April 1998 Mineral of the Month: Charoite

It lay hidden from view in one of the most barren and least populated places on Earth, yet it may someday take its place alongside turquoise and lapis lazuli among mankind's most treasured stones. There remains much to learn about this one half billion year old "new" mineral and gemstone. Read on!

PHYSICAL PROPERTIES

Chemistry: $K(Ca,Na)_2Si_4O_{10}(OH,F)\cdot H_2O$ (?) (See info under Composition) Calcium Potassium Silicate
Class: Silicates
Subclass: Inosilicates
Dana's: Column or Tube Structures
Crystal System: Monoclinic
Crystal Habits: Charoite forms finely fibrous aggregates with vitreous luster; in aggregates with parallel fibrous structure, silky luster
Color: Lilac to violet, white, brown, and grey
Luster: Vitreous to silky in aggregates
Transparency: Transparent to translucent
Cleavage: Good cleavage in three directions
Fracture: Conchoidal
Hardness: 5-6
Specific Gravity: 2.54-2.58
Streak: Pale purple
Distinctive Features and Tests: Color and habit; Insoluble in common acids
Dana Classification Number: 70.1.2.3

NAME

The name, pronounced chär′-ō-īt, (as we jokingly tell people we meet at shows, it is pronounced like the name of the "cuchi-cuchi" girl with an "ite" on the end,) comes from the Russian root word "*chary*," which means "charms" or "magic," hence it means "charming" or "magical." To us, it sounds like Russians pronounce it "chair′-yō-ēt." Several older sources (older meaning from the late 70's and 80's) including the original article concerning charoite by its discoverer published in the International Geology Review, list the Chara River, about 70 kilometers from the charoite deposit, as the source of the name, but the Russian magazine "World of Stones" contradicts these.

COMPOSITION

The exact chemical composition and atomic structure of charoite are not yet known with certainty. The formula above is followed by a question mark in the Glossary of Mineral Species, indicating this uncertainty. Dana's New Mineralogy lists two other chemical formulae, listed here along with the official formula for comparison purposes:

$K_5Ca_8(Si_6O_{15})_2(Si_2O_7)Si_4O_9(OH)\cdot 3H_2O$ and
$(K,Na)_5(Ca,Ba,Sr)_8(Si_{12}O_{30})Si_6O_{16}(OH,F)\cdot nH_2O$
$K(Ca,Na)_2Si_4O_{10}(OH,F)\cdot H_2O$ (?)

Why such a discrepancy? Perhaps because the atomic structure of charoite allows for easy admittance of other elements in substitution, or perhaps, since charoite is a rock-forming mineral, sufficient

specimens of pure charoite have not yet been discovered to get consistent test results. This lack of certainty illustrates the fact that the study of minerals and rocks is a living science, especially regarding a new mineral like charoite. Time will tell, for example, whether barium, strontium, or fluorine are essential components of charoite, or just possible elements that can fit into its atomic structure as substitutes.

Charoite is quite likely polymorphous, with intimate intergrowth between the polymorphs, another fact needed to be cleared up by additional research. Perhaps charoite will prove to be a series of minerals and definitive end members found. We have much to learn about this gorgeous and fascinating mineral!

The conditions where charoite formed are geologically quite complex and unique, which may explain why charoite is only found there. There exist approximately 25 masses of charoite, each pit having its own Russian name, in a roughly six square mile area including the Ditmar and Davan rivers in an area known geologically as the Murun Alkaline Complex, or the Murun Massif.

This area contains many rock bodies of quite diverse composition along with much limestone. Factor in millions of year's worth of tectonic activity, intrusions of potassium feldspar-rich magma at various times, the effects of tremendous heat and pressure and other complex geological processes, and the stage is set for the formation of a plethora of common and rare minerals plus new ones, like charoite. Another key process in the formation of charoite is **metasomatism**. When additional elements have been introduced into rock by means of circulating mineral-rich fluids, it is said to have undergone metasomatism, and the altered rocks are called metasomatites. The new mineral charoite is the result of mesatomatism at Murun Massif. The conditions necessary for the formation of charoite is so complex that the Russian magazine "World of Stones" states "It is as if someone personally guided the formation of this mineral."

Research suggests that charoite has ionic exchange properties (see the May 1997 write-up on scolecite under Technological Uses for more info on this), which may lead to technological uses in the future.

COLLECTING LOCALITIES

Now let us add to the locality information mentioned above. To find the charoite locality on a detailed map of Russia, start by finding Lake Baikal, (also spelled Lake Baykal; most of the Russian names in this write-up have alternate spellings,) which sits north of Mongolia. From there, look to the northeast about 800 miles or so until you find the city of Olekminsk on the Lena River, at about 120° longitude and 60° latitude. If your map does not show Olekminsk, perhaps you can find the coordinates. If it does, it may also show the Chara (or Chary) River, to the south of Olekminsk. It is in this area southwest of Olekminsk in the bends of the Chara river that charoite came into existence.

