Minerals

Mineral Identification Basics

What is a Mineral?

Cubic Fluorite Crystal

There is a classic four part definition for mineral.

Minerals must be:

- **Naturally occurring**
- **Inorganic**
- **Forms a crystal structure**
- **Has a definite chemical composition**

Mineral Identification Basics

What is a Mineral?

Tourmaline Crystal from Brazil

Naturally Occurring

- Minerals are not man made
  - For example: steel, brass, bronze and aluminum are not considered minerals

Mineral Identification Basics

What is a Mineral?

Barite Rose - A flower like growth of Barite crystals.

Inorganic

- Minerals are **NOT** produced by organic processes.
- As a result things like pearls, coral, coal and amber are not considered minerals.

- Also included in this

"NOT a Mineral List" are teeth, bones, sea shells

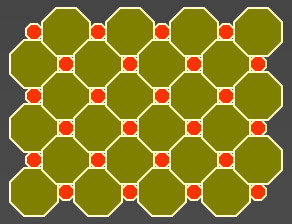
Mineral Identification Basics

Crystalline Structure

Halite (salt) from Searles Lake, CA

Minerals are the result of atoms joining together in a specific way.

The way the atoms bond will determine many of the minerals' physical and chemical properties.



Crystalline Pattern of Halite

Red = Sodium

Green = Chlorine

Physical Properties

Hardness

Cleavage / Fracture

Streak

Luster

Color

Specific Gravity

Taste

Magnetism

Light

Crystals

Mineral Identification Basics

PHYSICAL PROPERTIES **HARDNESS**

Pyrite Crystals

Hardness of 6.5

HARDNESS is determined by how easy it is to scratch the mineral. Hardness tests are done by scratching one mineral against another. The mineral that is scratched is **softer** than the other.

Mineral Identification Basics

PHYSICAL PROPERTIES **HARDNESS**

Quartz is harder than glass.

In this photo, a quartz crystal has been rubbed across a glass plate. The result is that the glass plate was scratched. The quartz is therefore harder than the glass.

Mineral Identification Basics

PHYSICAL PROPERTIES HARDNESS

MOH'S SCALE OF MINERAL HARDNESS

1. TALC
2. GYPSUM
3. CALCITE
4. FLUORITE
5. APATITE
6. FELDSPAR
7. QUARTZ
8. TOPAZ
9. CORUNDUM
10. DIAMOND

OTHER MATERIALS COMMONLY USED:

2.5 - FINGERNAIL

3 - COPPER PENNY

5.5 - GLASS

6-6.5 - STEEL FILE

Mineral Identification Basics

PHYSICAL PROPERTIES **CLEAVAGE**

These GALENA cleavage fragments were produced when the crystal was hit with a hammer.

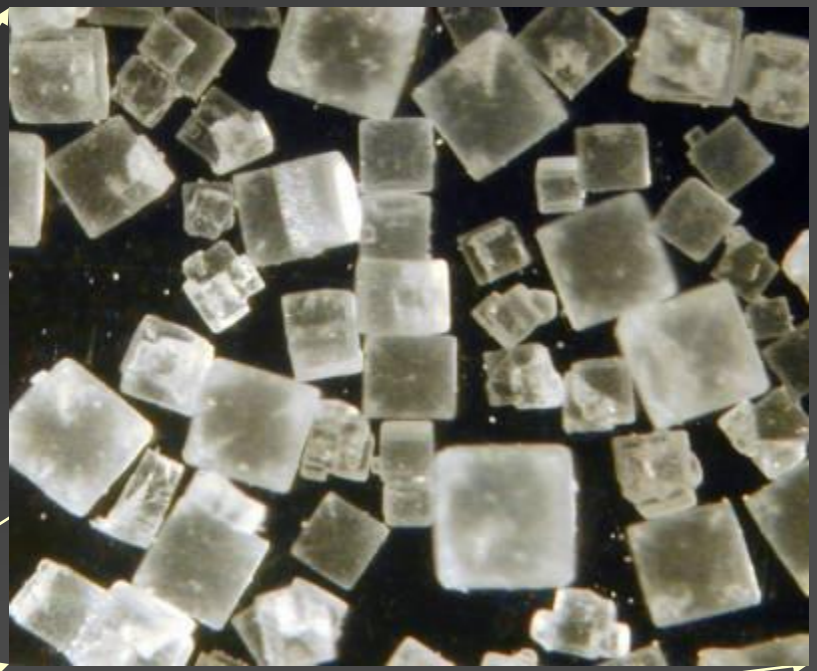
CLEAVAGE is the property that allows it to break repeatedly along smooth, flat surfaces.

