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Mineral Properties and Identification

Physical geology lab

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What are the minerals?

Minerals are the basic building blocks of rocks. In other words, the relationship of the minerals to rocks are similar to relation of the atoms to the molecules. A mineral can be defined as the having following properties:

1. They are natural occurring
2. They are not organic. So, they are not alive and do not contain molecules like proteins, lipids, amino acid and etc.
3. They are crystalline (their molecules have been arranged in the specific pattern)
4. 4-they are solid
5. They have fixed chemical formula. For instance: Quartz formula is SiO_2

Identification: minerals could be realized by their physical properties. The most useful properties would be presented as follows:

Color:

For some minerals, color is directly related to one of the major elements and can be characteristic, thus serving as a means of identification but it can also be the least useful in identifying a mineral. Most minerals occur in more than one color. Quartz, for example, may be clear, white, gray, brown, yellow, pink, red, or orange. The other properties, such as hardness, cleavage, and luster, must be used instead.

Purple quartz, known as amethyst, and clear quartz are the same mineral despite the different colors.

Streak:

This is the color of a mineral when it is ground up and powdered. A few minerals have streak that is very different from overall color of specimen. The streak test is done by scraping a specimen of the mineral across a piece of unglazed porcelain known as a "streak plate." This can produce a small amount of powdered mineral on the surface of the plate. For example, Yellow-gold pyrite has a blackish streak, another indicator that pyrite is not gold, which has a golden yellow streak.

Pyrite and its streak

Hardness:

Hardness is the strength with which a mineral resists its surface being scraped or punctured. In working with hand samples without specialized tools, mineral hardness is specified by the Mohs hardness scale. The Mohs hardness scale is based 10 reference minerals, from talc the softest (Mohs hardness of 1), to diamond the hardest (Mohs hardness of 10). It is a relative, or nonlinear, scale. A hardness of 2.5 simply means that the mineral is harder than gypsum (Mohs hardness of 2) and softer than calcite (Mohs hardness of 3). To compare the hardness of two minerals see which mineral scratches the surface of the other.

Because it is not always practical to use a set of these minerals to test hardness, you will instead use some basic tools such as one listed below.

Finger nail=2 **Glass=6**

Penny=3 **Streak plate=7**

Knife=5

Hardness	Index Minerals	Common Objects
1	talc	
2	gypsum	2.5-fingernail
3	calcite	3.5-pure, untarnished copper
4	fluorite	
5	feldspar	5 to 5.5-stainless steel
		5.5 to 6-glass
6	apatite	6 to 6.5-hard steel file
7	quartz	
8	topaz	
9	corundum	
10	diamond	

Hardness Table

Transparency:

This describes whether or not a mineral transmits light. The terms that describe varying states of transparency are as follows:

Transparent-light easily passes through the material; you can see through it.

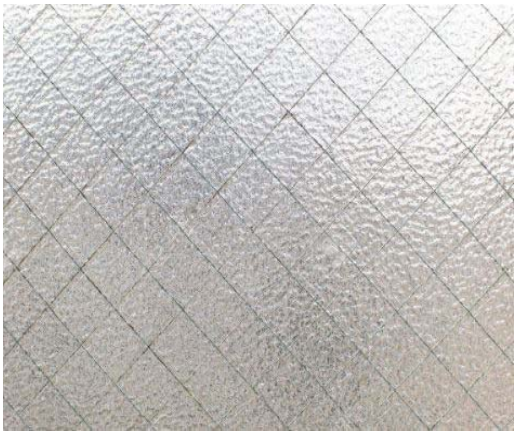
Example: window glass

Transparent glass

Translucent:

Some light passes through, but you cannot see through the material.

Example: frosted glass



Frosted glass

Opaque:

No light passes through the mineral.

Example: wood

Luster:

Luster describes the reflection of light off a mineral's surface. Mineralogists have special terms to describe luster. One simple way to classify luster is based on whether the mineral is metallic or non-metallic. Minerals that are opaque and shiny, such as pyrite, have a metallic luster. Minerals such as quartz have a non-metallic luster.

Metallic: the mineral bright and shiny but also opaque like piece of metal

Metallic luster

Sub-metallic:

Submetallic minerals have similar luster to metal, but are duller and less reflective.

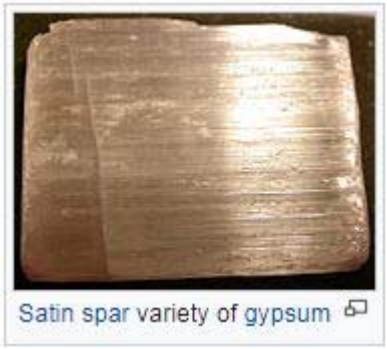
Sub-metallic

The following lusters are collectively called non-metallic:

Vitreous: the mineral is bright and shiny

Dull: the mineral is not at all shiny

Silky: the mineral reflects some light but has a soft glow to it



Satin spar variety of gypsum

Greasy: the mineral reflects light unevenly across its surface

Moss opal

Effervescence:

