MINI MINERS MONTHLY

A MONTHLY PUBLICATION FOR YOUNG MINERAL COLLECTORS

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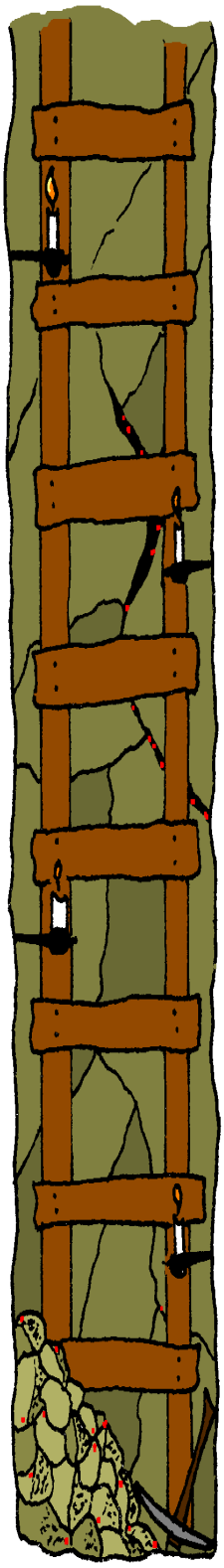


HOWDY, HOWDY, MINI MINERS!

Mini Miners Monthly™ is going to make you think! We have learned through the years that Mini Miners (you know, young mineral collectors) are very smart. We don't have to treat you like kids.

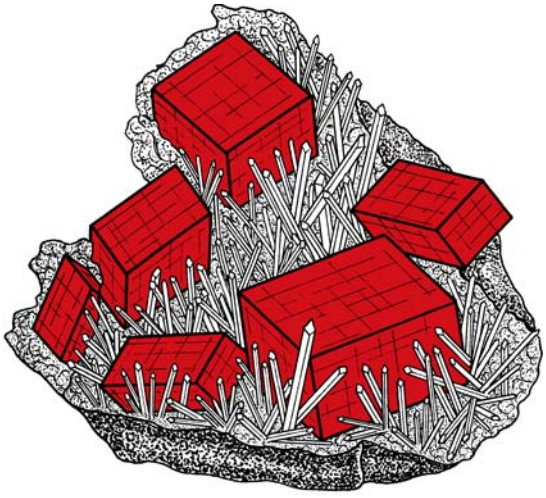
So, this issue continues to teach you about the study of Crystallography. Crystallography seems hard to understand, but it really isn't. Just take it step-by-step and you will soon understand what it is about.

One step is to learn some basic words like *face*, *axis*, *crystal*, *crystallography*, and *crystal form.* It is also fun to learn that sometimes two or more crystals grow together to make interesting forms. Crystallographers and mineralogists call these crystals *twinned* crystals. As you go through this issue, you will find out about all of this.

This month the focus is on the Monoclinic Crystal System. Each month you will learn about the other Crystal Systems. Step-by-step, you will understand crystallography!

Our very young Mini Miners had a request: We want more mineral drawings to color! Well, we want all of our Mini Miners to be happy, so there is a page of crystals to color. So, whatever your age…HAVE FUN!

By the way, Mini Miners, when you learn about something in Mini Miners Monthly™, we hope you are looking in your own collection for examples of what you find here. Do you have twinned crystals in your collection? Do you have Monoclinic minerals in your collection? Be sure you use what you learn and make your collection better and better.



What Mineral Am I?