These are FLUORITE cleavage fragments.

Mineral Identification Basics

PHYSICAL PROPERTIES **CLEAVAGE**

Common salt (the mineral HALITE) has very good cleavage in 3 directions.



These 3 directions of cleavage are mutually perpendicular resulting in cubic cleavage.

Mineral Identification Basics

PHYSICAL PROPERTIES **FRACTURE**

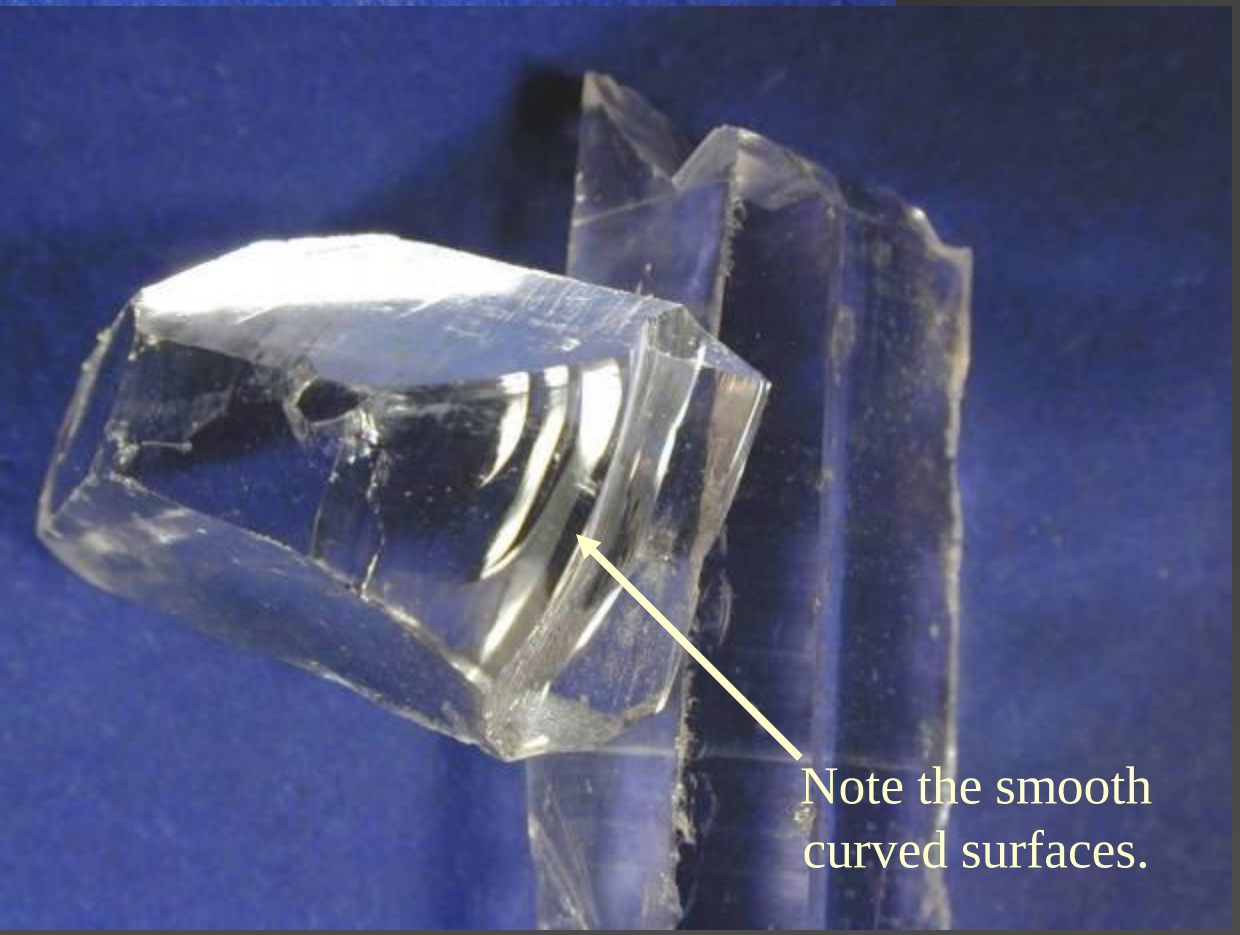
This is a piece of volcanic glass called OBSIDIAN. Even though it is NOT a mineral, it is shown here because it has excellent conchoidal fracture.

