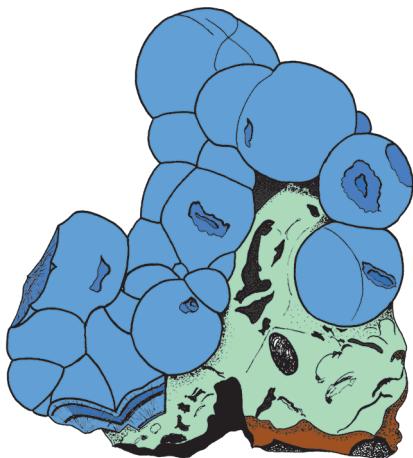


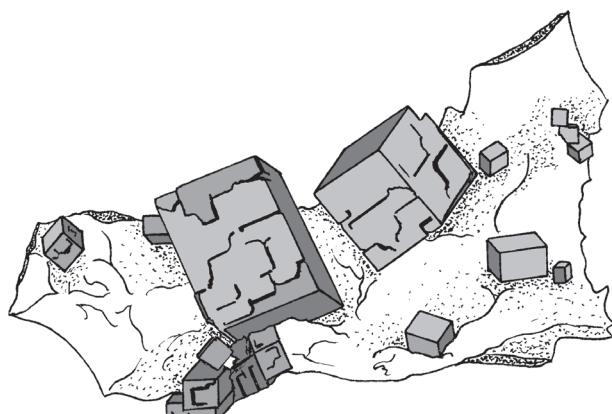
The World of Minerals & Crystals



Wulfenite, an ore of molybdenum



Azurite, an ore of copper



Galena, an ore of lead

Presented by Cranbrook Institute of Science



Michigan's Museum of Natural History

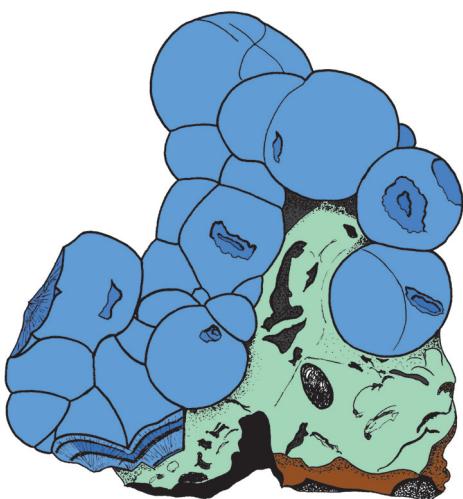
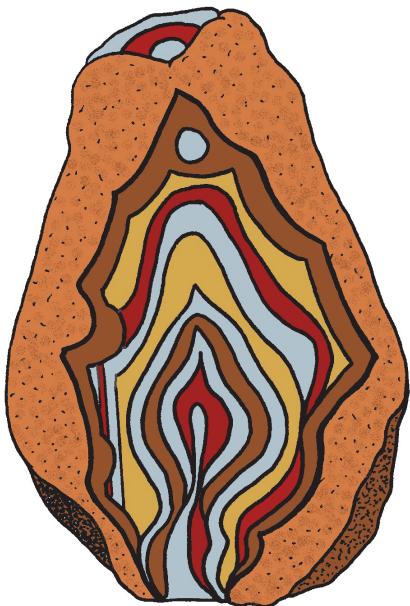
in partnership with the Michigan Mineralogical Society



A is for . . .

Agate

Agate is a variety of the mineral quartz. It's beautiful colors and patterns make agate a favorite of collectors. It is frequently polished and used as a semi-precious gemstone. Color each band a different color (red, white, blue, black, orange, gray). The specimen to the right is from California.



Azurite

Azurite is a beautiful blue mineral. Its name comes from the word *azure* which means *blue*. Azurite can be so dark blue that it is nearly black. It can also be light, powder blue like this specimen from Bisbee, Arizona. Azurite is a copper ore. It is also polished to make jewelry.

B is for . . .

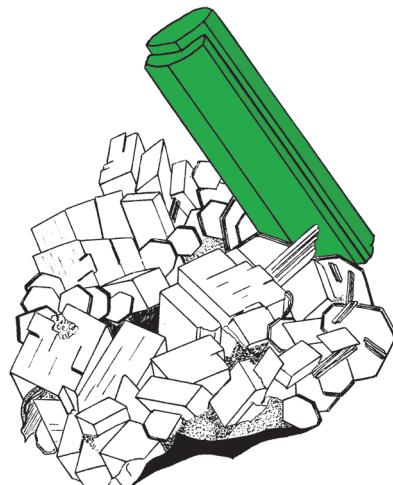
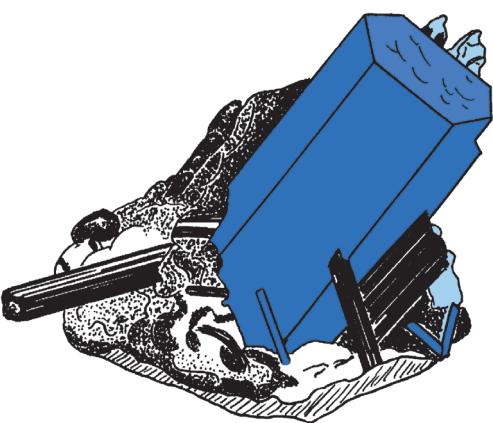
Beryl

Beryl is a gemstone that occurs in many colors. Each color variety has a different name.

Here are two:

Left: Blue aquamarine.

Right: Green emerald on white calcite.

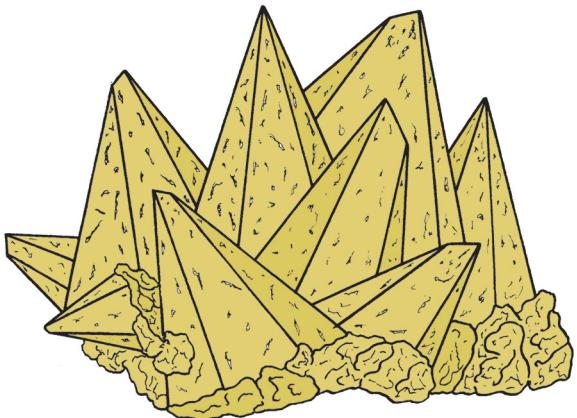


Beryl is a source of the important element beryllium.

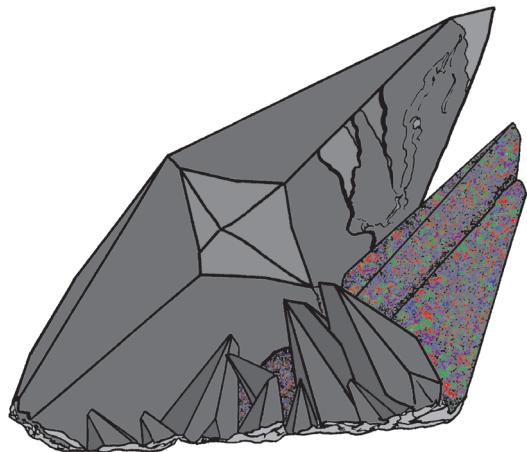
C is for . . .

