Mini Miners Monthly

A Monthly Publication for Young Mineral Collectors.
August 2015 Vol. 9 No. 8

Welcome back to yet another issue of *Mini Miners Monthly.* This issue is a collection of all sorts of things. It has hints about building a mineral collection. It has a crossword puzzle. It has an article on cataloguing your mineral collection (along with a catalog page you can copy and use for recording the specimens in your own collection.

This issue has a really fun item about crystals and math called "Euler's Magic Formula." You can print out two crystal models, cut and fold and paste them together and then put the formula to the test. I promise you, it really does work!

As always we have another good article for you by our Contributing Editor, Emma Fajcz, titled *Dangerously Green*. Do you know that there are some minerals that are actually dangerous? Emma's article will teach you about one special group of dangerous minerals.

So enjoy a little of this and a little of that. It is always fun to provide you with interesting mineralogical info to help you both enjoy this great hobby and help you build a really good mineral collection.

An afternoon with Diamond Dan on the golf course.

DANGEROUSLY GREEN

By Emma Fajcz

In the mineral world, there are many beautiful green minerals, like dioptase, malachite, and olivine. However, some green minerals not only have a spectacular appearance, but also have a fascinating danger to them. In this article, I will be examining torbernite, autunite, uranocircite, and each of these minerals' paramorphs: meta-torbernite, meta-autunite, and meta-uranocircite.

Figure 1: Torbernite's distinctive crystals have earned it the nickname "Green Wulfenite."

These minerals are regarded as dangerous because of their radioactivity. This phenomenon occurs when unstable atoms composing an element give off energy in the form of radiation. The atoms are unstable because the forces that hold the atom's center together are too weak. Radiation is the energy, which can be in form of an alpha particle, beta particle, or gamma ray. All three of these types of radiation can be dangerous to humans and even cause cancer.

Figure 2: Meta-torbernite, the paramorph of torbernite, is radioactive, like its cousin torbernite.

Think of an alpha particle, beta particle, or gamma ray each as a little bullet. The unstable atom shoots out one of these types of little bullets in all directions. Alpha particles are the weakest; beta are a bit stronger; and gamma rays are the strongest. If one of these "bullets" come in contact with a person, they probably will kill some of that person's cells. Generally speaking, this isn't too bad, as long as radiation is kept below dangerous levels, because millions of cells die in your body each day anyway. However, radiation can sometimes damage the DNA in a cell instead of killing it, which can cause cancer. That's why radiation is so dangerous.

Despite these specimens' radioactivity, we can still admire them. Torbernite, autunite, uranocircite, and their paramorphs all contain the radioactive element uranium, and can be found in granite. Another interesting fact is that minerals containing uranium are usually green or yellow, which is probably why all four of these are such spectacular shades of green.

Figure 3: This autunite specimen is a beautiful example of autunite's crystal structure and fascinating color.

Torbernite can be used as an ore for uranium, but is more commonly used as an eye-catching collector's specimen. Its exclusive green color helps in torbernite's identification. In addition

Figure 4: The thin, flaky-looking crystals of this meta-autunite specimen provide much visual interest.

to torbernite's radioactivity from uranium, this mineral emits the carcinogen, or cancer-causing substance, radon gas. That's why it is recommended that they be kept in clear containers to trap the gas or at least in well-ventilated rooms where people don't usually spend a lot of time.

Another interesting feature of torbernite is its dehydration. Each torbernite molecule contains about eight to twelve water molecules. Over time, the water leaves the specimen, dehydrating it into the pseudomorph meta-torbernite. A pseudomorph is a mineral that keeps its original shape but is replaced by a different mineral. In this case, though, torbernite isn't being replaced by a different mineral; its molecules are just being slightly changed, which alters the chemical composition enough for it to be considered a different mineral. Therefore, it should be technically called a paramorph.

Autunite, which is similar to torbernite, is composed of nearly fifty percent uranium. Although it was discovered in France in the mid nineteenth century, some of the best autunite comes from the state of Washington. Like torbernite, it also dehydrates into a paramorph called meta-autunite. To avoid this dehydration process, some museums have coated autunite specimens in lacquer. Both autunite and meta-autunite are florescent; under ultraviolet light, they glow yellow-green.

Figure 5: Uranocircite's brilliant green color is due to a composition of almost fifty percent uranium.

Like torbernite and autunite, uranocircite also contains significant concentrations of uranium and eventually dehydrates into meta-uranocircite. Uranocircite is actually a very soft mineral, like autunite and torbernite; its Moh's hardness is around 2 to 2.5. This means that you can scratch it with your fingernail. Like autunite, it is also florescent under ultraviolet light. However, it glows greener than autunite.

Now that you know a little bit about three different radioactive uranium minerals, take a look in some mineral books this month to see if you can discover any more interesting facts about these minerals, or about some other uranium minerals. Try looking for these minerals the next time you visit a mineral museum.

Photo Credits

Figure 1: "Torbernite-120982" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Torbernite-120982.jpg#/media/File:Torbernite-120982.jpg

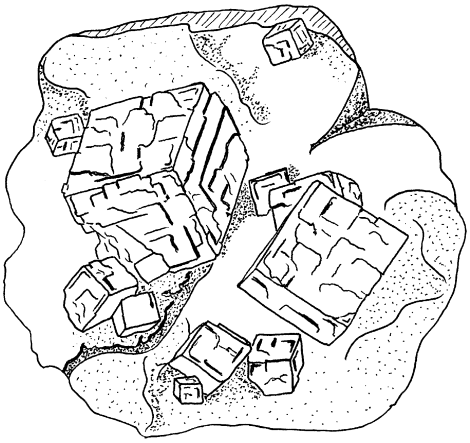
Figure 2: "Metatorbernite-4jg26a" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Metatorbernite-4jg26a.jpg#/media/File:Metatorbernite-4jg26a.jpg

Figure 3: "Autunite-203061" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Autunite-203061.jpg#/media/File:Autunite-203061.jpg

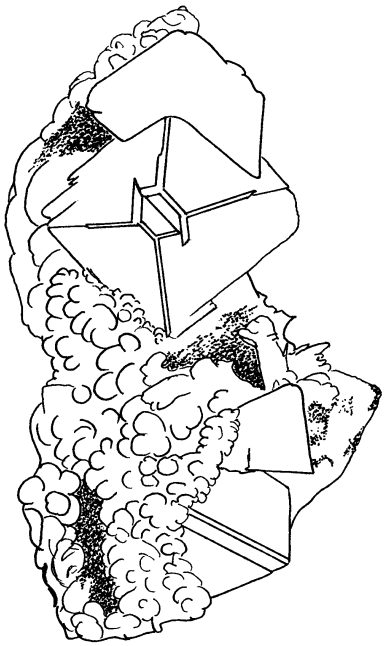
Figure 4: "Meta-autunite-167960" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Meta-autunite-167960.jpg#/media/File:Meta-autunite-167960.jpg

Figure 5: "Uranocircite-51177" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Uranocircite-51177.jpg#/media/File:Uranocircite-51177.jpg

Mineral of the Month

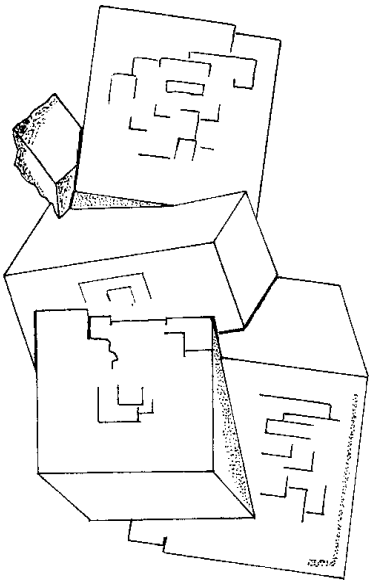


Fluorite



Fluorite is found all over the world. It occurs in many different colors including colorless, blue, purple, green, yellow, white, pink, and brown.

