April 2002 Mineral of the Month: Eudialyte

"If there is eudialyte– it is interesting!"– Professor Alexander Petrovich Khomyakov (1933-), Institute of Mineralogy, Geochemistry, and Crystal Chemistry of Rare Elements, Moscow, Russia

PHYSICAL PROPERTIES

Chemistry: $Na_{15}Ca_6(Fe^{2+},Mn^{2+})_3Zr_3(S,Nb)(Si_{25}O_{73})(O,OH,H_2O)_3(Cl,OH)_2$
Complex Sodium Calcium Zirconium Silicate
Class: Silicates Subclass: Cyclosilicates
Dana: Rings with Other Anions and Insular Silicate Groups
Crystal System: Trigonal (Hexagonal-Rhombohedral)
Crystal Habits: Usually as granular masses. Crystals rare, usually rhombohedral, short prismatic, pseudo-octahedral, or equant
Color: Carmine-red, orange-red, orange, pink, cherry-red, brownish red, yellowish brown, brown, yellow, violet, or green (The color seems to be controlled by the amount of iron and manganese present)
Luster: Vitreous to greasy
Transparency: Transparent to translucent
Streak: White to pale pink
Refractive Index: 1.606-1.613
Cleavage: Distinct in one direction
Fracture: Uneven to conchoidal; brittle
Hardness: 5-6
Specific Gravity: 2.70-3.10
Luminescence: Sometimes luminesces orange-red. Weakly electromagnetic
Distinctive Features and Tests: Color and mode of occurrence; gelatinizes with acids
Dana Classification Number: 64.1.1.1

NAME

The name, pronounced u-DIE-uh-lite, was given in 1801 for the new mineral discovered in Greenland, described by German chemist and mineralogist Friedrich Stromeyer (1776-1835), discoverer of the element cadmium. He shared specimens from his notable mineral collection with Abbé René Just Haüy (1743-1822), the founder of mathematical crystallography. Later, Stromeyer's collection was acquired by the University of Göttingen, Germany.

Stromeyer gave the name eudialyte from the Greek words *eu*, "well," and *dialytos*, "dissolve," in allusion to its easy reaction with acids. Varieties include eucolite, an optically negative kind with a high content of heavy multivalent cations, and barsanovite, a piezoelectric form of eucolite.

COMPOSITION

Understanding of the chemical composition and crystal structure of eudialyte is ongoing, so much so that if we featured it again in thirty years much more would be known! Eudialyte from different localities has somewhat different chemical compositions, showing that its crystal structure allows for a wide variety of elements to fit. Of course, the different elements cause slight changes in the color and optical properties. For example, the chemical formula listed above is the officially accepted one, but other sources give different formula containing rare earth elements (REE) such as cerium and yttrium as part of the formula.

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Dana's New Mineralogy gives this formula to fully reflect its atomic structure, where the symbol □ is used to indicate a vacancy or void in the crystal structure where ions with different charges may fit:

$Ca_6Zr_3(\square,Fe)_3Si_{24}(Si,\square_3)(Ti,\square)(Nb,Al,\square)(Fe,Mn,\square)_3(Na,K,Sr,REE,Mg)_3(\square,Sr,Mg)_3(Na,\square)_{36}O_{69}/(O,\square)_6(OH,\square)_6(Cl,\square)_2$

It may be that several eudialyte varieties will prove to be separate minerals, perhaps forming part of a eudialyte group of minerals. In fact, this seems to be what is happening now. Although no such eudialyte group has been officially accepted by the IMA (International Mineralogical Association), a group is being proposed by the authors of *Dana's New Mineralogy* and by the updaters of the Strunz classification. (See box.)

> Dana and Strunz are the two systems used to classify minerals according to their chemical compositions. The Dana system is based on the classifications used by James Dwight Dana (1813-1895), professor of natural history, geology, and mineralogy, at Yale University. He published his *Manual of Mineralogy* in 1848, with his mineral classification system. The Dana's New Mineralogy, published in 1997, is the eighth edition of his system of mineralogy. The Strunz system is based on the *Mineralogische Tabellen*, written by professor Hugo Strunz in 1941, and is now available in its ninth updated edition. We mainly use Dana's system in our write-ups, but many prefer the Strunz classification, and both are valued by mineralogists today.

