Uchucchacua Mine, Oyon Province
Lima Department, Peru

The Swedish chemist Carl Wilhelm Scheele (1742–86) has to be considered one of the preeminent scientists of his time. Scheele was on the forefront of chemical research doing experiments that led to the discovery of oxygen, molybdenum, tungsten, barium, and hydrogen; unfortunately, he is not credited with the discoveries. In the case of oxygen, he made the discovery three years before Joseph Priestly and Antoine Lavoisier, but he published his results after Priestly did. Scheele, working with the mineral pyrolusite, became the first to isolate a pungent, eye-watering gas that we know today as chlorine. Also, during his experiments with pyrolusite, he isolated a compound that he felt sure contained a new element, which eventually was named manganese (Strathern 2001; Stwertka 2002). Manganese is an important additive to steel, and manganese dioxide is a component of dry-cell batteries. Mineral collectors are most familiar with manganese oxides, such as manganite and pyrolusite; the carbonate rhodochrosite; and the silicate rhodonite, but manganese sulfides are decidedly rare. Of these, two may be familiar to collectors—one is hauerite from Sicily, which occurs in exceptional octahedral crystals. The second does not normally occur in exceptional crystals and until recently has usually not been represented in most mineral collections, and that is the mineral alabandite.

Alabandite is manganese sulfide with the chemical formula $Mn^{2+}S$. The mineral may have a significant amount of iron, as is true for specimens from Finland that contain about 7 percent Fe (Ramdohr 1969; Törnroos 1982). It is a member of the galena group, which includes the equally rare niningerite, a magnesium iron manganese sulfide, to date found only in meteorites. Crystallizing in the isometric (or cubic) system, alabandite crystals occur as cubes or octahedra with symmetry $4/m\bar{3}\ 2/m$. Crystals of alabandite generally do not reach enormous proportions, with microcrystals being the rule. The mineral also may occur as twinned crystals, typically as spinel-law twins. Alabandite possesses perfect cleavage on {001} and is brittle with an uneven fracture. Its hardness is 3.5–4, and it has a density of 3.95–4.04. Normally opaque, alabandite is translucent in very thin slivers. Typical of most sulfide-sulfosalt minerals, alabandite's color is black tarnishing to brown; it has a green streak and a submetallic luster (Anthony et al. 1990; Palache, Berman, and Frondel 1944).

For those interested in the etymology of mineral names, the origin of the name *alabandite* has been cast in doubt. It was alleged to have been named by Müller von Reichenstein in 1784, as cited in Beudant's 1832 edition of *Traité Élémentaire de Minéralogie* (Blackburn and Dennen 1997), with the type locality given as the ruins of Alabanda in Asia Minor, now Turkey. In fact, most mineral references list this as the type locality and as the origin of the name, most notably Anthony et al. (1990). However, the type locality is now in dispute, and Nagyág (now Săcărâmb), Transylvania, Romania, is currently considered to be the type locality (Szakáll 2002). Intrigued by this I went to Clark (1993) and found that the Romanian locality is the type locality, but the name appears to be a mix-up with the garnet name almandine. In the mat-

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Figure 1. **Spinel-twinned alabandite with rhodochrosite from the Uchucchacua mine, Oyon Province, Lima Department, Peru; the largest individual twin is 4 cm long. Arkenstone specimen, Joe Budd photo.**

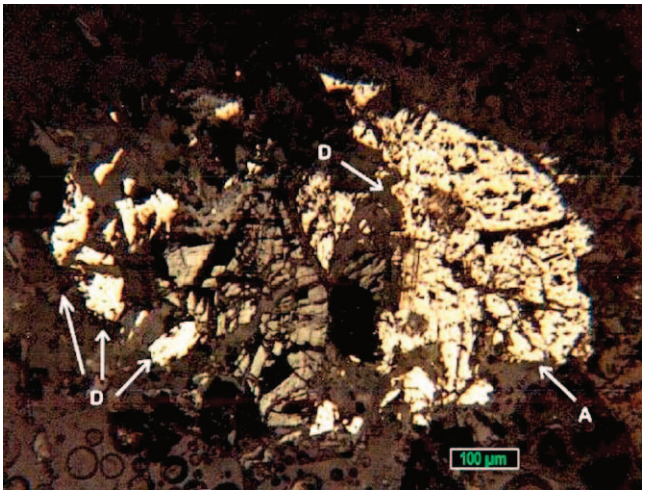

Figure 2. **Thin section taken from the Norton County, Kansas, meteorite showing alabandite (A) associated with daubreeite (D). The Norton County meteorite is an example of an achondrite meteorite known as an aubrite. Excalibur Mineral Corporation specimen, Jeffrey Weissman photo.**