It is number 4 on the mineral hardness scale (called Mohs' Hardness Scale).

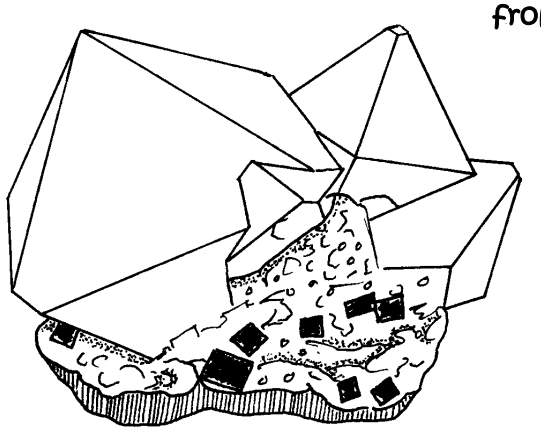


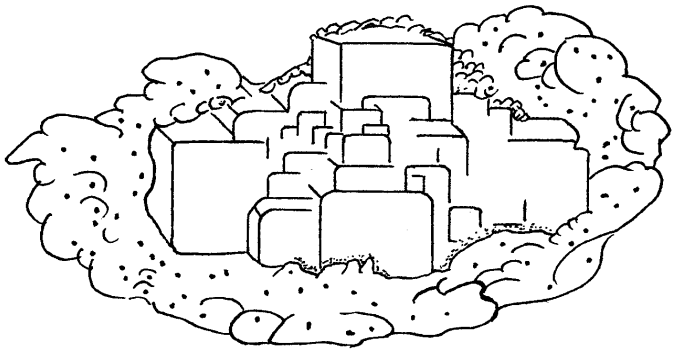
Fluorite crystallizes in the isometric system (also called the cubic system) and is found mostly as cubes or as octahedra. An octahedron is an eight-sided crystal that looks like a diamond.

The name comes from the Latin word *fluere* which means *to flow*. This name was chosen because when fluorite is added to iron ore, the iron melts (flows) out of the ore at a lower temperature than it does without the fluorite.

Fluorite contains the elements calcium (Ca) and fluorine (Fl). Its chemical formula is CaF_2.

Above left: Purple from China. Above right: Apple green from Colorado. Left center: Yellow from Illinois. Below left: Pink from Peru. Below: White with purple edges from Mexico.





Building a Mineral Collection

By David F. English

You will find building a mineral collection a lot more rewarding and fun if you follow some basic ideas. I found these ideas to be very helpful as I built my collection.

I started collecting when I was in 5th grade. Back then I wanted to collect any mineral I could get my hands on. After a few years, I discovered there were some minerals that I like better than others. So, I began to focus on these minerals. I like calcite, fluorite, quartz, gypsum and tourmaline. Once in a while I will see a really great pyrite, but since I don't collect pyrites, I enjoy looking at them but don't buy or trade for any.

Here is a list of some of the different mineral collections my friends have.

--Some like a specific type of mineral such as quartz, calcite, fluorite, etc. These are called "species collectors."

--Some collect minerals from a certain place, like a country, state or mine. One of my friends likes minerals from Colorado. Another likes crystals from China.

--Some collect different crystal shapes of the same mineral. Calcite is great for this since it has been found to have over 600 different crystal shapes!

--Some like old specimens with old labels. Others like new minerals that were only recently discovered.

--Some like to have one good specimen of every type of mineral. This is called a "Systematic collection."

--Some collect crystals the size of your thumbnail. Specimens this size are actually called "thumbnail specimens." They are often more perfect than larger specimens.

--Some collect microscopic crystals. These are called "micromounts." They can be nearly perfect crystal shapes, but you need a microscope to see them.

--Some collect minerals that belong to a certain crystal system. For example, fluorite, galena, pyrite and garnet all belong to the isometric (cubic) crystal system.

--Some like minerals that belong to a certain chemical group. For example, calcite, rhodochrosite, malachite and azurite all belong to the carbonate group of minerals.

--There are some collectors that collect what catches their eye! One friend of mine has a lot of calcite, a little galena, different specimens from India, others from China. He just buys or trades for things that look good to him.

What do you like? I suggest you just collect what catches your eye for a while. After a few years, look over your collection. You will start to see what you like best. And then you can start to focus on those minerals or categories.

The next good question is, "How to I get these minerals?" There are three ways to get specimens for your collection.

1. Buy them. Some people call this the "Silver Pick" meaning instead of digging them out of the ground with a steel pick, you go the "easy" way of using your money.
2. Trade for them. After a while, you will have specimens you no longer want. You can trade them with other collectors for specimens you do want.
3. Dig for them. You will find that the "best" specimens in your collection are the ones you found yourself. It is very exciting to pull a crystal out from its hiding place and know that you are the very first human in the history of the world to see, touch and enjoy that mineral specimen!

Building a Mineral Collection, Part 2

By David F. English

Last time I promised to tell you more about buying, trading, and digging for mineral specimens.

Trading Minerals

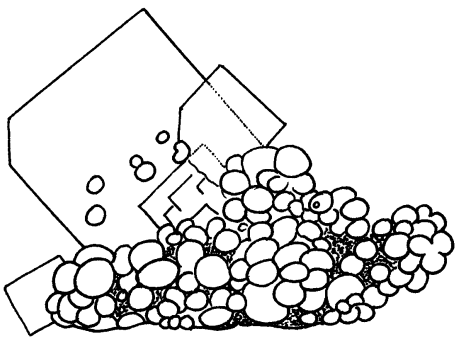
Trading mineral specimens can be a lot of fun! I try to live by the idea that the goal of trading minerals is . . .

Be Fair & Respect Each Other

What is a fair trade? A "fair trade" is when you give a specimen or specimens to another collector and the collector gives a specimen or specimens to you, and you both feel good about the mineral you received.