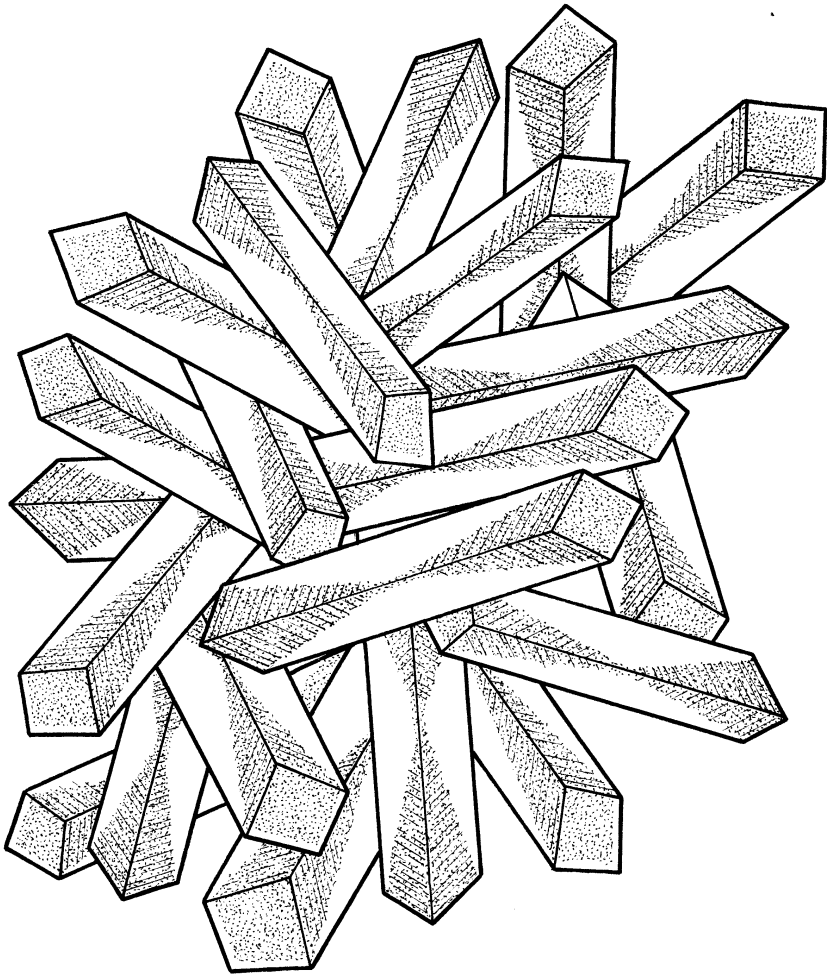
I can be pink or deep red. I crystallize in the Trigonal Crystal System. My crystals look like calcite crystals, but I am not calcite. I am made out of manganese, carbon and oxygen and my formula is $MnCO_3$. I can be found near Alma, Colorado in a silver mine. I can be found as pink, banded masses in Argentina.

My name is _____.

Check your answer on the next page.

Mineral of the Month

Gypsum



Above: Intergrown gypsum crystals from the Salt Plains of northwest Oklahoma. Trapped in the crystals are rust-red sand grains in the shape of an hourglass. This is why they are called "Hourglass Selenite" crystals.

Gypsum is a very soft mineral. It is Number 2 on the mineral hardness scale (which is also called Mohs' Hardness Scale). When it is found in massive beds, it is mined and used to make plaster (Plaster of Paris) and boards that are used to make walls. When gypsum in clear and glassy, it is given the informal name "Selenite."

Chemical Formula: $CaSO_4.2H_2O$

Crystal System: Monoclinic

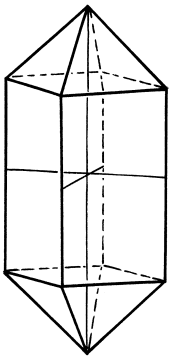
Color: When it is pure, gypsum is colorless or white. When it has impurities in it, it can be green, yellow, tan, blue, pink, brown, reddish brown or gray.

Physical Properties:
Mohs scale of Hardness: 2
Luster: Silky to Glassy
Streak: White
Specific gravity: 2.3

What mineral am I? Answer: Rhodochrosite

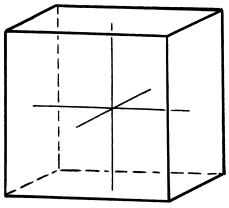
Let's Learn About Crystallography

You have to know the basic words used in this study of crystals and crystal forms. Keep coming back to this page as you read the rest of this book...it will help you.

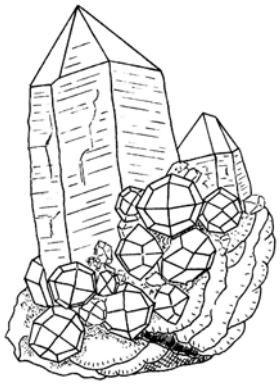


Crystallography. The scientific study of crystals, including

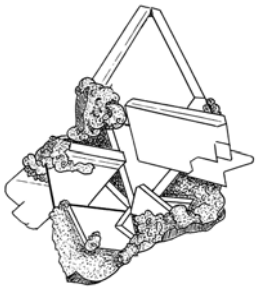
- how they grow
- the mathematical relationships of the angles between crystal faces
- the lengths and orientations of crystallographic axes
- the relationships of intergrown crystals.



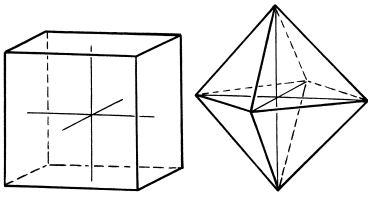
Axis. (two or more are called *Axes*). The Crystal Systems are described by axes (that is, imaginary lines) that go through their crystals and the angle at which these axes intersect each other. Think of an axis as a long, thin toothpick that goes through the center of the crystal, like the picture here to the left.



Crystal. A polyhedron (in other words, a three-dimensional form) that is bounded on all sides by flat surfaces (called faces). The position of the faces determines the way the atoms and molecules inside the crystal are attached to each other.

