September 1999 Mineral of the Month: Atacamite

Atacamite is a rare mineral that forms as small, gorgeous crystals, almost exclusively in arid climates. How can something so beautiful be so unknown?

PHYSICAL PROPERTIES

Chemistry: $Cu^{2+}_2(OH)_3Cl$ Copper Hydroxyl Chloride
Class: Halides Dana's: Oxyhalides and Hydroxyhalides
Crystal System: Orthorhombic
Crystal Habits: Commonly in slender prismatic crystals with vertical striations; also tabular; fibrous; granular
Color: Bright green, dark emerald green, and blackish green
Luster: Adamantine to vitreous
Transparency: Transparent to translucent
Streak: Apple green
Refractive Index: 1.831-1.880
Cleavage: Perfect in one direction
Fracture: Conchoidal
Hardness: 3-3.5
Specific Gravity: 3.77
Luminescence: None
Distinctive Features and Tests: Easily soluble in acids; easily fusible
Dana Classification Number: 10.1.1.1

NAME

Pronounced at-ă-cam′-īt, or rarely, ă-tac′-ă-mīt, the name was given in 1801 for the Atacama Desert (pronounced at-ă-cam′-ă) in Chile, where it was found originally, as sand-like grains. In fact, in days of yore when our ancestors wrote with quill pens and ink, before the use of blotting paper became common, every desk had its own little sandbox filled with a fine powdered black sand called "writing sand," which was sprinkled onto the paper to speed ink drying. The best "writing sand" came from Chile, and was composed of, as you have no doubt guessed, ground atacamite crystals.

COMPOSITION

This month's mineral is our third featured mineral of the halides class, which includes more than 85 species, though atacamite is much rarer than those we previously featured, fluorite and halite. Their unifying feature is the presence of one of the halogen elements, namely, fluorine, chlorine, bromine, iodine, and astatine. These five elements make up Group VII of the Periodic Table. Fluorine and chlorine occur naturally as gases, bromine as a liquid, iodine as a solid, and astatine as a solid, though it is not a natural element but is made by bombarding bismuth with high energy alpha particles [helium ions]. They are called halogens due to their tendency to form salts, as we discussed in detail last month. All the halogens are very poisonous; fluorine gas claimed the life of Baron Thenard, as well as other seekers of its secrets!

Atacamite is, by weight, about 59.51% copper, 22.47% oxygen, 1.42% hydrogen, and 16.60% chlorine. Though it contains the constituents of water, it forms almost exclusively in arid climates. Three polymorphs of atacamite are known: paratacamite, which crystallizes in the hexagonal-rhombohedral

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subdivision system; botallackite, which is monoclinic; and clinoatacamite, also monoclinic, which was accepted as a new mineral in 1996. The rare mineral hibbingite [y-$Fe^{2+}_2(OH)_3Cl$] is isostructural with atacamite.

COLLECTING LOCALITIES

Atacamite is a rare mineral that forms mainly in the oxidized zone of copper deposits, usually in arid regions, and often as malachite pseudomorphs after atacamite (See the February 1998 write-up on goethite for information on pseudomorphs.) Minute crystals of atacamite suitable only for micromounting have been found in the U.S. in Arizona at Bisbee and at Jerome; at Tintic, Utah; and at the Majuba Hill Mine, where our January 1999 olivenites were collected; and in the Silverton District, Colorado, and the Portales Mine, Socorro County, New Mexico. In Mexico, it is found at Boleo, near Santa Rosalia, Baja California Sur, where the very rare and valuable boleite crystals were found. At Mount Vesuvius, Italy, it is found in fumaroles. Exceptional crystal clusters come from the New Cornwall Mine, near Kedina, New South Wales, and other localities in Australia. We rarely see atacamite specimens offered for sale from any of these localities.

At least five mines in Chile have produced wonderful specimens like ours: the famous, minerally diverse Mina Chuquicamata; Mina Quetena, near Antofagasta; Mina Herminia, Sierra Gorda; and Mina Abundanca and Mina La Farola, both in the Copiapó Department, about 500 miles north of Santiago, the capital of Chile. All are copper mines in the northern part of Chile, a vast area known as the Atacama Desert, the most arid region of the world. This great desert covers about 140,000 square miles of northern Chile, with the Andes Mountains to the east and low coastal mountains and the Pacific ocean to the west.
Llamas, vicunas, alpacas, and flamingos make a life on the sparse vegetation amid breathtaking salt flats, geysers, and volcanoes. Temperatures are relatively cool, averaging about 65°, due to the high elevation, about 2000 feet.

