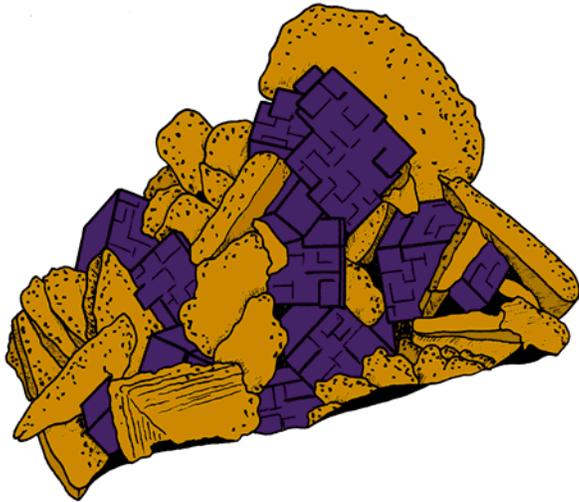


# MINI MINERS MONTHLY

In this issue . . .



## LIGHT!

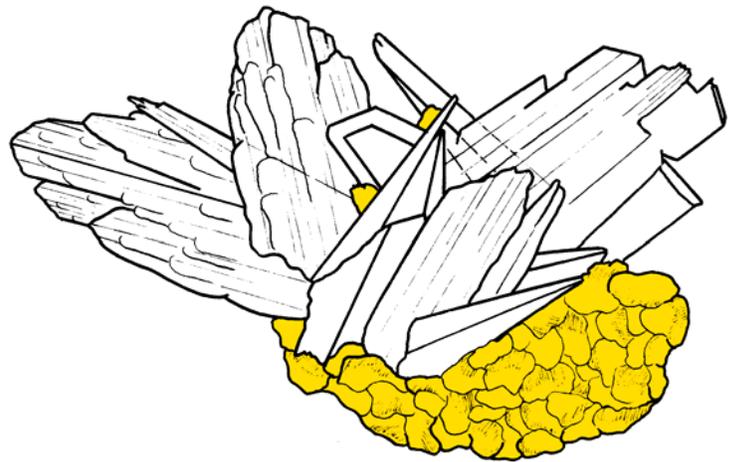
This is the November issue, of course. The days are getting shorter here in the northern hemisphere. More dark, less light. As we move into December, holiday celebrations filled with light will be upon us. So, this issue of *Mini Miners Monthly* is devoted to light and minerals. Color, luster, transparency, double refraction . . . all these properties have something to do with light.

Mini Miners who have been with us for a long time will look at some of the articles here and say, "Hey! You presented this to us before! This is a repeat!" Yes, some of the articles in this issue are a repeat. But others are brand new. We have never published one single issue that covers all the different ways minerals and light interact with each other. AND . . . since color comes from the way light is absorbed and reflected by a mineral, we decided that an entire section of

### "A Coloring Book of Minerals & Crystals, A to Z"

would be a fitting end to this special issue. To create the coloring book section we have used many mineral drawings that you have seen before. In addition, we have included a number of new mineral drawings. You have our permission to make copies of the coloring book for use in your mineral club meetings, scout meetings, classrooms or at home. (In 2015 it will be printed and published as a book, an old-fashioned coloring book about minerals and crystals.)

Our contributing editor, Emma Fajcz, has prepared a series of mineral flashcards that you can print, cut out and use to learn about 26 interesting minerals (A to Z, of course!!)



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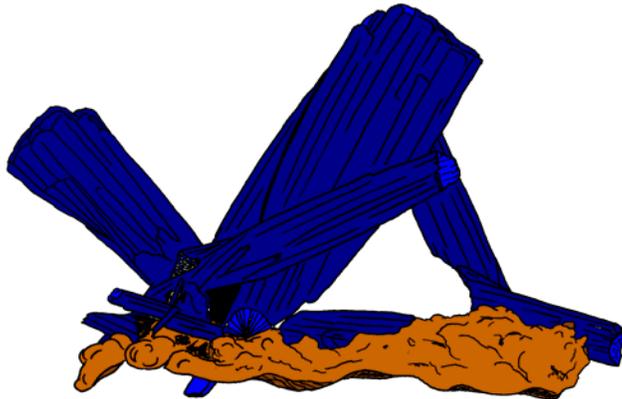
# How Does "Color" Work?

MINI MINERS MONUMENTAL

Let's start with the light itself. Suppose you are outside and your mineral collection is laid out on the picnic table in the backyard. The light shining on your minerals is coming from the sun. The sun gives off (scientists would say "emits") white light. "White light" is light that has all of the different wavelengths of light that are visible to the human eye. Each wavelength is a different color of light!

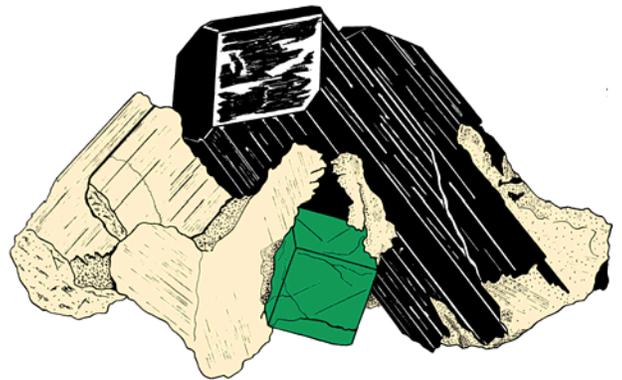
The minerals on your table are able to soak up some of the wavelengths (colors). Scientists don't say "soak up;" they say "absorb." At the same time, some of the wavelengths (colors) bounce off of the minerals. Scientists don't say "bounce off;" they say "reflect."

When a mineral doesn't absorb any wavelength (color) of light, you will see it as white. This means that it reflects all of the wavelengths and your eye sees them all at once. Your brain takes this light information and mixes all the colors together and you see a white mineral specimen.



But say you have a dark blue azurite specimen on the table. The specimen absorbs (soaks up) all of the wavelengths (colors) of the sunlight EXCEPT dark blue. The blue bounces off of the specimen and goes to your eye. Your brain takes that wavelength (color) information and tells you, "What a pretty BLUE azurite specimen!"

Now you have a large SCHORL crystal on the table. For those who may have forgotten, SCHORL is the name for black tourmaline. Why is it black? Your eye sees it as black because it absorbs ALL of the light and reflects no wavelengths (colors) back to your eye. In other words, black is the absence of light! But you already knew that.



So, here to the right you have a SCHORL crystal with a green fluorite cube. Let's do a quick test: why is the fluorite green?

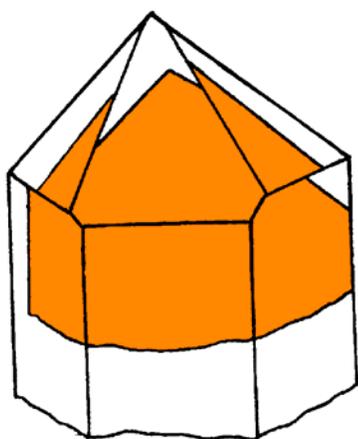
Wait for it.....wait for it... wait for it....

Because it absorbed all wavelengths (colors) except green. The green bounced off of the crystal (reflected) and went to your eye and your eye sees it as green! Ta Da!

Now you know why your minerals have different colors.

# Can Light Go Through Minerals?

There are many different ways to describe the look and the physical properties of a mineral. Some of these have to be done using special equipment (like "specific gravity" which you can read about in this issue. To measure specific gravity you need a "Jolly Balance"). To measure hardness you need a set of minerals in the Mohs' Hardness Scale. However, color is determined simply by looking at the mineral and describing the color. Another description that you can do with the mineral specimens in your collection is "Transparency." Transparency is a description of how much light goes through a particular mineral. This is very easy, and includes only three simple categories. Here they are:

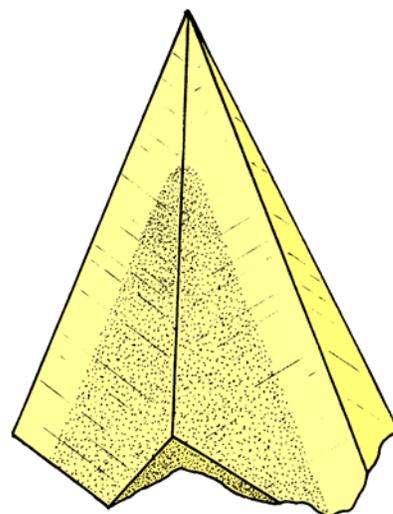
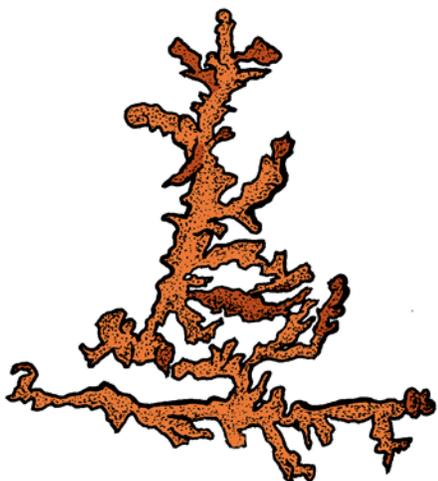


**Transparent** A mineral is described as transparent if light travels through it. Quartz crystal, beryl (like emerald and aquamarine), some specimens of gypsum, and some specimens of calcite can be described as transparent. When you hold them up to a light, you can see right through them as if they were pieces of clear, perfect glass.

**Translucent** A mineral is described as translucent if light can pass through it, but you can't see through it because there are inclusions or other things inside the specimen. You can see shapes and shadows through the specimen, but not clear objects. Minerals that are sometimes transparent can, very often, be translucent. Other

examples of translucent minerals are tourmaline, some quartz, calcite and fluorite specimens, etc.

**Opaque** A mineral is described as opaque if it doesn't let any light pass through it at all, even when it is sliced into thin pieces. Examples of opaque minerals include galena, pyrite, sphalerite, marcasite, etc.



Go to the specimens in your collection and try to look through them. Are they transparent, translucent or opaque? This can be a challenging project. There are some specimens that are translucent. However, on a very, very thin edge of a crystal, you may be able to see right through that edge. You may end up describing the specimen as "translucent (with some transparent edges)."

Also, keep in mind that there are surprises in the mineral world. Minerals like sphalerite are nearly always opaque. But once in a rare while, a unique and wonderful specimen is found that, on a thin edge, is translucent! On the other hand, some mineral species, like galena and py-

rite, are opaque and will never, ever be translucent.

Have fun. If you keep a catalog of your specimens and their properties, analyze them and write down the "Transparency" of each specimen.

# Colorful Mineral Word Search

The mineral of the month this time is Crocoite. Crocoite is very popular with collectors because of its bright, glassy, orange-red color. It has been a long time since we had a word search in Mini Miners Monthly. So, here is a word search of some of the mineral kingdom's most colorful species.

Remember the words can be left to right, right to left, top to bottom, bottom to top and diagonally. If you don't know what one of these mineral names is, look it up! Good luck!

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

Amethyst, Aquamarine, Azurite, Benitoite, Calcite, Crocoite, Diamond, Diopside, Elbaite, Emerald, Fluorite, Fuchsite, Garnet, Malachite, Olivine, Opal, Orpiment, Pyrope, Realgar, Rhodochrosite, Ruby, Smithsonite, Spinel, Sulfur, Topaz, Turquoise, Wulfenite

# Fiber Optics

## Ulexite

The mineral called ulexite contains the element *boron*. In Boron, California, the ulexite is found in groups of long crystals that have grown side by side. It was discovered that when these bundles of crystals are sliced and polished on the top and bottom, something interesting happens.

What you will need:

Paper and pen or pencil.

A piece of ulexite that has been polished on both ends.

Heavy fishing line.

Scissors.

A flashlight.

A rubber band.

What to do:

Step 1: Write your name on a piece of paper.

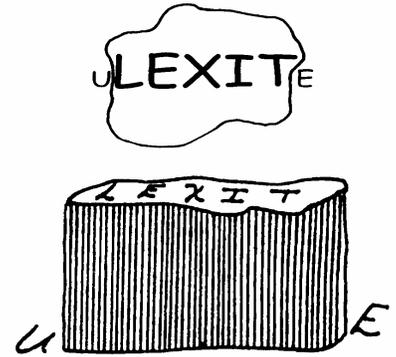
Step 2: Take a piece of ulexite and place it on top of your name. What do you see? You should discover that it looks like the name is on the top of the crystal.

Because of this, some mineral collectors call ulexite *television stone*.

Step 3: Cut 24 pieces of heavy fishing line that are the same length. 6 inches would be fine. Longer would be even better.

Step 4: Hold the 24 pieces together in a bundle. Hold the bundle together with the rubber band at one end of the bundle.

Step 5: Place the end of the bundle on the flashlight lens so the light can shine on the end of the bundle. Look at the other end of the bundle (the end that is not held together with a rubber band). What do you see? You will see light at the end of each piece of fishing line.



*The light travels down the fishing line and comes out the end, not the sides, of the line. This is called fiber optics. The same thing is happening in the ulexite crystals.*

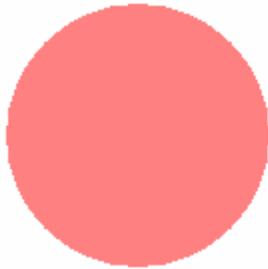
## Streak

***Streak*** is the color of a mineral when it is crushed to a powder. The easiest way to determine a mineral's streak is to rub the edge of a specimen against an unglazed porcelain tile. Minerals with a hardness less than 7 will leave a streak. For many the streak will be white, **so always look carefully**. Minerals harder than 7 will not leave a streak and might even scratch the streak plate itself.



# Color Match

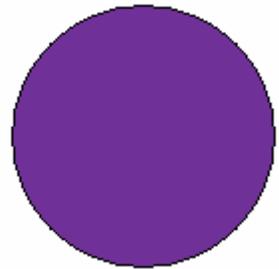
Color is not the best physical property to use to identify minerals. This is because some minerals occur in many different colors while others occur in only a single color. Draw a line from the mineral drawing and name on the left to the correct color on the right. If a mineral can be found in many different colors, draw lines to all of its different colors.