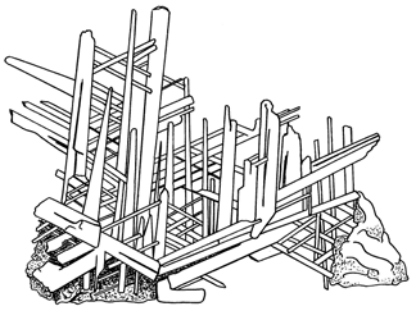
Here are helpful steps to trading:

1. Look over your minerals and decide which ones you want to keep. Put them aside in a safe place.
2. Then, put the specimens you are willing to trade in a special box. Many collectors store their trading specimens away from their collection.
3. Compare your trading specimens with a friend's trading specimens.
4. Talk with your friend and decide which of his or hers you would like to have.
5. Ask which specimens of yours your friend would like to have.
6. Then decide which specimen is a fair trade for the one you want.
7. If you agree, then exchange specimens and shake hands with a "Thank You."
8. If you can't agree, it is ok to ***not*** make a trade. Still, shake hands and say "Thank You."

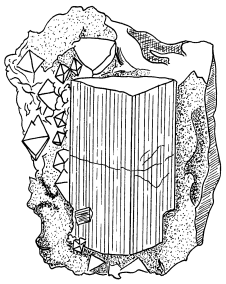


Buying Minerals

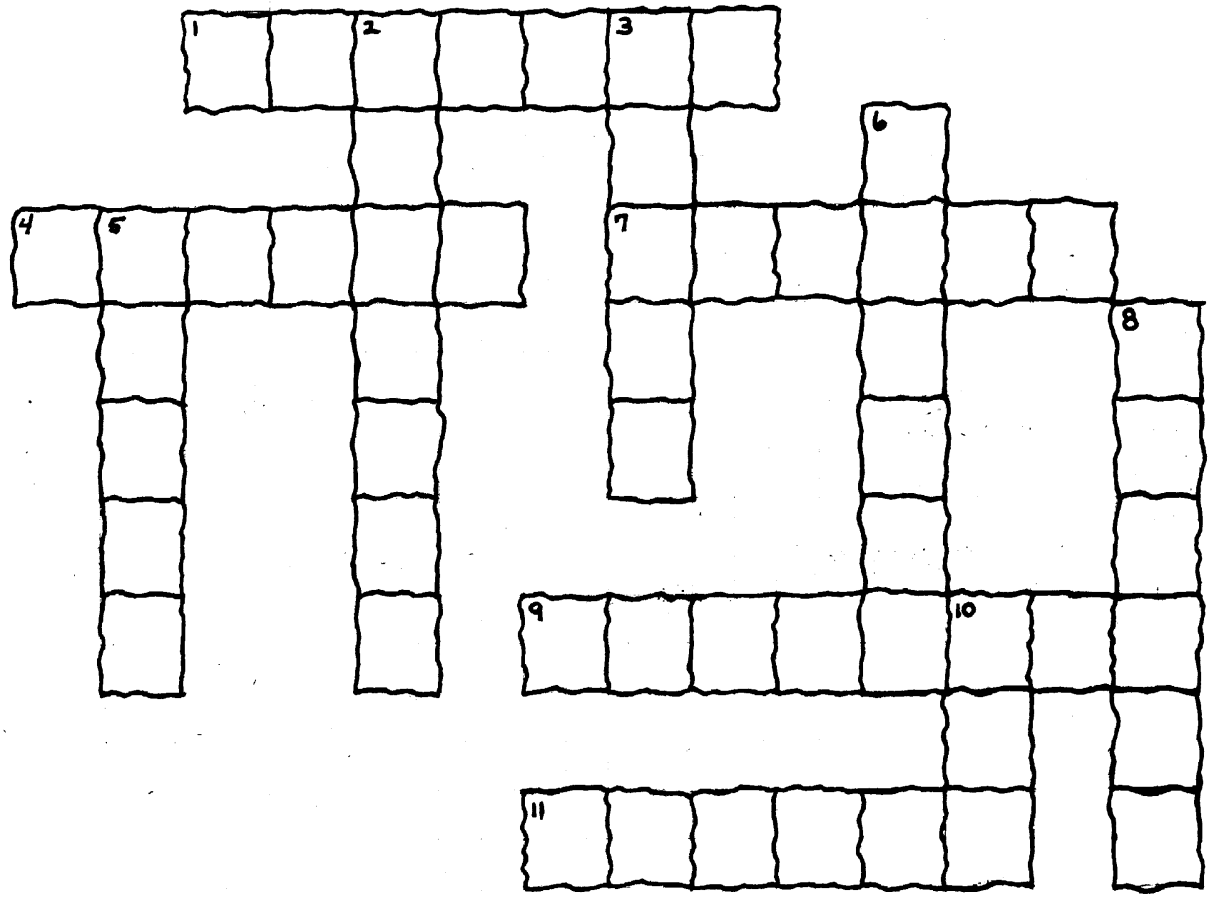
Here's a question: How do you know what to buy when you are at a mineral shop or at a show? Here are some rules to help you make a good purchase:



1. What can you afford? There is always a more expensive mineral. Buy the one in your price range. If you have $5, choose from the $5 or less group. (If you have $5,000, you can choose from the more expensive section.)
2. Is the mineral damaged? It is always better to purchase a specimen that is not damaged. What is "damage"? Look for chips and places where the mineral has been banged up. Buy the specimen that looks good to you. This is <u>your</u> collection. Collect the minerals that you enjoy.
3. What looks great to you may not look great to another collector. That doesn't matter. What matters is that you are happy with <u>your</u> choice.
4. Pick a specialty. For example, specific mineral species like quartz or pyrite, minerals from a mine or state, one special crystal system like cubic minerals, or minerals that have a special shape (I once saw an entire display of different minerals that grew like perfect balls!) The list can go on and on. Decide what you like best, and focus on that. A dealer may have 100 GREAT fluorite specimens. But if you like galena, then you can pass by the fluorites. **More to come. Stay tuned.**



Mineral Crossword Puzzle



Across

1. A blue mineral named after a word which means *blue*.
4. A red variety of the mineral *quartz*. It can sometimes be yellow, too.
7. Also known as "Fool's Gold."
9. This mineral contains the element *fluorine*. It comes in many colors.
11. The mineral name for *salt*.

Down

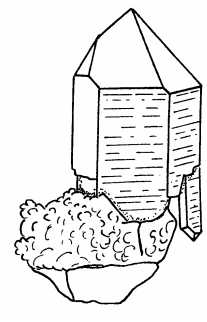
2. Also called "Television Stone."
3. This mineral can form crystals weighing hundreds of pounds.
5. A variety of *quartz* with many colors and patterns.
6. This mineral is used in photography and chemistry. It can form long wires.
8. A very heavy mineral with metallic luster. It is an ore of lead.
10. This mineral melts above 32 degrees Fahrenheit.

Building a Mineral Collection, Part 3

By David F. English

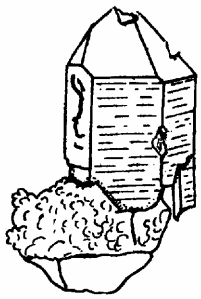
When I choose a mineral specimen, either when I am trading or when I am buying, I find the following ideas give me a feeling of success.