FRACTURE is defined as the way a mineral breaks other than cleavage.

If you try this yourself, use caution. Conchoidal fracture in obsidian can produce extremely sharp edges.

Mineral Identification Basics

PHYSICAL PROPERTIES **FRACTURE**



This Quartz crystal has been struck with a hammer to show how the external form of the crystal does not repeat when broken.

This is a good example of conchoidal fracture.

Mineral Identification Basics

PHYSICAL PROPERTIES **STREAK**

STREAK is defined as the color of the mineral in powder form.

Streak is normally obtained by rubbing a mineral across a "streak plate". This is a piece of unglazed porcelain. The streak plate has a hardness of around 7 and rough texture that allows the minerals to be broken into a powder. This powder is the streak.

Hematite has a reddish brown streak.

Mineral Identification Basics

PHYSICAL PROPERTIES **STREAK**

Sphalerite has a light yellow streak.

Sphalerite is a dark mineral, however, it has a light colored streak. Next to the reddish brown streak of hematite is a light yellow streak. This is the streak of the sphalerite.

Light colored streaks are often difficult to see against the white streak plate. It is often useful to rub your finger across the powder to see the streak color.

Mineral Identification Basics

PHYSICAL PROPERTIES **LUSTER**

Native Silver has a Metallic Luster

LUSTER is defined as the quality of reflected light. Minerals have been separated into either METALLIC or NON-METALLIC lusters.

Following are some examples:

Mineral Identification Basics

PHYSICAL PROPERTIES LUSTER METALLIC

Pyrite

Marcasite

Mineral Identification Basics

NON-METALLIC **LUSTER VITREOUS**

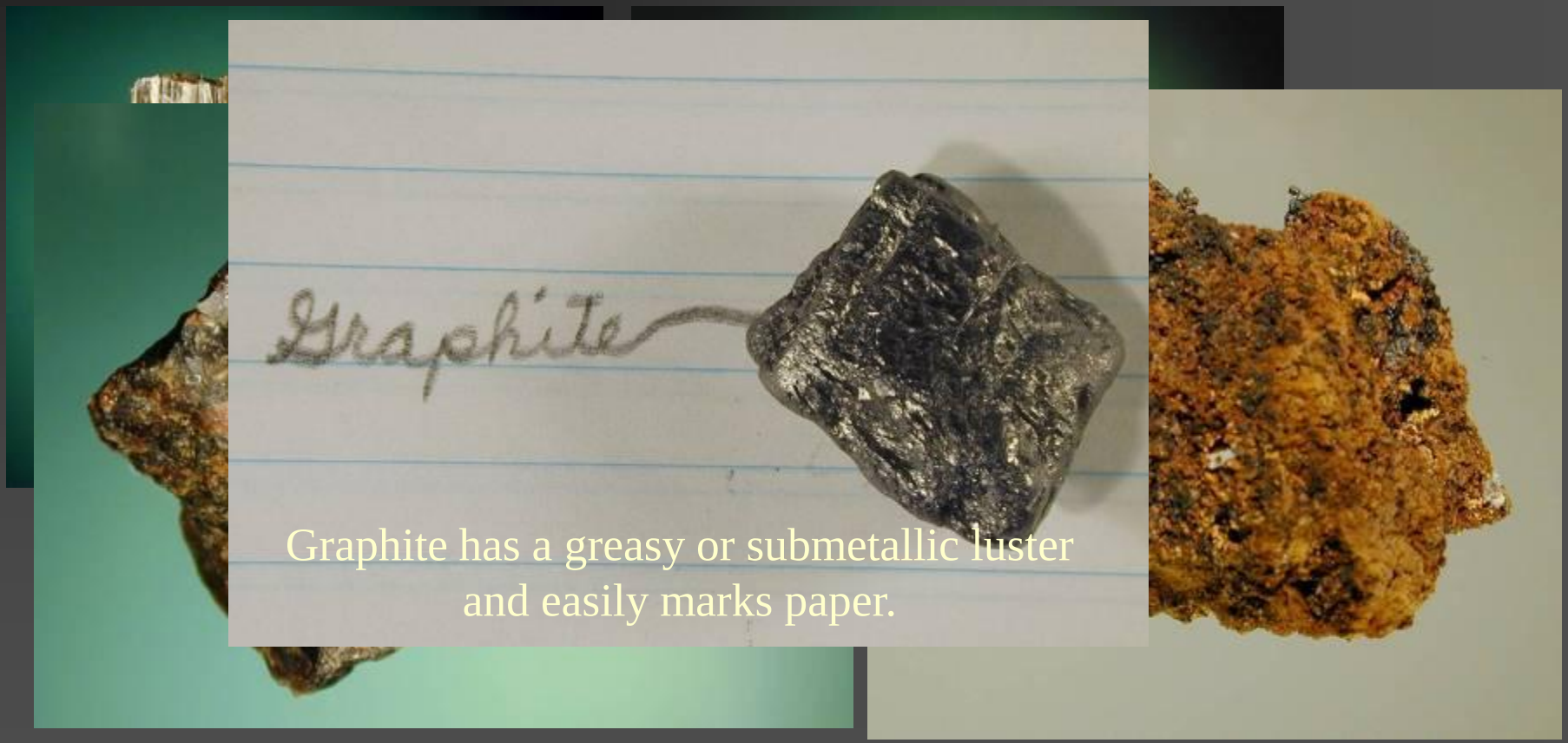
Quartz

Spinel

Mineral Identification Basics

NON METALLIC LUSTER

Miscellaneous Lusters



Graphite has a greasy or submetallic luster and easily marks paper.

Sphalerite - Resinous

Limonite - Dull or Earthy

Mineral Identification Basics

PHYSICAL PROPERTIES LUSTER

This piece of Native Copper is severely weathered. It does not look metallic.

This is the same piece but the left side has been buffed with a steel brush. Note the bright metallic luster.

Mineral Identification Basics

PHYSICAL PROPERTIES **COLOR**

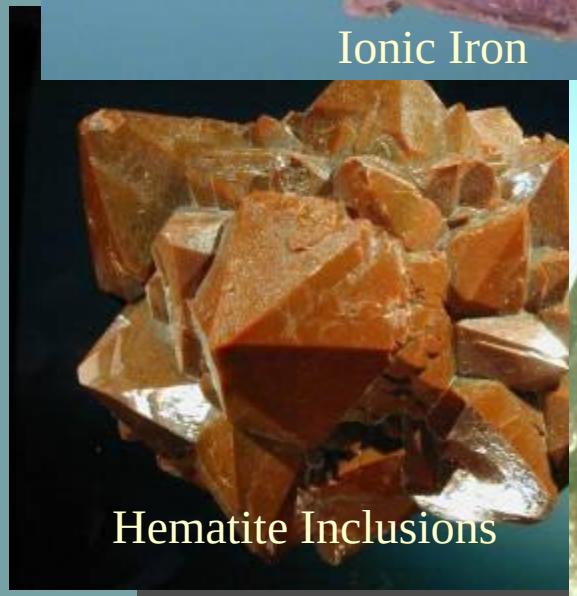
Various colors of CALCITE.

The **COLOR** of a mineral is usually the first thing that a person notices when observing a mineral. However, it is only one of many properties to look at.

Following are some examples of color variation within mineral species followed by minerals that have a distinctive color:

Mineral Identification Basics

PHYSICAL PROPERTIES COLOR



Various colors of Quartz.