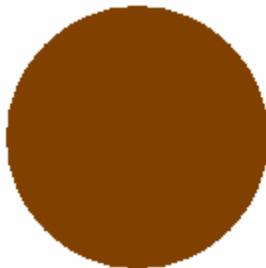
Quartz

Sulfur

Galena

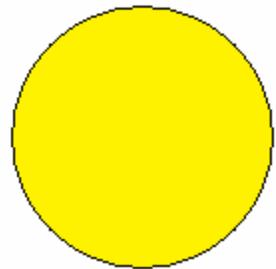


Malachite



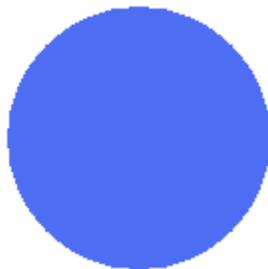
Feldspar

Gypsum



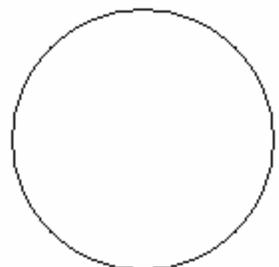
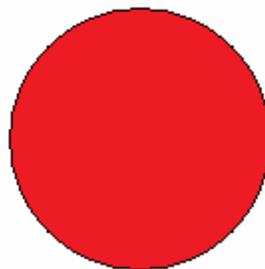
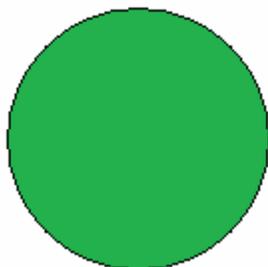
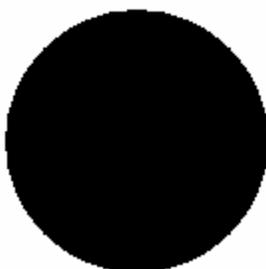
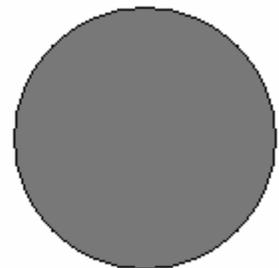
Corundum

Fluorite



Azurite

Calcite



# Luster

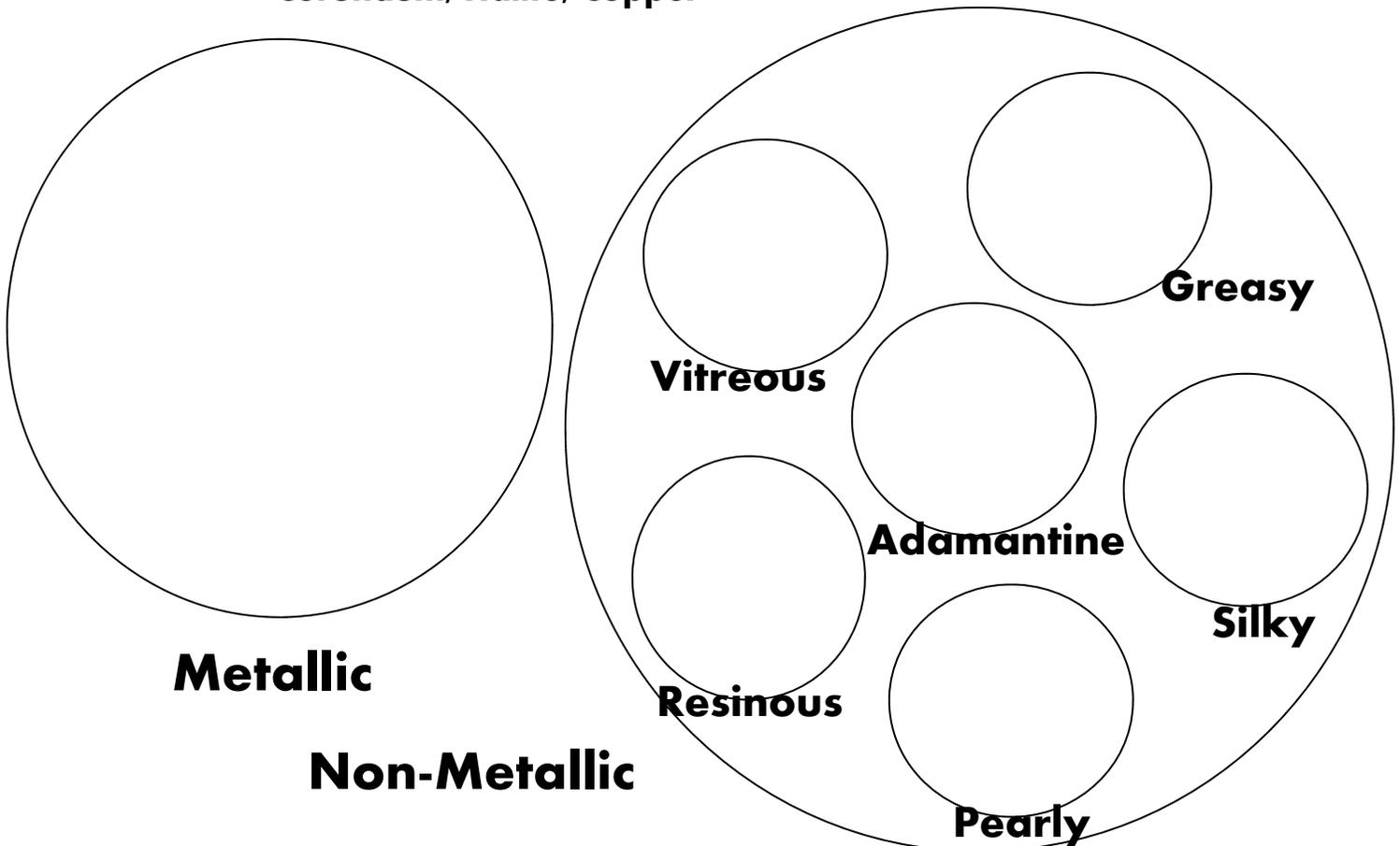
The luster of a mineral is a description of the way light bounces off of the surface of a mineral. The words used to describe luster are pretty easy to understand.

There are two main groups: **metallic minerals** (those minerals that look like shiny metal) and **non-metallic minerals**. The lusters for non-metallic minerals are

- A. **Vitreous.** Also called *glassy*.
- B. **Resinous.** Minerals that look like resin (a little bit like the look of plastic).
- C. **Pearly.** Minerals with a pearl-like, iridescent luster.
- D. **Greasy.** Some minerals look like they have a thin layer of oil on them.
- E. **Silky.** Minerals that look like fibers of silk. Fibrous gypsum and malachite have this luster.
- F. **Adamantine.** This describes minerals with a brilliant luster, sometimes with colors flashing in the mineral. Diamond is the best example. Some clear lead minerals, like cerussite and anglesite, also have adamantine luster.

Here is a list of 21 minerals. Write each mineral name in the correct circle below.

Graphite; Sulfur; Galena; Quartz; Diamond; Asbestos; Gold; Sphalerite; Calcite; Fluorite; Talc; Topaz; Apatite; Gypsum; Magnetite; Feldspar; Muscovite; Barite; Corundum; Halite; Copper



# Special Mineral Properties

## Double Refraction

In this experiment, you will see a special property that happens with clear, colorless pieces of calcite. Another name for clear calcite is *Iceland Spar*.

**What you will need:**

--Paper and pen or pencil

--A piece of colorless, clear calcite (*Iceland Spar*).

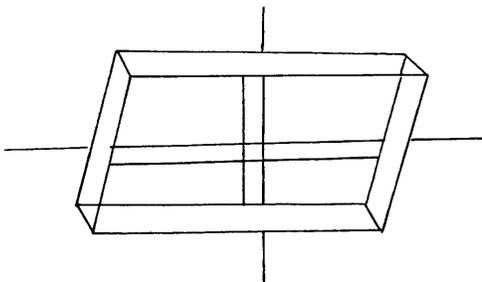
When calcite breaks, it breaks into *rhombs*. A *rhomb* is like a box that has been pushed over on its side. It looks like the specimen to the right.

**What to do:**

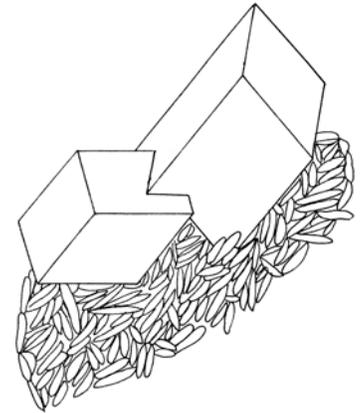
**Step 1:** Draw a large "+" sign on a piece of paper.

**Step 2:** Place a piece of *Iceland Spar* on top of the lines.

**What do you see?**



This is a special property called *Double Refraction*. When light goes into *Iceland Spar*, the crystal breaks the light into two parts. As a result, you see two lines instead of one.



## Sparks

The mineral *pyrite* is named after the Greek word *pur* which means *fire*. You will learn why in this experiment.

**What you will need:**

**Safety goggles, a piece of pyrite (not a good display specimen), a steel hammer.**

**Step 1:** Put on the safety goggles to protect your eyes.

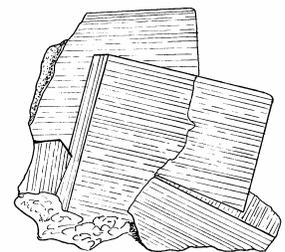
**Step 2:** Hold a piece of pyrite firmly in one hand.

**Step 3:** Hit the pyrite with the edge of a hammer (or any other item made of steel).

Turn the lights down (or off) and do this again. The results will be more dramatic.

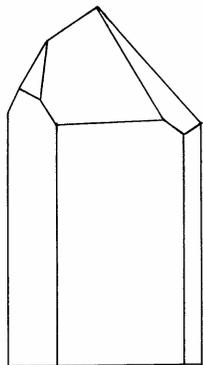
**What do you see?** \_\_\_\_\_. You will see the flash of sparks.  
(You will also *smell* something. This is the smell of the sulfur that is in the pyrite crystal.)

A long time ago, this was a way people could start campfires in the wilderness.



# Triboluminescence

*Luminescence* means *light*. *Triboluminescence* is light that is produced when certain objects are rubbed against each other, or pressure (force) is applied to some objects. You will see triboluminescence in the mineral quartz.



## What you will need:

Safety goggles, two clear quartz crystals (not display quality specimens).

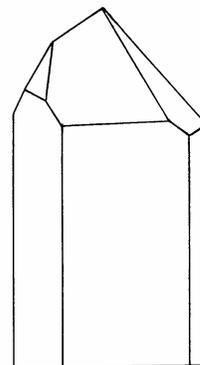
This activity may take a little practice. You will need fairly large quartz crystals, about palm size or larger. To make this work, you will have to be in a dark room.

## What to do:

Step 1: Hold one crystal in each hand.

Step 2: Rub the edge of one crystal back and forth across the face of the other crystal. A "face" is the flat surface of a crystal. The "edge" is where two faces come together. *For best results, repeat this with the lights out.* When you rub the edge of one crystal against the face of the second, push down so that you are really grinding the two crystals together. If you cannot create light, try again, this time pushing even harder.

Step 3: What do you see? You will see a brief flash of light on the *inside* of the quartz crystal.



## Triboluminescence: Making Light with Candy

### What you will need:

A roll of *Wintergreen Lifesavers™*. No other flavor will work!

A dark room.

A friend to do the experiment with.

### What to do:

Step 1: Face a friend in a dark room or under a blanket.

Step 2: Bit into a wintergreen lifesaver with your mouth open!

Be sure to really crunch it into lots of little pieces all at once.

When you do it right, your friend will see a very fast, small *flash of blue light*.

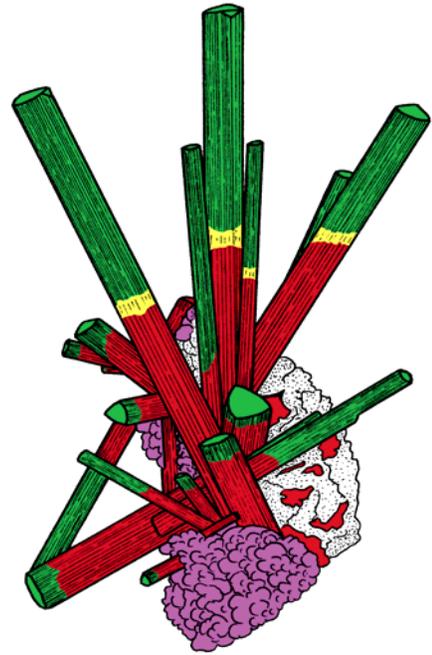
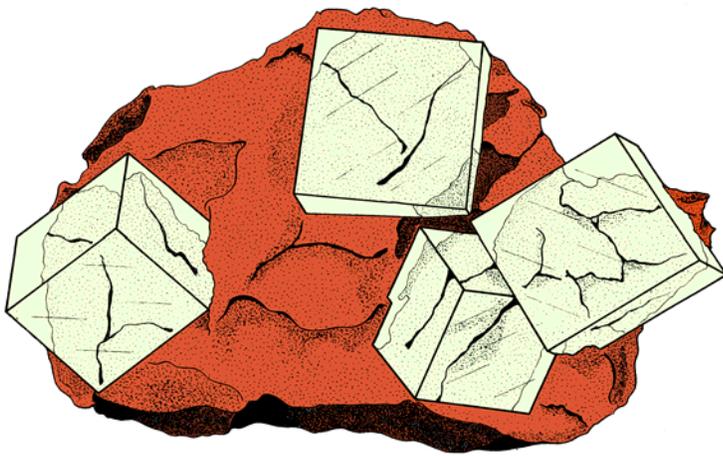
Step 3: Brush your teeth really, really well!!!!!!!!!!!!

### What makes it work? Go to

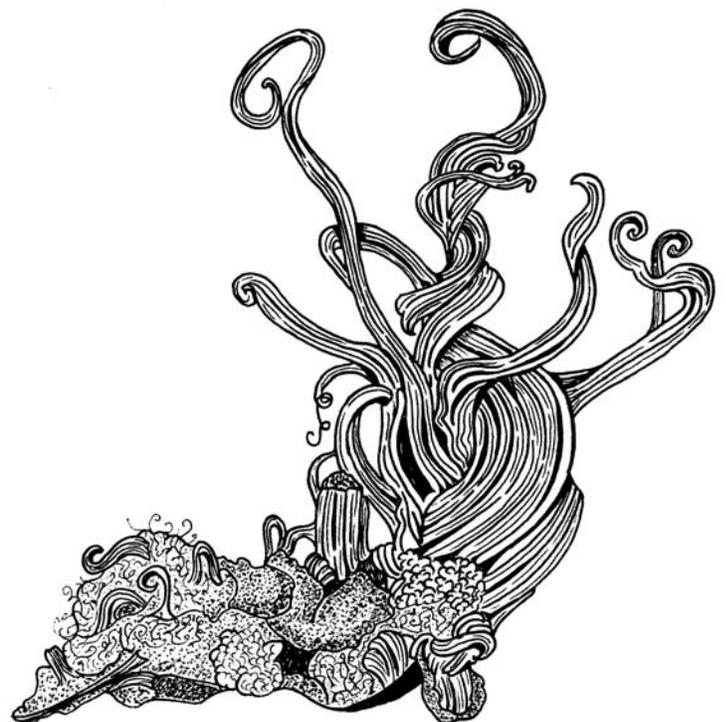
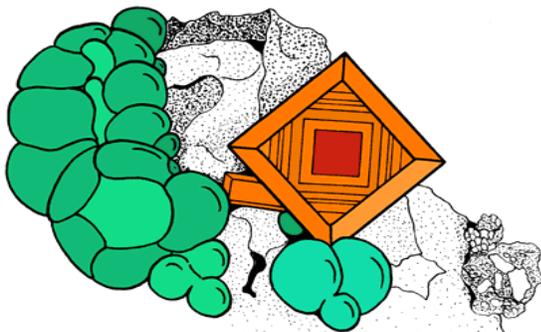
<http://www.waynesthisandthat.com/wintergreen.htm> and find out!