First, I try to buy specimens that are not damaged. What is "damage"? Look for chips and places where the mineral has been banged up.



A really good specimen (left).

The same specimen with damage (Right).



Look all over the specimen. If the damage is hidden in the back of the specimen, it may not be a big deal. But if the damage is on a crystal face or edge that is right in front, you may want to choose a different one.

Second, remember that this is *your* collection. The goal is to choose the specimens that make *you* happy. Buy the specimen that looks good to you. This is <u>your</u> collection. Collect the minerals that you enjoy. What looks great to you may not look great to another collector. That doesn't matter. What matters is that you are happy with <u>your</u> choice.

Third, you will have to learn by reading and by experience. The more you know about minerals, the more you will be able to identify a higher quality specimen. I find that a high price does not always mean the specimen is better. One year I saw magnetite crystals for $30 on one table, and larger, better crystals for $10 on another! Study mineral books, visit shows, go to mineral museums. The more you see and learn, the more expert you will become.

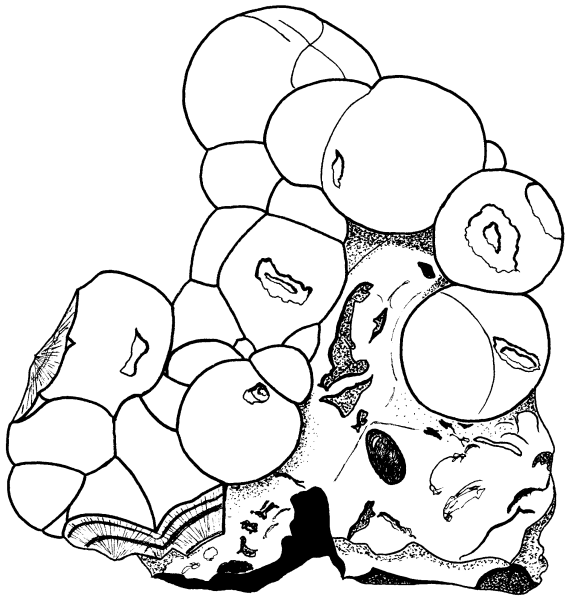
Good luck building your collection. I hope you will find it to be a rewarding experience.

Mineral Shapes

Mineralogists use special names to describe the shape of a mineral specimen. When you read mineral books, you will see words like *acicular, blocky, botryoidal, tabular,* and more.

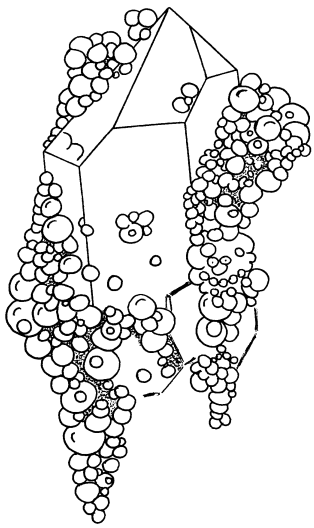
Botryoidal

"Botryoidal" describes a mineral that looks like a bunch of grapes. Below is a famous specimen of Azurite from Arizona. See how it looks like a bunch of grapes? (Hold it upside down!)



(Color the azurite "balls" light blue.)

Another example is this specimen of hematite from Graves Mountain, Georgia. Its color is described as *iridescent* which means it is a mixture of bright red, green, blue and purple. The hematite has formed on a quartz crystal.



Keeping a Catalogue of Your Mineral Collection

What do you do after you take a mineral specimen home? There are a few things that you should do to take good care of your specimens.

By Darryl Powell

When you add a specimen to your mineral collection, it is important to write down as much information about the specimen as you possibly can. Mineral dealers from all over the world tell me that a specimen that has information with it is much more valuable than a specimen without any information.

On the next page is a simple two-page catalogue you can use for your specimens. Let's go through it.

1. When you get a new specimen, give it a number. Keep a list of your numbers and the specimen that goes with each. It is easiest to number them 1, 2, 3, 4, and so on.
2. Write down the name of the mineral on the long line.
3. If there are other minerals with it, list those next.
4. In the next section, record how you came to own the specimen. Did you buy it? If so, from whom and for how much? Was it a gift? Who gave it to you? Is it an old specimen that was owned by another collector? Who was it? Do you know who actually dug it out of the ground? When was it found?
5. Then measure it with a metric ruler and describe the crystals if there are any.
6. On the second page, add any other special information you may have. I like to mention magazine articles about the specimen or the place where it was found. I also make comments about anything special that happened or that I learned when I received the specimen. If it reminds you of a special event or person, make a note about this. I even make personal comments like, "This is one of my favorite minerals!" or "This is ok, but someday I'll buy a better specimen." Anything you want to write here is ok.
7. Save any labels that came with the specimen, including the dealer's label. Labels are very collectible by themselves. Also, a specimen with all its labels is worth more money.

You can copy the following pages as much as you want to for your own collection.

If you would like some mineral catalogue pages that are printed in full color, contact us at Diamond Dan Publications. They are available in packages of 100 sheets. The cost is $20/100 sheets. We know this is a bit expensive, but we believe you will find the bright, color printing makes for a very good looking catalogue page. You can reach us at 278 Howland Ave., Rochester, New York 14620, or give us a call at 585-278-3047. Ask for Darryl Powell.

No. _____

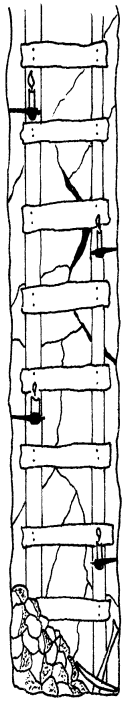
_____

Associated Minerals _____

_____

Locality _____

_____



Specimen History

Date Acquired _____/_____/_____

Acquired by . . . _____self-collected, _____purchase,
_____trade, _____gift

Acquired from _____

Price $_____

In trade for _____

Previous Owner (s) _____

_____

Previous Number (s) _____

Collected by _____

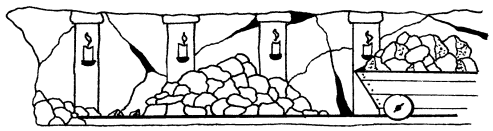
Date Collected _____/_____/_____

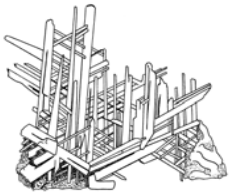
Specimen Description

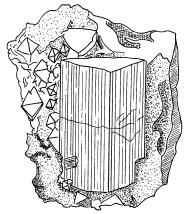
Size _____ cm x _____ cm x _____ cm

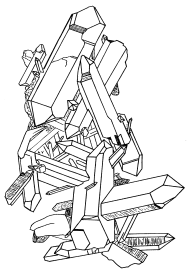
Color _____

Crystal Form (s) _____









Additional Information

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

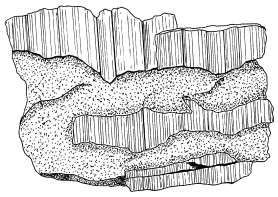
Drawings, Labels, Etc.