Mineral Identification Basics

INDICATIVE COLOR

Azurite

Malachite

Rhodochrosite

Mineral Identification Basics

PHYSICAL PROPERTIES SPECIFIC GRAVITY

Gold in Quartz

The SPECIFIC GRAVITY of a mineral is a measure of the mineral's density. Water has a specific gravity of 1.0

Gold has a Specific Gravity of 19.2. It is 19.2 times the weight of an equal volume of water.

Mineral Identification Basics

PHYSICAL PROPERTIES **SPECIFIC GRAVITY**

The SPECIFIC GRAVITY of a mineral is determined by finding the density of the specimen divided by the density of water.

$$\text{Specific Gravity} = \frac{\text{Density of mineral}}{\text{Density of water (1)}}$$

Mineral Identification Basics

PHYSICAL PROPERTIES **TASTE**

Halite cubes from Trona, CA

It is NOT recommended that a taste test be performed on minerals as a standard process as some minerals are TOXIC.

However, the mineral **HALITE** is common salt and has a unique taste.

Mineral Identification Basics

PHYSICAL PROPERTIES MAGNETISM

MAGNETISM is the ability of a mineral to be attracted by a magnet. This most commonly is associated with minerals rich in iron, usually magnetite.

This is a piece of MAGNETITE with a magnet adhering to it. Magnetite is strongly magnetic in that a magnet will easily be attracted to it.

Mineral Identification Basics

PHYSICAL PROPERTIES **MAGNETISM**

This is a sample of "black sand" from Lynx Creek, Arizona. Its dark color is due to its high concentration of magnetite. See what happens when a magnet is placed beneath the bottom right portion of the paper.

This technique is used to separate out much of the unwanted material in the search for gold in placer deposits.

Mineral Identification Basics

PHYSICAL PROPERTIES LIGHT

The manner in which minerals transmit light is expressed by these terms:

TRANSPARENT: A mineral is considered to be transparent if the outline of an object viewed through it is distinct.

TRANSLUCENT: A mineral is considered to be translucent if it transmits light but no objects can be seen through it.

OPAQUE: A mineral is considered to be opaque if, even on its thinnest edges, no light is transmitted.

Mineral Identification Basics

PHYSICAL PROPERTIES **LIGHT**

TRANSPARENT: A mineral is considered to be transparent if the outline of an object viewed through it is distinct.

Topaz from Topaz Mountain, Utah

Mineral Identification Basics

PHYSICAL PROPERTIES LIGHT

Sylvite from Salton Sea, California

TRANSLUCENT: A mineral is considered to be translucent if it transmits light but no objects can be seen through it.

Garnet from Arizona

Note: Dark minerals like this garnet are translucent on thin edges.