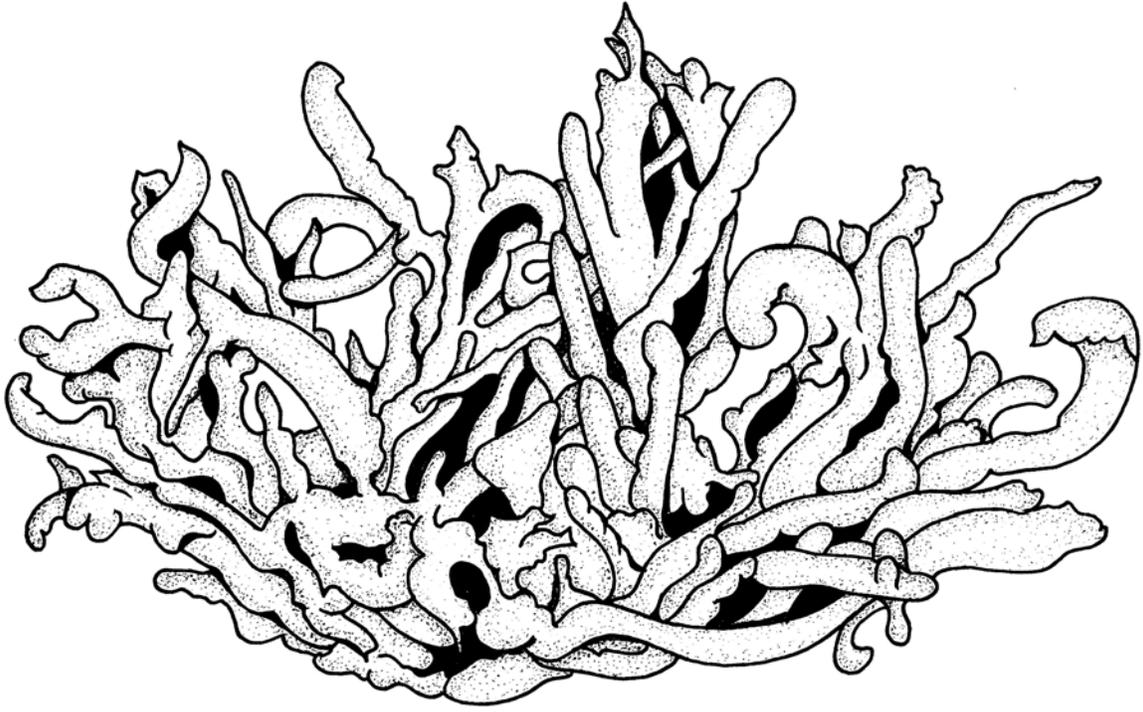


# A Coloring Book of **Minerals & Crystals, A to Z**



**Another Fun Production of  
Diamond Dan Publications**





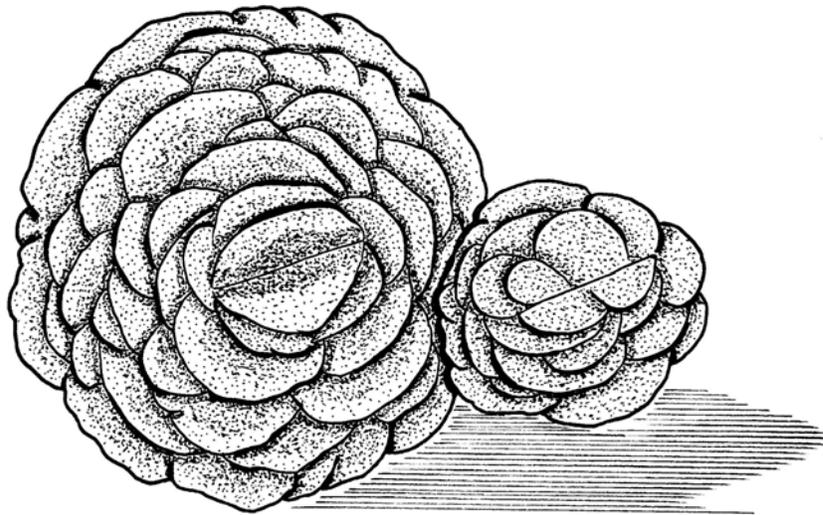
# **Aragonite**

**White when pure. Can be stained light blue.**



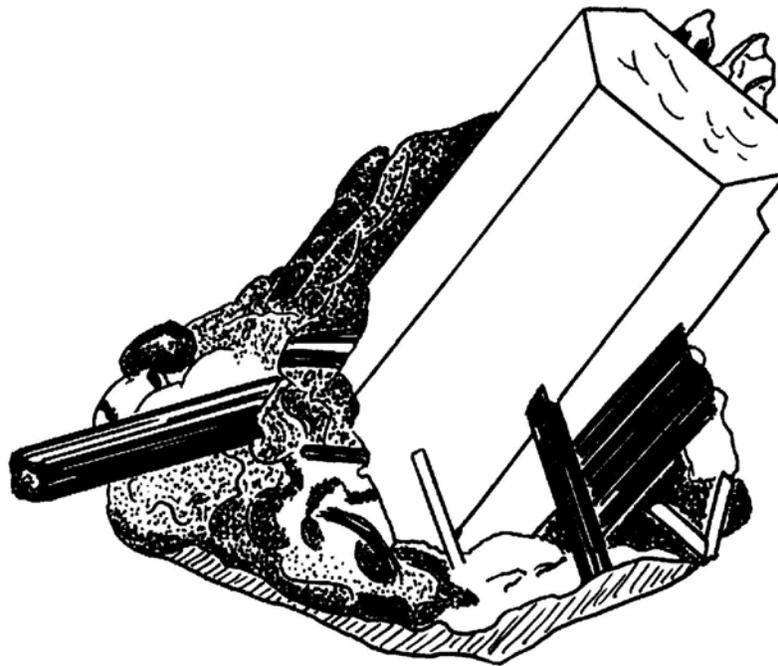
# **Azurite**

**Light Blue**



# Barite "Rose"

Rust Red

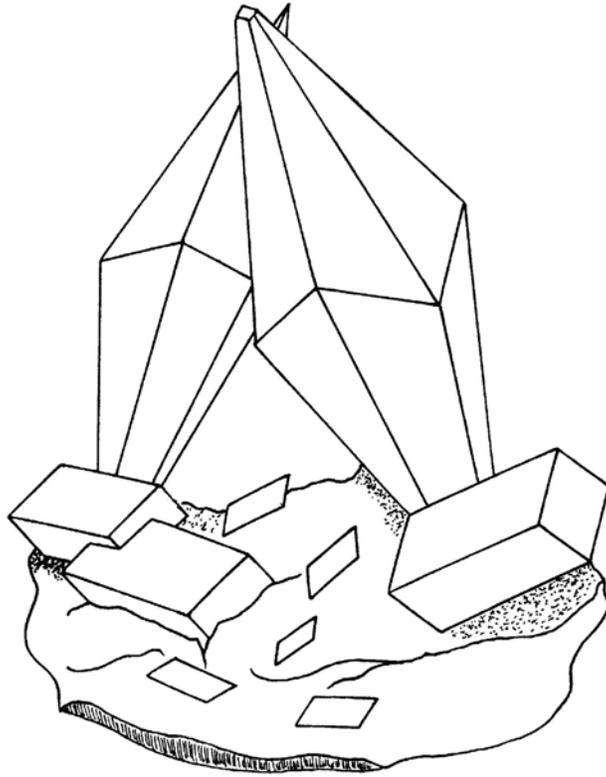


# Beryl

Blue (Aquamarine)

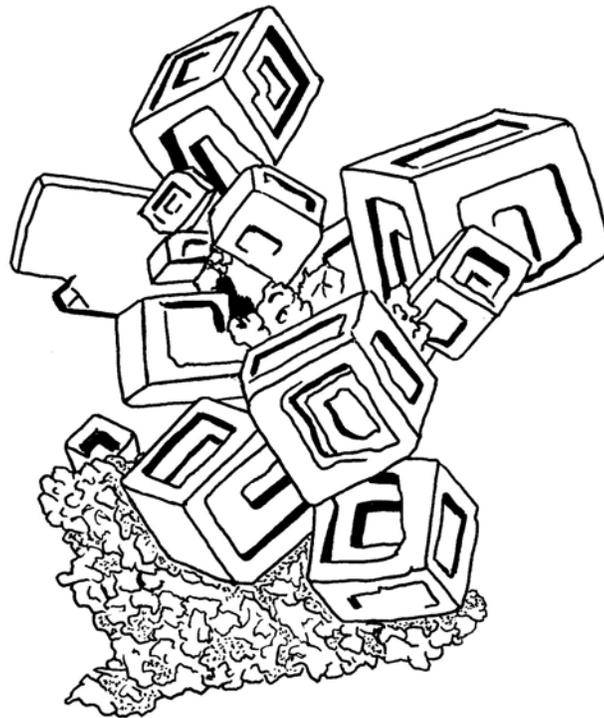


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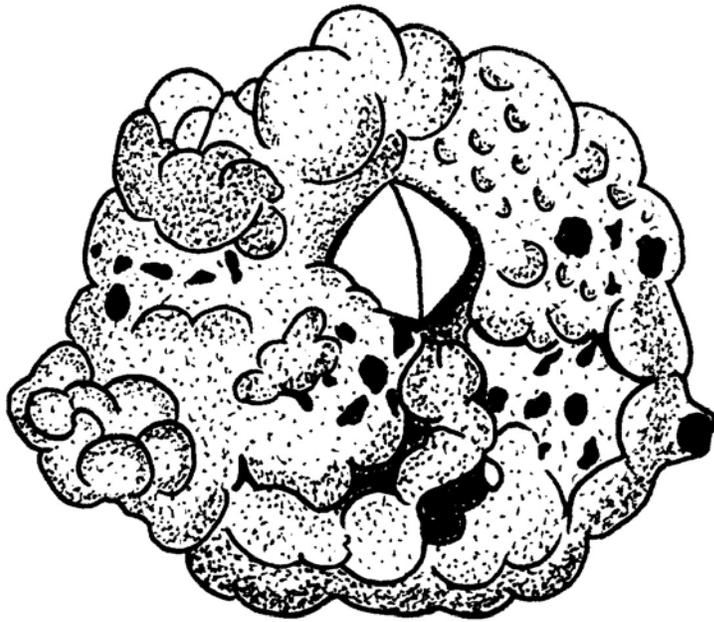
# Calcite