JEWELRY & DECORATIVE USES, HISTORY & LORE, TECHNOLOGICAL USES

Although we have seen photos of stunning, transparent, gemmy atacamite, the crystals were micromounts, far too small for gemstone use. However, if crystals large enough are ever found, cut atacamite gemstones, though very low on the hardness scale, would be exceptionally brilliant and beautiful! Crystal healers believe that atacamite is beneficial for treating problems of the nervous system and the reproductive system, and against venereal diseases, and thyroid problems. Atacamite is an important ore of copper in Chile, and as such, has a number of uses essential to our modern life. See the 1998 September write-up on native copper under *Technological Uses* for more information on the importance of copper from mankind's beginning right up to our advanced technological society.

ABOUT OUR SPECIMENS

Like last month's thenardite, atacamite crystallizes in the orthorhombic crystal system. Unlike thenardite, it tends to form prismatic rather than pyramidal crystals, meaning that its crystals tend to be elongated, rather like a four-sided needle. Atacamite may also form tabular crystals, a term used when one crystal dimension is much smaller than the other two. A household example of this would be a table, the root word for tabular, which is usually quite long and wide, but only an inch or two thick. Such tabular atacamite crystals are more common from the Australian localities.

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Our specimens are aggregates of prisms of brilliant green, especially when seen up close in bright light. Terminations are present on many crystals, but are difficult to view because of their size. Striations are also clearly visible on larger crystals. No testing has been done to determine the composition of the dense, heavy matrix.

If you can find a detailed map of Chile, you may find the city of Copiapó in the southern portion of the Atacama. Mina La Farola, (the Farola Mine), is the name of the mining complex where our specimens were unearthed, and is located near the city of Tierra Amarilla (meaning yellow earth), about eight miles east of Copiapó. This mining town exists only because of the still-productive copper mines in the area, and is on an important route to the copper and gold mines in the Andes Mountains to the east.

The name “La Farola” is evidently Spanish for “lighthouse” and refers to the prominent position of the mountain, which is dotted with adits dug in search of copper ore. Though now abandoned, it produced much copper in its day. Only intrepid (some might say, foolhardy) collectors search through its dangerous recesses for rich green crystals of atacamite, which formed in fractures in the rock, some wafer thin, some as big as a table. The arid conditions and the presence of chlorine in the rock are perhaps what made possible the formation of these rare crystals.

Many of our specimens have powdery mineral coatings in shades of blue-green, green and white. Judging by color alone, as we know of no testing done so far, we are probably seeing chrysocolla (our April 1999 featured mineral), malachite, and perhaps olivenite (our January 1999 featured mineral). The white coating may be a clay mineral called halloysite [$Al_2Si_2O_5(OH)_4$]. Though lovely specimens of atacamite have been intermittently coming out from La Farola since the 1970's, crystals larger than ours have never been found there, and would be of tremendous value if they ever are.

Dana’s New Mineralogy states that atacamite is one of the corrosion products common on the Statue of Liberty. Miss Liberty, or “Liberty Enlightening the World” as she was originally known, is one of the largest statues in the world, standing 306 feet high (including her pedestal) and weighing in at 254 metric tons. She was presented to the United States by France to mark the centennial of the American Revolution (1776), and was dedicated in 1886 by President Grover Cleveland.

In 1924, the statute, along with Liberty Island on which she rests, and nearby Ellis Island, through which some 20 million immigrants are estimated to have passed on their way to becoming American citizens, were declared a national monument. In the mid 1980's, in anticipation of her centennial, a major restoration of Miss Liberty was undertaken. Her massive armature, made of iron that had rusted, was replaced with stainless steel. Yet her copper “skin” had remained intact through a near-century of rain, sun, and wind! Only her torch had to be replaced, with one made of gilded copper. Her “skin” had oxidized to a depth of just .005" in one century’s time, testifying to the durability of copper. What portion of her “skin” had altered to atacamite as compared to other copper minerals is not known.

Opportunities to add such a fascinating and vividly colored specimen from this foreboding region of South America are few and far between, so we are pleased to have taken advantage of such. And knowing that the same mineral has formed on parts of the Statue of Liberty makes it even more special!

References: Mineralogy, John Sinkankas, Van Nostrand Reinhold Company; Dana’s New Mineralogy, Richard V. Gaines, et al, John Wiley & Sons, Inc.; Fleischer’s 1999 Glossary of Mineral Species, Joseph A. Mandarino, The Mineralogical Record, Inc.; Manual of Mineralogy, 21st Edition, Cornelia Klein & Cornelius S. Hurlbut, Jr., John Wiley & Sons; What’s New in Minerals-- Munich 1977, Bob Sullivan, Mineralogical Record, May-June 1978; Atacamite, Gems & Minerals, September 1962; www.copper.org/general/g_endur.htm; Encarta, Microsoft & Funk & Wagnalls

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