ter of the type locality, I personally favor the tactful approach of Back and Mandarino (2008)—"type locality unknown."

Alabandite normally occurs in epithermal vein deposits, which are defined by Guilbert and Parks (1986) as low-temperature, shallowly emplaced deposits that result from volcanic-related hydrothermal activity. Commonly associated minerals include acanthite, sphalerite, pyrite, chalcopyrite, galena, rhodochrosite, rhodonite, calcite, and quartz. Alabandite also occurs as a rare constituent of meteorites, particularly some enstatite chondrites and in some achondrite meteorites known as aubrites (Emma Bullock, pers. comm., 2011). The species is not noted for especially large or well-developed crystals, as has already been stated, with the normal run-of-the-mill alabandite specimens showing either massive or well-developed cleavages. So it was a surprise to collectors the world over to learn during the 2009 Tucson Gem and Mineral Show of the fantastic find of alabandites from the Uchucchacua mine.

In the United States the western states have provided the best examples, mainly as massive specimens of interest only to the most ardent of species collectors. However, there is one locality that has produced specimens of particular note, the Lucky Cuss mine, located near Tombstone, Cochise County, Arizona. Specimens measuring up to 3 cm have been recorded, such as the exquisite example illustrated here as figure 3, which is currently on display in the Natural History Museum of Los Angeles County. For the micromount enthusiast the Sunnyside mine, in the Silverton district of San Juan County, Colorado, has produced specimens containing microscopic grains associated with the rare manganese silicates friedelite and alleghanyite (Eckel 1997). South

Figure 3 (bottom left). **Alabandite from the Lucky Cuss mine, Tombstone, Cochise County, Arizona; main crystal is 3.5 cm across. This specimen is on display at the Natural History Museum of Los Angeles County; Anthony Kampf photo.**

Figure 4 (right). **Arborescent habit of alabandite from the 18th level of the Zinc Corporation mine, Broken Hill, New South Wales, Australia; specimen is 13.5 cm long. Arkenstone specimen (ex-Ed David collection), Joe Budd photo.**

Figure 5 (left). **Alabandite with rhodochrosite from the Uchucchacua mine, Oyon Province, Lima Department, Peru; specimen is 6.2 cm high. Luis Miguel Fernandez Burillo specimen, Jeff Scovil photo.**

Figure 6 (above). **Alabandite specimen, composed of single crystals and spinel twins, from the Uchucchacua mine, Oyon Province, Lima Department, Peru; specimen is 10.1 cm long. William Pinch specimen, Jeff Scovil photo.**

of the border, in Mexico, Cerro Tlachiaque and La Ilucha, both in the state of Puebla, have produced large cleavage examples. The specimens in the Smithsonian collection from La Ilucha reach up to 12 cm in length and are associated with minor amounts of calcite.

Before the fabulous Peruvian find, arguably the best specimens of alabandite that are familiar to most collectors are those from Broken Hill, New South Wales, Australia. The Broken Hill alabandite was first found in 1965 on the 18th level of the Zinc Corporation (ZC) mine and between the 19th and 20th levels of the North Broken Hill Consolidated (NBHC) mine. The 17th level of the NBHC mine has also provided specimens to the collector market. Alabandite occurred as patches to 20 cm across scattered randomly in cavities along a fracture through the orebody. The Broken Hill specimens occur in a stalactitic, plumose, or arborescent habit, all of which are a dark brown color due to a surface alteration of hausmannite. Associated minerals include calcite, barite, pyrite, chabazite, and pale yellow sulfur (Birch 1999).