Calcite

Calcite can be found in over 600 different crystal forms. Calcite can also be found in many colors including green, blue, red, yellow, black, gray, white and colorless. Calcite is used to make cement, fertilizers and some special chemicals.



Above Right:
Gray calcite
from Missouri.



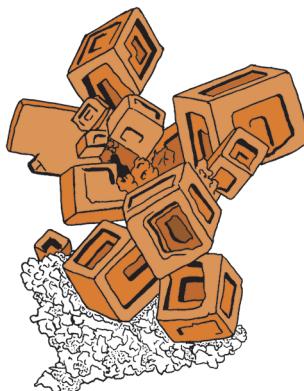
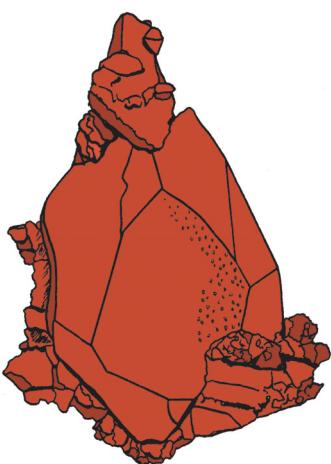
Left: Calcite with pieces of metallic copper trapped inside.

Copper

Copper has been removed from copper-bearing minerals for thousands of years. Minerals that are some shade of green or blue typically contain copper. So, minerals like malachite, azurite, cuprite and chrysocolla have been mined for their copper. Earliest cultures discovered, quite by accident, that when these copper minerals (geologists call them ores) are heated to very high temperatures, pure copper is left behind.

Natural copper (called *native copper*) is rare. It is found in great masses, though, around Lake Superior in Northern Michigan on the Keweenaw Peninsula. Masses of copper weighing more than 8,000 pounds have been discovered there. Native copper is also found in Arizona.

Copper is essential to modern life. Electricity moves on copper wires. We wouldn't have lights without copper wires.

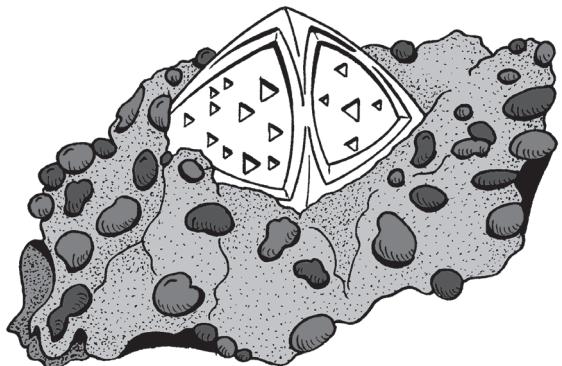


D is for . . .

Diamond

Clear diamonds are very valuable and are cut for jewelry. Most gem diamonds are colorless, but some "fancy" diamonds are blue, yellow, green and, rarely, red.

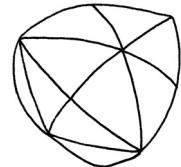
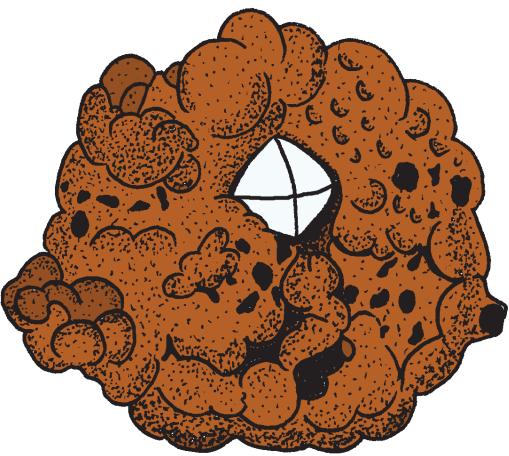
Diamond crystallizes in the *isometric crystal system*. This is also known as the *cubic crystal system*.



Diamonds in the shape of cubes can be found.

More often, however, they are found in the shape of the *octahedron* (which means *eight faces*). The octahedron is also known as "diamond shaped."

Diamond is the hardest substance on earth. Low-quality diamonds are crushed and embedded in saw blades and drill bits to make tools that can cut into solid rock.

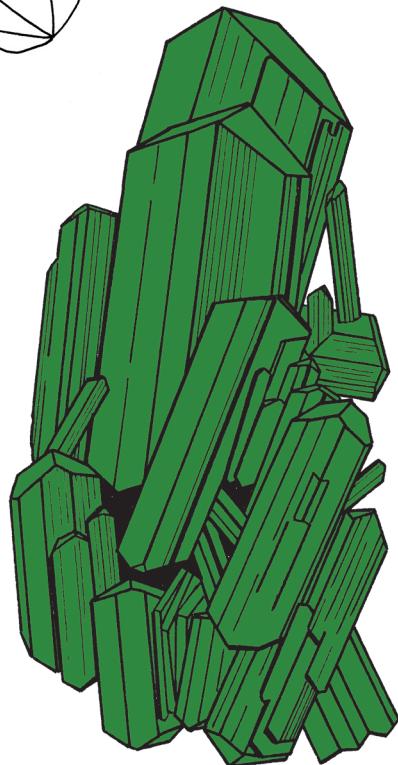


E is for . . .

Epidote

Epidote is a beautiful, dark green mineral. Sometimes it is used for making jewelry. Its well-formed crystals, glassy luster and deep green color make it a favorite of mineral collectors.

Right: A dark green epidote crystal group from Salzburg, Austria.



F is for . . .

Fluorite

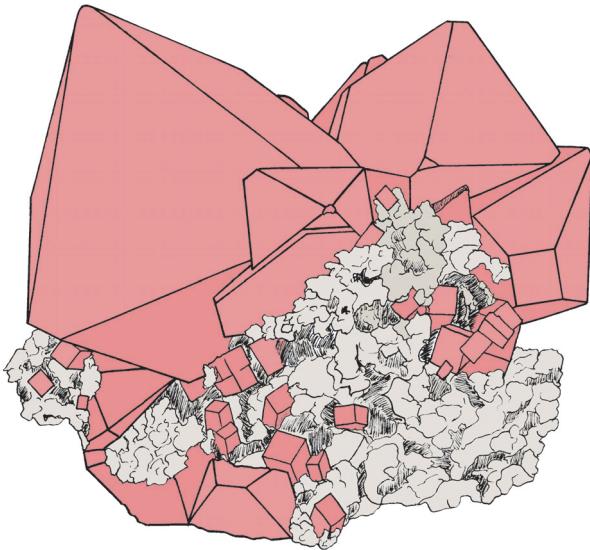
Fluorite is a favorite mineral with collectors for a number of reasons. Its beautiful crystals are found in many colors...yellow, blue, purple, colorless, pink, and green. It is not unusual to have a single fluorite crystal that has two or more colors. It also displays a special physical property called *cleavage*. If you hit a piece of fluorite with a hammer, it will cleave (which means *break*) into diamond-shaped pieces.