In the *New Dana's*, the mineral alluaivite [$Na_{19}(Ca,Mn^{2+})_6(Ti,Nb)_3Si_{26}O_{74}Cl \bullet 2H_2O$, accepted as a new mineral in 1990] has been placed in a group with eudialyte. This grouping indicates it has the same basic atomic structure as eudialyte. The latest Strunz update states it forms a series with eudialyte. (Not surprisingly, it occurs closely intergrown with eudialyte in the Lovozero Massif of the Kola Peninsula.) According to internet updates to the Dana system, several recently discovered minerals may also belong to the eudialyte group, including kentbrooksite [$(Na,REE)_{15}(Ca,REE)_6Mn^{2+}Zr_3NbSi_{25}O_{74}F_2 \bullet 2H_2O$], and oneillite [$Na_{15}Ca_3Mn_3Fe2+_3 Zr_3Nb(Si_{25}O_{73})(O,OH,H_2O)_3(OH,Cl)_2$ along with two newly accepted minerals, khomyakovite (named for the author of our opening quote) and manganokhomyakovite, and four others minerals that have yet to be named! So an update on the evolution of the eudialyte group may certainly be in order!

COLLECTING LOCALITIES

Eudialyte commonly forms in alkaline igneous rocks and associated pegmatite, such as nepheline syenite and syenite pegmatite. The term **nepheline syenite** describes a medium to coarse-grained, light- to medium-gray, igneous rock composed mainly of alkali feldspar and the mineral nepheline [$(Na,K)AlSiO_4$], with little or no quartz content. (The alkali feldspars are sodium-rich or potassium-rich aluminosilicates, including microcline [$KAlSi_3O_8$], orthoclase [$KAlSi_3O_8$], albite [$NaAlSi_3O_8$], anothoclase [$(Na,K)AlSi_3O_8$], and sanidine, a K-Na feldspar with a disordered Al-Si arrangement.) Nepheline syenites also commonly contain other minerals rich in sodium and/or potassium, iron, and magnesium, such as minerals of the amphibole group (such as hornblende) and the pyroxene group (such as aegerine.) In such an environment, eudialyte may crystallize directly from magma at about 720°. Over the course of eons of time, eudialyte can alter to catapleiite, zircon, feldspar, acmite, analcime, clays, and other minerals. Additionally, eudialyte occasionally is found in silica-saturated rocks.

Rare and fascinating minerals, including eudialyte, are frequently found in such an environment, which is why Professor Khomyakov said "If there is eudialyte– it is interesting!" Eudialyte is found in places that belong on the honor roll of worldwide collecting localities. These include Magnet Cove, Arkansas, famous for magnetic minerals and titanium-containing minerals such as rutile and brookite; Mont Saint-Hilaire, Quebec, Canada, where nearly 300 minerals have been unearthed, including thirty or so new ones, with new ones still being discovered; Langesundfjord, southern Norway; the Kangerdluarssuk intrusion, Greenland, where eudialyte was first discovered 200 years ago; and on the Kola Peninsula, Russia, particularly the Khibiny and Lovozero massifs, and on the Kovdor Massif, where green eudialyte crystals are found. (See the July 2001 Astrophyllite write-up for more on the Kola Peninsula. Astrophyllite is also found at Magnet Cove and Mont Saint-Hilaire.) Not surprisingly, several of the new potential eudialyte group members were discovered at these same localities. Each of these localities is famous among serious collectors, and the subject of many magazine articles and books. We could even say each region has its own "fans," collectors who specialize in a suite of minerals from each particular locality.

Lesser known producers of nice eudialyte include localities in New Mexico, Montana, and Alaska; Labrador, Canada; Siberia, Russia; Madagascar, Tanzania, Australia, and Brazil. We will examine the Kipawa Complex, original home of our specimens, in *About Our Specimens*.

JEWELRY & DECORATIVE USES , TECHNOLOGICAL USES

As a gemstone, eudialyte has much going for it, especially its lovely color, and lack of easy cleavage. Its negatives are its brittle nature, but mainly the dearth of crystals large enough to be faceted, so that a faceted stone more than one or two carats is unheard of. Very small clear gemstones of rose-red hue have been cut from Mont Saint-Hilaire crystals, and occasionally from Kipawa material like ours. Cabochons are made from less translucent massive eudialyte from Kipawa, Magnet Cove, and Kola.

In 1994, an egg fashioned from purplish-red eudialyte with black prismatic crystals of riebeckite in fine-grained white albite was displayed at the Tucson Show, made from a new find on Prince of Wales Island, Alaska. This material was used in cabochons, eggs, and spheres, which is how most eudialyte we have seen, both from the Kipawa Complex and from the Kola Peninsula, is utilized, also as hearts, massage points, and freeform polished pieces. In Tucson this year, we saw an large box made from Kola Peninsula red eudilayte of breathtaking beauty!

No information was found as far as eudialyte being a source of any ores for technological applications.

HISTORY & LORE

Crystal power believers attribute to eudialyte the power to assist in the manifestation of unconditional spiritual love, to bring insight and confidence into being, to bring new forms of psychic energy to people, and to bring a sense of joy and awakening.

