CHAPTER 4 - MINERALS
MINERAL - DEFINITION

• Naturally occurring
• Inorganic
• Solid
• Specific chemical composition
• Definite crystalline structure
MINERAL SYSTEMS

- If space is not restricted, a mineral will exhibit a crystal pattern with a definite number of sides and specific angles.

### Table 4-1 Crystal Systems

<table>
<thead>
<tr>
<th>Examples</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrite</td>
<td>Wulfenite</td>
<td>Pyromorphite</td>
<td>Topaz</td>
<td>Gypsum</td>
<td>Feldspar</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Systems</th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cubic</td>
<td>Tetragonal</td>
<td>Hexagonal</td>
<td>Orthorhombic</td>
<td>Monoclinic</td>
<td>Triclinic</td>
<td></td>
</tr>
</tbody>
</table>
1. A MINERAL OCCURS NATURALLY.
2. A MINERAL IS SOLID.
3. A MINERAL HAS A DEFINITE CHEMICAL COMPOSITION.
4. A MINERAL’S ATOMS ARE ARRANGED IN AN ORDERLY PATTERN.
5. A MINERAL IS INORGANIC (WAS NEVER ALIVE)
Of the almost 4000 known minerals, only about 30 are common. The most common are quartz, feldspar, mica, and calcite.
These minerals make up most of the rocks found in the Earth’s crust.
In fact, over 60% of the Earth’s crust is made up of the family of minerals known as feldspar!
To be able to identify these and other minerals, we need to look at the properties used to separate and distinguish these minerals.
MOH’S HARDNESS SCALE

• Friedrich Mohs devised a hardness scale.
• In this scale, ten well known minerals are given numbers from one to ten.
• Lets take a look at the ten minerals used and some of the simple tests.
MINERAL IDENTIFICATION

- Hardness – the ability to resist scratching; ranges from 1 (softest) to 10 (hardest)

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Hardness</th>
<th>Hardness of Common Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talc</td>
<td>1</td>
<td>(softest) fingernail (2.5)</td>
</tr>
<tr>
<td>Gypsum</td>
<td>2</td>
<td>piece of copper (3.5)</td>
</tr>
<tr>
<td>Calcite</td>
<td>3</td>
<td>iron nail (4.5)</td>
</tr>
<tr>
<td>Fluorite</td>
<td>4</td>
<td>glass (5.5)</td>
</tr>
<tr>
<td>Apatite</td>
<td>5</td>
<td>steel file (6.5)</td>
</tr>
<tr>
<td>Feldspar</td>
<td>6</td>
<td>streak plate (7)</td>
</tr>
<tr>
<td>Quartz</td>
<td>7</td>
<td>scratches quartz</td>
</tr>
<tr>
<td>Topaz</td>
<td>8</td>
<td>scratches topaz</td>
</tr>
<tr>
<td>Corundum</td>
<td>9</td>
<td>scratches all common materials</td>
</tr>
<tr>
<td>Diamond</td>
<td>10</td>
<td>(hardest)</td>
</tr>
</tbody>
</table>
MOH’S HARDNESS SCALE

- Talc (left) is the softest and has a hardness of 1. A soft pencil lead will scratch talc.
- Gypsum is a bit harder and has a hardness of 2. A fingernail scratches gypsum.
MOH’S HARDNESS SCALE

- **Calcite** (left) has a hardness of 3 and a copper penny just scratches it.
- **Fluorite** has a hardness of 4 and it can be scratched by an iron or brass nail.
MOH’S HARDNESS SCALE

• Apatite (left) has a hardness of 5 and can be scratched by a steel knife blade.
• Feldspar has a hardness of 6 and it will scratch a window glass.
MOH’S HARDNESS SCALE

- Quartz (left), with a hardness of 7, is the hardest of the common minerals. It easily scratches hard glass and steel.
- Topaz has a hardness of 8 and will scratch quartz.
• Corundum (left) has a hardness of 9. Corundum will scratch topaz.
• Diamond with its hardness of 10 can easily scratch the rest of the minerals.
MINERAL IDENTIFICATION

• Luster— the way a mineral reflects light
• In our class we will use three terms:
  • Dull— not reflecting light well
  • Glassy – reflects like water or glass
  • Metallic – reflects like a metal
MINERAL IDENTIFICATION

- Cleavage (flat surfaces) or Fracture (no flat surfaces) – the way a mineral ___breaks___
The **cleavage** of a mineral is its tendency to split easily or to separate along flat surfaces. Cleavage can even be observed on tiny mineral grains making it a very useful property!
Mica is probably the best example as it splits into thin sheets. It is said to have one perfect cleavage.
CLEAVAGE

- *Feldspar* splits readily in two directions, always at or near right angles.
CLEAVAGE

- Calcite and galena cleave in three directions.
- They are said to have three good cleavages.
Not all minerals show cleavage.

Those that don’t break along cleavage surfaces are said to have fracture.
MINERAL IDENTIFICATION

- **Streak** – the color of the powdered form of a mineral
Streak of a mineral is the color of its powder when rubbed on an unglazed white tile.
• The streak is often not the same color as the mineral.
• A minerals color may vary, but the streak rarely will!
Crystal shape can be a useful property to identify minerals if the minerals have had the time and space to form crystals. Most mineral grains that are found in rocks, lack the room to grow.
Specific gravity tells you how many times as dense as water the mineral is.

Pure gold can have a specific gravity as high as 19.3!
ACID TEST

• **Calcite** is calcium carbonate, $\text{CaCO}_3$. If a drop of weak hydrochloric acid is placed on calcite, the acid bubbles as carbon dioxide is released.
OTHER SPECIAL PROPERTIES

Malleable

Magnetic

Radioactive

Flourescence

Taste
MALLEABLE OR DUCTILE

• Minerals that can be hammered thin or shaped are said to show these properties.
• Can you think of a mineral that might be shaped or hammered?
GOLD WOULD BE A PERFECT EXAMPLE!
Some minerals that contain Iron, are magnetic and can be picked up by a magnet.
This is the state of glowing while under a ultraviolet light.
Some minerals even glow once the light is turned off!
Some minerals, such as this **uraninite**, are radioactive.

They give off subatomic particles that will activate a **Geiger counter**.
Halite (rock salt) can be identified by its taste.

This practice is not recommended!