Fluorite is named from the Latin word

fluere which
means *flow*.

When iron ore is heated to very high temperatures, the iron *flows out* of the iron ore. When fluorite is added to the iron ore, the iron flows out at a *lower temperature* than it would without the fluorite!

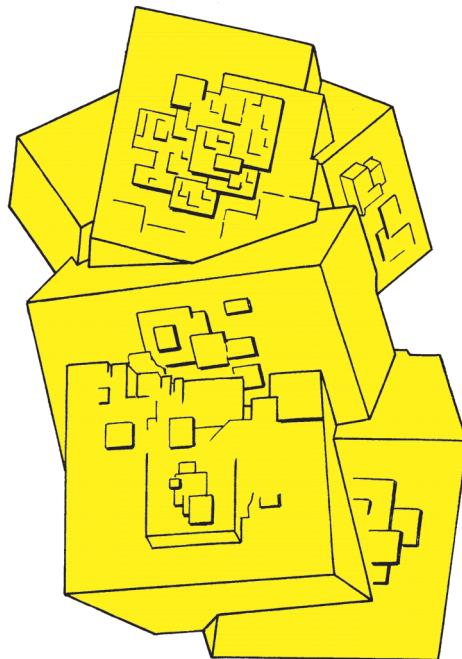
Fluorite contains the element *fluorine*. Fluorine is combined with other elements to make the chemical *fluoride*. Fluoride is added to toothpaste because it helps make teeth strong and resistant to cavities.



Above Right: Yellow fluorite from Illinois.

Above Left: Pink fluorite from Peru.

Right: Light Green fluorite on red matrix from Russia.



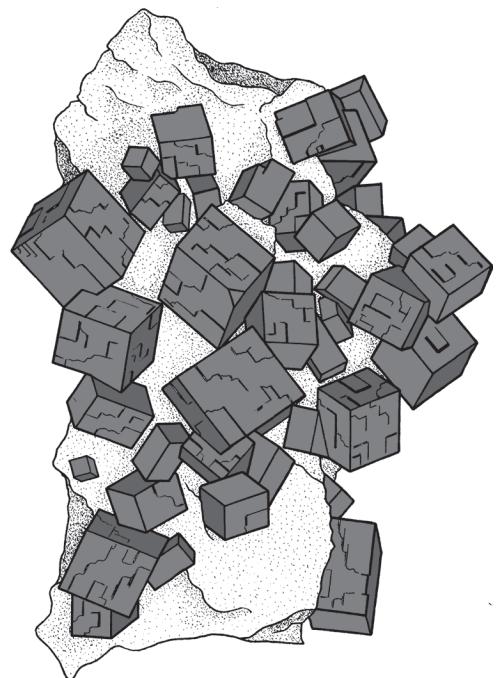
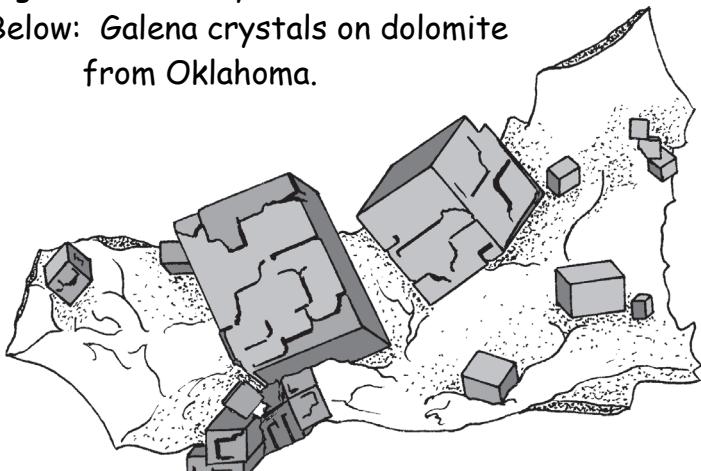
G is for . . .

Galena

Galena is an ore of the metal lead. It is very heavy and is often very shiny. Minerals that look like shiny metal have *metallic luster*. Galena often has silver trapped in it. When it does, it can be an ore of silver, too. Galena is metallic gray.

Right: Galena crystal from Illinois.

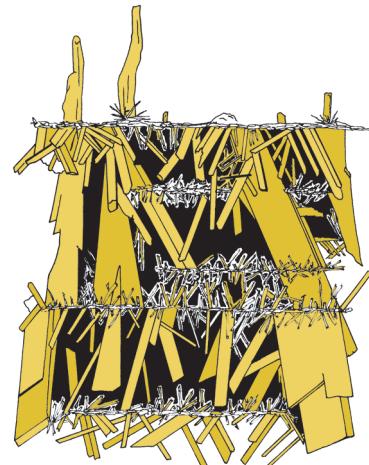
Below: Galena crystals on dolomite from Oklahoma.



Gypsum

Only a few minerals - like talc and graphite - are

softer than gypsum. Because it is so soft it is easy to crush into a powder. This powder is heated and turned into Plaster of Paris. Plaster made from gypsum is also used to make the walls in your house! When gypsum is clear it is called Selenite. Gypsum can be colorless, brown, tan, green, yellow and white.



Above: Golden brown gypsum crystals from Australia.

Left: Miners discovered gypsum crystals as big as a school bus in a cave deep underground in Mexico.

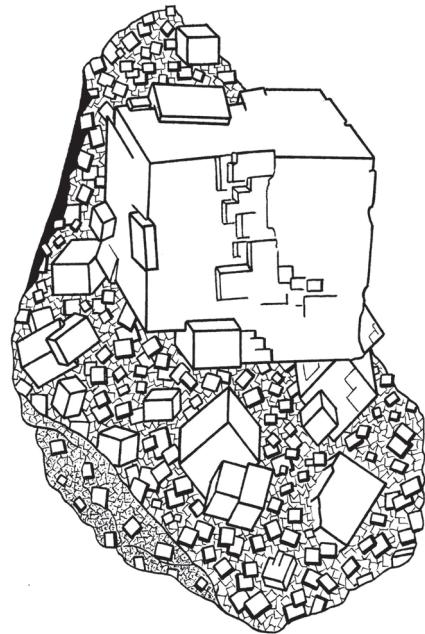
H is for . . .

Halite

Halite is the mineral name for salt. Halite crystals form in the shape of cubes. In the United States, large deposits of massive halite (also known as rock salt) can be found in New York, Michigan, Ohio and Texas.

The Greek word for salt is *hals*. This is the origin of the mineral name for salt, *halite*. Halite is colorless, but impurities can make it blue, purple, pink, yellow, red, brown and black.

Halite is used to preserve food, it is a source of the elements *sodium* and *chlorine*, and it is put on roads in winter time to melt ice and make driving in the cold weather easier.