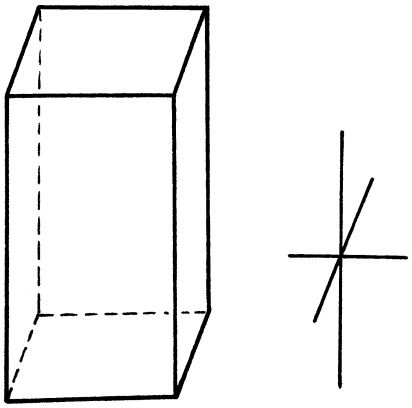


Face. A flat surface on a mineral crystal.



Crystal Forms. A group of crystal faces. The relationship of the crystal faces to one another can tell you to which crystal system the crystal belongs.

As you discovered on the "Mineral of the Month" page, gypsum crystallizes in the Monoclinic Crystal System. Some collectors think that crystallography (that is, the science of crystal forms) is very confusing and difficult to understand. We're going to show you that even though it has some hard words, once you know these words you will be able to understand crystal forms. We are going to help you with this by giving you crystal models to cut-and-paste. With these accurate crystal models, you will be able to understand crystallography!

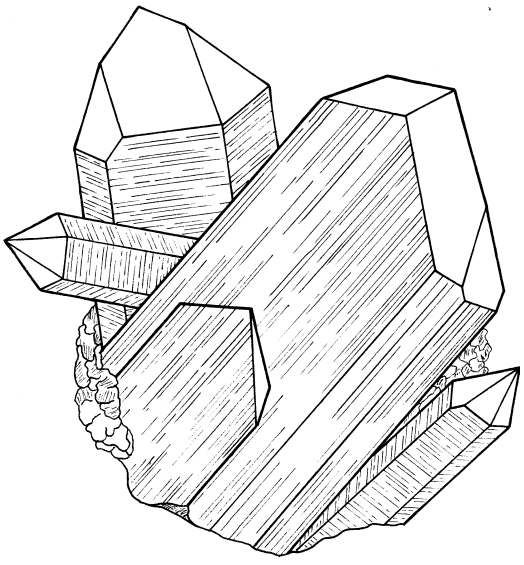


This month, we will start with the Monoclinic Crystal System. Monoclinic crystals have three axes and all of the axes have different lengths. Two of the axes intersect each other at 90 degrees. However, the third axis intersects the other two at an angle that is not 90 degrees.

On the next page you will find a crystal model of gypsum. Cut it out on the solid lines, fold on the dotted lines and glue or tape the tabs into the opposite face. (We have discovered that if you print it out on heavy paper like card stock, it will fold and tape together easier than if you print it on light printer paper.)

Once it is all together, hold your gypsum crystal model with your thumb at point A and your index finger at point B. Look straight at a crystal face and label it "1." Rotate the crystal model to the right. When you see another crystal face that looks like "1," stop and label it "2." Rotate it again to the right. The next time you see a crystal face that looks like "1" it will be "1"!

You have made two turns and have discovered that there are only two crystal faces that are the same. Crystallographers call this two-fold symmetry. There is a special feature of Monoclinic crystals. They have only ONE axis of two-fold symmetry. Next month we will study Orthorhombic crystals and discover that they have THREE axes with two-fold symmetry.