Backlit Apophyllite Crystals

Mineral Identification Basics

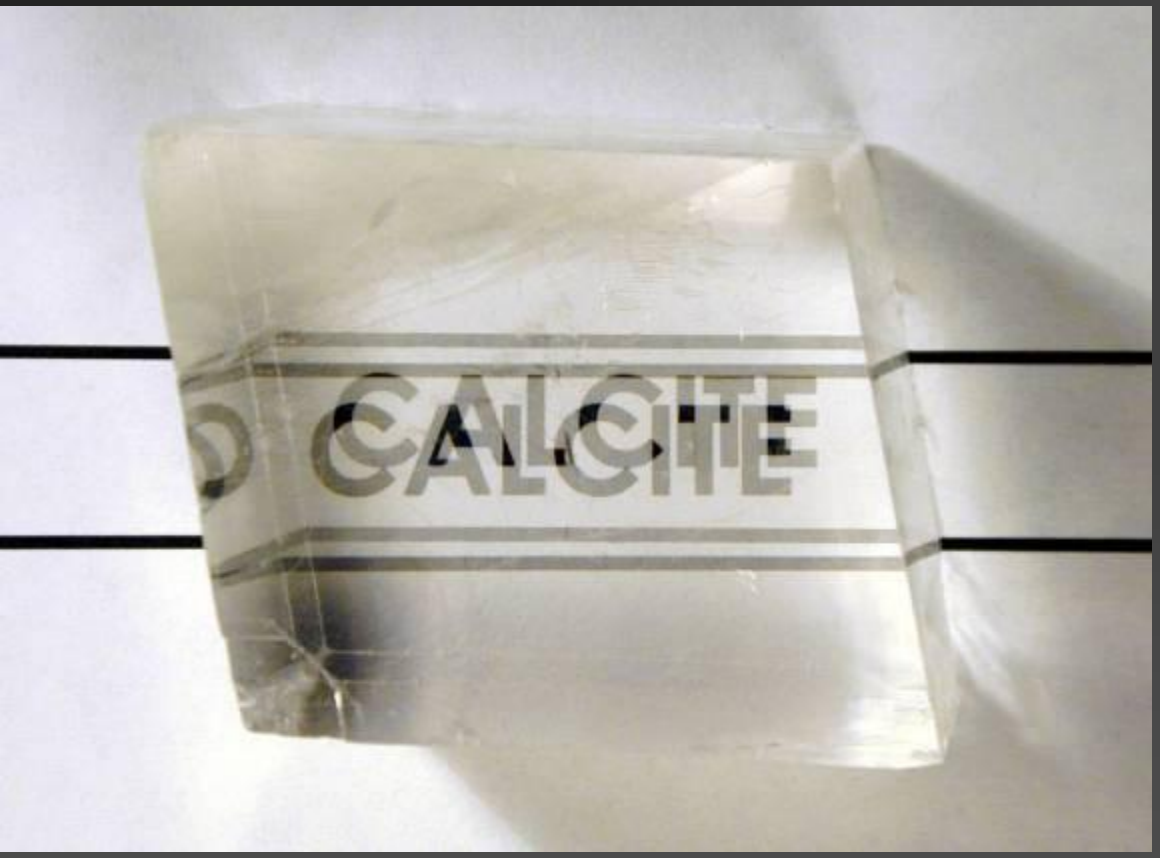
PHYSICAL PROPERTIES LIGHT

Pyrite

OPAQUE: A mineral is considered to be opaque if, even on its thinnest edges, no light is transmitted.

Mineral Identification Basics

DOUBLE REFRACTION



DOUBLE REFRACTION: Is a property shared by many minerals (but not those in the isometric crystal system). It is best displayed in the mineral CALCITE. This image clearly shows the double image below the calcite

Mineral Identification Basics

CHEMICAL PROPERTIES

REACTION TO HYDROCHLORIC ACID

Some minerals, notably the carbonates, react to cold dilute HCl. In this illustration a piece of CALCITE is shown to react (fizz) after HCl is applied.

Calcite Reacts to HCl

Mineral Identification Basics

PHYSICAL PROPERTIES **CRYSTALS**

Drusy Quartz on Barite

A CRYSTAL is the outward form of the internal structure of the mineral.

The 6 basic crystal systems are:

ISOMETRIC

HEXAGONAL

TETRAGONAL

ORTHORHOMBIC

MONOCLINIC

TRICLINIC

Mineral Identification Basics

- **ISOMETRIC CRYSTALS**

Octahedron

Cube

Cube with Pyritohedron Striations

Trapezohedron

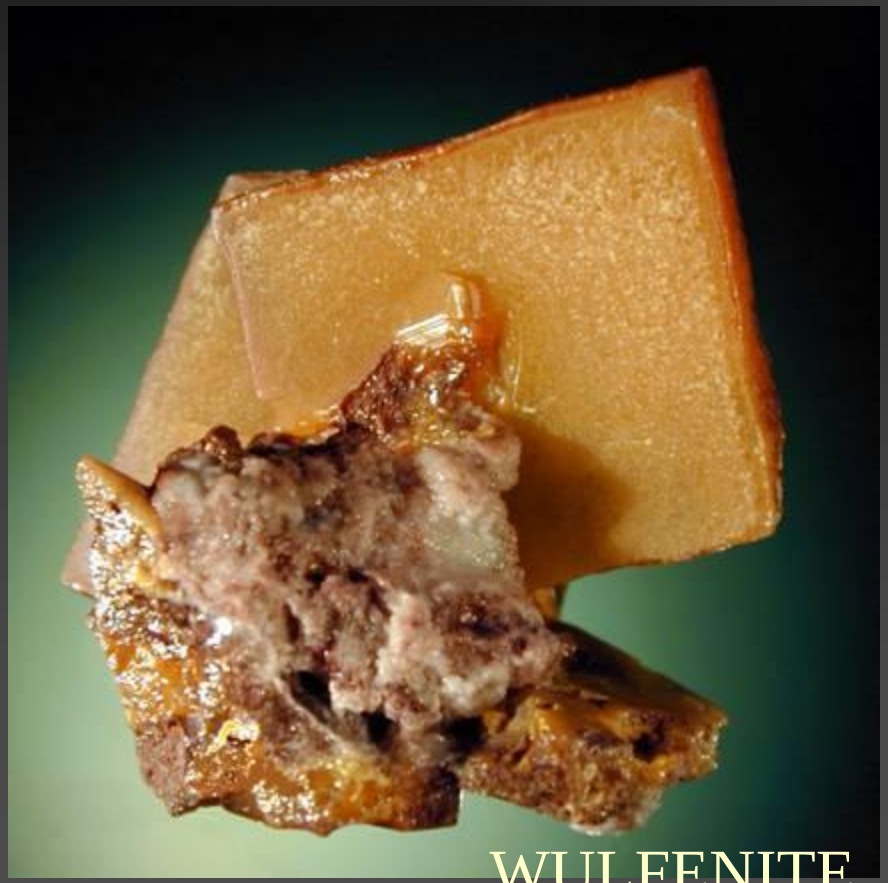
Mineral Identification Basics

- **HEXAGONAL CRYSTALS**

These hexagonal CALCITE crystals nicely show the six sided prisms as well as the basal pinacoid.

Mineral Identification Basics

- **TETRAGONAL CRYSTALS**



WULFENITE

Same crystal seen edge on.

Mineral Identification Basics

- **ORTHORHOMBIC CRYSTALS**

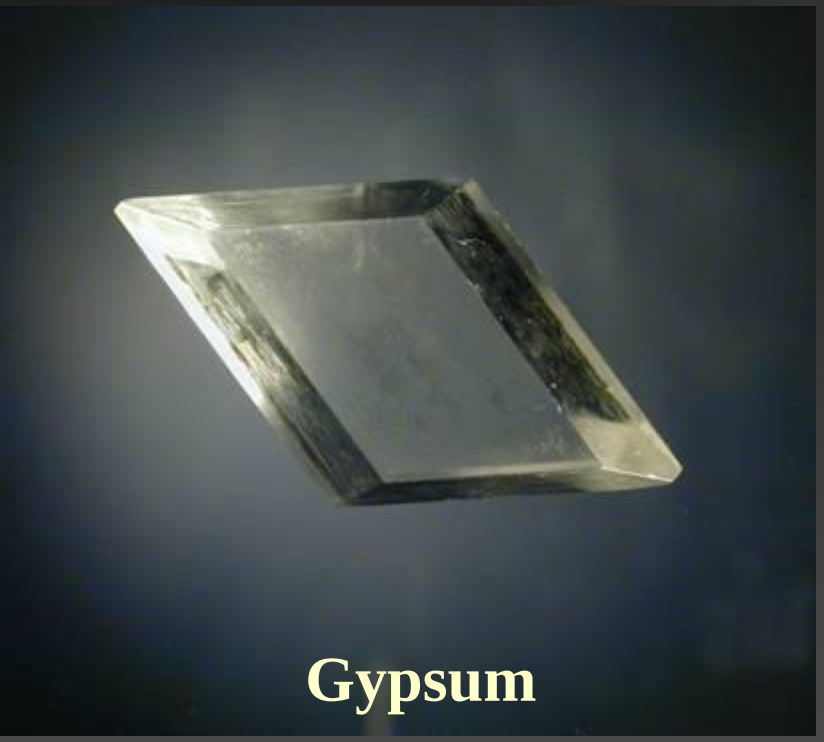
STAUROLITE

Pinacoid View

Prism View

Mineral Identification Basics

- **MONOCLINIC CRYSTALS**



Mineral Identification Basics

- **TRICLINIC CRYSTALS**

Microcline, variety Amazonite

Mineral Identification RESOURCES

For lots of useful images of minerals and more facts about minerals, check out this web site:

http://www.gc.maricopa.edu/earthsci/imagearchive/index.htm