**Green, Red, Orange, Yellow, Tan, Golden Brown**



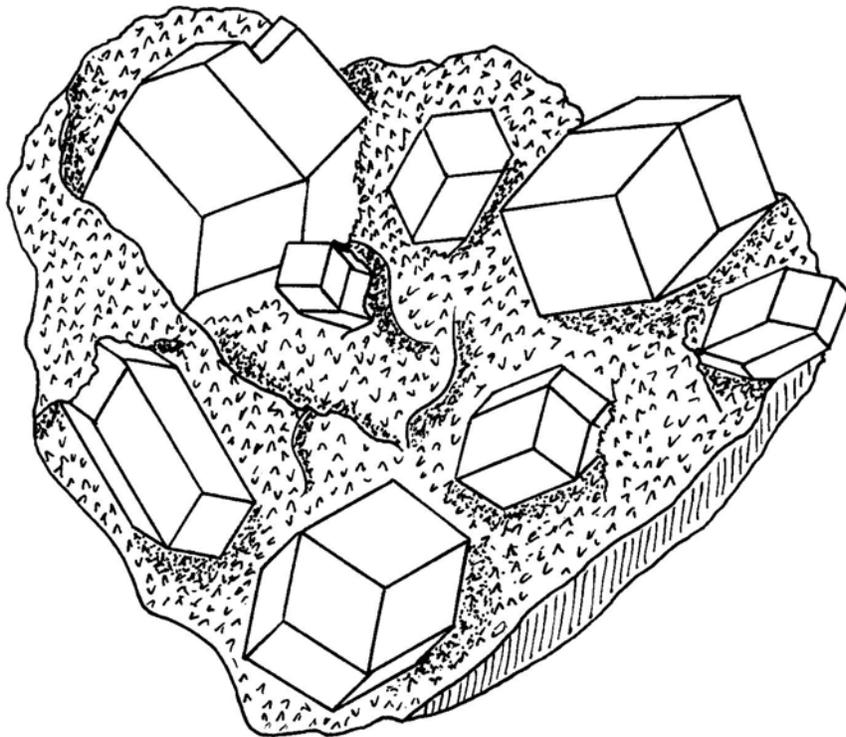
# Copper

**Copper-Red**



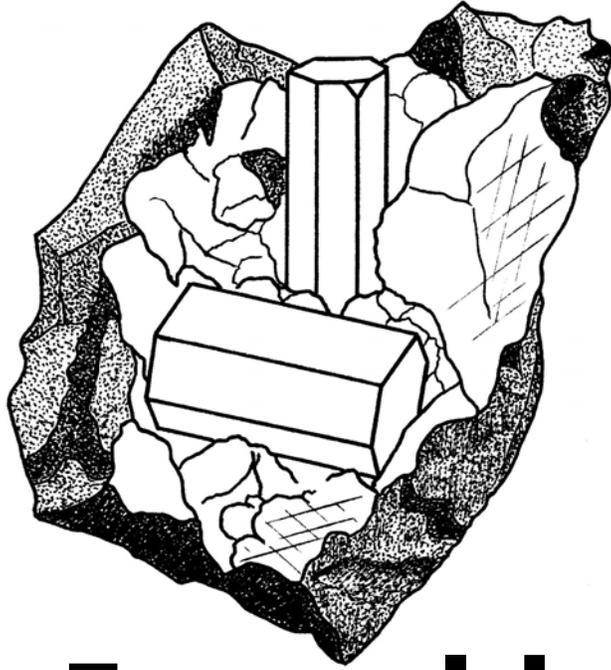
# Diamond

**Any Color You Want! (In dark brown matrix.)**



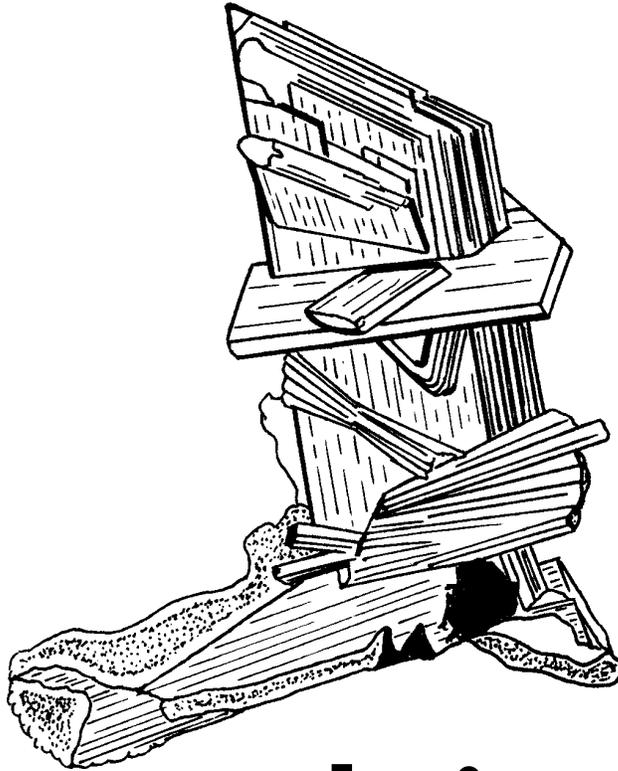
# Diopside

**Green**



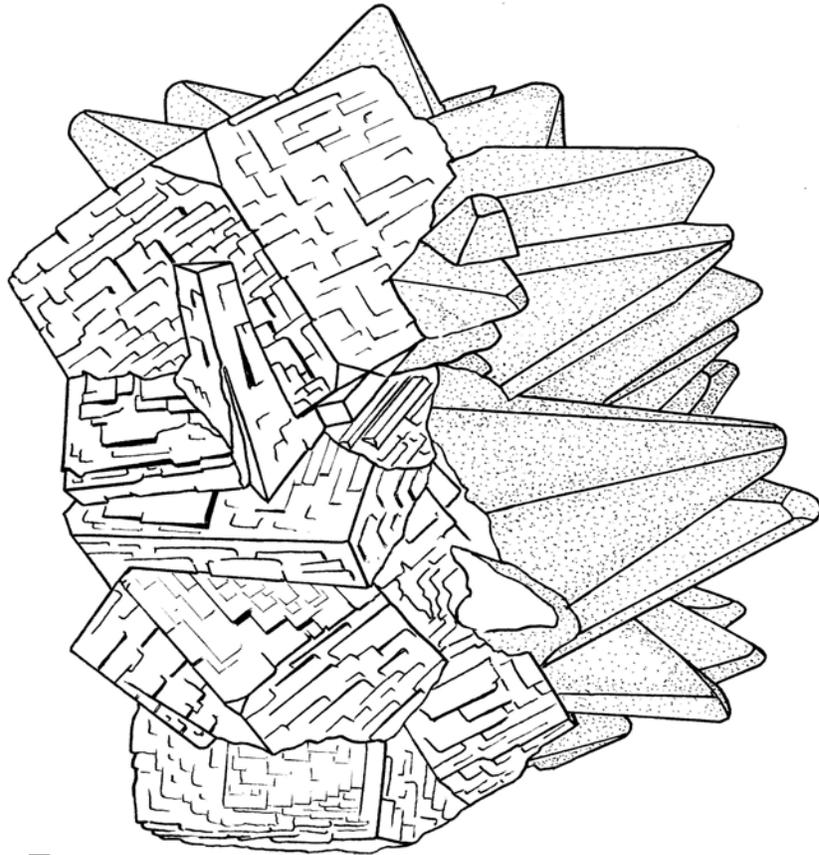
# **Emerald**

**Green crystals on white calcite.  
Emerald is the green variety of Beryl.**



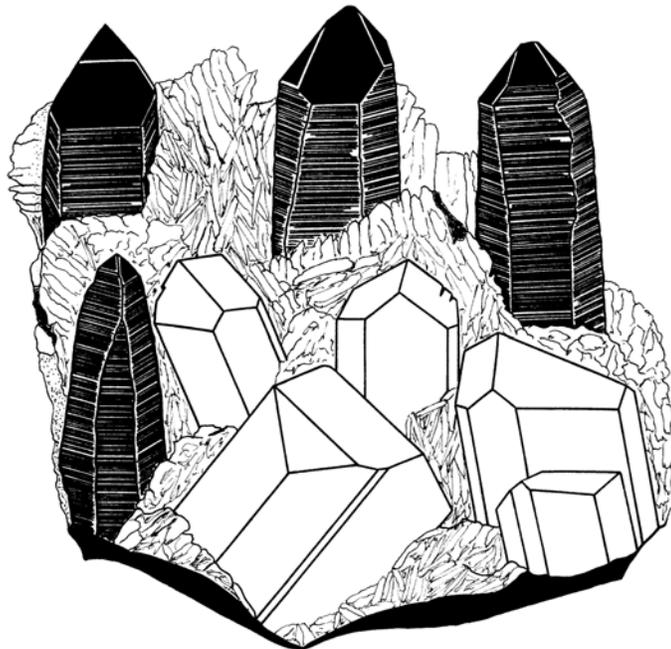
# **Erythrite**

**Dark Purple-Red**



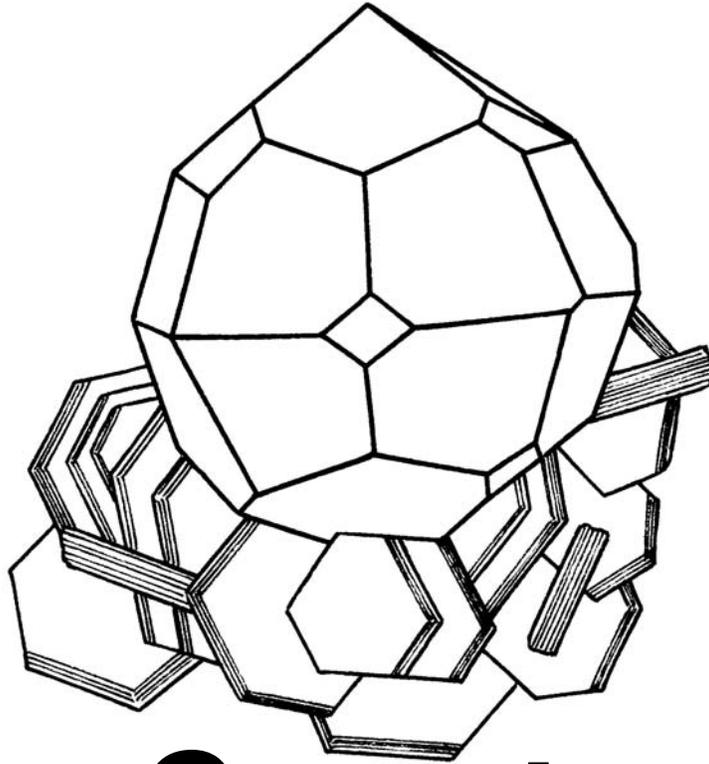
# **Fluorite and Calcite**

**Dark purple fluorite with golden yellow calcite**



# **Feldspar (var. Amazonite)**

**Green**



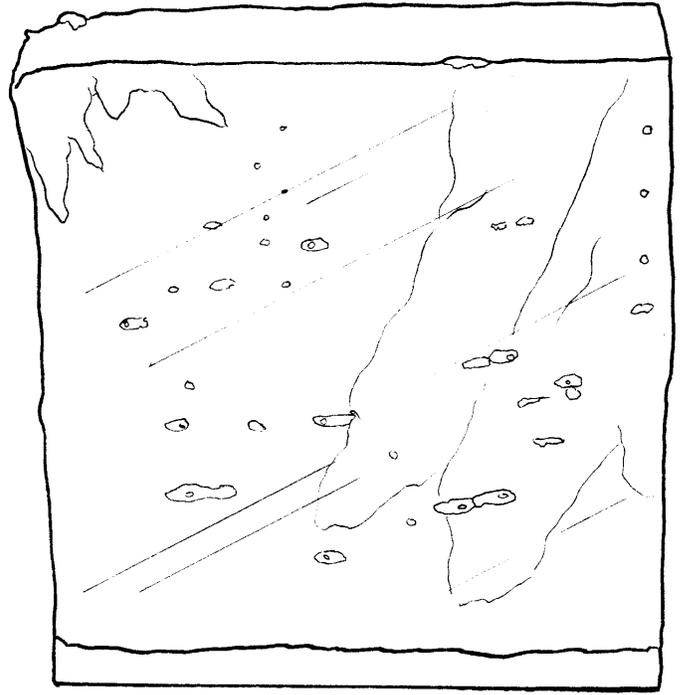
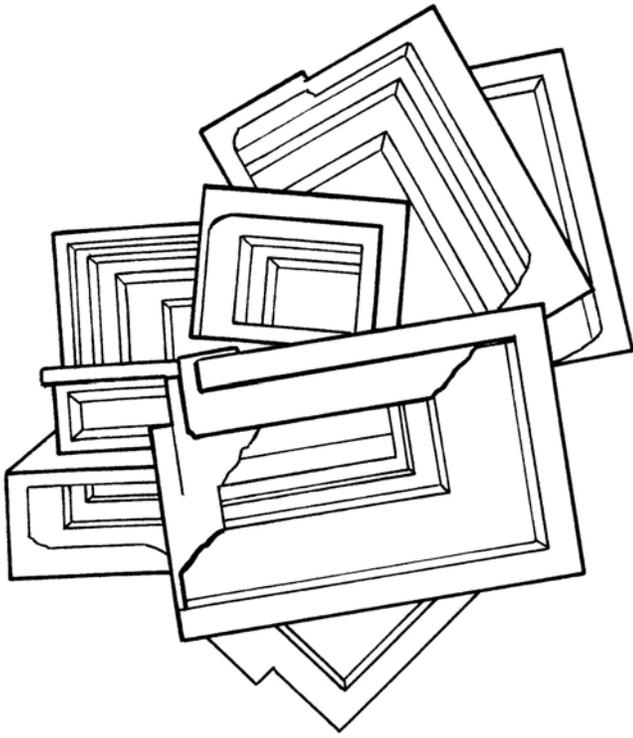
# Garnet

Deep red garnet on silver-white muscovite crystals.



# Gold

Golden Yellow



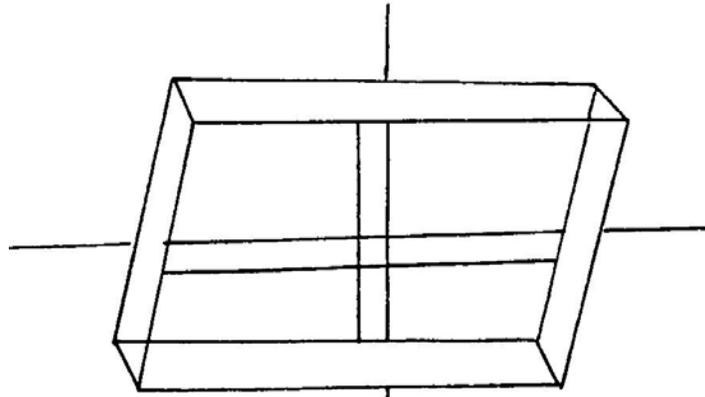
# Halite

**Left: Light pink crystals.**  
**Right: Colorless with dark purple "fingers" inside that look like purple smoke!**



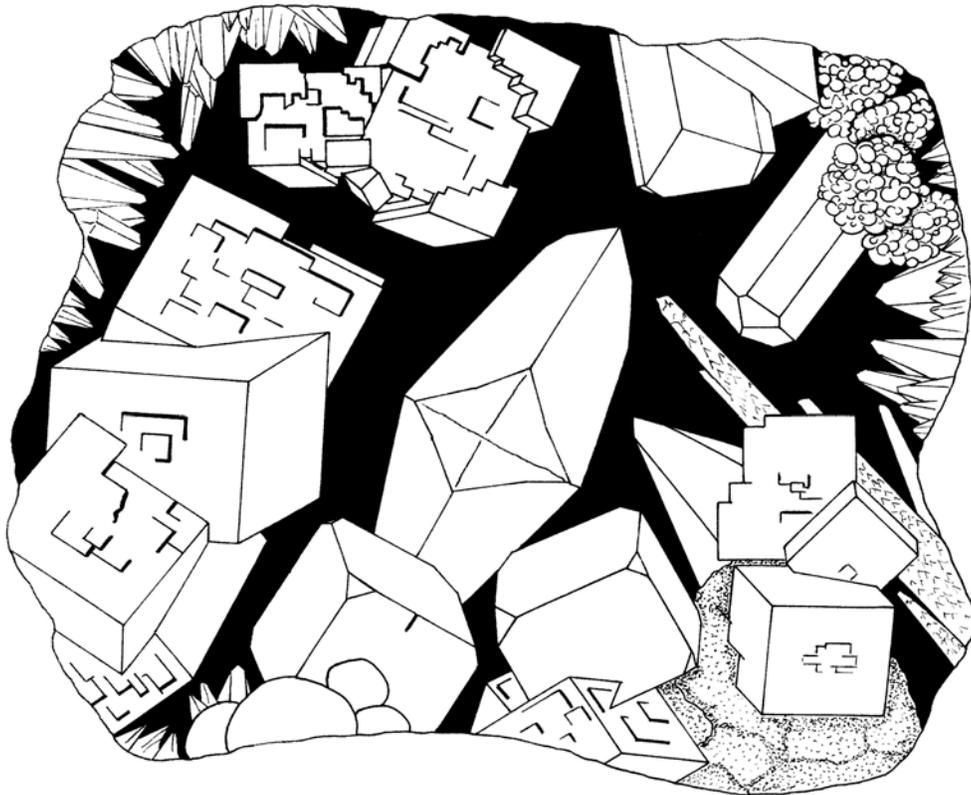
# Hematite

**Above: Deep red**  
**Right: Steel-gray**



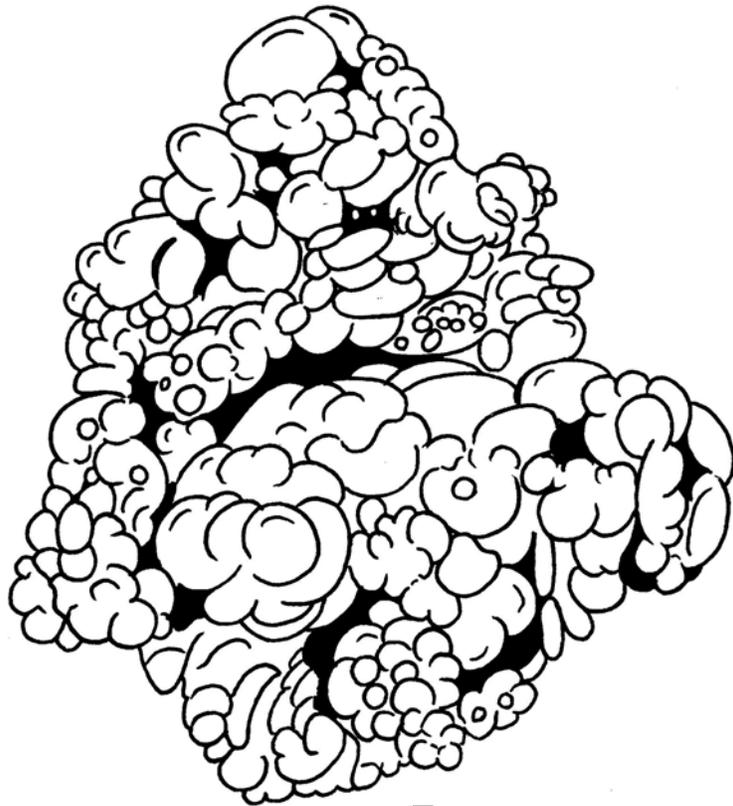
## **“Iceland Spar” (Calcite)**

**Clear calcite that breaks light into two! See the lines? Pure Iceland Spar is colorless. It can also be green, yellow, golden, or red.**



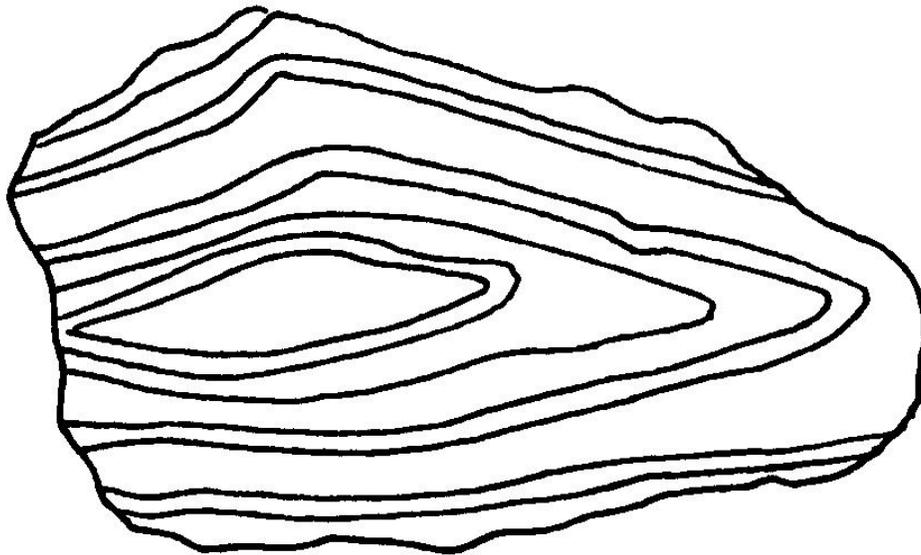
## **“Illinois Fantasy Pocket”**

**Minerals found in the old Illinois fluorspar mines: purple and yellow fluorite, golden calcite, silver galena, yellow calcite.**



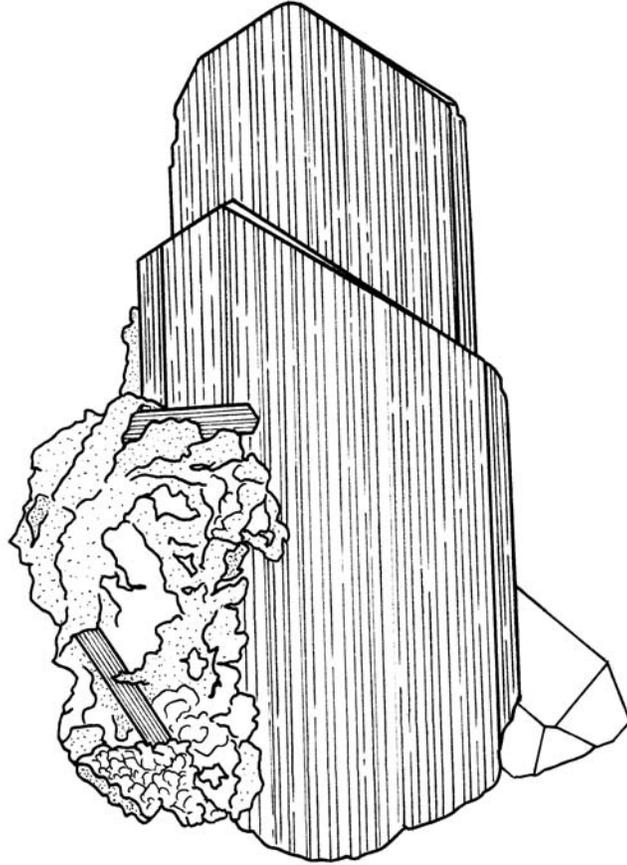
**Jade**

**Dark Green**



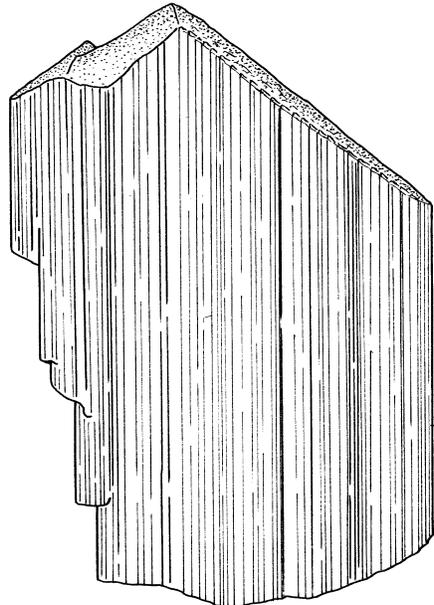
**Jasper** (Chalcedony)