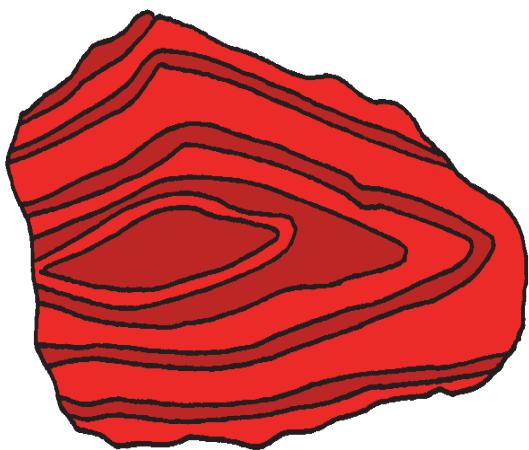
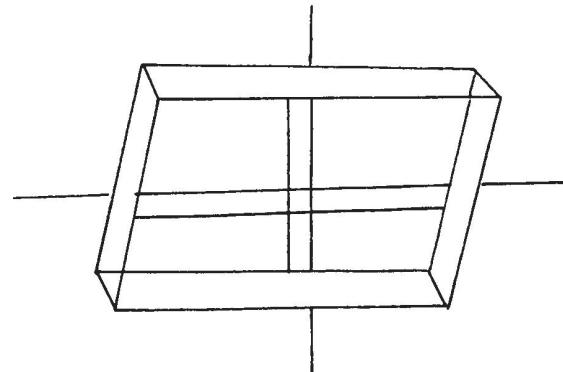


I is for . . .

Iceland Spar

Iceland Spar is the name used for perfectly clear and colorless pieces of calcite. When you look at a line through a piece of Iceland Spar, you see two lines. This effect is called *double refraction*.

Iceland Spar is colorless. However, colored pieces of calcite that are transparent can also show the property of double refraction. Calcite can be colorless, white, yellow, brown, orange, pink, red, purple, blue, green, gray, and black.



J is for . . .

Jasper

Jasper is a variety of *chalcedony*. Chalcedony is a variety of quartz. Mineralogists describe chalcedony as *cryptocrystalline* which means that it forms crystals, but the crystals are so small that they can only be seen with a microscope. Jasper is always a shade of red or yellow.

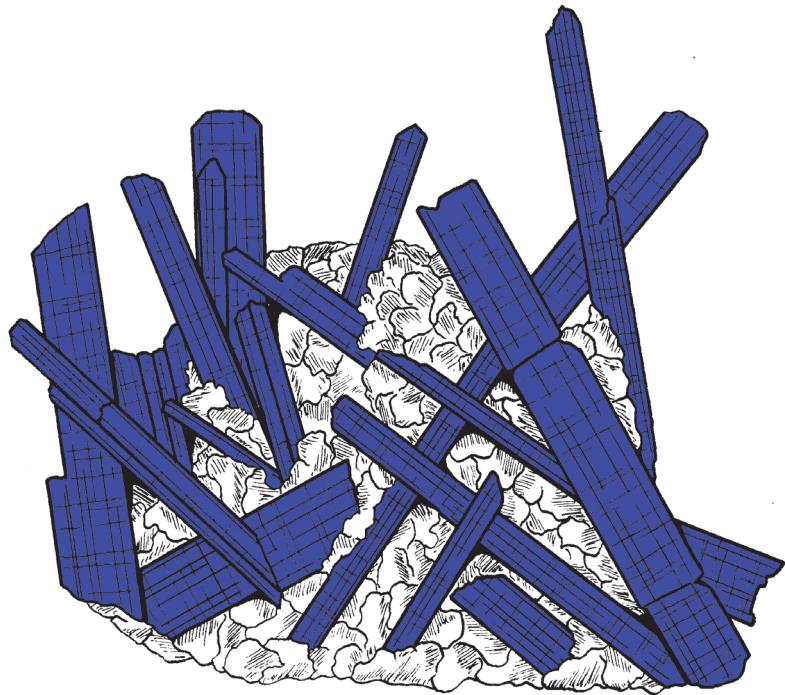
K is for . . .

Kyanite

Kyanite can be found in a variety of different colors. It can be white, pink, green, black and even orange. The most common color for kyanite, however, is blue. In 1789, the famous German mineralogist, Abraham Gottlob Werner, named this mineral after the Greek word *kyanos* which means deep blue.

Kyanite has an interesting and unique physical property. If you test its hardness across the crystal you will discover it is 6.5 to 7. However, if you measure its hardness along the length of the crystal, you will discover it is 4.5 to 5. (The mineral hardness scale was established by the German mineralogist, Friedrich Mohs in 1812, and it is still used today.)

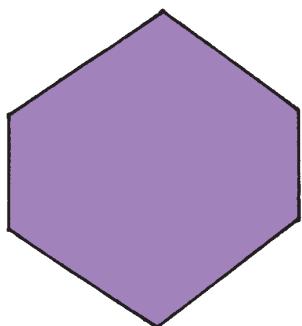
Pictured here is a group of blue kyanite crystal "blades" on white to tan quartz from Barra de Salinas, Minas Gerais, Brazil.



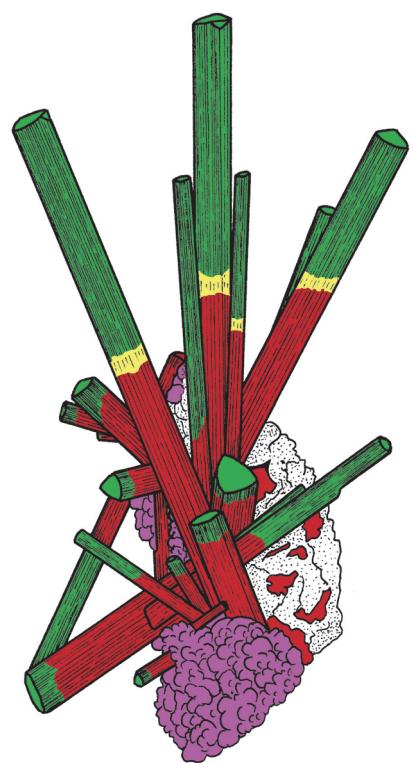
Lepidolite

There is a group of minerals called the *micas*. Micas can all be broken into very thin sheets. This is a physical property that is called *micaceous cleavage*. The minerals in this group include lepidolite, muscovite, phlogopite, and biotite, to name a few. Lepidolite is a light purple variety of mica that contains the element lithium. It is a source of lithium.

Lepidolite is often found with spectacular minerals like tourmaline.



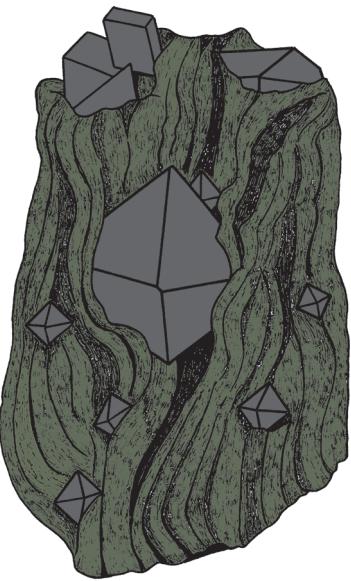
Left: A perfect lepidolite mica crystal.
Right: Tourmaline crystals on light purple lepidolite. The tourmaline crystals are green on top, yellow in the middle, and red on the bottom. This specimen is from Minas Gerais, Brazil.