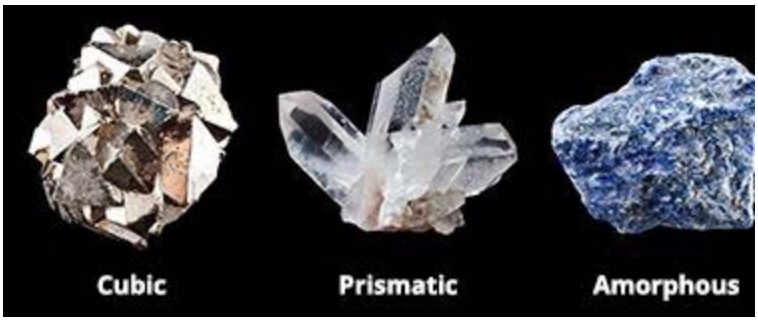
Minerals in the carbonate family react when dilute acid is applied to them. The resulting reaction is similar to opening a new can of soda; the mineral bubbles and makes a fizzy noise. Carbonate minerals are unstable in contact with hydrochloric acid. When acid begins to effervesce (fizz) on a specimen, a reaction similar to the one shown below is taking place.

$$CaCO_3 + 2HCl \longrightarrow CO_2 + H_2O + Ca^{++} + 2Cl^{--}$$

To check for effervescence, drop of dilute (5% to 10%) hydrochloric acid on a rock or mineral and watching for bubbles of carbon dioxide gas to be released.

Crystal Form:

The external shape of a mineral crystal (or its crystal form) is determined largely by its internal atomic structure, which means that this property can be highly diagnostic. Specifically, the form of a crystal is defined by the angular relationships between crystal faces. Some minerals, like halite (NaCl, or salt) and pyrite (FeS) have a cubic form; others like tourmaline are prismatic. Some minerals, like azurite and malachite, which are both copper ores, don't form regular crystals, and are amorphous.

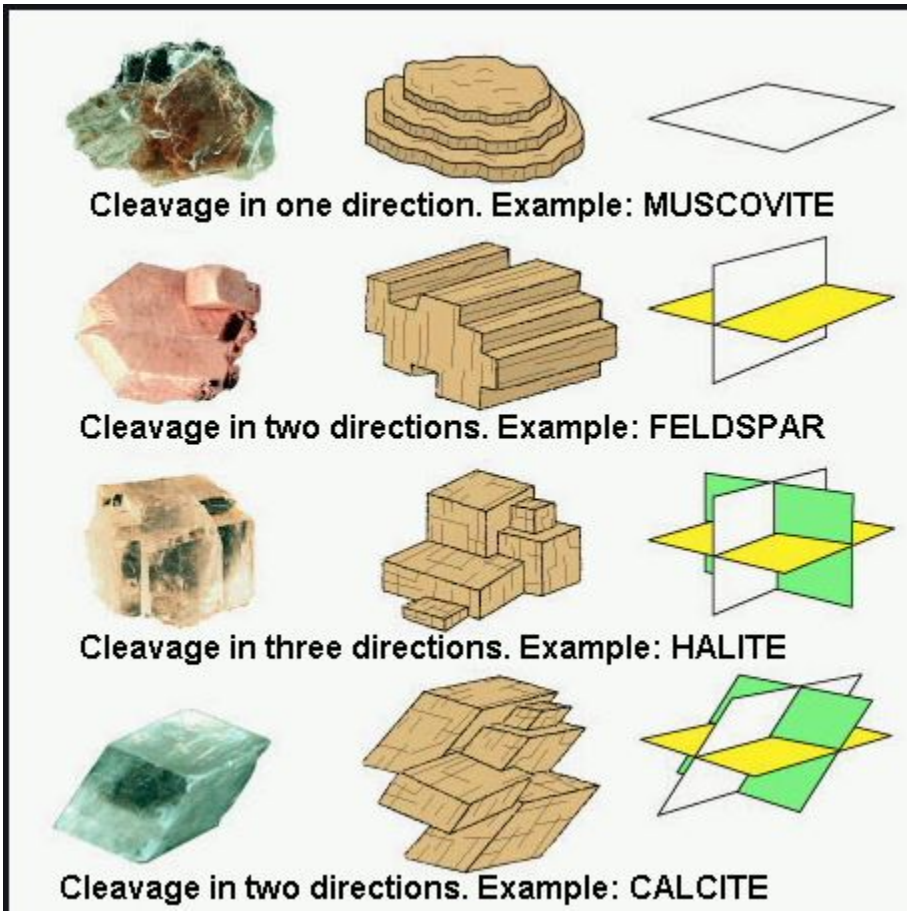


Breakage pattern:

Minerals can fragment in different ways when broken depending on their atomic bonding and crystalline molecular arrangement.

Cleavage:

Describes minerals that tend to break along smooth, flat surfaces that are parallel to one another. Each flat side is a cleavage face, and each parallel set of faces represent a cleavage plane. In mineral identification, it is important to note both the number of cleavage planes and also the angle at which the planes meet one another. You could see some examples at following figure.



Striation:

striations are thin, straight, parallel lineation that are visible on some cleavage surfaces of certain mineral, To see them, you have slowly turn the mineral around under light to get a good reflection on cleavage plane.

Fracture:

The way a mineral breaks other than along a cleavage plane. These are not flat or smooth, and they do not occur in pairs.

Magnetism:

Some minerals are strongly attracted to a magnet. Relatively few common minerals have this property, so it is very diagnostic when identifying those minerals. Note that some minerals are weakly magnetic.