October 1999 Mineral of the Month: Creedite

"Creedite is one of those inexplicable minerals, first found late in mineralogical history, and then suddenly seeming to turn up in a dozen different places." -- Frederick H. Pough, Ph.D.

PHYSICAL PROPERTIES

Chemistry: $Ca_3Al_2(SO_4)(F,OH)_{10}\cdot 2H_2O$ Calcite Aluminum Sulfate Fluoride Hydroxide Hydrate
Class: Halides Dana's: Compound Halides
Crystal System: Monoclinic
Crystal Habits: Crystals short prismatic to acicular, commonly in radiating aggregates or drusy masses
Color: Colorless to white, pink, purple
Luster: Vitreous
Transparency: Transparent to translucent
Streak: White
Refractive Index: 1.46-1.48
Cleavage: Perfect in one direction
Fracture: Conchoidal; brittle
Hardness: 4
Specific Gravity: 2.71-2.73
Luminescence: None
Distinctive Features and Tests: Slowly soluble in acids
Dana Classification Number: 12.1.4.1

NAME

This month's mineral, pronounced crē′-dīt, was discovered earlier this century in the Creede mining district of Mineral County, Colorado, and was given its appropriate name in 1916.

COMPOSITION

Creedite is the fourth member of the halides class of minerals we have featured (see last month's atacamite write-up under Composition for more on this class.) It is considered a chemical anomaly because it contains both a halide element (fluorine) and a radical (sulfate.) Only eight very rare minerals have a similar chemistry: stenonite, grandreefite, pseudograndreefite, chukhrovite-(Y), chukhrovite-(Ce), boggildite, barstowite, and arzrunite.

COLLECTING LOCALITIES, HISTORY & LORE

Creedite's history is in the making! Each new find adds to our limited understanding of this rare newcomer. When it was discovered at the Wagon Wheel Gap in the Creede district in Colorado earlier this century, only microcrystals were found, with fluorite [CaF_2], barite [$BaSO_4$], and the chemically similar gearksutite [$CaAl(F,OH)_5\cdot H_2O$] embedded in halloysite [$Al_2Si_2O_5(OH)_4$], a clay mineral, in the upper oxidized portion of a small fluorite-barite vein. When we compare creedite's chemical formula [$Ca_3Al_2(SO_4)$] with these four, we notice the presence of similar elements. From this find and another at Granite, Nye County, Nevada, where creedite was found in quartz fluorite veins, mineralogists might have believed creedite would only be found as microcrystals in similar environments. No doubt collectors of rare minerals paid big bucks for those rare microcrystals!

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This understanding remained until the early 1970's and perhaps is the reason creedite is not mentioned in important mineral books like John Sinkankas' *Mineralogy* or the *Dana's Manual of Mineralogy* series. In 1975, the *Mineralogical Record* reported six known localities for creedite: the above two plus the Colquiri Mine, La Paz Department, Bolivia, where exceptional crystals up to one inch had been found in a tin-zinc ore body in 1949; Darwin, Inyo County, California; Kazakhstan (formerly U.S.S.R); and Santa Eulalia, Chihuahua, Mexico.

A milestone in the history of creedite is highlighted by Bob Jones in the March 1970 *Rocks and Minerals* magazine, where he reported an exceptional find of creedite at Santa Eulalia, Chihuahua, Mexico. In a limestone replacement lead-zinc-silver ore body were found crystals up to one inch in length, most colorless, some tinted lavender to violet! The 1981 *Mineralogical Record* called subsequent finds at Santa Eulalia "easily the largest and best ever found." In the 1980's equally gorgeous violet colored creedite crystals were dug at the Aktschatau Tungsten Mine, central Kazakhstan, then in the U.S.S.R.

It was now becoming apparent that larger creedite crystals were most likely to be found in hydrothermal veins, the type of environment our specimens formed in. (See *About Our Specimens*.) The earliest reference to our creedite from Mina Navidad is the 1989 *Mineralogical Record*, where two specimens 5 x 7 cm and 4 x 4 cm seen at a mineral show in Germany were offered for $275 and $140, respectively. "Not too pricey" said the magazine. Our specimens made "What's New in Minerals" three more times, in 1990, 1997, and 1999, showing the obvious delight serious collectors have in these wonderful specimens! (In these references, the locality is given as Mina Navidad, Rodeo, Durango, Mexico, while ours are labeled as Mina Navidad, Abasalo, Durango, Mexico. Abasalo is the nearest city to Mina Navidad, about 14 miles away, while Rodeo, though a larger city, is about 40 miles away. Either locality is accurate.)

Among those who believe in the healing properties of crystals, creedite is proposed as an aid in mending broken bones and torn muscles, assimilating vitamins A, E, & B, cleansing the liver and regulating the heartbeat, and providing a driving force toward goals and promoting insight into overcoming obstacles.