M is for . . .

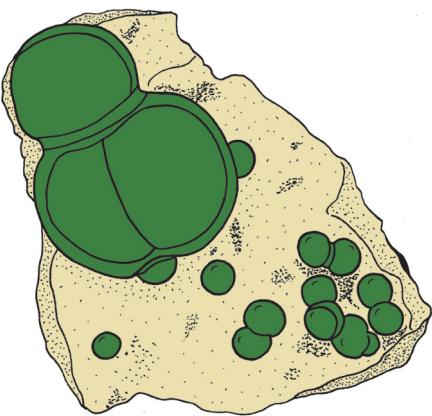
Magnetite

Magnetite is a natural magnet. It is the most important ore of iron. Its crystals are diamond-shaped. Mineralogists call them octahedral crystals. "Octahedral" means they have eight faces or sides. Pictured to the right are metallic gray magnetite crystals in a dark metamorphic rock known as schist. This specimen is from Switzerland.

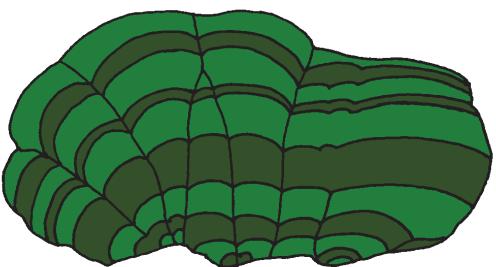


Malachite

Malachite is a beautiful green mineral which sometimes forms zones or bands. Each band is a slightly different shade of green. It polishes well and is used for carvings and jewelry. It can also be an ore of copper. Malachite gets its green color from the copper in its crystal structure.



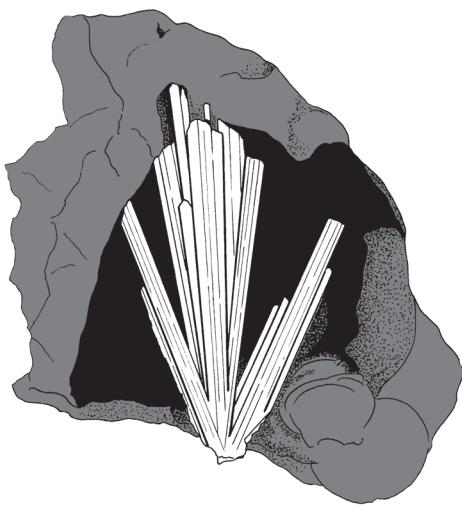
To the left is a group of light green malachite "balls" from the Morenci Mine, Arizona. They are sitting on a matrix of light tan rock. To the right is a sample of banded malachite from Zaire.



N is for . . .

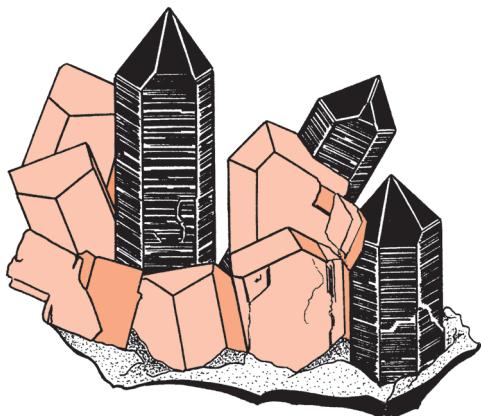
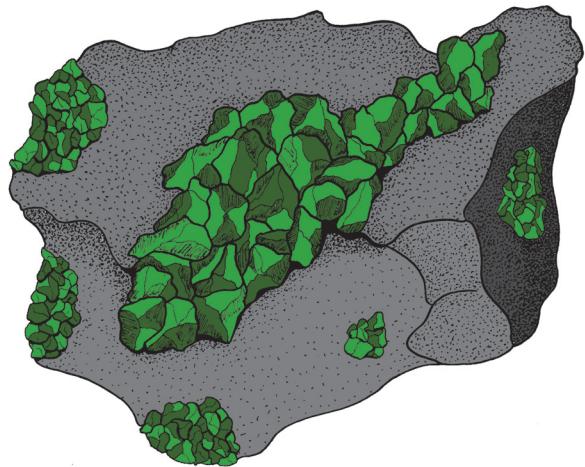
Natrolite

Natrolite is a mineral that belongs to the zeolite group of minerals. Zeolite minerals, like natrolite, are used to "soften" water. This works through a process called "ion exchange." Water that has a lot of calcium in it ("hard water") is passed through crushed zeolites, like natrolite. The calcium in the water exchanges with sodium in the mineral, and the water is now "soft water." This specimen is from India.



O is for . . . Olivine

Olivine is found in igneous rocks. Igneous rocks are rocks that began as hot liquid inside the earth. This group of olivine grains is grass green and is called by the special name, Peridot. Peridot is a gem variety of olivine. The green peridot grains are sitting in dark gray matrix. "Matrix" is the word mineralogists use for any rock or material upon which a mineral or minerals sit. This specimen is from Arizona.



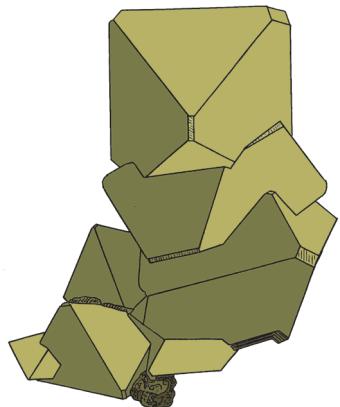
Orthoclase

Orthoclase is a variety of the mineral group called feldspar. It is used to make porcelain, and in the manufacture of paint and paper. Pictured to the left are pink orthoclase crystals with smoky quartz crystals from New Hampshire.

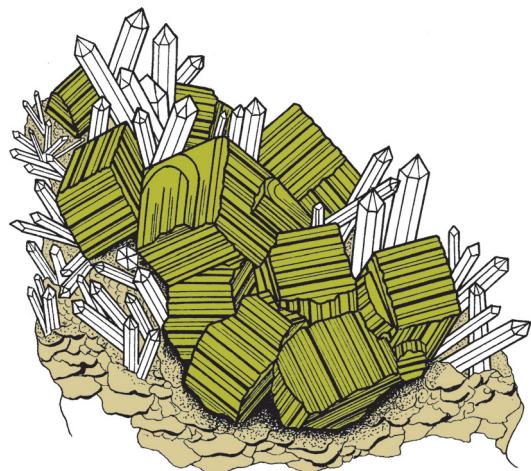
P is for . . . Pyrite

Pyrite is also known as "Fool's Gold" because a lot of prospectors thought they had discovered gold when they had only found worthless pyrite! Actually, gold is softer and has a more yellow color than pyrite. Pyrite is named after the Greek word for fire, because

if you hit pyrite with steel there will be a spark that is hot enough to start a fire. Pyrite is brassy yellow and has a shiny, metallic luster.