ABOUT OUR SPECIMENS

Our lovely specimens of eudialyte come from a locality on the Kipawa River, close to Sairs Lake, about twenty two miles east of the town of Kipawa, in Temiscamingue County, in the southwestern part of Quebec, Canada, about 250 miles west and slightly north of Montreal. This lush area, with over 750 lakes in about 2500 square kilometers, is known for its fishing and water sports. The area was originally inhabited by Algonquin Indians, and became a logging center in the 1800's. Now Kipawa is synonymous with hunting, fishing, scenic beauty, and clear blue waters.

The eudialyte occurs in a small part of what is called by geologists the Kipawa syenite gneiss complex. Geologists believe in the distant past a unique zone about 1500 meters long and less than five meters thick containing rare minerals was metamorphosed by the intrusion of alkaline igneous rocks along a syenite-marble contact. The tremendous heat and pressure melted the existing rocks and allowed the elements to recombine as various minerals and rocks. Since much sodium was present in the syenite, rare sodium-rich minerals such as eudialyte and vlasovite formed along with sodium-rich feldspar, while calcium-, fluorine-, and rare earth-containing minerals such as fluorite, mosandrite, britholite, and agrellite were also formed.

Several of these minerals can be found on our eudialyte pieces, as described here:

Richterite [$Na(CaNa)Mg_5(Si_8O_{22}(OH)_2$], a member of the amphibole mineral group, was found on quite a few pieces, as black prismatic crystals and clusters.

Agrellite [$NaCa_2Si_4O_{10}F$] is found in some pieces as shiny white crystals, some of which appear somewhat fibrous. The agrellite gives off a magenta color in shortwave ultraviolet light.

Mosandrite [$Na(NaCa)_2(Ca,Ce)_4(Ti,Nb,Zr)(Si_2O_7)_2(O,F)_5F_2$, not approved by the IMA] is found as tan to green colorled laths, meaning shaped like a small, thin plaster lath, tabular (rectangular) in shape.

Feldspar close to **albite** [$NaAlSi_3O_8$] in composition is founs in many pieces as white grains that give off the typical red color of feldspar under shortwave UV light.

Fluorite [CaF_2] in the form of purple masses was found on just a couple of our pieces.

Miserite [$K(Ca,Ce)_6Si_8O_{22}(OH,F)_2$] forms as brown grains, and **vlasovite** [$Na_2ZrSi_4O_{11}$] forms as veins, but we could not find either of these on our specimens.

Did you find some of these on your specimen? Virtually all the eudialyte in our pieces are in the form of minute crystal grains, that are far too small to develop any of the crystal faces we would all love to see. Occasionally, a small area will show a gemmier, more translucent red color, perhaps indicating a zone of purer composition or perhaps a small crystal, but still with no crystal faces apparent, or perhaps just a hint of one. These are the areas that could perhaps be faceted into a one or two carat gemstone. (We have seen photos of rare six-sided hexagonal eudialyte crystals from the Kola Peninsula, and you can be sure now we know they exist we will be checking with all our Russian sources to obtain one.) When polished, Kipawa eudialyte with its accessory minerals can be quite stunning, with the contrasting pink and red against black and white, and other colors. Many of our pieces are quite colorful under shortwave UL light, with the agrellite glowing light purplish-pink, the feldspar red, and occasionally some bright green can be seen, evidence of an activator present in minute quantities.

The vein containing eudialyte is just a small part of the whole Kipawa complex. Much has happened geologically to allow for the formation of many common and rare rocks and minerals. In addition to those mentioned above as being found particularly in the unique eudialyte-bearing zone, other minerals found at the complex include purple fluorite, amphibole minerals, diopside, magnetite, biotite, zircon, and the rare minerals gittinsite and hiortdahlite, among others. As mentioned, books could be written on the wondeful mineral treasures of localities like the Kipawa complex. Perhaps some of us might be able to arrange a visit while on a vacation to some of these famous localities. Then we'll experience the truth of the statement "If there is eudialyte– it is interesting!"

References: Mineralogy, 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.; Minerals, George Robinson, Ph.D., Simon & Schuster; Gem & Lapidary Materials, June Culp Zeitner, Geoscience Press; Khomyakovite and manganokhomyakovite . . ., Ole Johnson , et al, The Canadian Minerologist, Volume 37, pp. 0893-0899 (1999); Preliminary report on peralkaline silica-undersaturated rocks in the Kipawa syenite gnesii complex, western Quebec, K.L. Currie and John Gittins, Geological Survey of Canada Paper 93-1E, p. 197-205; Eudialyte from the kipawa Lake Area, Temiscaminque Co., Quebec, A.D. Edgar and C.E. Blackburn, Canadian Mineralogist, Vol. 14, pp. 554-559 (1972); webmineral.com; mindat.org

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