Specimens with crystals averaging 1 cm on edge have been reported from the mines in the area of Săcărâmb, Hunedoara County, Romania (Szakáll 2002). In the Smithsonian collection is a specimen from this locality that formerly was part of the Gustav Seligman collection, later incorporated into the Carl Bosch collection. This particular specimen is approximately 6.5 cm long and is composed of single crystals and spinel twins of alabandite to 1.7 cm on edge. It is illustrated in Reinhard Brauns' classic introductory text *Das Mineralreich (The Mineral Kingdom)*, on plate 35, figure 3. (A brief aside here concerning Bosch labels for those collectors who possess a specimen from this collection: In the main the labels are done on a manila-like paper and are hand-written, some legibly and some barely so. However, there are others that have a rectangular, gold-lettered, black leatherette label that is 5.6 × 1.75 cm. Specimens bearing these labels were Bosch's display specimens, and he considered them to be the best examples of the species that he owned. Collectors with specimens having these labels have very special specimens indeed. This particular alabandite specimen has one of these leatherette labels in its tray, affirming that it was one of the best specimens available at the time.)

The Vysokogornoe manganese deposit in the Saha (also written as Yakutia) Republic, Eastern Siberia Region, Russia, has produced some rather large examples of alabandite for collectors. These specimens are mainly excellent cleavage specimens coming from veins up to 2 meters thick. Specimens from here appeared on the market a few years ago. One of these in the Smithsonian collection is approximately 9 cm long, but this is by no means the largest that was available. Crystals from this locality are rare and when found are only up to 1 cm on edge.

The Uchucchacua mine, Oyon Province, Lima Department, Peru, is famous among collectors for very fine specimens of silver and rhodochrosite. The mining district has been known since 1897, but mining on a major scale did not begin until 1960. The Uchucchacua district is the largest primary silver producer in South America (Petersen et al. 2004). The mine is noted for its diverse mineralogy, having an abundance of manganese and silver minerals, and it is the type locality for the rare minerals benavidesite [$Pb_4(Mn, Fe)Sb_6S_{14}$] and uchucchacuaite [$AgPb_3MnSb_5S_{12}$]. Alabandite is listed as common in the Uchucchacua mine by Crowley, Currier, and Szenics (1997), and Petersen et al. (2004) list the mineral as occurring in two out of four recognized stages of mineralization. Incredible groups of single octahedral crystals, as well as some fantastic examples of spinel twins, were

found in 2008, with even higher quality specimens coming out in 2009 and 2010. The average size of the crystals is 2 cm on edge; the largest of these specimens is an octahedron measuring 4 cm on edge! The alabandite that occurs is intimately associated with fluorite, proustite, rhodochrosite, and a new silver-manganese sulfide (Hyršl et al. 2010). An interesting story of this new mineral was related to me by William Pinch, who happened to be among the first people to recognize one of the associated minerals as a new species. During the 2010 Tucson Gem and Mineral Show Pinch looked at at least two hundred specimens of alabandite, seeking any that contained this new mineral. The result of this search was disappointing; no specimens of the new species were found. After making inquiries, Pinch eventually learned that all of the specimens since the original 2008 find were cleaned with an air-abrasive device. Although the cleaning makes for a lustrous alabandite specimen, it also removes the new mineral as well as a secondary growth of alabandite microcrystals (Pinch, pers. comm., 2011). The Uchucchacua alabandite specimens are found in the silver stage of mineralization, the same stage that also provides fine specimens of silver, acanthite, pyrargyrite-proustite, polybasite, pyrite, calcite, kutnahorite, benavidesite, and uchucchacuaite (Petersen et al. 2004).

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Finally, I would like everyone reading this to join me in thanking Dr. Robert Cook for writing this column for the past eighteen years. In that time he has covered the gamut of collectible minerals from proustite to emerald and has made the Connoisseur's Choice column one of the most popular in the history of *Rocks & Minerals* magazine. He has left a large pair of well-worn shoes to fill, and I thank him for believing that I can fill them.

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Rhodocrosite - Colorado 9 cm wide Photo by Jeff Scovil

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