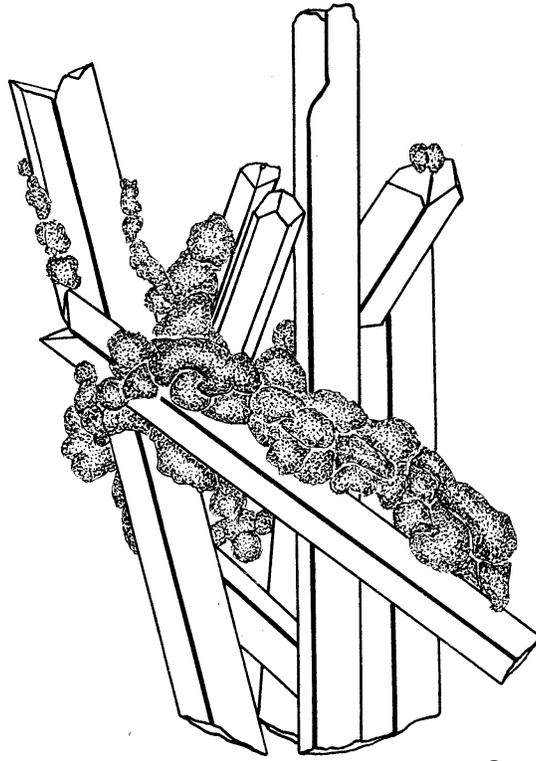
**Red Bands**



# Kunzite

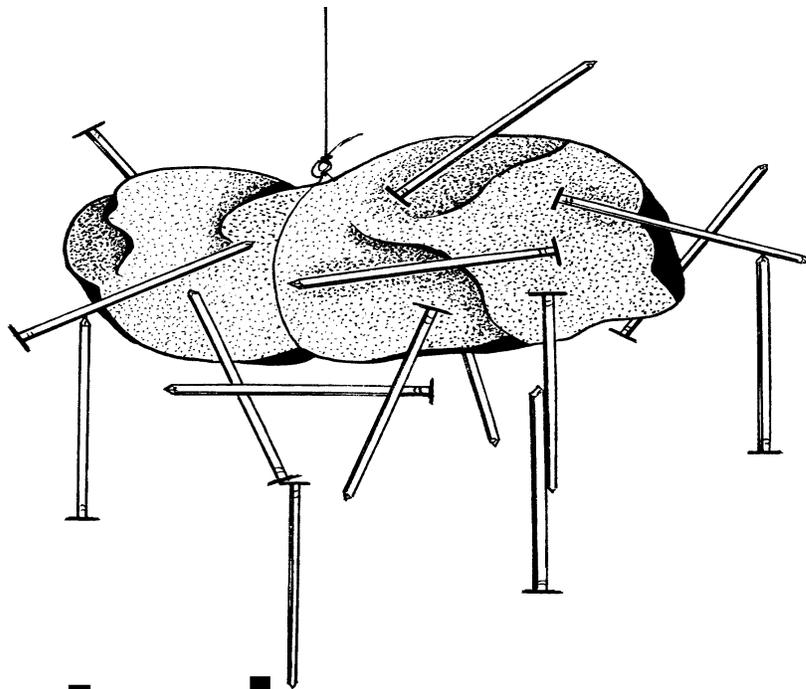
**Lilac purple. Kunzite is a light purple, gem-quality variety of the mineral spodumene.**





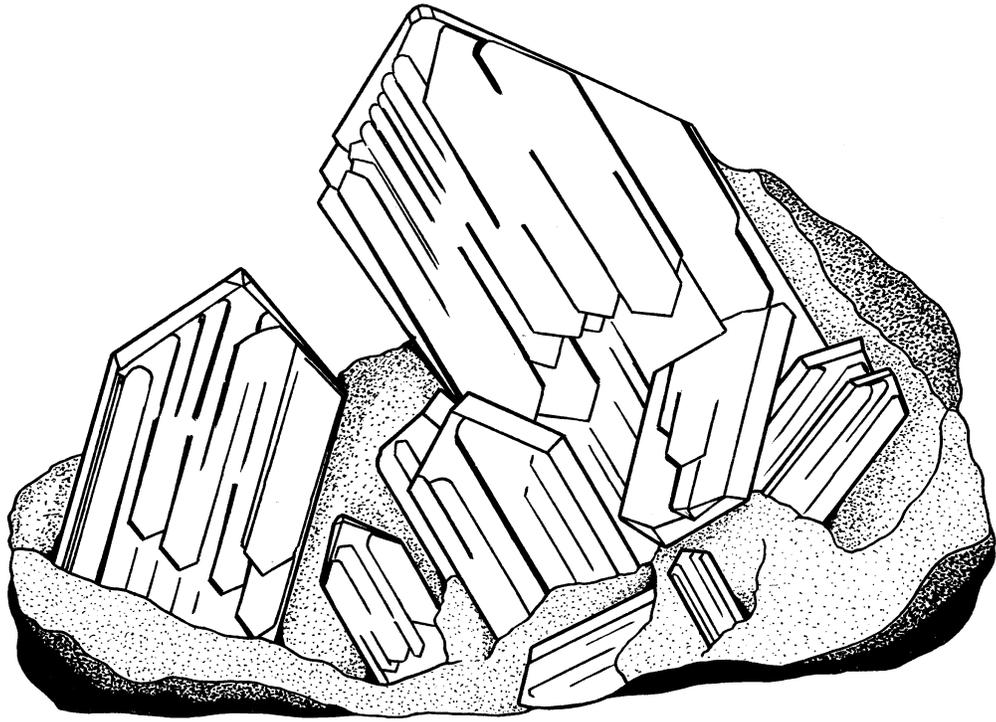
# Laumontite

Tan

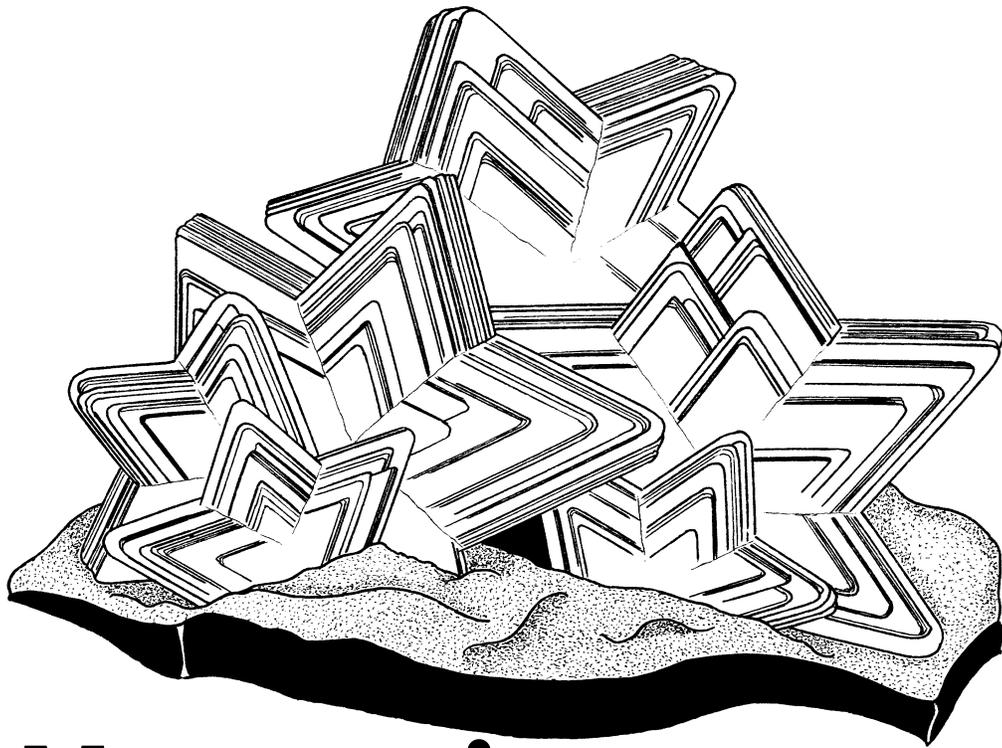


# Lodestone

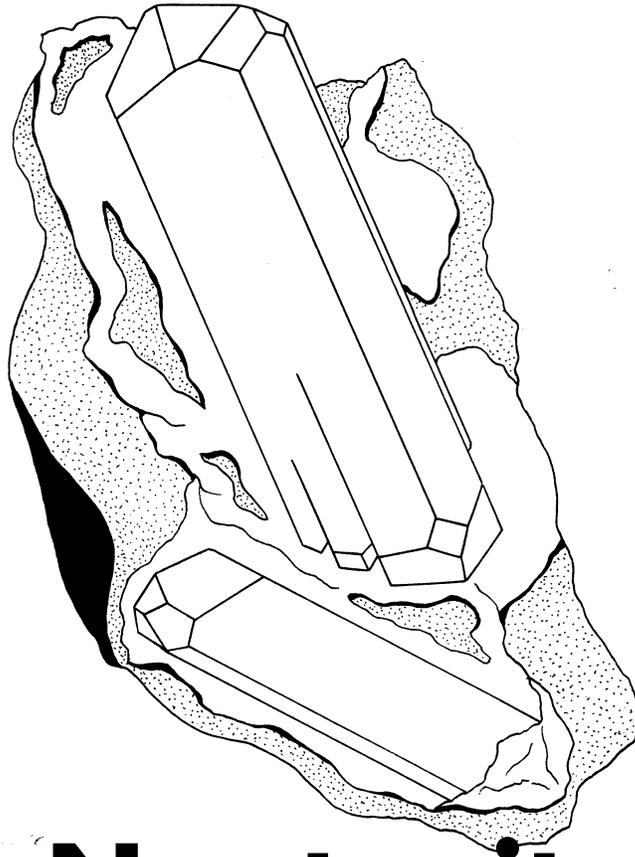
**Steel Gray. Lodestone is massive magnetite and is naturally magnetite.**



**Malachite** after Azurite  
Green



**Muscovite** "Star Mica"  
Yellow

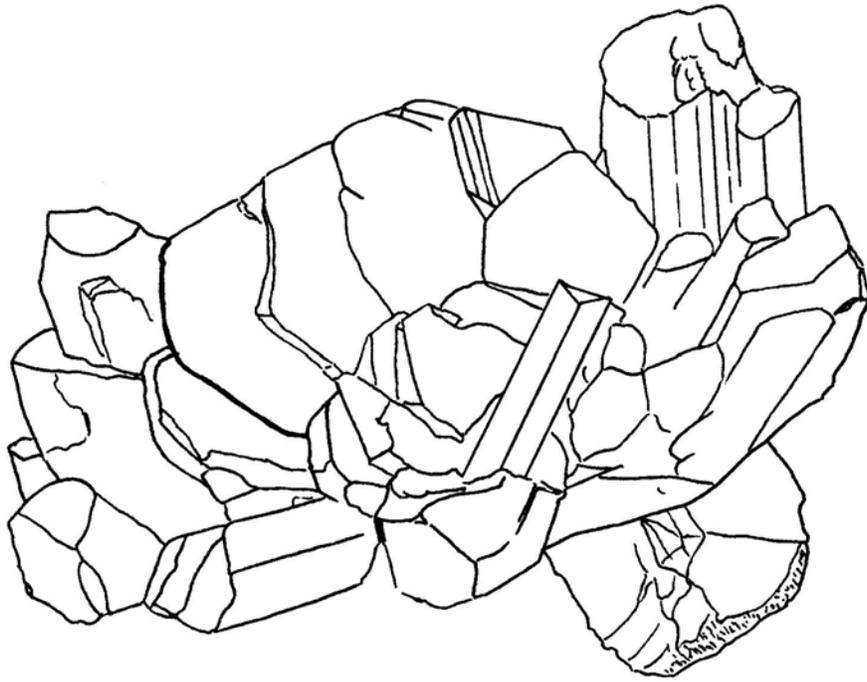


# Neptunite

Deep red on light green matrix

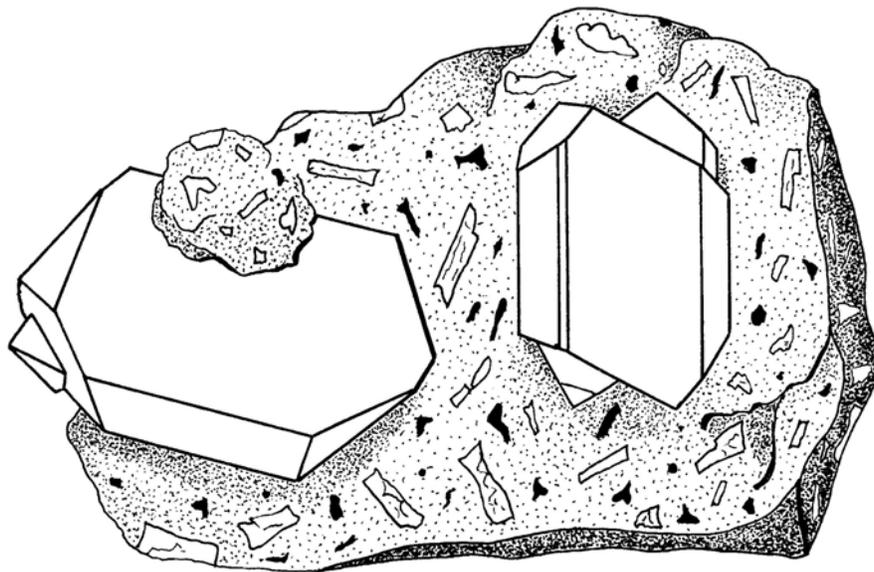


**Nick & Nancy  
Rockhound**



# Orpiment

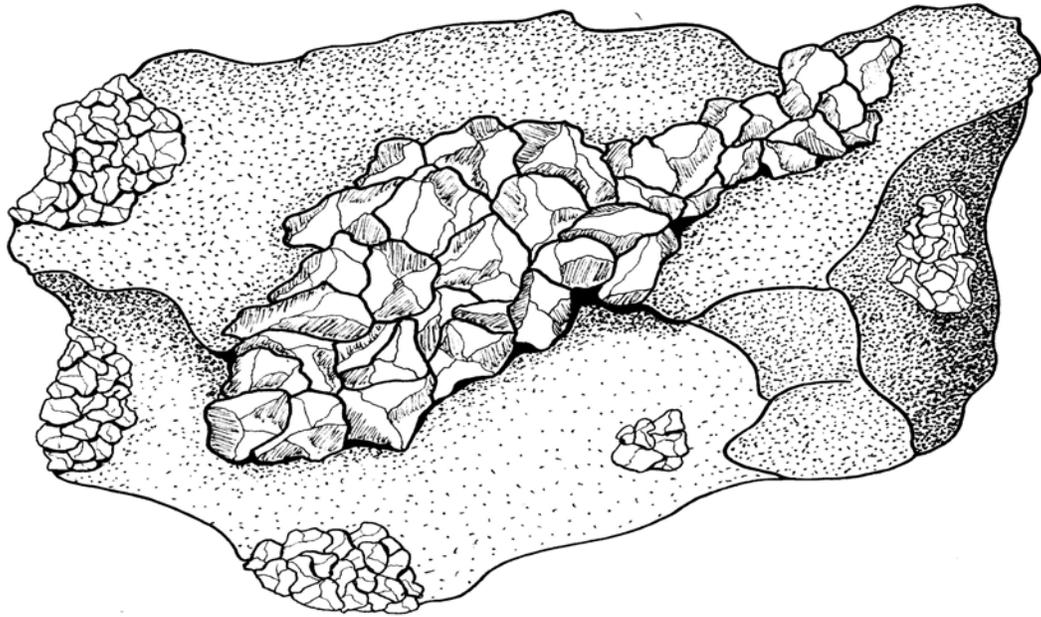
Deep orange-yellow



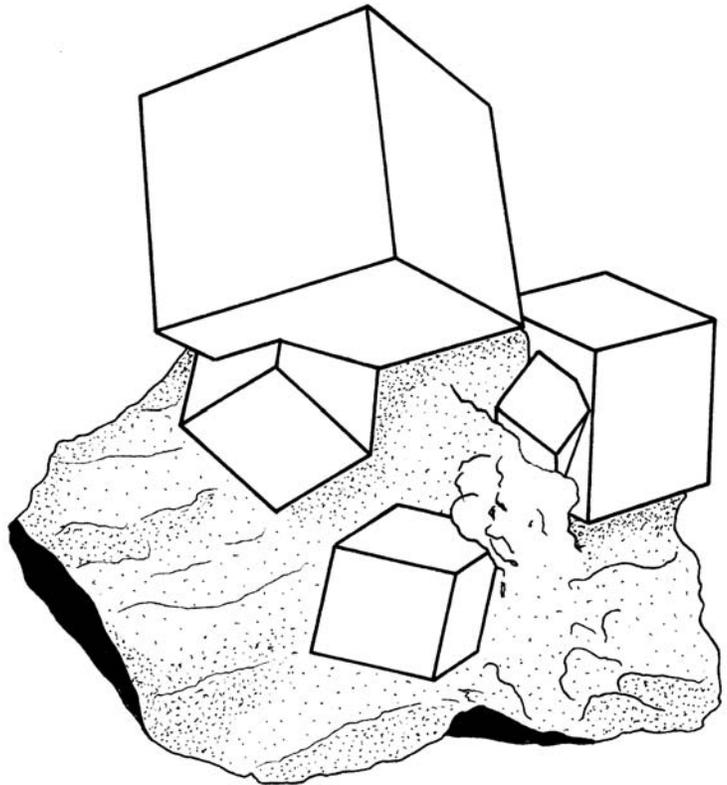
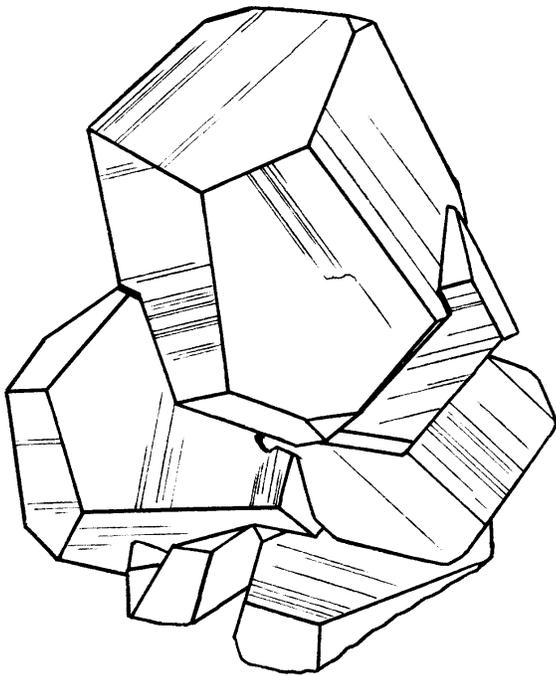
# Orthoclase