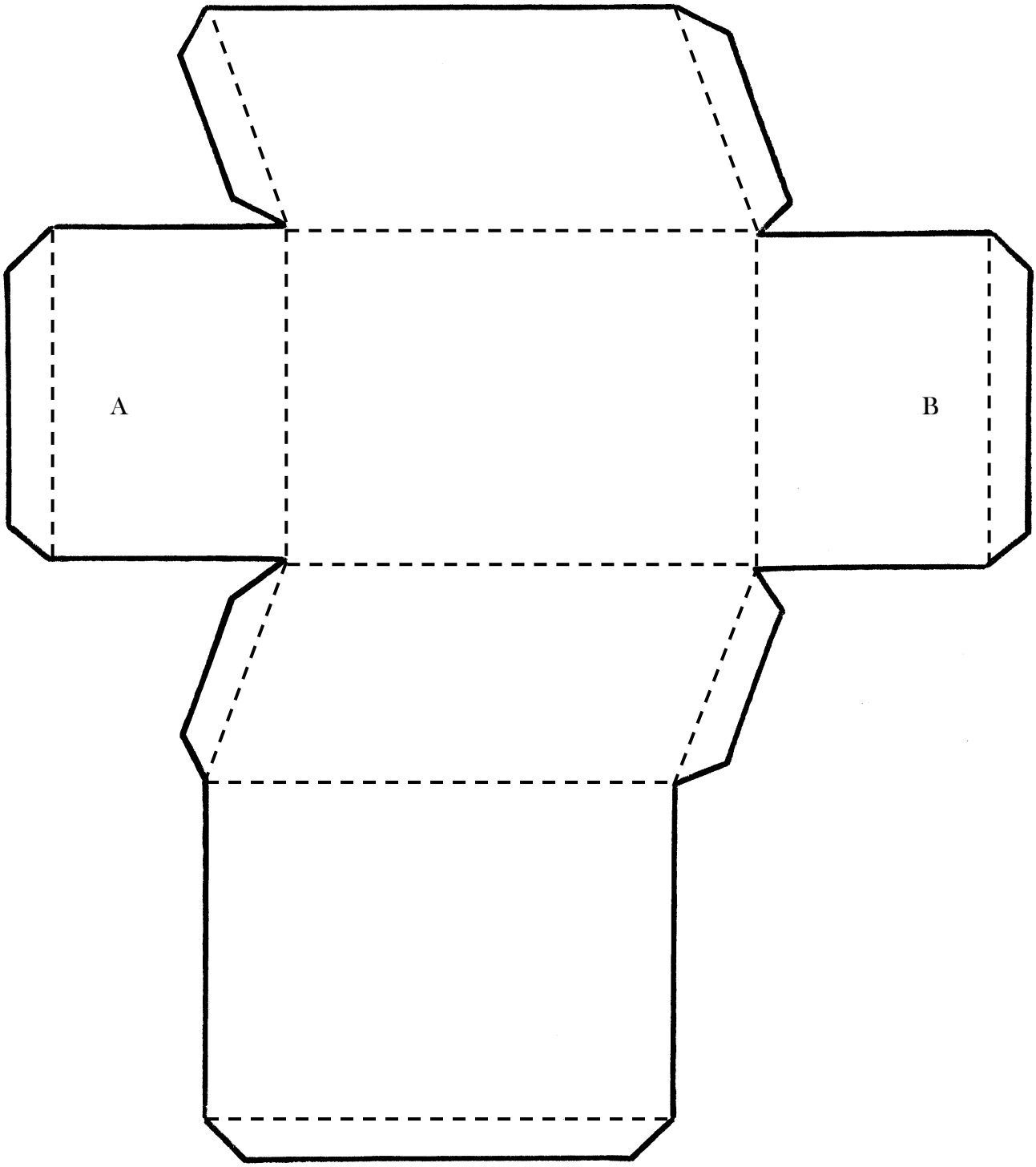


Crystal Challenge

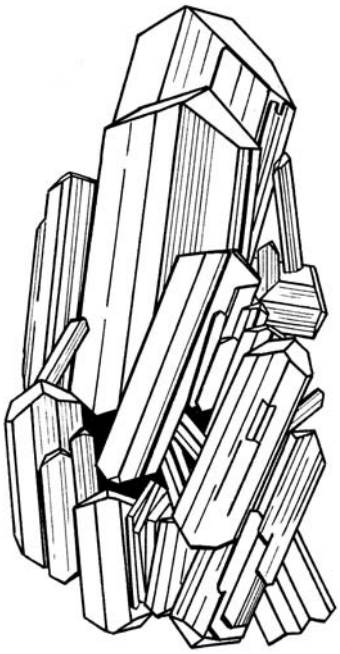
You just learned that monoclinic crystals have only one axis of two-fold symmetry. Prove that this is true. Hold your gypsum crystal many different ways and rotate it. Prove to yourself that you cannot find any other axis of two-fold symmetry.

Left: Light purple
Spodumene var. Kunzite with white quartz from Pakistan.