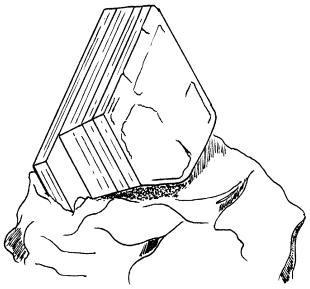
Removed from Collection _____/_____/_____

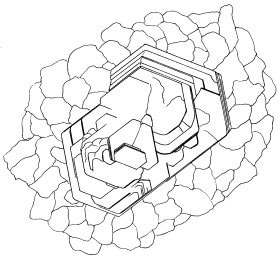
Removed to _____

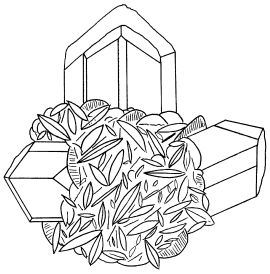
Mineral Match

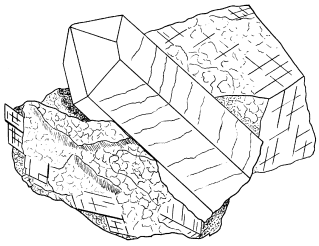
Can you identify the minerals on this page?
Draw a line from the name to the picture of the mineral.
Use a good mineral book to look up the mineral names listed here and to study some pictures of the minerals. This will help you complete this challenge!
(The answers are on page 11.)

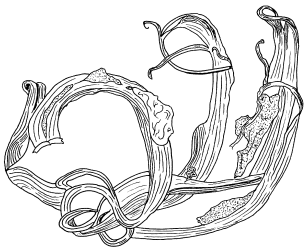


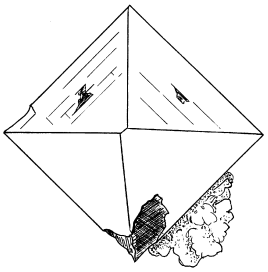


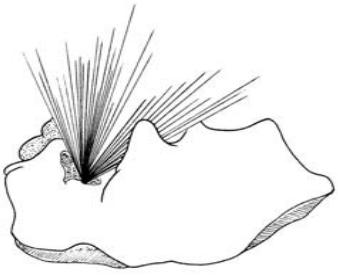


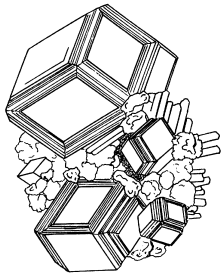


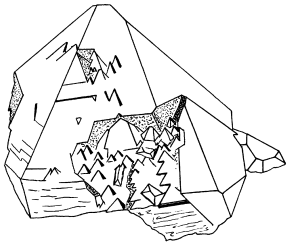












Molybdenite

Apatite

Garnet

Amethyst

Biotite

Zircon

Asbestos

Gypsum

Silver

Millerite

Once in a while we will be introducing to you some terrific and important people in the mineral hobby. It is our hope that their stories will inspire you to pursue mineral collecting as a hobby and maybe even as a career when you are older. You will discover that men and women, young and old, rich and modest all have made important contributions to our hobby.

Interview of the Month
Mr. Bob Jones

Bob Jones is a very well known mineral collector and author of dozens of articles on minerals and mineralogy. He was introduced to minerals in 1935. Mr. Jones earned a Masters of Science in Education and his thesis was about the fluorescent minerals of Connecticut. For 32 years he was a teacher (1st, 2nd, 4th, 5th, 7th, and 8th grades as well as adults). Presently he lectures about minerals all around the world and he serves as the International Liaison (representative) for the American Federation of Mineralogical Societies. He is also a member of the Tucson Gem & Mineral Society.

What advice would you give young mineral collectors?
It is important to hook up with someone who is knowledgeable about minerals and is willing to share his or her knowledge. Learn whatever you can about good mineral books, how to identify minerals, and where good museum displays of minerals can be found.

Are mineral clubs valuable for a new collector?
Any connection you can make with other collectors will pay off. It is very important to join a club. Very often local museums have mineral clubs associated with them.

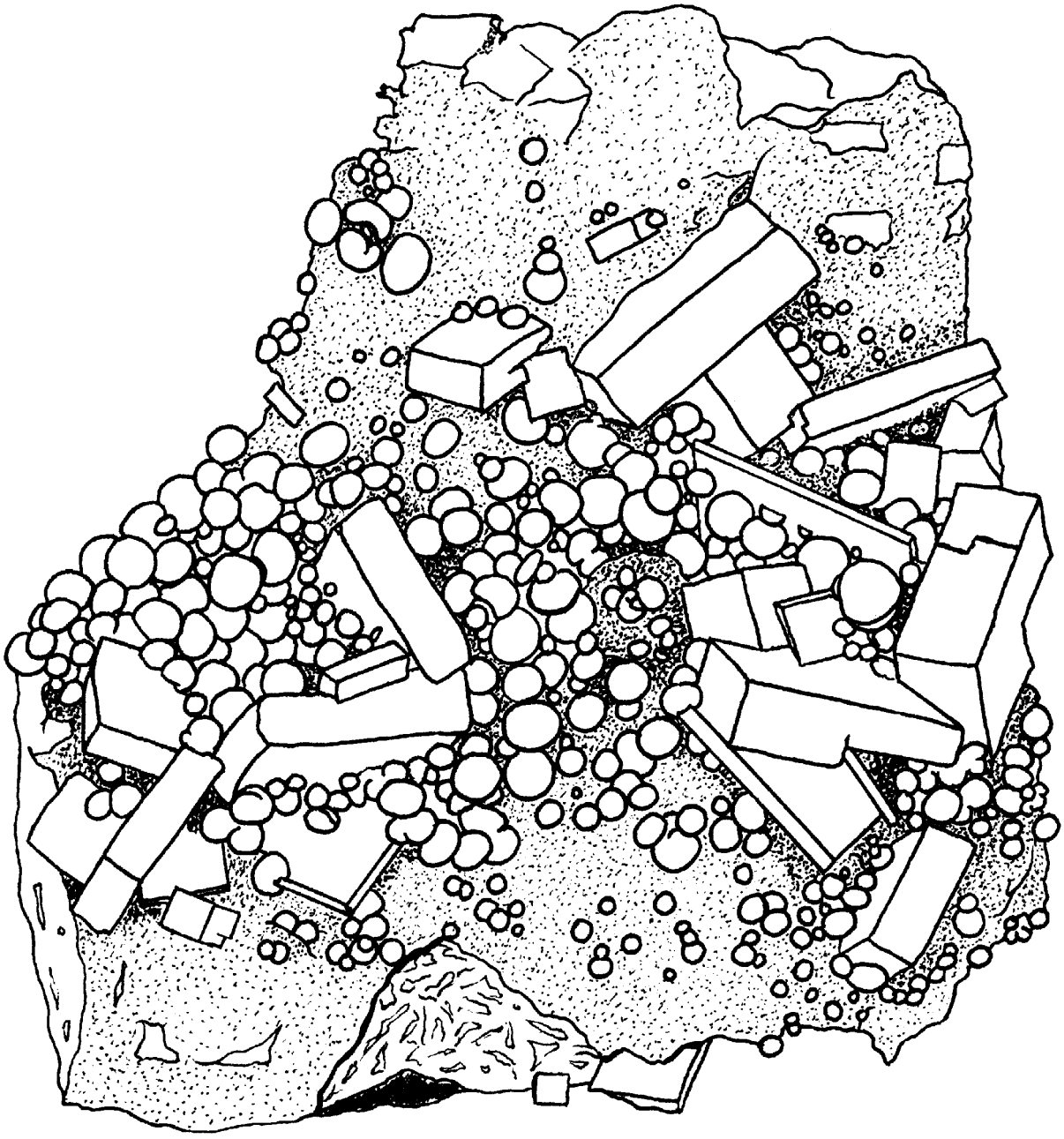
What do you think about buying mineral specimens on the internet?
I am always very cautious about buying minerals from sources on the internet. It is hard to accurately picture the specimens based on the picture on the computer. It is always better to see a mineral specimen in person before deciding to purchase it or not.

