METHODS USED TO IDENTIFYING MINERALS

More than 4,000 minerals are known to man, and they are identified by their physical and chemical properties. The physical properties of minerals are determined by the atomic structure and crystal chemistry of the minerals. The most common physical properties are crystal form, color, hardness, cleavage, and specific gravity.

CRYSTALS

One of the best ways to identify a mineral is by examining its crystal form (external shape). A crystal is defined as a homogenous solid possessing a three-dimensional internal order defined by the lattice structure.

Crystals developed under favorable conditions often exhibit characteristic geometric forms (which are outward expressions of the internal arrangements of atoms), crystal class, and cleavage. Large, well-developed crystals are not common because of unfavorable growth conditions, but small crystals recognizable with a hand lens or microscope are common. Minerals that show no external crystal form but possess an internal crystalline structure are said to be massive.

A few minerals, such as limonite and opal, have no orderly arrangement of atoms and are said to be amorphous.

Crystals are divided into six major classes based on their geometric form: isometric, tetragonal, hexagonal, orthorhombic, monoclinic, and triclinic. The hexagonal system also has a rhombohedral subdivision, which applies mainly to carbonates.

CLEAVAGE AND FRACTURE

After minerals are formed, they have a tendency to split or break along definite planes of weakness. This property is called cleavage. These planes of weakness are closely related to the internal structure of the mineral, and are usually, but not always, parallel to crystal faces or possible crystal faces. Minerals may have one, two, three, four, or six directions of cleavage. These cleavage forms are cubic, octahedral, dodecahedral, rhombohedral, prismatic, and pinacoidal. Minerals that break easily along these lines of weakness have shiny surfaces. Many crystals do not cleave, but fracture or break instead. Quartz, for example, forms well-developed crystal faces but does not cleave at all; instead, it fractures or breaks randomly with a conchoidal fracture.

COLOR

The color of a mineral is, for the amateur mineralogist, the most important identifying characteristic. Many minerals exhibit various colors; the varieties are mainly caused by impurities or a slight change in chemical composition. For example, calcite can be white, blue, yellow, or pink. Surface tarnish may have changed the color of a specimen, so a fresh surface should be examined.

HARDNESS

The hardness of a mineral can be measured by its resistance to scratching or abrasion. The Mohs scale is a set of 10 common minerals chosen for comparative hardness. The minerals are arranged in order of increasing hardness; each mineral will scratch all that precede it, and be scratched by all that follow it. The Mohs scale is as follows:

1. talc
2. gypsum
3. calcite
4. fluorite
5. apatite
6. orthoclase
7. quartz
8. topaz
9. corundum
10. diamond

STREAK

The streak of a mineral is the color of the powder produced when the mineral is rubbed against an unglazed porcelain plate or other fine-grained, hard, abrasive surface. The color of a particular mineral may vary, but the streak is generally constant. The streak may be the same color as the mineral or an entirely different color, but the streak of all white minerals, including calcite, is white.

LUSTER

Luster refers to the brightness of light reflected from the mineral's surface. The main types of luster are metallic and nonmetallic. Some of the more important nonmetallic lusters are:

Adamantine: brilliant, like that of a diamond
Earthy: dull, like kaolin
Silky: having the sheen of silk, like satin spar, a variety of gypsum
Greasy: oily appearance
Resinous: waxy appearance, like sphalerite
Vitreous: the appearance of broken glass, like quartz
Nacreous (pearly): like mother of pearl; for example, pearly luster on fossil gastropods and cephalopods

SPECIFIC GRAVITY

The specific gravity (relative density) of a mineral is its weight compared to the weight of an equal volume of water; thus, a mineral with a specific gravity of 4 is four times heavier than water. Special instruments are needed to measure specific gravity.

TENACITY

Tenacity is the measure of a mineral's cohesiveness or toughness. Tenacity terms are:

Brittle: breaks or powders easily; for example, pyrite or marcasite
Ductile: can be drawn into a wire; for example, copper
Elastic: bends and resumes its original position or shape when pressure is released; for example, biotite or muscovite
Malleable: can be hammered into thin plates or sheets; for example, gold or copper
Sectile: can be cut or shaved with a knife; for example, gypsum or galena

ACID TEST

When carbonates (especially calcite) are treated with cold, dilute hydrochloric acid, they will effervesce (foam and bubble) and give off carbon dioxide gas. When sulfides, such as galena, pyrite, and sphalerite, are treated with dilute hydrochloric acid, they will give off the rotten-egg odor of hydrogen sulfide.

MAGNETISM

A few minerals, such as magnetite and pyrrhotite, are attracted by a magnet and are said to be magnetic. Magnetic minerals are rare in Kentucky, but do occur in the kimberlite in Elliott County. If you find a large piece of highly magnetic material, it may be a meteorite or a furnace product.

FLUORESCENCE

Some minerals, such as calcite, gypsum, halite, uranium minerals, and fluorite, will fluoresce in brilliant colors when viewed with an ultraviolet light. UV light is not normally visible to the human eye, and you should avoid looking directly at the UV source, because it can damage eyesight.