This seems to be about as exact a locality as we are able to find; the area is just so sparsely populated and so poorly detailed on maps it seems to be near impossible to pin the location down further! It is the epitome of the expression "out in the middle of nowhere." To go to the charoite site, one must travel via helicopter or halftrack from Olekminsk. The Murun complex is along the border of southwestern Yakutia, also known as Republic of Sakha, in the enormous area of Russia known as Siberia. According to one Russian mineralogist, some charoite outcroppings are in Yakutia, while the rest are not, and the authorities have posted guards and built fences to keep people away from their charoite deposits. As you can imagine, considerable cost is involved in transporting charoite rough from the site, and this is another reason charoite usually sells at a premium price.

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JEWELRY & DECORATIVE USES

Charoite's potential in jewelry and decorative use is limited only by the imagination of designers and the supply of rough from Russia. Cabochons cut from charoite look gorgeous set both in sterling silver and gold, and are often sold by the carat. We have seen exquisite beads, spheres, eggs, cups, vases, decanters, plates, boxes, and other objects made from high quality charoite. For a time, we carried a choice Russian-made charoite desk set. We have seen custom-made intarsia boxes combining charoite with opal, malachite, lapis, rhodochrosite, and other highly decorative stones on display in museums and commanding prices in the $10,000+ range at shows. Noted mineral writer and collector Bob Jones, who has toured Russia and viewed the magnificent fireplaces, columns, urns, and other objects made from Russian malachite, lapis lazuli, and other gemstones remarked, "Imagine what the czars would have done with it had charoite been discovered in their day!" We certainly can!

If we had a nickel for every time someone came up to our booth at a show and mistook charoite for sugilite, we would have a whole lot of nickels. Both are complex silicates and both were recognized as new minerals in the 1970's. However, sugilite is found several places, and charoite, only one. Actually, they are usually easy to differentiate, as sugilite tends to be more reddish-purple, or magenta, and charoite is more bluish-purple, violet, or indigo. Charoite also has its characteristic swirls of purple and white, and the characteristic inclusions of other minerals, as explained under "About Our Specimens."

It might be worth investing in some highest quality charoite if one has the opportunity. Reports from the site say there is a considerable amount there, and it should last for at least a number of years, but no one knows what percentage of it is of the superb quality that is so gorgeous. From what we have gleaned, the most desirable charoite is that which exhibits an intense, brilliant color, with swirls or bands of white and purple together in an aesthetic arrangement. A feathery spray of needle-like aegerine can enhance the stone if it is in a pleasing arrangement, as can a touch of orange-brown tinaksite or tokkonite. (See About Our Specimens for more detail on these minerals.) Inclusions of quartz, feldspar, and other minerals may give character to a gemstone or carving if they are arranged in a pleasing way, but take away from the appearance if not. Each batch of charoite we see seems to be different.

Lapidarians and gemstone cutters find charoite, though it takes an excellent polish, a challenging stone to cut and shape. It seems that the more beautiful aspects of charoite are the ones that make it more difficult to cut! (See the information on the different kinds of charoite under About Our Specimens.) Generally, it may be said that the more silky iridescence a charoite piece shows, the more difficult it will be to work up. The tremendous variety seen in charoite should be a boon to jewelry designers. This difficulty in cutting and the amount of rough material that is wasted is another factor in the premium price of charoite.

HISTORY & LORE

Although Russian mineralogists believe charoite to be about one half billion years old, its modern history is within the lifespan of most of us! The first mention of it was in 1949 by a geological field crew from the All-Union (now called All-Russian) Institute of Geology, searching for uranium, who mentioned in their report finding "lilac cummingtonite," an amphibole group mineral. Evidently, the exposed areas of charoite had altered over the millenia to "charoite asbestos," a white to cream-colored felt-like mass, which differs from charoite in its OH content, and the true beauty of charoite remained hidden beneath. A Russian geologist who had previously passed through the area doing survey work had named the occurrence "Sirenevyi Kamen," meaning "Lilac Stone."

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Ten years later, a team of geologists again was in the area, with sufficient lab equipment to study their new purple stone. Two young mineralogists named Vera Parfent'evna Rogova and Yurii Gavrilovich Rogov studied the "Lilac Stone" and reached the conclusion that it was a purple variety of the chemically similar mineral canasite, which had been approved as a new mineral in 1959. This misconception continued for years, and the first few pieces of charoite that made their way to American shores in the 1970's were called canasite by the Russian exporters!