Monoclinic Crystal Model

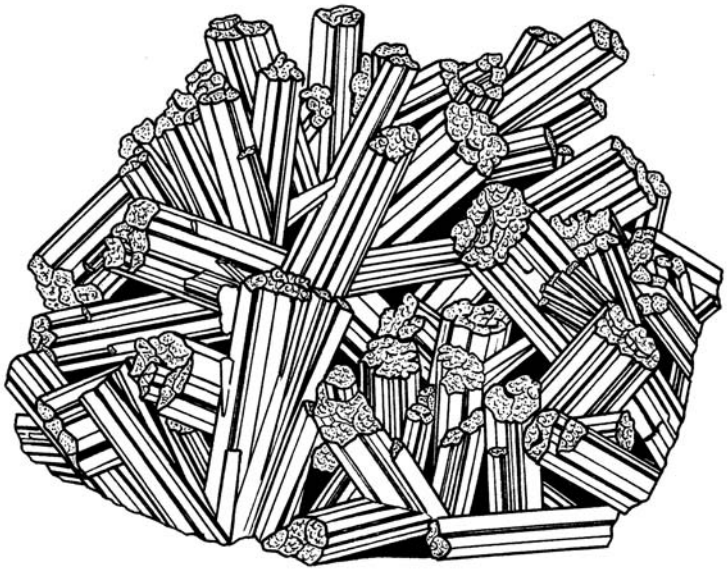


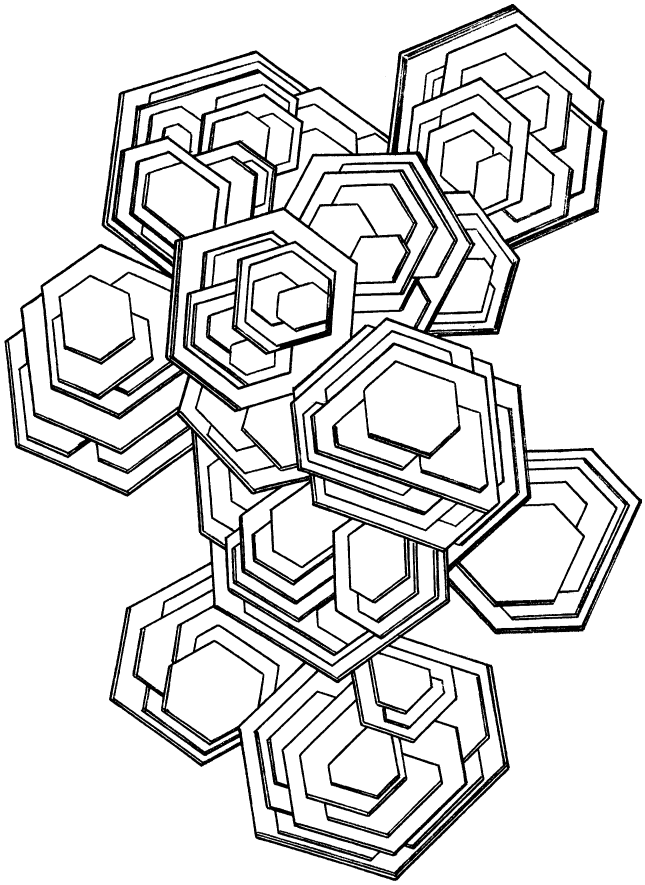
Minerals in the Monoclinic Crystal System

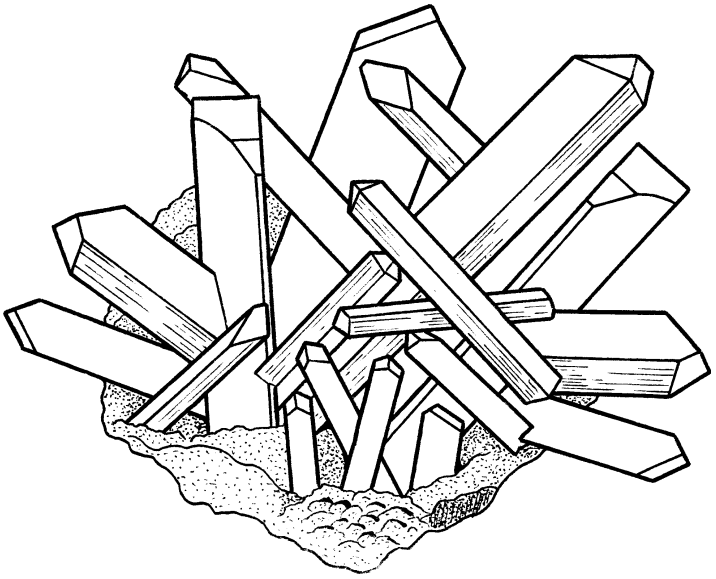


Left: Dark green Epidote crystals from Salzburg, Austria.

Right: Silver-gray Manganite from the Harz Mountains, Germany.

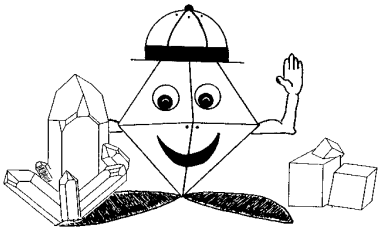






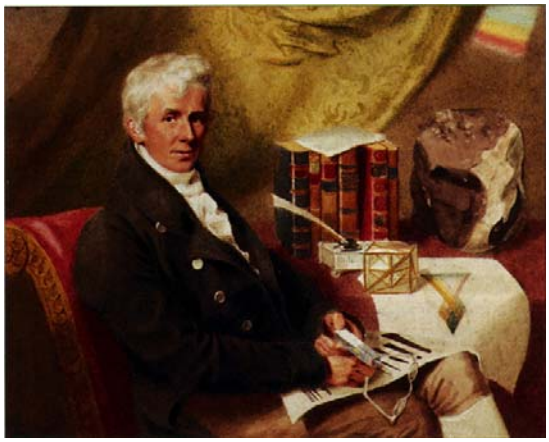
Left: Silvery-tan muscovite crystals from California. Muscovite belongs to the Mica group of minerals (that also includes, Lepidolite, Biotite, and Phlogopite.)