Feldspar

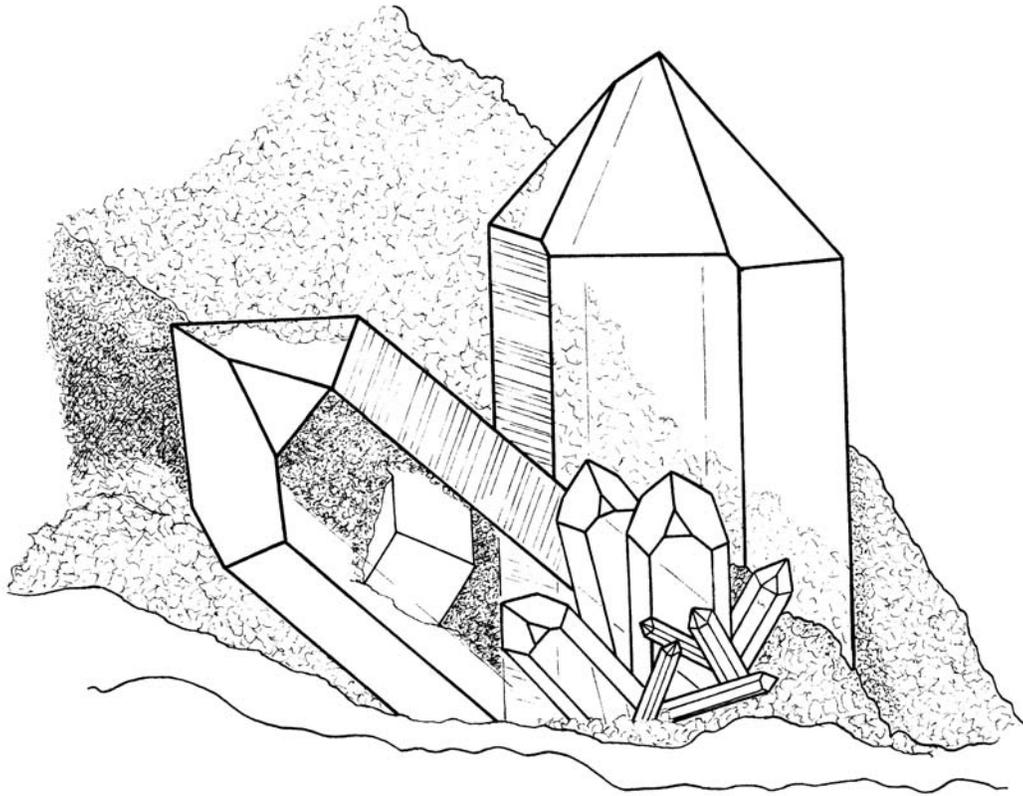
Light tan



**Peridot** (a variety of olivine)  
Grass green

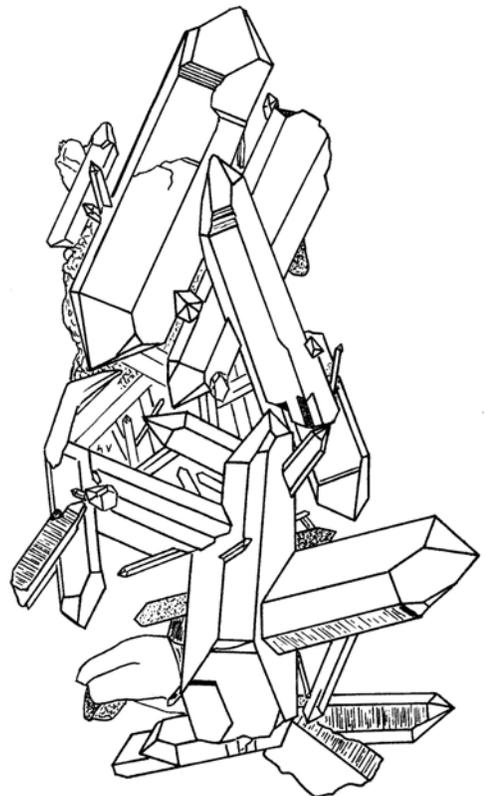
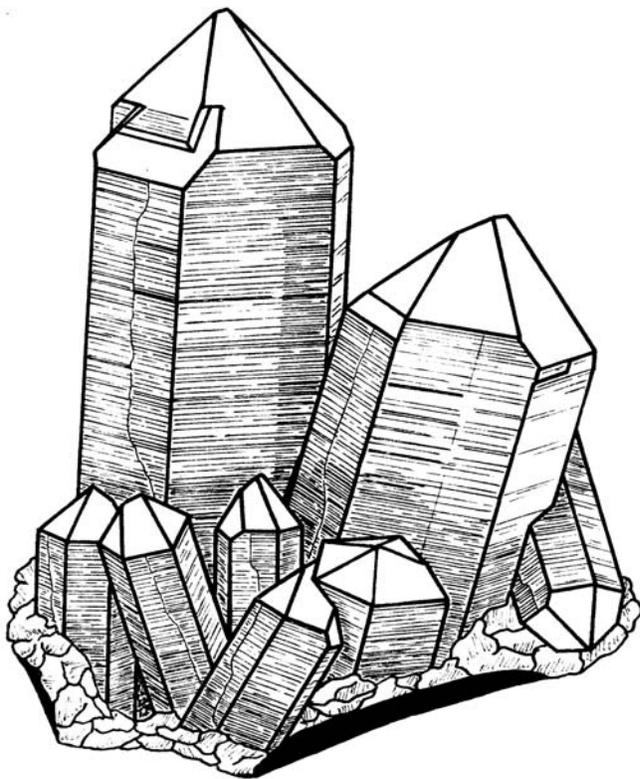


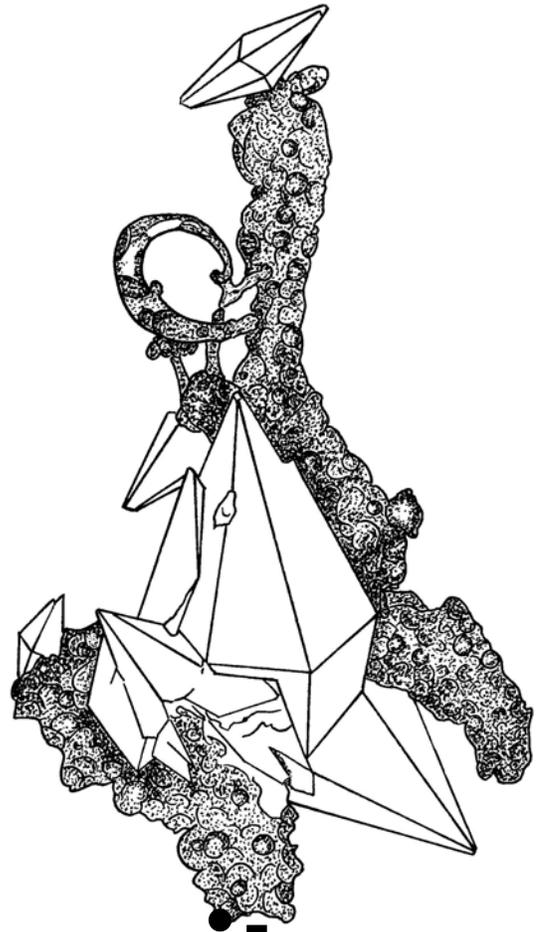
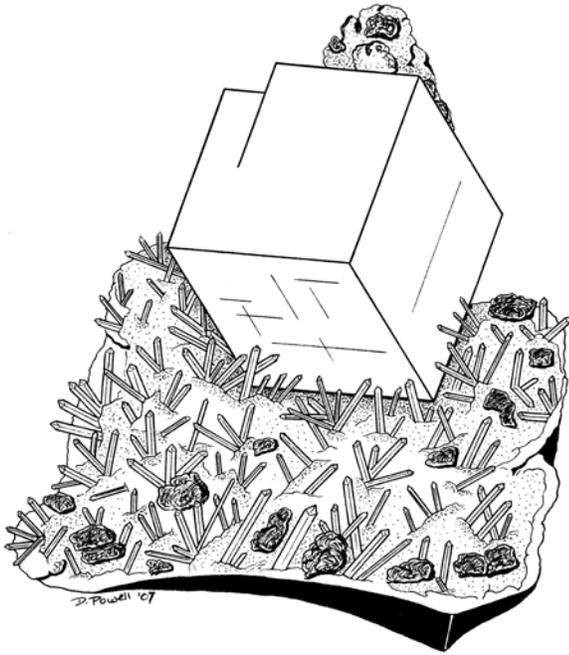
**Pyrite** ("Fool's Gold")  
Shiny, brassy yellow



# Quartz

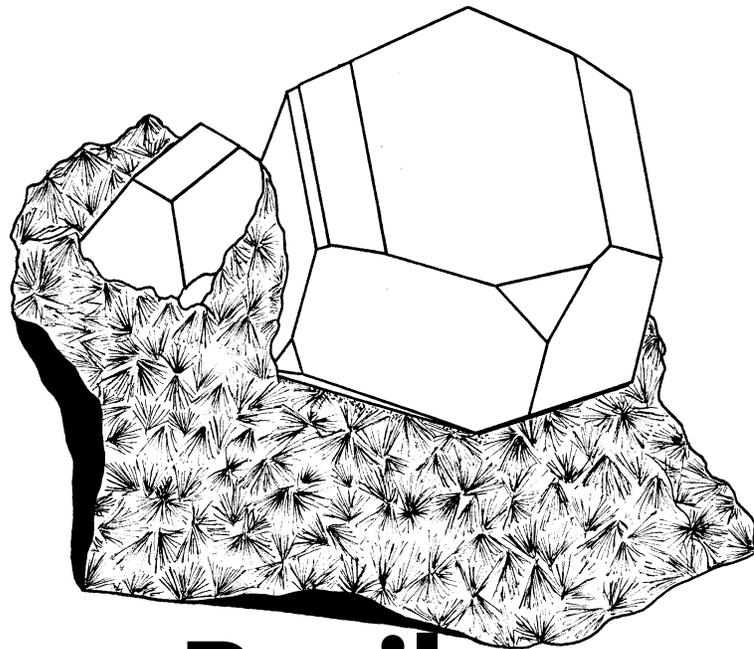
**Quartz can be colorless, white, black, brown, yellow, orange, green, blue, purple.**





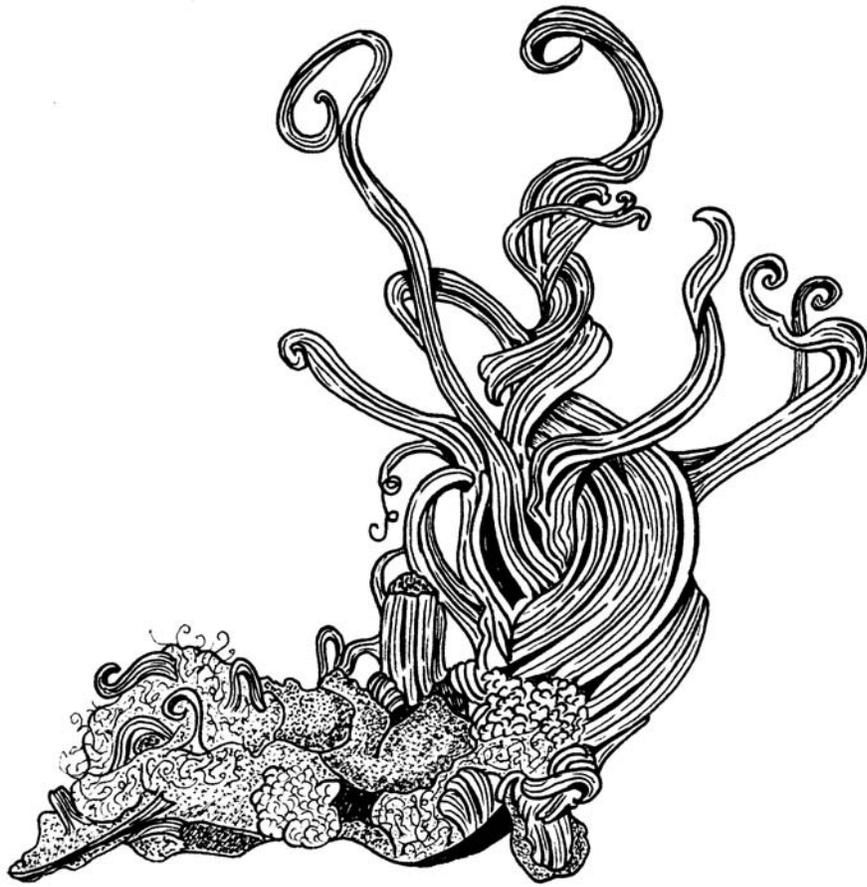
# Rhodochrosite

Red



# Rutile

Deep red to black on tan pyrophyllite



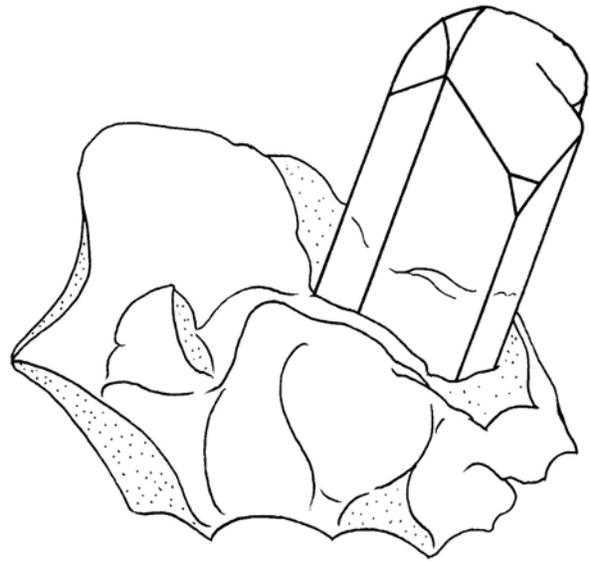
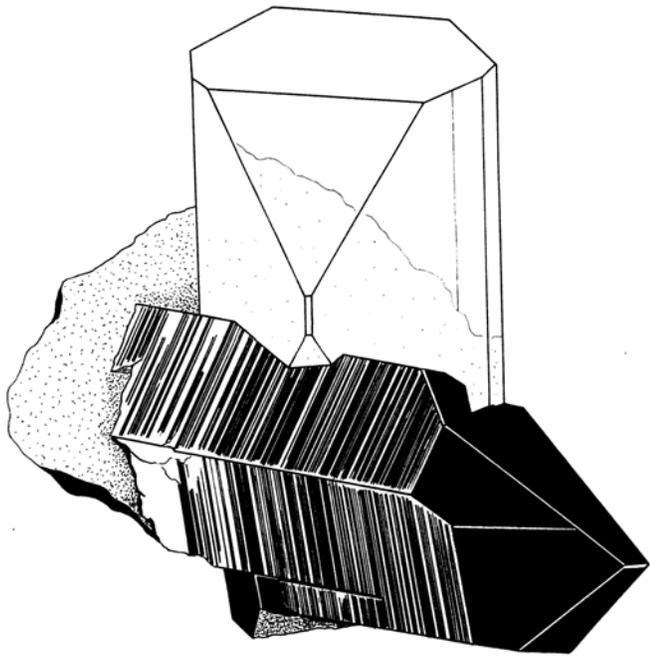
**Silver**