Why is collecting and studying minerals important to you?
Knowing about minerals helps us understand the environment and how to conserve the environment. It helps us know how to preserve the natural beauty of the Earth. I have also found that each mineral specimen is a unique creation of nature. No two specimens that are alike.

At your lecture today you told us that after many years of collecting minerals, you now have only 2 special specimens in your collection. Why are you still so involved in the mineral hobby if you are no longer collecting?
Life is about people and friendships. There are many special people in the mineral hobby. There can be a lot of energetic competition for specimens between collectors. However, I find that people in our hobby respect nature and, most importantly, respect each other.

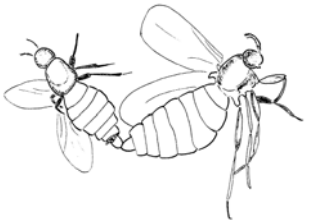
Mr. Jones, thank you *very* much for sharing your time, wisdom and experience with us. With all you have to do, we are fortunate to receive a little of your time.

Coloring Page



This is an awesome specimen from the Ojuela mine, Mapimi, Durango, Mexico. The large, boxy crystals are wulfenite. Color them yellow. The round balls are mimetite. Color them light green. The rest is called *matrix* (that's just the rock on which the crystals are sitting). Color it rust red.

Amber by Wesley Powell



Amber is fossilized tree sap which often has different things in it such as bugs and spiders. (Don't worry! The bugs are dead!) Hundreds of years ago, amber, which is today used in jewelry, was used in many other different ways. In the 1500's, many different items like bowls, plates, and sometimes chess sets were made from amber.

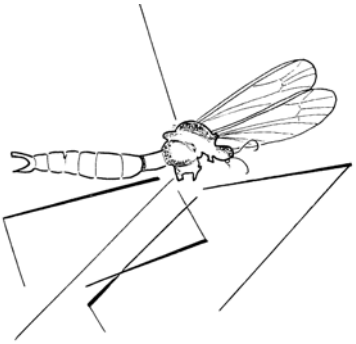
The two best places to find amber is in are in the Baltic States, and the Dominican Republic. The price of amber can be from $20 to as high as $40,000!

Amber is very useful for people called paleontologists. Paleontologists are able to identify different things inside the amber. Over 1,000 extinct different insects have been discovered in amber!

Some of the insects and bugs inside the amber can be pretty old, too. Millions of years old! In fact, one scientist claimed to have found an insect inside of amber which is 135 million years old! That's when the dinosaurs roamed the earth!

A few of the most common insects and other things you can find in amber is termites, moths, caterpillars, spiders, and midges.

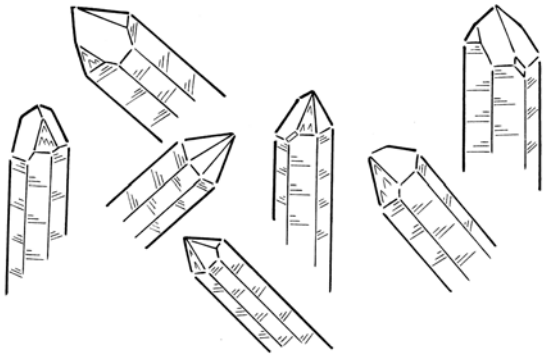
There have been many different myths about this gemstone. For example, Phaethon, who was the son of Helios, the sun god, asked his father if he could ride the chariot of the sun for a day through the heavens. Helios agreed. Phaethon got too close to the earth and burned it! To save the earth, Zeus threw a lightening bolt at Phaethon and killed him. His mother and sisters mourned and turned into trees and their tears are the amber.



Insects found in amber: Top: Scavenger flies Left: Ants Right: Crane fly

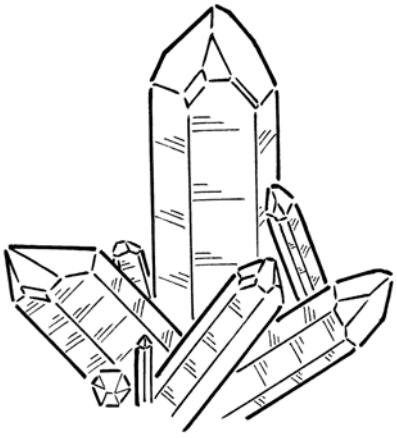
Some mineral fun facts

The Roman writer named Pliny the Elder



noticed that quartz crystals are very cool to the touch. He also found many quartz crystals high in the mountains. So, he came to the conclusion that quartz is *petrified ice*. In other words, he believed that quartz was ice that had frozen so hard that it would never thaw out and melt!

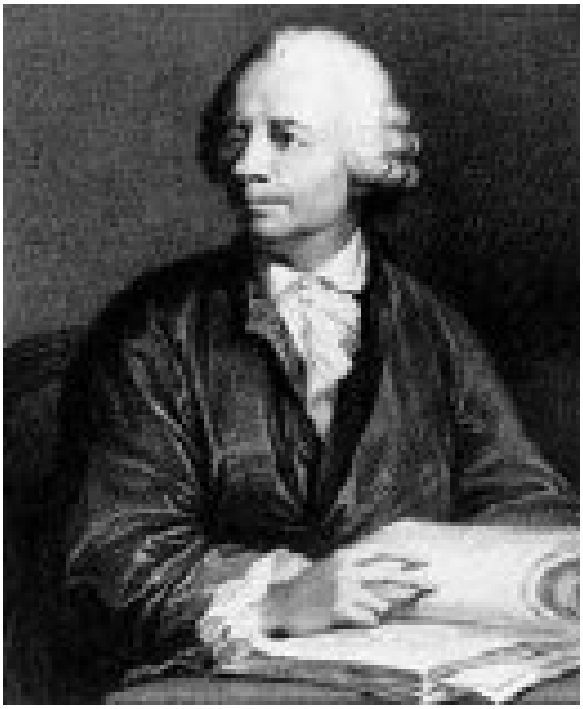
(Today we know that quartz is silicon and oxygen and that it absorbs heat quickly and easily.)