Above: Dark blue Azurite crystals from Tsumeb, Namibia, Africa.



CRYSTAL FACES

This month we introduce you to



James Sowerby

James Sowerby was born March 21, 1757 in London, England to John and Arabella Sowerby. He was a naturalist who studied and wrote about plants and flowers, shells and minerals. Early in his life he excelled in art and painting. His first passion was painting flowers.

Sowerby combined his knowledge of nature with his talent for painting. His first set of books was on the flowers and plants of England. In 1790 he began writing and illustrating *English Botany*. By the time it was finished in 1813 it was not one book; it was 36 volumes. It was written in a style that average readers interested in plants and flowers would find it easy to understand. It was also illustrated with wonderful, accurate, colorful drawings of the plants included in the books. In all, Sowerby drew and colored 2,592 drawings for these books.

For those interested in minerals and mineralogy, Sowerby's works *British Mineralogy* and *Exotic Mineralogy*. British Mineralogy was written over time. He would complete a section at a time and sell it to his customers. Then he would work on the next. By the time it was completed, his customers would usually have the individual sections bound into books. Bound sets of *British Mineralogy* are usually 5 volumes. They are very, very rare and, if you can find a complete set, are very, very expensive. In 2017, the least expensive set for sale was approximately $21,000. It is not unusual to find a complete set for over $25,000 today.

The Sowerby family continued to publish books for the public on natural science themes. They all included detailed, high-quality colored pictures. An interesting fact is that the illustrations were colored (painted) by hand. Some mineral collectors like to collect antique mineral books that have hand-painted mineral illustrations.

James Sowerby died on October 25, 1822.

Above: James Sowerby
Right: Calcite from British Mineralogy

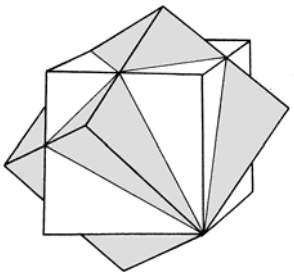
Twinned Crystals

As you study crystals you will also see that two or more crystals of the same mineral species can grow together. When they do, they form what mineralogists call *twinned crystals*. A *twinned crystal* forms when two crystals (and sometimes three or six) grow into each other in a symmetrical pattern. These symmetrical intergrowths are called *twinned crystals*.

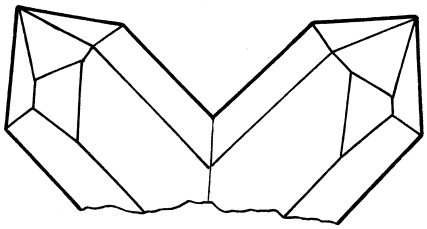
There are two different types of twinning. One type is *contact twinning* where there is a flat surface that separates the two individual crystals. The second type is *penetration twinning* where the two individual crystals grow into each other.

Below you will find examples of each type of twinning for each crystal system.

Isometric System

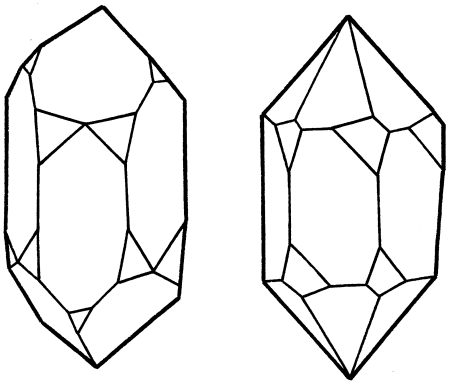


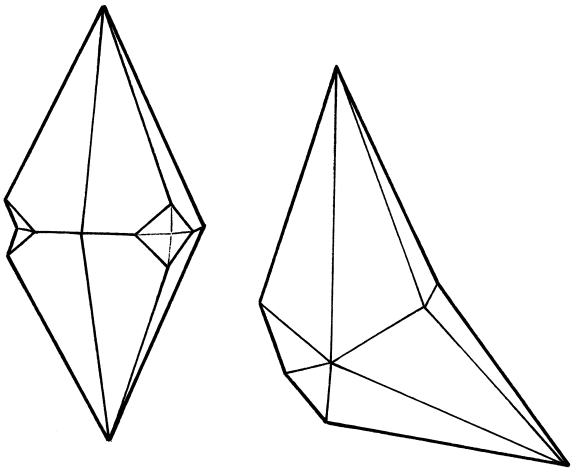
Left: Interpenetration Twins of Fluorite cubes.