**Gray**



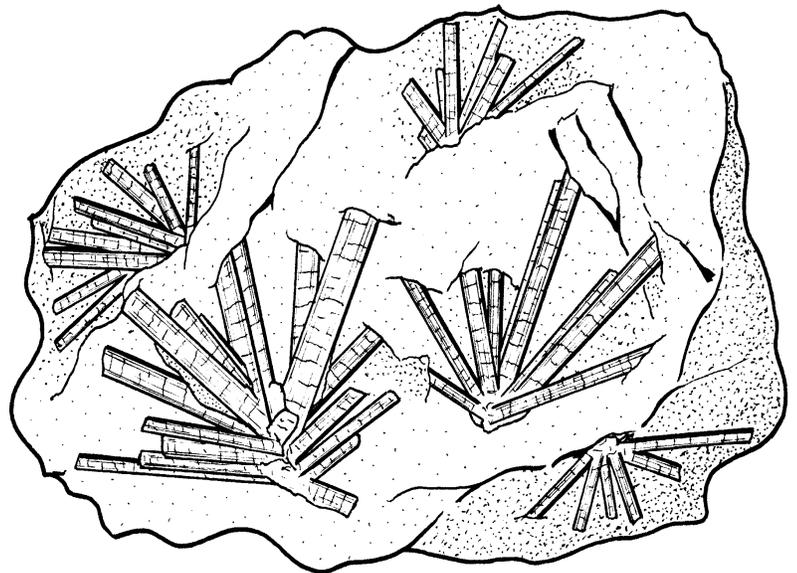
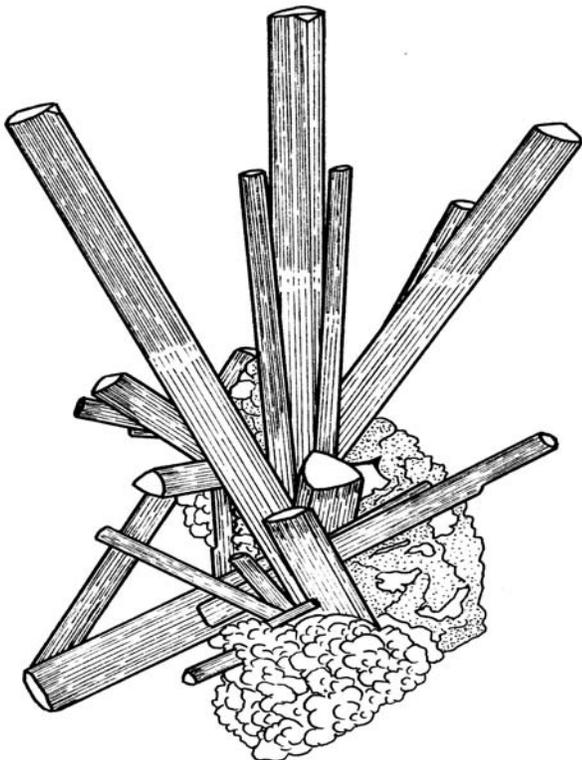
**Scheelite**

**Orange**



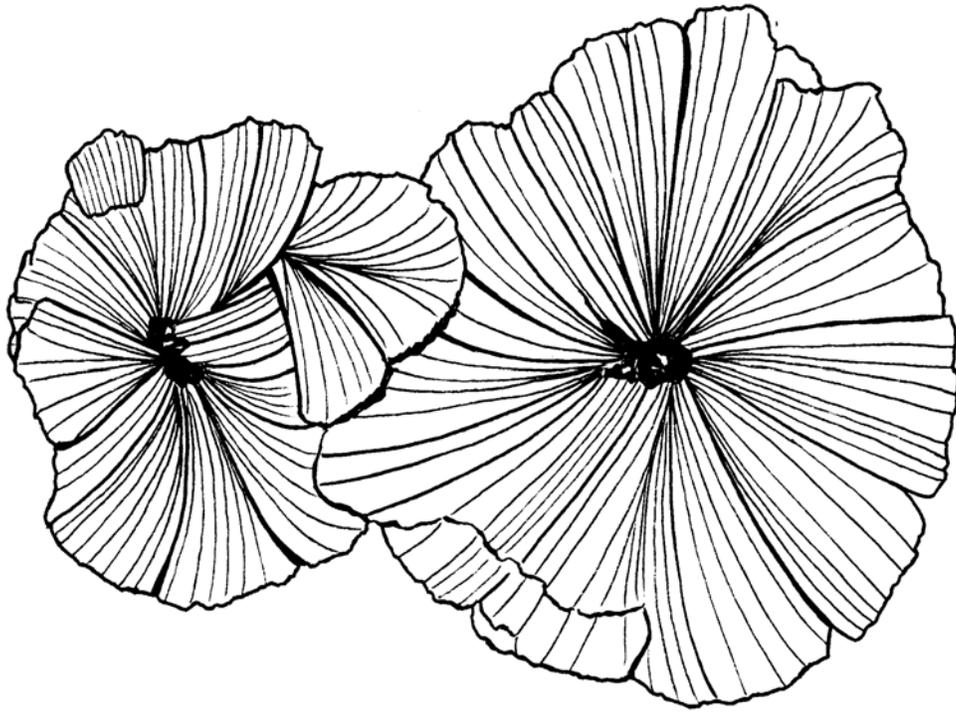
# Topaz

**Left: Orange; Right: Red-brown**

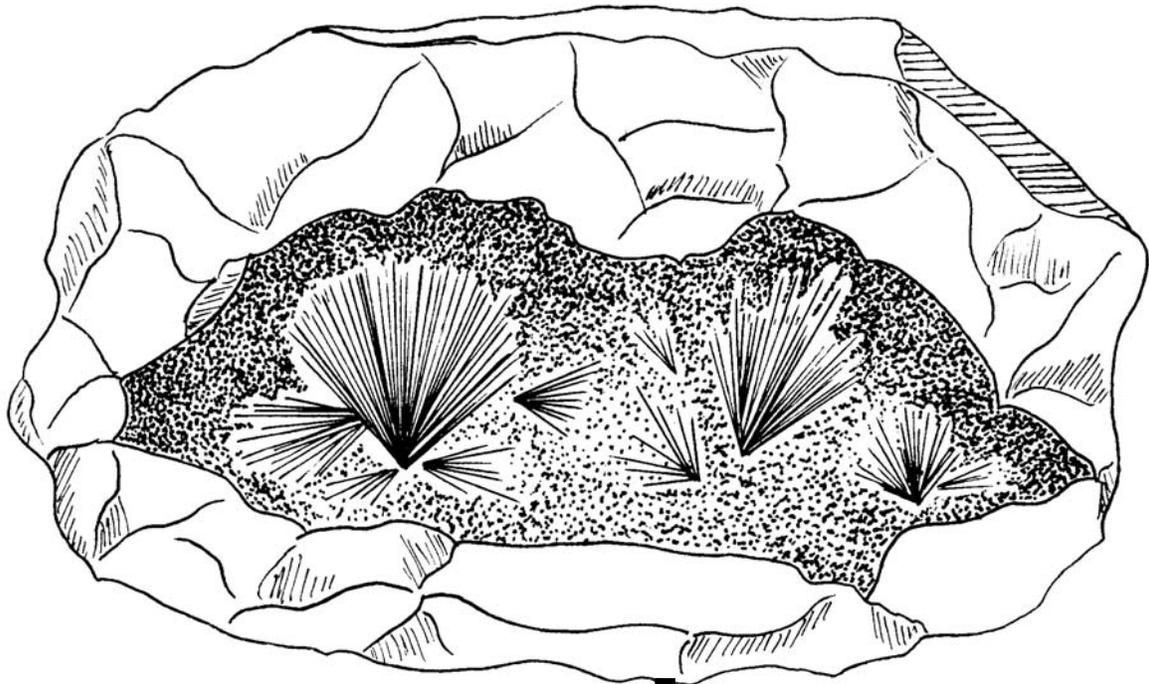


# Tourmaline

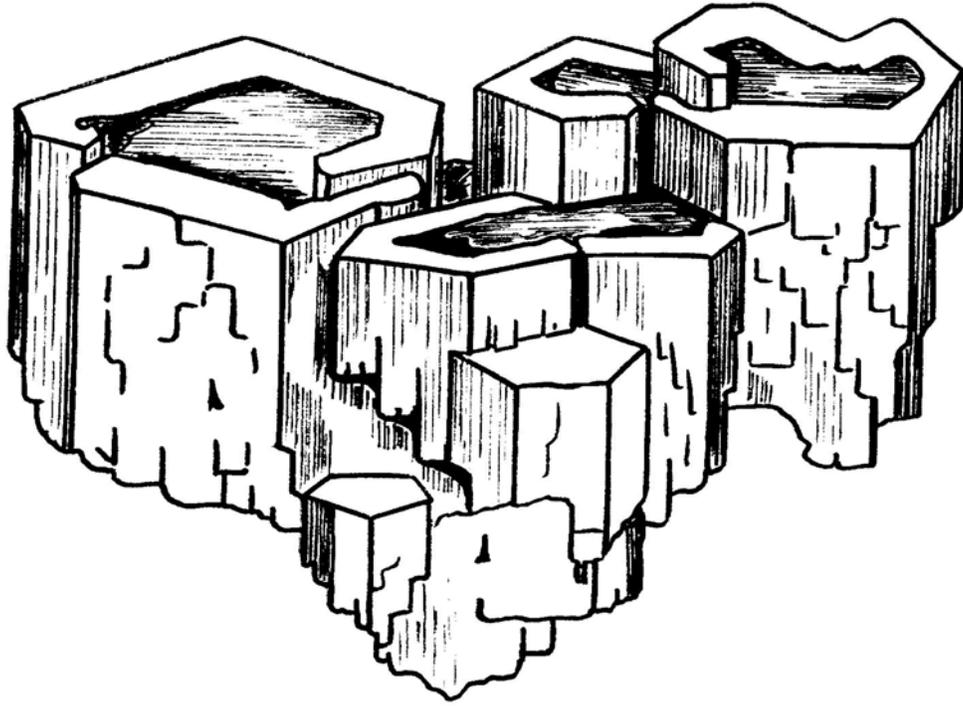
**Left: Three-colored crystals: Green tops, yellow in the middle and cranberry-red on the bottom.  
Right: Purple-pink crystals in pink lepidolite**