TECHNOLOGICAL USES

Mina Navidad is currently being worked for its massive fluorite deposits, which are milled right on the site into acid-grade fluorite for use in the manufacture of hydrofluoric acid. Tons of fluorite are mined and processed there every day! Though extremely toxic and highly dangerous, hydrofluoric acid (HF or H_2F_2) is in constant demand for the fabrication of electronic components, the manufacture of semiconductors, for digesting minerals, in metal pickling, and as a fluorination agent and chemical reagent. Because it will easily dissolve glass, and attacks glazes, enamels, pottery, concrete, rubber, and leather, it is used to etch designs on glassware, ceramics, and the like, such as the marking of divisions on a thermometer tube. Lead and platinum containers are often used to store this highly hazardous chemical.

Those who work with hydrofluoric acid must be extremely careful or pay a heavy price. Skin, eye, or lung exposure to solutions with a greater than 50% HF concentration causes immediate, severe, penetrating, excruciatingly painful burns. HF immediately eats through skin and tendons, and upon reaching a bone, reacts with the calcium to form calcium fluoride (fluorite), killing the bone marrow in the process. This happened to a laboratory technician processing mineral samples who spilled about 100 millilters of hydrofluoric acid onto his thighs. Although the wound was immediately flushed with water and he was hospitalized, he still received 10% body burns. The following week, his leg had to be amputated due to bone damage, and he finally died fifteen days after the accident from HF poisoning. In New York City,

someone illegally placed a plastic container containing 70% hydrofluoric acid in a trash receptacle. The container burst when compacted in a sanitation truck, spraying acid onto a sanitation worker, who subsequently died of lung damage caused by inhalation of HF fumes. A second worker was hospitalized after coming to his aid. These tragedies illustrate the dark side of the deadly element fluorine (see the July 1996 Fluorite write-up under *Technological Uses* for its more beneficent uses.)

JEWELRY & DECORATIVE USES

Creedite gemstones are occasionally cut, although we have never seen any offered for sale. Colorless or violet colored creedite crystals would make lovely gems, but its low hardness and refractive index, combined with the usual small size of the crystals, make creedite an impractical choice for anyone but the collector of rare gemstones.

ABOUT OUR SPECIMENS

No doubt you were impressed with the beauty of your specimen soon as you laid eyes on it. Its rarity and attractiveness equals high value in the eyes of collectors. Most of the individual crystals on our specimens are tinted orange or brown by clay inclusions or black by manganese oxide inclusions drawn into the crystals as they formed. Upon examination with a 10x lens, you may see that some included crystals have clear zones and colored zones. And some specimens do have some colorless crystals. If you're lucky, you might find a few small pale green or purple fluorite crystals on your piece! These crystals fluoresce purple in short wave ultraviolet light, which has no effect on creedite.

According to one digger who has collected at Mina Navidad, the source of our specimens is a large vein of green fluorite with occasional minor creedite that runs through rhyolite prevalent in the area. This fluorite vein is at least three miles long, and ranges from eighteen inches to more than seven feet in thickness. The green fluorite is massive and therefore not desirable as specimens, though some of it is sold as cutting rough, while most is milled as previously mentioned. Evidently, high temperature fluorine-bearing solutions interacted with the elements present in the host rhyolite to cause the formation of the fluorite and creedite. No serious investigation of the geology of the mine has been done yet.

Many small fluorite veins intersect this large one, and purple fluorite is sometimes recovered from these. The collector was amazed to find, on one of his first trips to Mina Navidad some years ago, some beautiful pieces of pink fluorite casually laid out on the ground! He frantically searched in the mine for more, without success. Much later, while examining part of a vein exposed by a bulldozer cut, he found more pink fluorite, and realized what was happening-- exposure to sunlight was turning the purple fluorite pink! He immediately collected all the purple he could, brought it to his shop, and set it out on the roof. After about three months of blazing summer sun, he had pink fluorite, a formula he has been following to this day!

The Mineralogical Record describes these specimens as "spheres of divergent, well individualized spiky prisms . . . The luster is high and the overall aspect of the bristling, glittering specimens is extremely attractive." We couldn't agree more, and look forward to, in the decades to come, learning more about this little known rarity of the Mineral Kingdom!

References: 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.; Mineral Notes: Creedite, Frederick H. Pough, Ph.D., Lapidary Journal, June 1990; The Contact Zone, Robert W. Jones, Rocks and Minerals, March 1970; Various Authors, What's New in Minerals, Mineralogical Record, Jan-Feb 1999, Nov-Dec 1997, Sept-Oct 1990, July-August 1989, Nove-Dec 1981

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