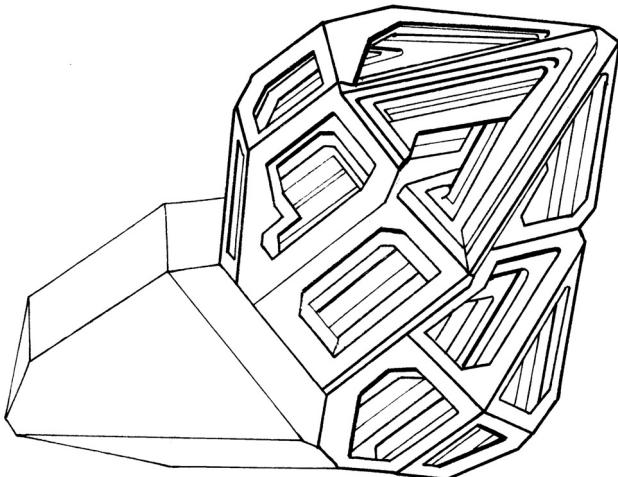
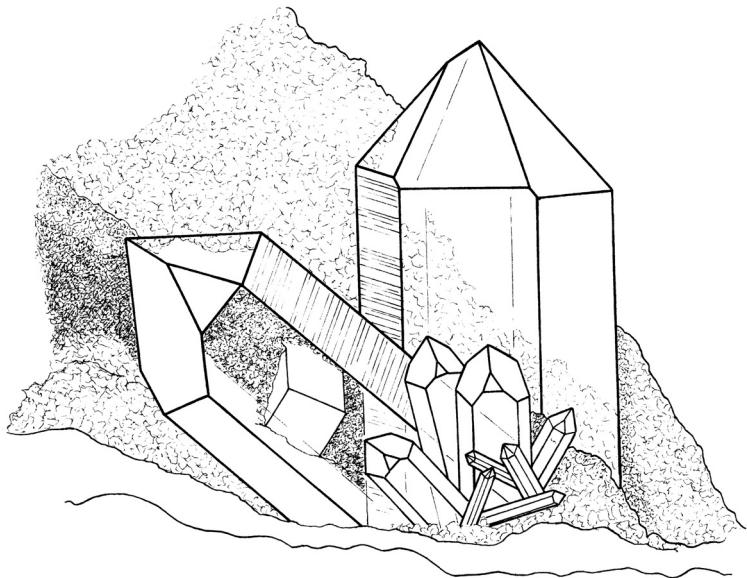
Pyrite contains iron and sulfur (FeS_2). The sulfur is removed from pyrite to make sulfuric acid and other chemicals which are used in industry and in the manufacture of many products including paper, plastics and rubber.



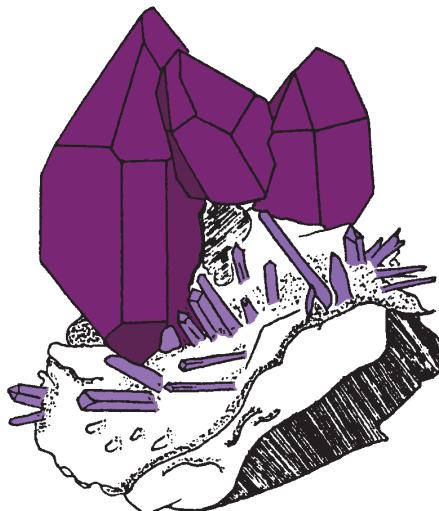
Q is for . . .

Quartz

Quartz is the second most common mineral in the earth's continental crust. (Feldspar is the first.) It is found in well-formed and often very large crystals. It can be found in a variety of colors each of which has its own name. Colorless is called *Rock Crystal*. Purple is called *amethyst*. Brown is called *citrine*. Black is called *smoky quartz*. White is called *milky quartz*. Pink is called *rose quartz*. Green is called *aventurine*.



Quartz is used in electronic equipment. Many watches and clocks have small slices of quartz in them. Quartz is also used to make glass. Colorful, clear specimens of quartz are cut and polished to make gemstones and jewelry.

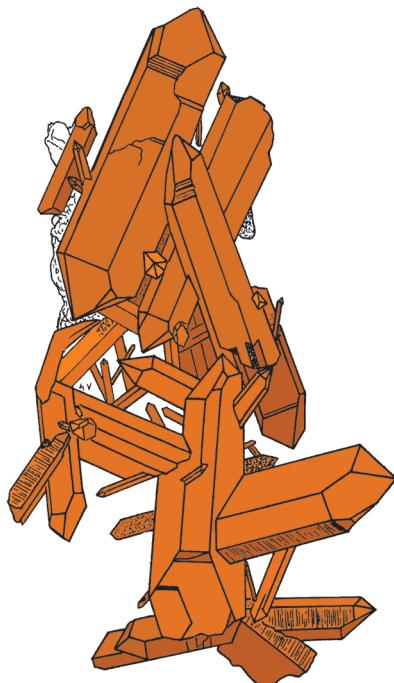


Above: Perfectly clear quartz from Italy.

Above Left: "Skeletal" quartz.

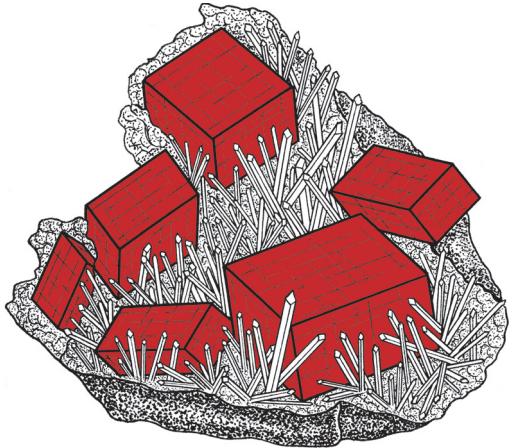
Left: Deep purple amethyst from Georgia.

Right: Quartz with iron oxide staining from Georgia.



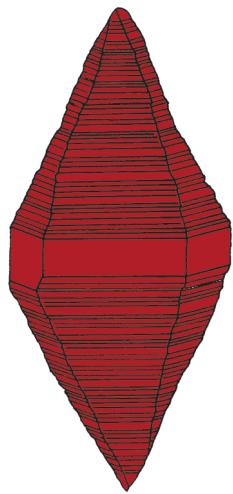
R is for . . .

Rhodochrosite



Rhodochrosite forms pink to deep red crystals, as well as banded masses. The banded masses are cut, sculpted and polished. Like calcite and dolomite, rhodochrosite crystallizes in the rhombic crystal system.