**Ulexite** "Clamshell"  
White to gray

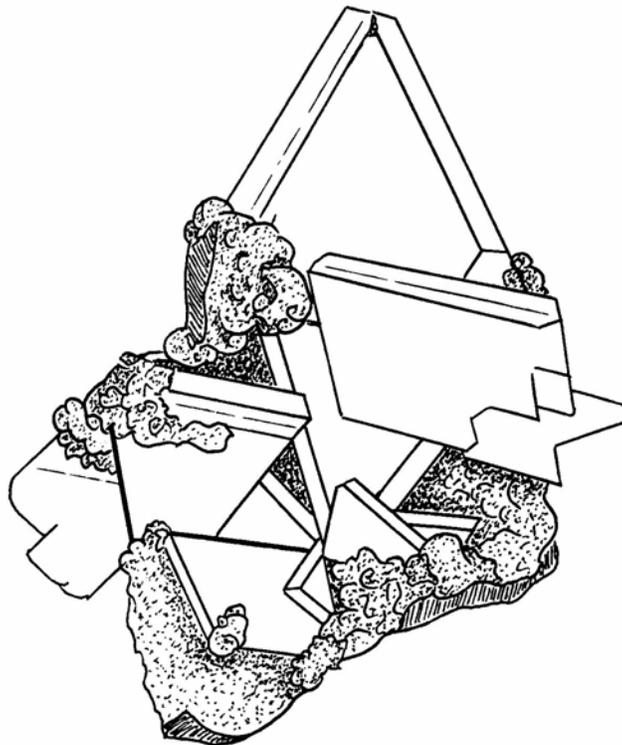


**Uranophane**  
Lemon yellow crystal "sprays"



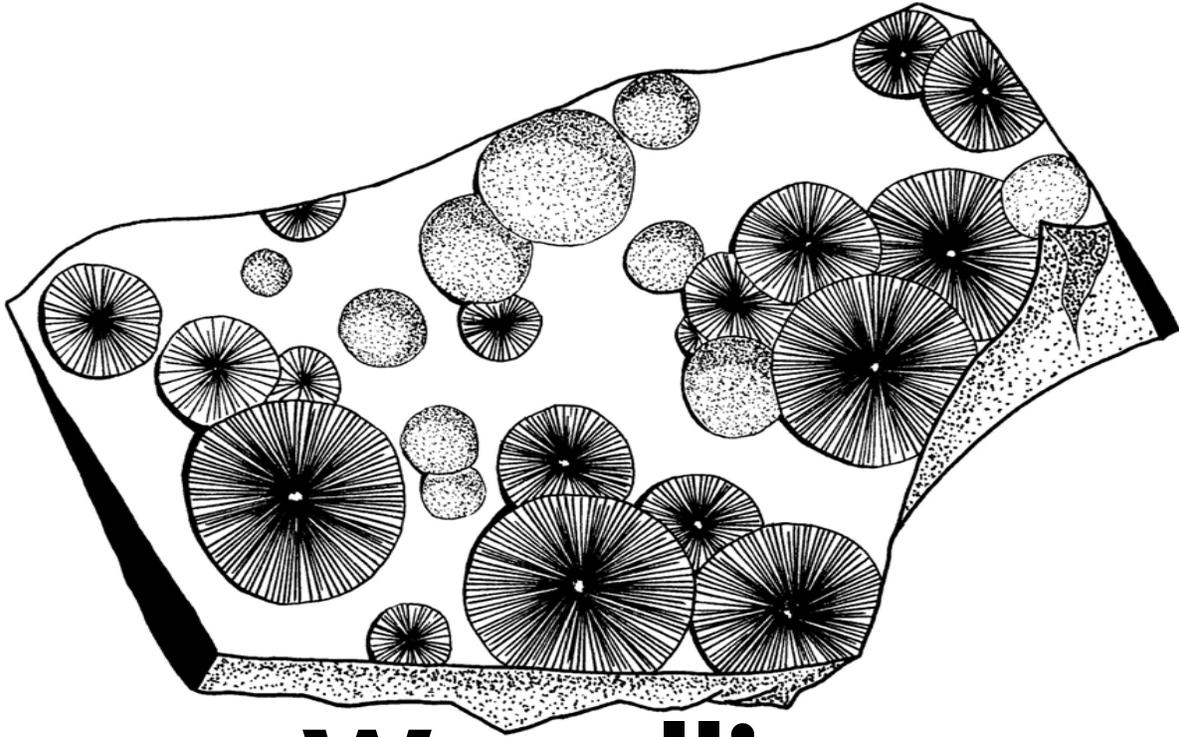
# Vanadinite

Bright red



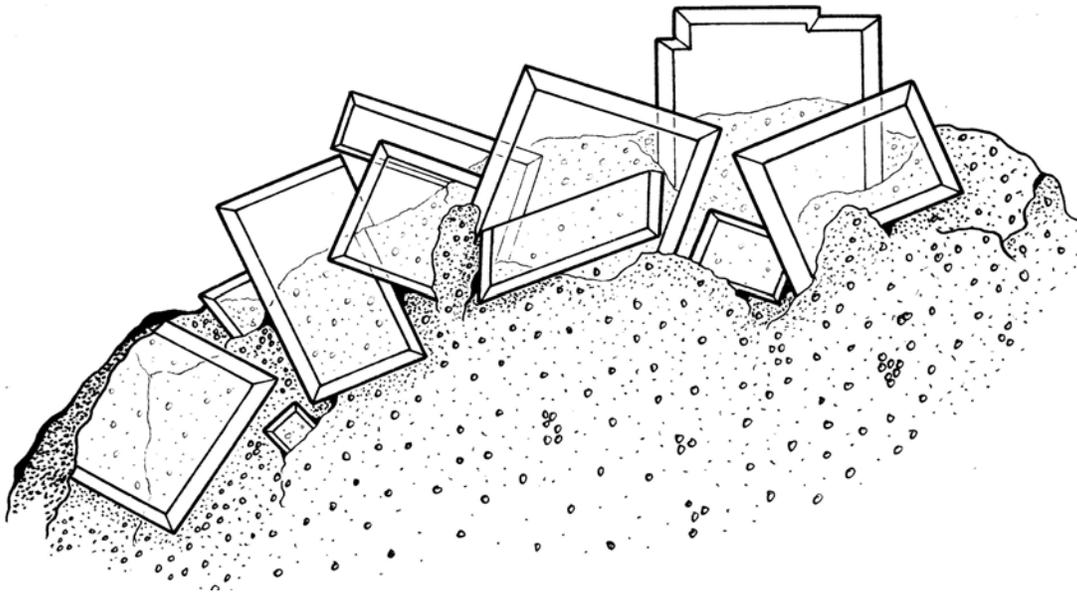
# Vivianite

Dark green on red-brown matrix



# Wavellite

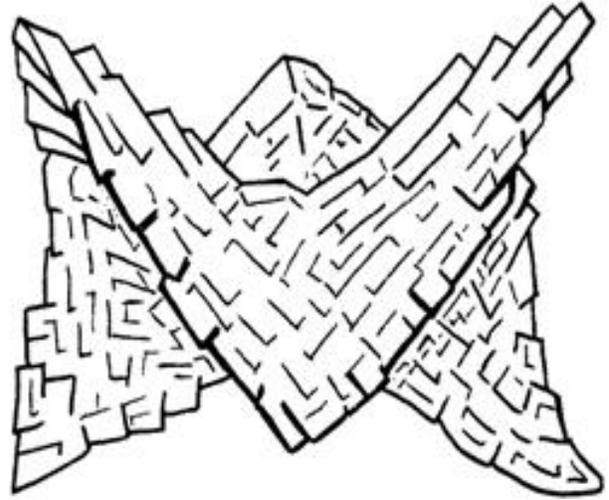
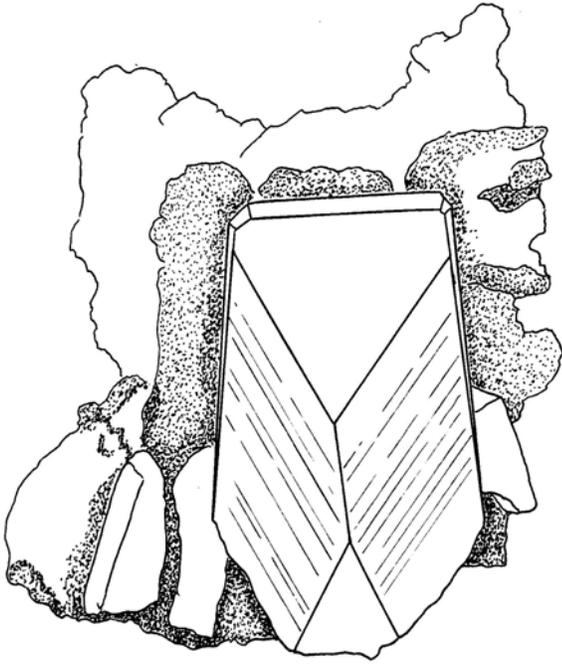
Grass green with yellow tints on tan matrix



# Wulfenite

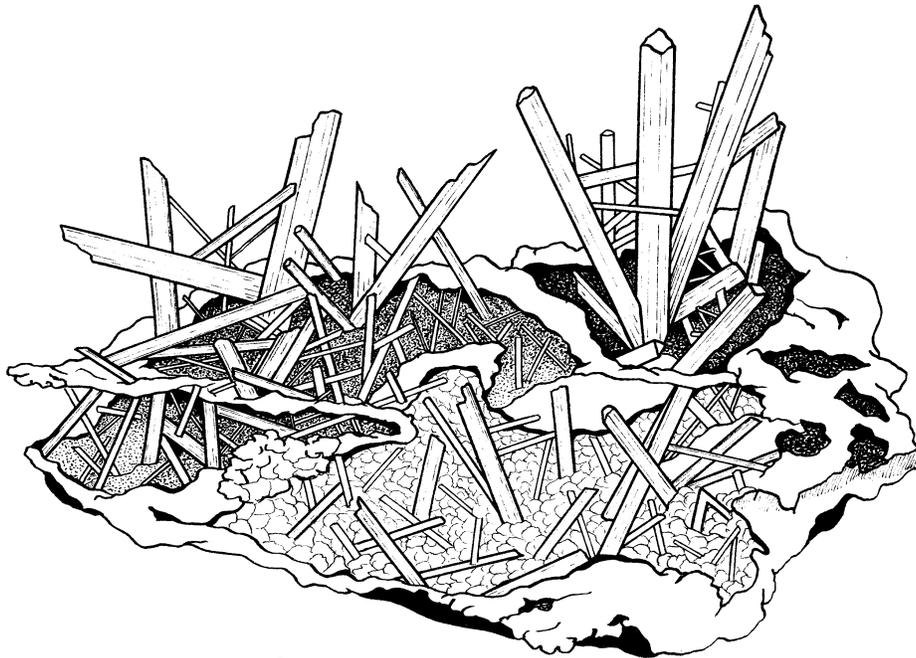
Orange

# Xtra Mineral Drawings to Color



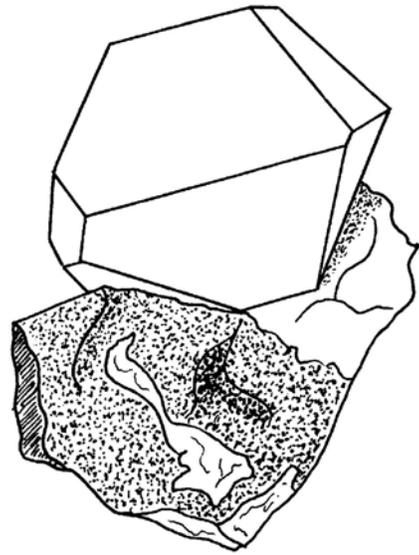
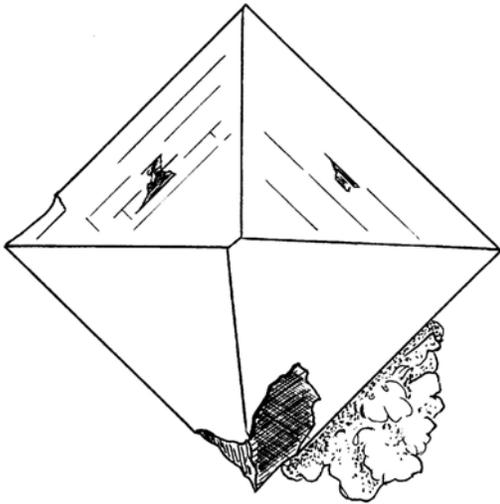
**Phosphophyllite** (left)  
Turquoise Blue

**Dolomite** (right) ~ Pink



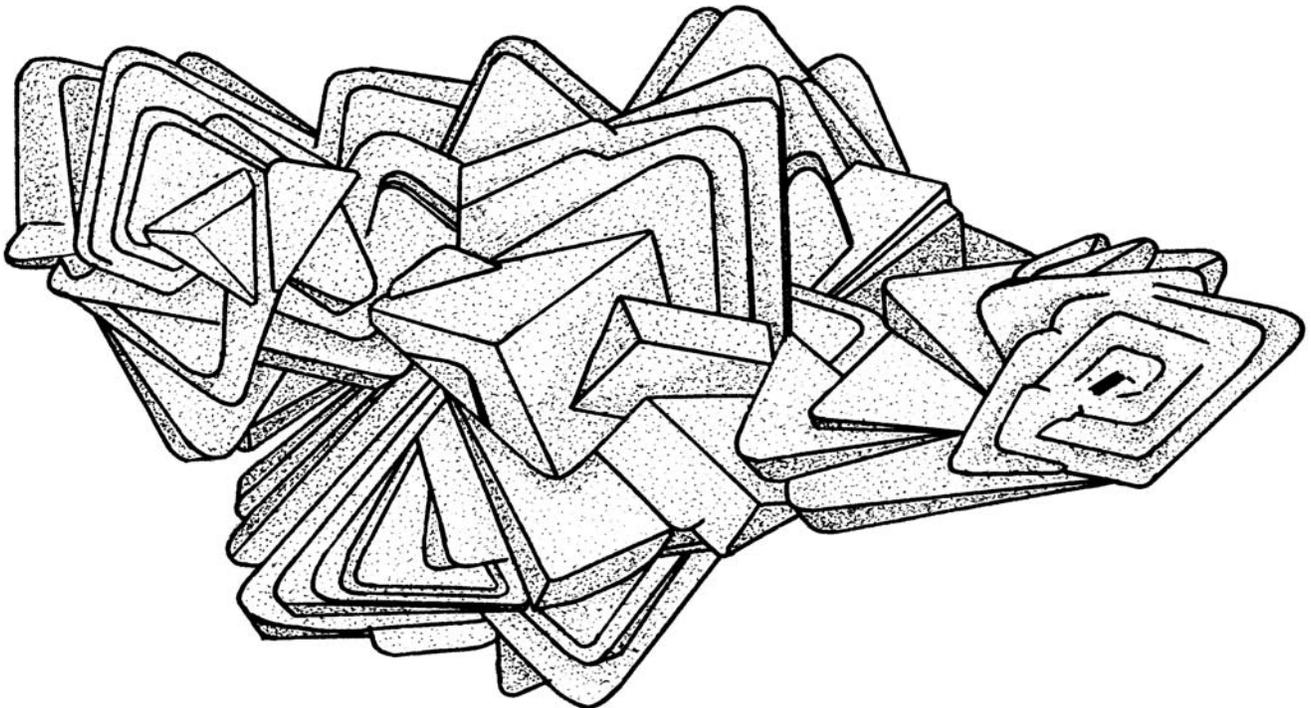
**Crocoite** Bright orange-red

**“Y” Don’t You Try to Draw Your  
Own Mineral Pictures and then  
Color them In?!**



# Zircon

**Left: Brown; Right: Deep red**



**Sand Calcite** (a bonus picture!)

**Gray to tan (like sand)**

# Mineral Flashcards

By Emma Fajcz

Have you ever wanted to teach your younger siblings or friends about minerals from A to Z? Here's some mineral "flashcards" that you can use! I've selected one mineral for each letter; however, some of them are rather obscure. With an adult's help, you can find many pictures of these minerals online. If you'd like to find out even more about the following minerals, a good resource is [www.mindat.org](http://www.mindat.org).

If you're curious about the colors for these cards, the featured color on each card starts with that letter. For example, on Card A, the color is aquamarine. Here's the colors and the minerals on each card, from A to Z:

1. Aquamarine (Aquamarine)	8. Hazel (Hessite)	15. Olive (Orpiment)	22. Violet (Vesuvianite)
2. Burgundy (Bismuth)	9. Ivory (Ilvaite)	16. Periwinkle (Peridot)	23. White (Woframite)
3. Coral (Chalcedony)	10. Jade (Jade)	17. Quartz Gray (Quartz)	24. Xanthic (Xenotime)
4. Denim (Diopase)	11. Khaki (Kaliocalcite)	18. Red (Realgar)	25. Yellow (Yoderite)
5. Eggplant (Elbaite)	12. Lavender (Labradorite)	19. Silver (Sodalite)	26. Zucchini (Zoisite)
6. Fuchsia (Feldspar)	13. Mint (Mesolite)	20. Tan (Talc)	
7. Gold (Gypsum)	14. Navy Blue (Nickeline)	21. Ultramarine (Umbite)	

The largest faceted aquamarine is the Dom Pedro Aquamarine, which is housed at the Smithsonian Museum of Natural History. This gem weighs 10,363 carats!

Aquamarine is blue to blue-green beryl.

This mineral is composed of the elements of bismuth and sulfur.

Bismuth is found in a medicine called Pepto-Bismol.

Chalcedony has been featured in many pieces of jewelry.

This beautiful gemstone comes in a variety of colors, most notably a bluish-purple.

Dioptase, which is a deep blue-green, can be used to make paint.

This stone may be mistaken for an emerald.

Elbaite is an expensive kind of tourmaline.

This mineral can occur in red, pink, and green.

Feldspar makes up sixty percent of the earth's crust.

This mineral is part of the rock called granite.

Gypsum is a soft white mineral used in paint, Plaster of Paris, and cement.

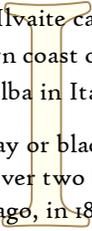
The crystals in The Cave of Crystals, located in Mexico, are a type of gypsum. The largest of these crystals weighs an impressive fifty-five tons!

Hessite is a rare mineral made up of silver and tellurium.

This mineral was named after Germain Henri Hess, the scientist who proposed Hess's Law.

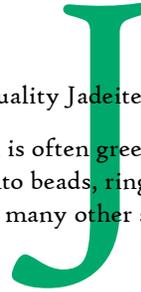
Like Elbaite, Ilvaite can also be found on the eastern coast of the island of Elba in Italy.

This dark gray or black mineral was discovered over two hundred years ago, in 1811.



Gem-quality Jadeite is called Jade.

Jade, which is often green, has been carved or shaped into beads, rings, bracelets, vases, and many other sculptures.



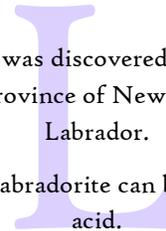
Kaliochalcite is a green or colorless mineral from the far eastern region of Russia.

This mineral was approved to be an official mineral in 2013.



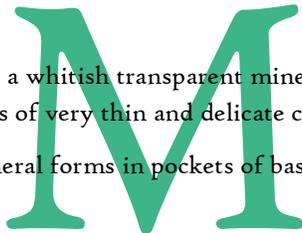
Labradorite was discovered in 1770, in the Canadian province of Newfoundland and Labrador.

Powdered Labradorite can be dissolved in acid.



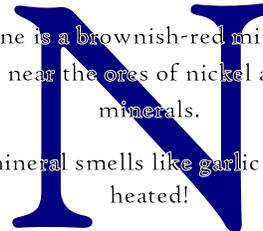
Mesolite, a whitish transparent mineral, forms in tufts of very thin and delicate crystals.

This mineral forms in pockets of basaltic lava.



Nickeline is a brownish-red mineral often found near the ores of nickel and other minerals.

This mineral smells like garlic when it is heated!



Orpiment, a gold-colored mineral, sometimes looks much like mica, but is much softer.

This mineral has been used to give gold-tone accents on silk.

Peridot is actually just olivine that is suitable for cutting and faceting.

This is one of only a few minerals that comes in only one color: green.

Quartz is pretty much the most common mineral, and comes in numerous varieties, including smoky quartz, milky quartz, amethyst, green quartz, rose quartz, and citrine.

Tiger's eye is actually a kind of quartz.

Realgar, a brilliant red mineral, contains the elements arsenic and sulfur.

This mineral is even used in fireworks!

Sodalite, a deep blue mineral often featuring white streaks, was first discovered in Greenland.

This brittle mineral often looks bright orange when seen under ultraviolet light.

Talc is the world's softest mineral, with a hardness of 1 on Moh's Scale.

This mineral is used in baby powder and many cosmetics.

Umbite, a pale yellow or colorless mineral, was originally discovered in Russia.

This mineral was named after a lake close to where the mineral was discovered.

U

Vesuvianite was first found on the lava from Mt. Vesuvius in Italy.

Gem-quality Vesuvianite can be called "idocrase."

V

Wolframite is a gray-brown mineral from which you can obtain the element tungsten.

It is actually the name of a mineral series, which is a group of minerals with the same crystal structure but different composition, or a mineral in this series which can't be distinguished from the two key minerals in this group.

W

Xenotime is a mineral sometimes containing components called "heavy rare earth elements," which are certain elements from the Periodic Table that are really not that rare, despite their name.

Although Xenotime is usually yellow-brown, it can also occur in gray and shades of brown.

X

Yoderite is a beautiful mineral that occurs in blue, purple, and two other colors.

It was originally discovered in 1959 in what is now the country of Tanzania.

Y

Zoisite was originally named saualpite.

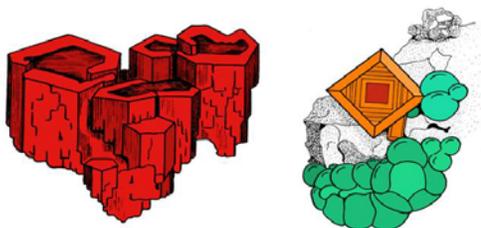
This mineral is used for jewelry making and carving.

Z

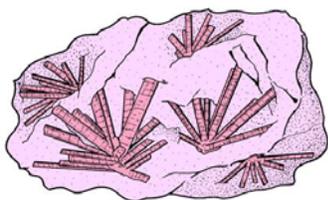
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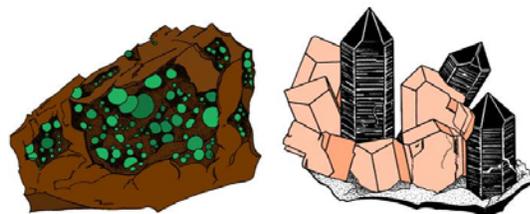
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