Sulfur cannot absorb heat very well. If you put your warm finger on the surface of a sulfur crystal, the crystal will crack. Sometimes you can ever hear the cracking.

Euler's Magic Formula

Here's a little something for the mathematicians out there!



Leonhard Euler was a mathematician from Switzerland. He lived from 1707 to 1783. He is famous for the many mathematical discoveries that he made in his lifetime. He proved one special theorem that mineral collectors would find interesting.

Before I tell you the theorem, you have to know the definition of the word *polyhedron.* A *polyhedron* is a three-dimensional shape made up of flat faces (like crystal faces). A line (also called an edge) is formed where the faces meet each other and a point is formed where the edges meet each other. These points are called *vertices*.

And now, Euler's Magic Formula.

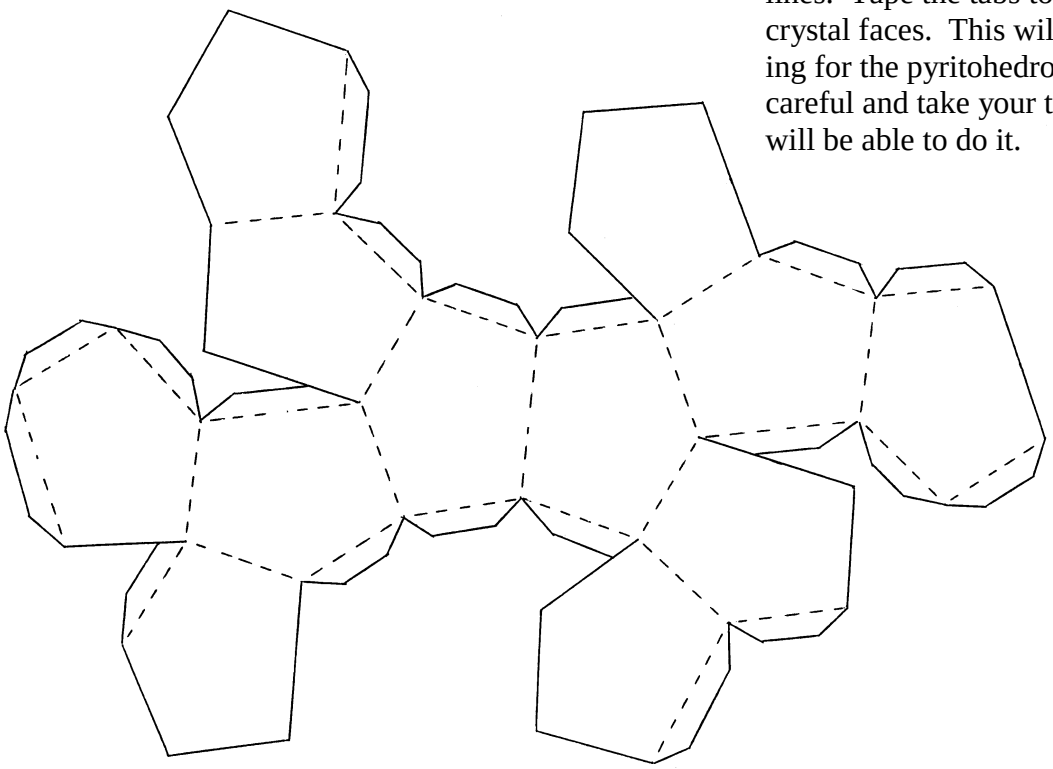
If you add the number of faces (call them "F") of a polyhedron to the number of its vertices (call them "V") and then subtract the number of edges (call them "E"), you will **always** get the number 2.

$$F+V-E=2$$

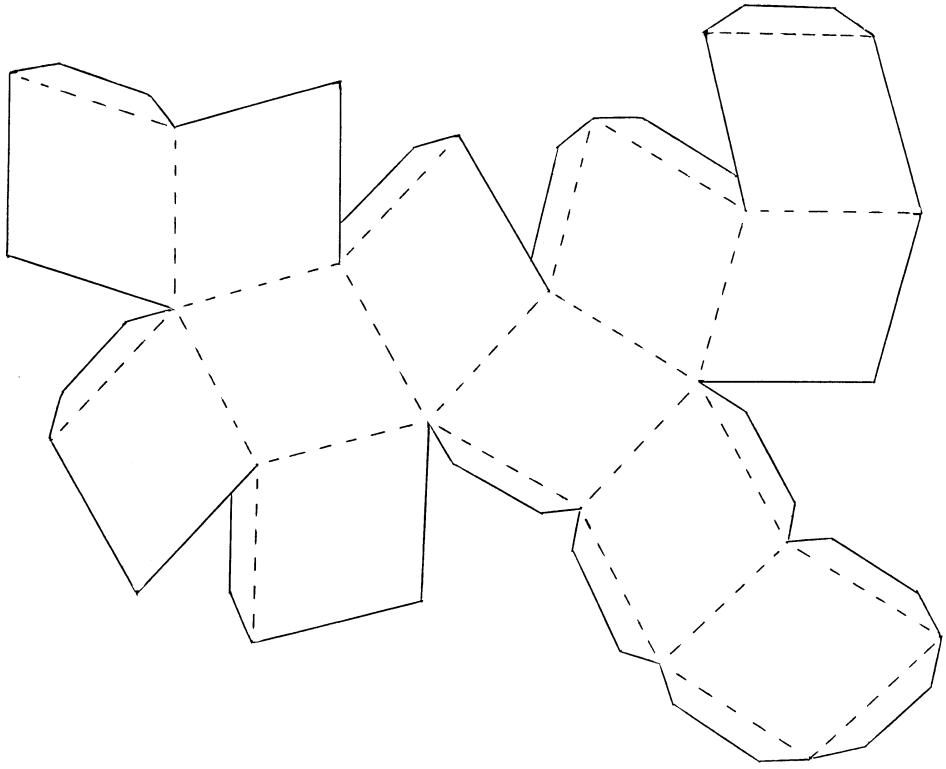
On the next page are two paper crystal models. Put them together and see that the magic formula works. Or, find a crystal in your collection that is completely covered with crystal faces, like a perfect pyrite cube, and check out Euler's Magic Formula.