Left: Deep red, glassy rhodochrosite crystals on quartz "needles" from the Sweet Home Mine near Alma, Colorado.

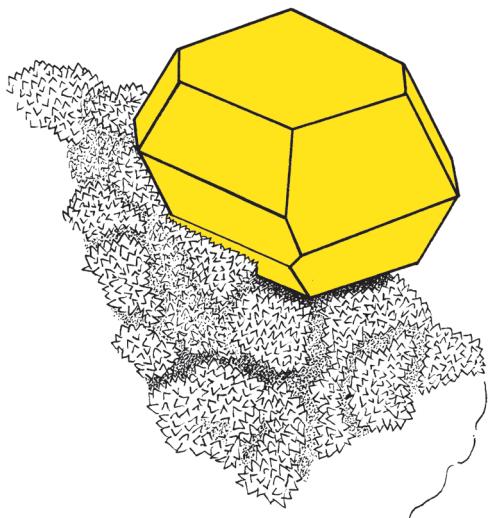


Ruby

Ruby is the red gem variety of the mineral corundum. The only mineral harder than ruby is diamond. Blue corundum is called sapphire. Colorful sapphire crystals of any color (blue, yellow, green, pink) are called *fancy sapphires*. Gem quality ruby is cut to make gemstones for jewelry. Low quality ruby is crushed and used as an abrasive.

S is for . . .

Sulfur



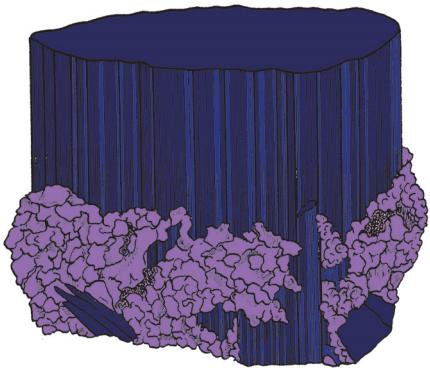
Sulfur is amber yellow to bright lemon yellow. It is an element. Sulfur specimens are commonly referred to as *native sulfur*, meaning it is sulfur that has occurred naturally rather than being made in a laboratory or a factory. Sulfur is used in making rubber, matches and fertilizers. It is used to make sulfuric acid which is then used in many different industries. Sulfur will burn, and when it does it smells like rotten eggs. Sulfur is very soft. The United States is the world's largest producer of sulfur.

Left: A large sulfur crystal on small aragonite crystals from Sicily, Italy.

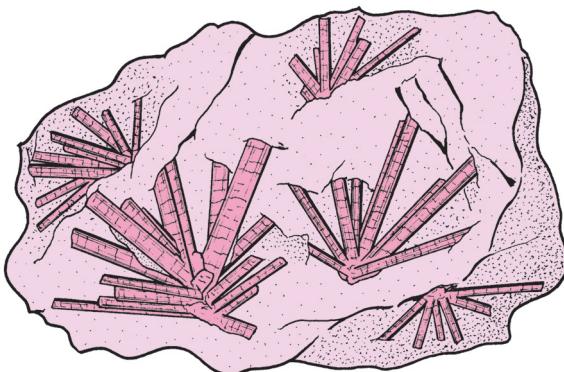
T is for . . .

Tourmaline

Tourmaline can be red, green, black, blue, pink, brown, yellow and colorless. The different colors have different names: Colorless, Red, Pink, and Green tourmaline is called *Elbaite*. "Watermelon Tourmaline" is an informal name given to specimens that are green on the outside and red or pink on the inside. Black tourmaline is called *Schorl*. Brown tourmaline is called *Dravite*.



Tourmaline has a special physical property called piezoelectricity which makes it useful in electronic equipment. "Piezoelectricity" means that when pressure is applied to one end of a tourmaline crystal, an electric charge is created where one end of the crystal is electrically positive and the other is electrically negative.



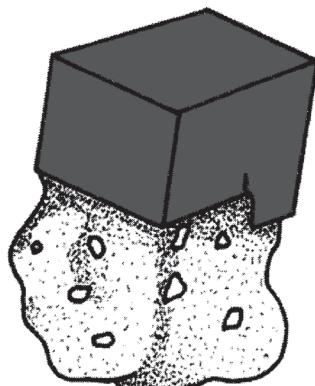
Above: Dark blue crystal (called *indicolite*) on pink lepidolite from Afghanistan.

Left: Pink tourmaline (*elbaite*) on light purple lepidolite from California.

Uraninite

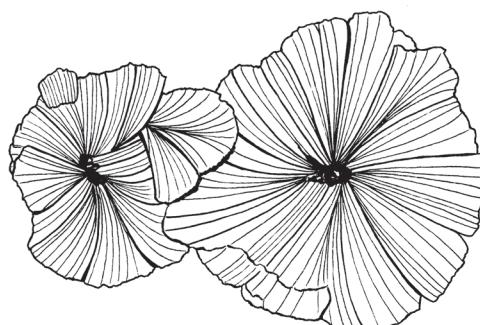
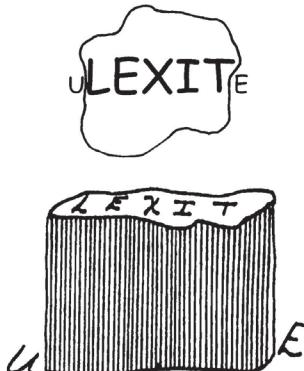
Uraninite contains the radioactive element *uranium*. Uranium is very important as a source of energy in nuclear reactors. It is dark gray to black and shiny.

Right: A single, black, well-formed uraninite crystal from Canada.



Ulexite

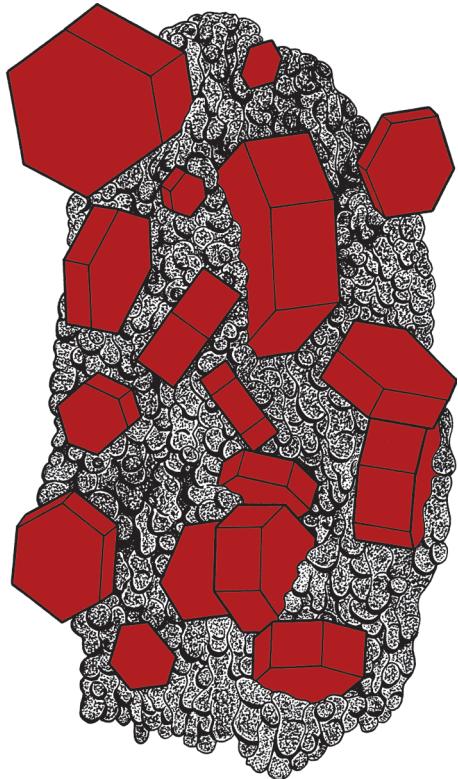
When a cut and polished piece of some ulexite specimens is placed over writing, it appears that the writing is on the top of the specimen! This is why it has the fun name, "Television Stone." Ulexite can be white, colorless or gray. Ulexite is an ore of the element boron.