Trigonal System

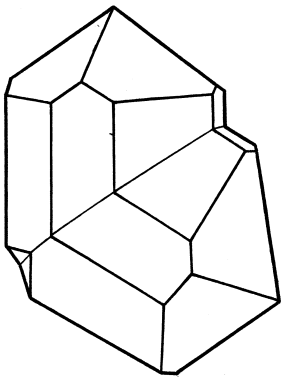
Above Right: Quartz, Japan-Law Twin.
Right: Quartz, Brazil Twin.
Far Right: Quartz, Dauphine Twin.





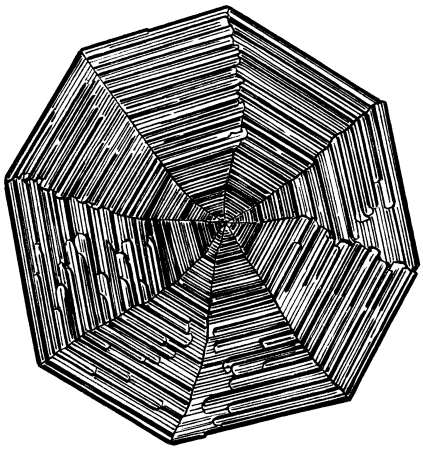
Left: Two different types of Calcite Twins.

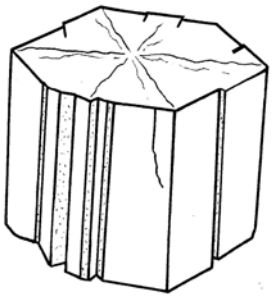
All of the twins shown here in the Trigonal System are examples of Contact Twinning.

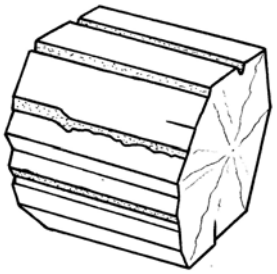


Tetragonal System

Left: Cassiterite, "Elbow Twin."
Right: Rutile, Cyclic Twin.
These are both examples of contact twins.

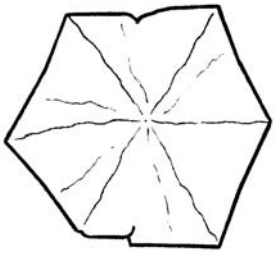


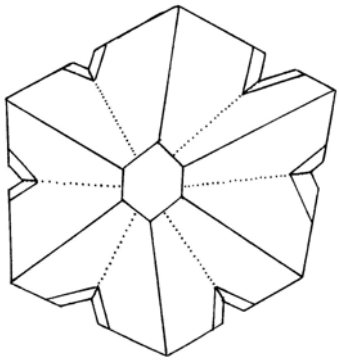




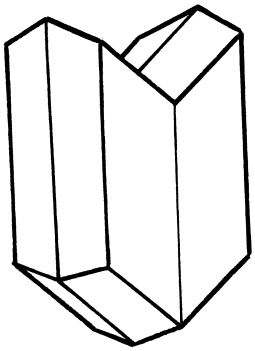
Orthorhombic System

Left and Right:
Aragonite, Cyclic Twin
This is also called *pseudohexagonal*, which means *false-hexagonal*. It looks like a hexagonal (six-sided) crystal but actually is orthorhombic.



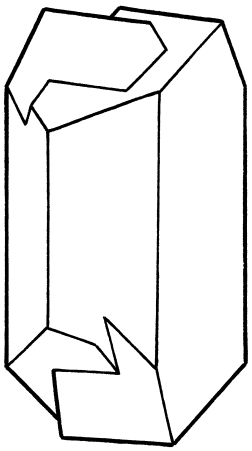


Left: Chrysoberyl, Cyclic Twin. Cyclic Twinning is an example of Contact Twinning. Also pseudohexagonal.

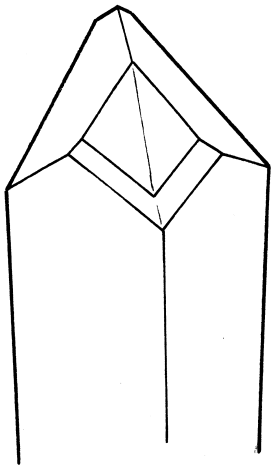


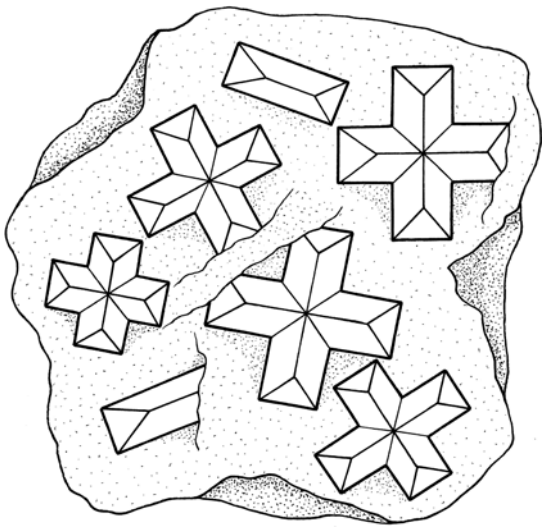
Monoclinic System

Right: Gypsum, "Swallowtail" Twin
(also called "Fishtail" Twin.)
This is another example of Contact Twinning.