Pyritohedron

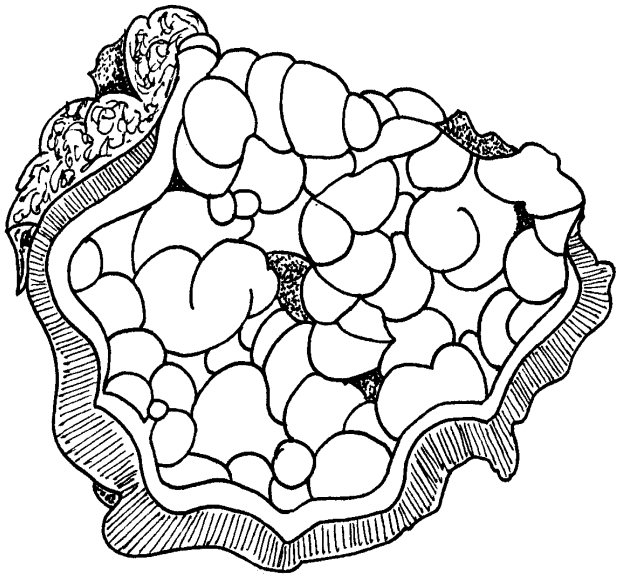
Use these crystal model to try out Euler's Magic Formula. Cut on the solid lines. Fold on the dotted lines. Tape the tabs to the opposite crystal faces. This will be challenging for the pyritohedron, but be careful and take your time and you will be able to do it.

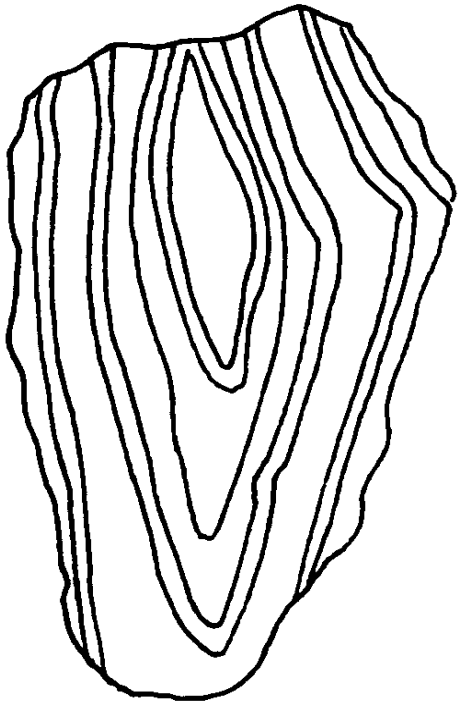


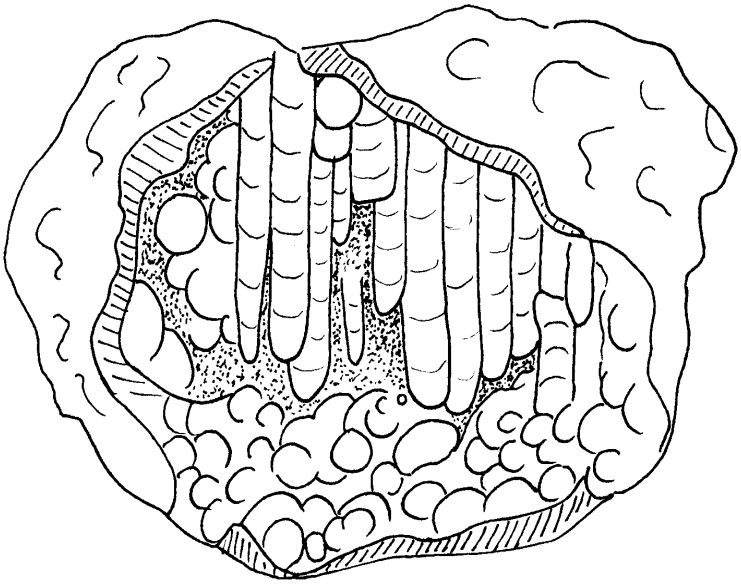
Dodecahedron



Agate & Chalcedony







Top Left: Deep red chalcedony. Top Right: Red, orange and brown agate. You can choose which parts are red, which are orange and which are brown. Lower Left: Banded agate. Each band is a different color (red, yellow, white, gray, purple. Lower Right: Blue chalcedony geode.

Agate = Quartz

You are familiar with quartz. We have had a lot of quartz crystals in Mini Miners issues. Most of the quartz you are familiar with forms crystals. Examples include rock crystal, amethyst, citrine, smoky quartz, and milky quartz.

There is another type of quartz that you have probably seen, but you may not know that it is quartz. This type of quartz forms crystals that are so small that they can only be seen with a special microscope. Mineralogists call this type of quartz *cryptocrystalline*. Chalcedony and agate are two varieties of this special type of quartz.

Chalcedony is very hard, 7 on the hardness scale. It is light. Chalcedony is usually banded. The bands alternate between fibrous bands and bands that are made up of microscopic grains. There are a number of different varieties, or types, of chalcedony. The most popular and well-known is agate.

Agate is banded chalcedony. The bands can be different shades of gray. But they can also be a number of different colors. On the previous page is a banded agate (lower left). Color the different bands different colors (white, gray, red, yellow, brown, purple, etc. Sometimes the different bands form randomly in the specimen, like the upper right agate on previous page. The bands are red, orange and dark brown.

Another type of chalcedony is called *jasper*. Jasper is red chalcedony. The specimen pictured on the previous page, in the upper left corner, is dark red, rounded jasper. Chalcedony often forms in rounded masses like this specimen.

Light to dark brown chalcedony is called *carnelian*. Apple-green chalcedony is called *chrysoprase*. Dark green chalcedony with red spots is known as *bloodstone* or *heliotrope* because the red spots look like drops of blood. Gray and black, waxy-looking chalcedony is called *flint*.

All the different chalcedony varieties are cut and polished by jewelers and lapidary artists to make jewelry. Flint can be chipped into very sharp edges. Native peoples have used flint for arrowheads, spearheads, and various cutting tools.

Now that you have read about chalcedony, what do you think the lower right specimen is on the previous page?

Famous Mines in the U.S.A.

In this word search are the names of famous mines in the United States of America.
The names can run left to right, right to left, top to bottom, bottom to top or diagonally.
When you are done, use the internet and find information and pictures of each mine.

H I M A L A Y A A R O N O M W
C O L O R A D O Q U A R T Z I
B C M W P E A S I J N T S T L
O N E E U Q R E P P O C T U L
A C F S S E L G G U R E E E I
T B R I S T O L S A N P R D A
Q U I N C Y A Y W N M O L V M
Z N U R T C B K E L Q W I H W
K K B C T R U B E W Q L N O I
R E D C L O U D T H A P G P S
T R O W N G T F H A N N A N E
L H N W O I G C O M S T O C K
T I L L Y E K I M R E K N U B
A L I E F O S T E R W E S M O
Y L L E K Q F E I H C A L A P

Ruggles; William Wise; Sweet Home; Tilly Foster; Pala Chief; Himalaya; Bennett; Quincy; Kelly; Red Cloud; Colorado Quartz; Sterling; Homestake; Bristol; Copper Queen; Comstock; Etta; Bunker.