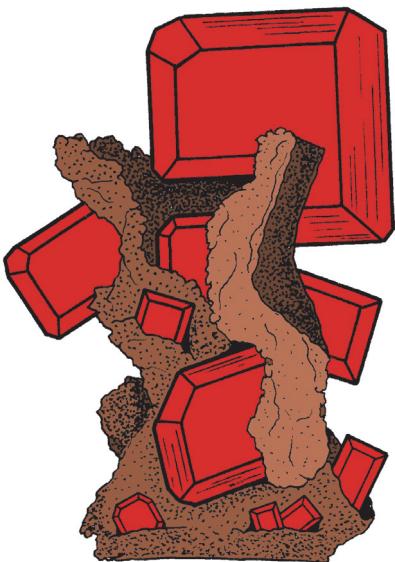
V is for . . . **Vanadinite**

Vanadinite forms bright red to reddish-orange, six-sided crystals. Six-sided crystals are called hexagonal crystals. Vanadinite contains the element vanadium. You probably already guessed that it gets its name from vanadium. Vanadinite is an ore of vanadium and a minor ore of lead.

Above Right: Bright red vanadinite crystals on black goethite from Morocco.



W is for . . . **Wulfenite**



Wulfenite crystals are often bright colors like red, yellow and orange. Some wulfenite crystals are thick and look like boxes. Others are so thin that you can see through them like the specimen shown below.

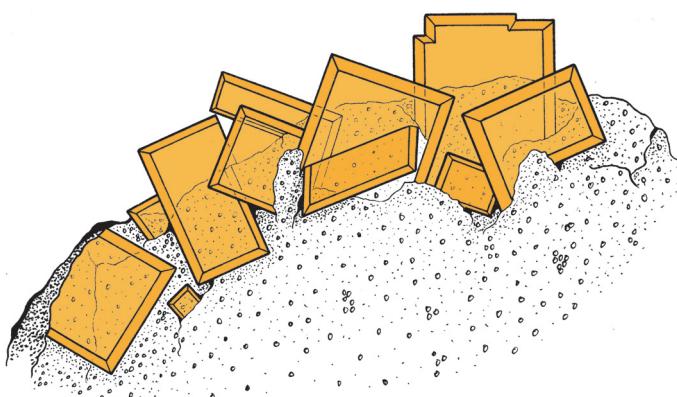
Wulfenite is a secondary mineral. This means that it is formed when very hot fluids break down other minerals that formed first. It forms in mines that contain the elements lead, molybdenum and silver.

To the left is a specimen of bright red, glassy wulfenite crystals from the famous Red Cloud Mine near Yuma, Arizona. The crystals are sitting on brown matrix.

Wulfenite is a
minor ore of the
elements molyb-

dium and lead. It is also very popular and eagerly sought by mineral collectors.

To the right are glass-clear, orange wulfenite crystals from the Mammoth-St. Anthony mine, Pinal County, Arizona.

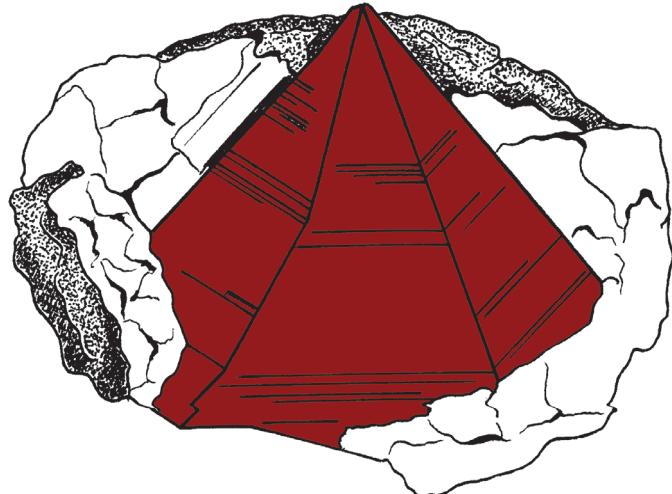


Z is for . . .

Zincite

Zincite is an important ore of the element zinc. Notice that it is named after this element. It seldom forms crystals. The well-formed zincite crystals from Franklin, New Jersey are the best zincite crystals in the world.

You may find some beautiful red, orange and yellow zincite crystals for sale at mineral shows today. These crystals, however, were made in a laboratory: they are not natural and, therefore, are technically not minerals.



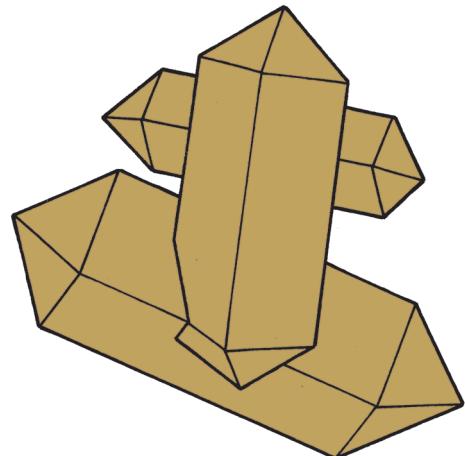
Pictured here is an orange-red zincite crystal from Franklin, New Jersey.

Zircon

Zircon occurs in a number of different colors including colorless, red, blue, brown, yellow, and green. Colorless zircon that is gem quality is sometimes cut and faceted and used as a substitute for diamonds. They are called "Matura Diamonds." Yellow zircon is known as *hyacinth* and is also cut as a gemstone.

The name zircon comes from the Persian word *zargun* which means *golden-colored*. This is a reference to a common color of zircon crystals.

Zircon is the most important ore of the element zirconium. The compound, zirconium carbonate, is added to lotions to treat poison ivy. It is also a source of the rare elements hafnium and the radioactive element thorium.



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Visit the Mineral Gallery at Cranbrook Institute of Science!



Do you love the natural beauty and art of minerals? Then visit Cranbrook Institute of Science, known internationally for its fine collection of over 11,000 mineral specimens from classic localities around the world.

Bancroft, Ontario; and a perfect basketball-sized topaz from Utah.

While you're here check out our meteorites and scale up to rocks and plate tectonics in our Every Rock Has A Story exhibit, where touchable samples of the Earth's and Michigan's oldest rocks are displayed.

We've also started a major swap out of minerals from



our reserve collection starting with stunning opals from Australia and Nevada to be followed by Mineral Masterpieces, the crème de la crème of the reserve collection not seen in over 20 years. This changeover will continue throughout the course of the following year.

Ticket Discount: Bring this booklet to Cranbrook Institute of Science and receive one **FREE** children's general admission ticket with the purchase of one adult general admission ticket.

Please visit our website: science.cranbrook.edu or call 248.645.3200 to learn more about the Mineral Gallery and other exhibits and programs at the Institute of Science. We look forward to seeing you!

Cranbrook Institute of Science
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Bloomfield Hills, MI 48304

Michigan's Museum of Natural History

In partnership with Michigan Mineralogical Society
www.michmin.org