Though Ms. Rogova left the area in the 1960's, she continued to research the "Lilac Stone." On May 16, 1974, these efforts culminated in a priority submission for the discovery of the new mineral charoite to the Commission on New Mineral Species. While consideration was underway, the Commission received another request concerning the recognition of charoite from an American mineralogist named P.J. Dan, who had received a charoite sample and performed the necessary tests. (See the box below.) When Mr. Dan became aware of this situation, he wrote to the Commission and had his request removed in order to avoid controversy over priority, and had them forward his test results to Ms. Rogova. The commission officially recognized charoite as a new mineral in 1978.

How a Mineral Becomes Recognized as a New Mineral

The study of minerals is an ongoing one, and new minerals are regularly discovered and recognized, at the rate of about 50 per year. In 1959, the Commission on New Minerals and Mineral Names (CNMMN, for short) of the International Mineralogical Association (IMA) was established as a means of controlling mineral nomenclature. This body is responsible for accepting or rejecting proposals for new minerals and mineral names, as well as proposals to redefine or discredit an existing mineral or mineral group.

When a proposal is received, the CNMMN looks at all pertinent data regarding the new find or proposed change. The proposal should include data regarding the geographic and geologic occurrence and paragenesis of the new mineral, details about its crystallography and optical and physical properties, along with the proposed name and the reason for its selection. This international body then considers the data, requests clarifications if needed, and votes regarding acceptance. For acceptance of a new mineral, more than half of the CNMMN members must vote on the proposal, and more than ⅔ of these voters must vote "yes." For a new name to be accepted, more than one half of those voting must vote "yes." Guidelines are given by the CNMMN regarding the naming of a new mineral.

If a new mineral is approved by the CNMMN, the author then releases a paper with all the data concerning the new mineral, or the redefining or discrediting of an existing mineral or mineral group. Every few years, a revised version of the "Glossary of Mineral Species" is released, reflecting the most up-to-date compilation of minerals, groups, and names, based on the activity of the CNMMN. The latest version was released in 1995, and reports say that a new version is on its way. This is the publication we use to derive the chemical formulae for minerals featured in the Club.

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Yet uncertainty over its identity did not prevent those coming in contact with charoite from falling in love with it! The Russians involved with the charoite find were already polishing pieces to display in their homes. By the time mineral recognition came, boxes, vases, decanters and other objects made from charoite were adorning homes and museum displays in the Soviet Union.

According to Lapidary Journal, charoite under its misnomer canasite first bewitched American eyes around 1974 or 1975. An American dealer named Lawrence Stalling received some in a shipment of Russian rough rock, made some cabochons, and began displaying them at gem and mineral shows, with predictable results. Mr. Stalling hooked up with Ed and Mary McNamar, who after falling in love with its swirls of purple and white, agreed to jump on the charoite bandwagon. The McNamars purchased a gorgeous collection of Russian-made vases and other objects and with polished slabs, and put together a show exhibit, which was often difficult to view because of the mobs of camera operators blocking it! In the years that followed, charoite of varying degrees of quality has become available in the United States.

We first fell for charoite just before we began doing shows in 1995, and it was truly love at first sight. We had to have the first beautiful little pendant we saw of it set in sterling silver, and it was the first stone we chose to purchase and sell in quantity. Evidently, very little high quality charoite had been on the market in the years prior, for people were constantly surprised at its beauty, many indicating they were seeing it for the first time, or having only a faint recollection of seeing it before. Truly, it may be said that we all are having a small share in shaping the history of this glorious gemstone!

ABOUT OUR SPECIMENS

No doubt you were struck by the beauty of your specimen as soon as you laid eyes on it. A closer examination under bright light, especially if done with a magnifier, will allow you to examine some of the individual purple and white charoite fibers, and notice how some twist while others bend and swirl. There is a lot happening in each piece of charoite!

Russian scientists have identified different textural varieties of charoite, relating to the conditions under which the charoite formed. In massive charoite, the charoite fibers are not readily visible, there are no swirls or silky iridesence, and the color is a solid light purple or lilac color. This variety is said to be most popular in Russia, which may explain why we rarely see it here. Parallel-fibrous charoite has a tigereye effect and is ideal for cabochons and decorative objects. Undulatory-fibrous charoite is similar to parallel-fibrous but the fibers seem to have been twisted and bent. Felted charoite is made of small but visible, seemingly interwoven fibers, and rarely, radial charoite is seen where the fibers radiate outward from a central point. Mosaic-fibrous charoite is the type that shows the greatest amount of silky iridescence when moved slightly, with a high degree of white color. This variety makes the most attractive eggs, spheres, boxes, and the like, and is arguably the most stunning aspect of charoite, where there seems almost to be a color change from violet to white as the piece is rotated. It is also the most difficult to hold together when cutting. Tectonic shoves are thought to be responsible for the formation of slaty charoite, where short fibers seem to overlap, and plicated charoite, where the fibers are broken apart. These variations are thought to have crystallized in the order they are here listed, with sheaf-like charoite being the final one. In the mesatomically altered areas of the Murun Massive, charoite is the principal rock-forming mineral and constitutes 50-90% of the rock. Such rocks that are not 100% charoite are sometimes called charoitites. The source of the purple color in charoite is manganese.