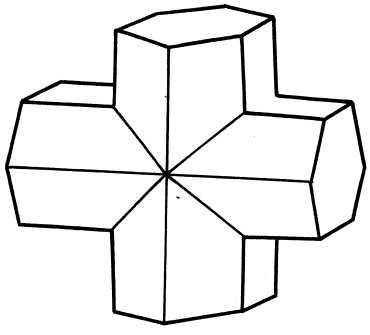


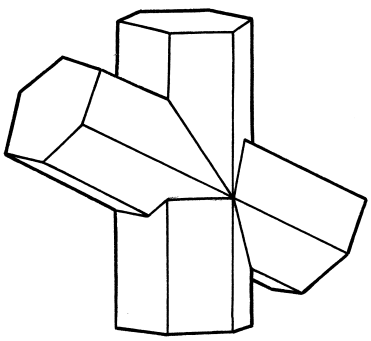
Right: Microcline Feldspar, Baveno Twin.
Baveno Twinning is Contact Twinning.
Left: Feldspar, Carlsbad Twin.
Carlsbad Twinning is Penetration Twinning.





Left and Below: Staurolite Twins.
This is another example of Penetration Twinning.



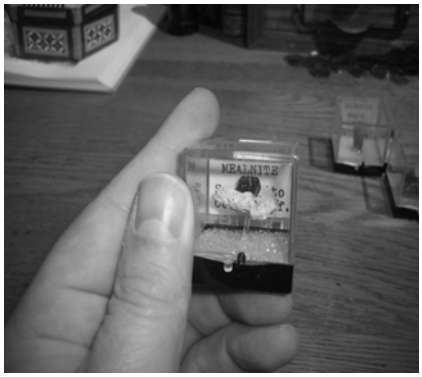


MINI MINERS MONTHLY

Minerals As Big As Your Thumb

by Darryl Powell

Many mineral collectors like to collect minerals that are large enough to display on a shelf or in a cabinet. Did you know, though, that there are different size groups of minerals and there are mineral collectors who specialize in specimens of a very specific size? First, here are the sizes that you will find when you look for minerals in shops and at shows.



HS = Hand Size which refers to any specimen larger than 10 centimeters (cms).

SC = Small Cabinet which refers to specimens between 5 and 10 centimeters.

Min = Miniature which refers to specimens between 3 and 5 centimeters.

TN = Thumbnail which refers to specimens 2 to 3 centimeters large. Think of them as approximately the size of an adult's thumbnail. Some collectors say, "1 inch all around or less."

MM = Micromount which refers to specimens 5 millimeters to 2 centimeters large. Micromounts are so small that you will need a microscope to see them well.

Why would someone want to collect thumbnail and micromount specimens? Aren't they too small? There are a few answers to these questions. First, there are some collectors who wish to collect as many specimens as they possibly can, but don't have the space for hand sized specimens and definitely not for cabinet specimens. Thumbnails and micromounts are great because they are small and take up much less space. Second, high quality thumbnails and micromounts are less expensive than a high quality hand specimen so a collector can build a really fine collection with a smaller budget. (Be prepared, though, that some high-quality thumbnail specimens can be extremely expensive.) Third, smaller specimens like thumbnails and micromounts are very often very well-crystallized and undamaged. It is an exciting experience to look into a microscope at a micromount crystal and see a perfectly formed, undamaged crystal of any mineral species. Fourth, there are a lot of mineral species that do not form large crystals. For example, rose quartz crystals are always thumbnail size or smaller. Turquoise crystals are extremely rare and are always micromount size.

Here are some pictures of thumbnail sized crystals. Notice that they all fit nicely into small plastic boxes. The boxes are known as "Perky Boxes." The name "Perky Boxes" comes from the man who made them popular, Willard Perkins, who was better known by his nick-name, Perky. Perky was a mineral dealer from California who purchased large quantities of these little plastic boxes, put a small square of Styrofoam on the bottom and attached thumbnail mineral specimens. When you buy a mineral specimen in a perky box, you already have a safe storage space for the specimen. Simply put the specimens in their perky boxes into a cabinet with drawers and your collection can just grow and grow.