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There are, as always, several possible modifications of these basic varieties. So as you examine your piece, perhaps under a lens, can you see some of these varieties? Each polished piece may have several of these showing, in association with the minerals listed here:

Tinaksite, $K_2Na(Ca,Mn^{2+})_2TiSi_7O_{19}(OH)$, and tokkoite, $K_2Ca_4Si_7O_{17}(O,OH,F)_4$, are isostructural and chemically similar to charoite and occur quite commonly as orange to brown radiating prismatic sprays throughout the charoite. Tinaksite was discovered and named in 1965 by the aforementioned Mr. Rogov at the Murun Massif, the name taken from the symbols of some of its component elements, namely, Ti, Na, K, and Si. Tokkoite's name comes from the Tokko river, which flows into the Chara.

Aegerine, $NaFe^{3+}Si_2O_6$, a member of the pyroxene group is the black mineral often seen amongst the different forms of charoite. When it forms as a delicate spray or as needles or gives the charoite a landscape appearance, it can be quite striking, but it takes away from the beauty when it appears in a less than artistic fashion or overwhelms the charoite. The aegerine evidently formed later in the charoite.

Quartz, SiO_2, is seen mainly as milky, light-colored circle shaped brecciated zones, and microcline, $KAlSi_3O_8$, a member of the feldspar group of minerals, as larger cream-colored to milky green misshaped zones.

Canasite $(Na,K)_6Ca_5Si_{12}O_{30}(OH,F)_4$, also named for its elemental composition, Ca-Na-Si, is another rock-forming mineral that formed alongside charoite at the Murun Massif, in shades of gray, lilac-gray, and greenish brown. In another form, it can be lilac-gray, blue-gray, and rarely, greenish. Miserite, $K(Ca,Ce)_6Si_8O_{22}(OH,F)_2$, is very similar to charoite in chemistry, crystal structure, and color, and comes in shades of pink to lavender, and reddish brown. Pectolite, $Na,Ca_2Si_3O_8(OH)$, is found with charoite in shades of pink. (Interestingly, a blue variety of pectolite from the Dominican Republic is used as a decorative stone and marketed under the name "Larimar.") These three minerals are associated in varying degrees with charoite, particularly when seen in the unfinished form. A number of other rare minerals, including ekanite, arfvedsonite, fedorite, agrellite, kalsilite, wadeite, among others, have been found in the charoite deposits, as well as apatite and galena. Ongoing research may reveal many others!

There is a lot happening in each of our charoite specimens! Without doing months of research, it may not be possible to recognize minerals other than the tinaksite-tokkonite, aegerine, quartz, and feldspar. In fact, researching this write-up has made us reconsider whether the orange-brown sprays we have heard referred to as tinaksite may actually be tokkonite. And the texture varieties are difficult to recognize.

No doubt more scientific research will give us greater understanding into the nature of charoite. And don't be surprised if it contradicts some of the information here! While you examine your specimen, may it bring to mind the ongoing nature of the study of minerals; the barren area half a world away where it originated; the extremely complex geological processes that seemed to conspire to produce it; the enormous potential charoite has as gem material, and we wait to see where that leads; and above all, the unique and dazzling magnificence of the one half billion year old "new" mineral!

References: Dana's Manual of Mineralogy, 18th Edition, Cornelius S. Hurlbut, John Wiley & Sons, Inc.; Dana's New Mineralogy, Richard V. Gaines, et al, John Wiley & Sons, Inc.; 1995 Glossary of Mineral Species, Michael Fleischer & Joseph A. Mandarino, The Mineralogical Record, Inc.; Minerals, George Robinson, Ph.D., Simon & Schuster; 1001 Questions Answered About the Mineral Kingdom, Richard M. Pearl, Dover Publications, Inc.; Encyclopedia of Minerals, Van Nostrand, Reinhold; Charoite: A Unique mineral from a Unique Occurrence, Mikhail D. Evdokimov, World of Stones,September 1995; Charoite, a New Mineral and a New Jewelry Stone, V.P. Rogova, et al., International Geology Review, American Geological Institute, May 1979; From Russia . . . A New Gem, June Culp Zeitner, Lapidary Journal, April 1979; Procedures involving the IMA Commission on New Minerals and Mineral Names and guidelines on mineral nomenclature, Ernest H. Nickel and Joseph A. Mandarino, American Mineralogist, Volume 72, 1987 Special thanks to Keith Harschberger

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