Cleavage and Fracture

Cleavage is the way a mineral breaks. Many minerals break along flat planes, or cleavages—some in only one direction (like mica), others in two directions (like feldspar), and some in three directions (like calcite) or more (like fluorite). Some minerals, like quartz, have no cleavage. Cleavage is a profound property that results from a mineral's molecular structure, and cleavage is present even when the mineral doesn't form good crystals. Cleavage can also be described as perfect, good or poor.

Fracture is breakage that is not flat. The two main kinds of fracture are conchoidal (shell-shaped, as in quartz) and uneven. Metallic minerals may have a hackly (jagged) fracture. A mineral may have good cleavage in one or two directions but fracture in another direction.

Biotite is a common phyllosilicate mineral within the mica group, with the approximate chemical formula K(Mg,Fe)₃AlSi₃O₁₀(F,OH)₂. Like other mica minerals, biotite has a highly perfect basal cleavage, and consists of flexible sheets, or lamellae, which easily flake off. It has a monoclinic crystal system, with tabular to prismatic crystals with an obvious pinacoid termination. It has four prism faces and two pinacoid faces to form a pseudohexagonal crystal. Although not easily seen because of the cleavage and sheets, fracture is uneven. It appears greenish to brown or black, and even yellow when weathered. It can be transparent to opaque, has a vitreous to pearly luster, and a grey-white streak. When biotite is found in large chunks, they are called “books” because it resembles a book with pages of many sheets.

Microcline (KAlSi₃O₈) is an important igneous rock-forming tectosilicate mineral. It is a potassium-rich alkali feldspar. Microcline typically contains minor amounts of sodium. It is common in granite and pegmatites. Microcline forms during slow cooling of orthoclase; it is more stable at lower temperatures than orthoclase. Sanidine is a polymorph of alkali feldspar stable at yet higher temperature. Microcline may be clear, white, pale-yellow, brick-red, or green; it is generally characterized by cross-hatch twinning that forms as a result of the transformation of monoclinic orthoclase into triclinic microcline. Microcline may be chemically the same as monoclinic orthoclase, but because it belongs to the triclinic crystal system, the prism angle is slightly less than right angles; hence the name "microcline" from the Greek "small slope." It is a fully ordered triclinic modification of potassium feldspar and is dimorphous with orthoclase. Microcline is identical to orthoclase in many physical properties; it can be distinguished by x-ray or optical examination; viewed under a polarizing microscope, microcline exhibits a minute multiple twinning which forms a grating-like structure that is unmistakable. Crystal shape: Can be anhedral or euhedral. Grains are commonly elongate with a tabular appearance. May contain lamellae which formed from exsolved albite. Cleavage: Has perfect cleavage parallel to {001} and good cleavage on {010}. Cleavages intersect at 90°41.

Hornblende is a complex inosilicate series of minerals (ferrohornblende – magnesiohornblende).[1] Hornblende is not a recognized mineral in its own right, but the name is used as a general or field term, to refer to a dark amphibole. Hornblende is a common constituent of many igneous and metamorphic rocks such as granite, syenite, diorite, gabbro, basalt, andesite, gneiss, and schist. It is the principal mineral of amphibolites. Very dark brown to black

Halite commonly known as rock salt, is the mineral form of sodium chloride (NaCl). Halite forms isometric crystals. The mineral is typically colorless or white, but may also be light blue, dark blue, purple, pink, red, orange, yellow or gray depending on the amount and type of impurities. It commonly occurs with other evaporite deposit minerals such as several of the sulfates, halides, and borates. Halite occurs in vast beds of sedimentary evaporite minerals that result from the drying up of enclosed lakes, playas, and seas. Salt beds may be hundreds of meters thick and underlie broad areas. In the United States and Canada extensive underground beds extend from the Appalachian basin of western New York through parts of Ontario and under much of the Michigan Basin. Color: Colorless or white; also blue, purple, red, pink, yellow, orange, or gray. Crystal habit: Predominantly cubes and in massive sedimentary beds, but also granular, fibrous and compact. Crystal system: Cubic. Cleavage: Perfect {001}, three directions cubic. Fracture: Conchoidal. Tenacity: Brittle. Mohs scale hardness: 2 - 2.5. Luster: Vitreous. Streak: White. Diaphaneity: Transparent.


Fluorite (also called fluorspar) is a halide mineral composed of calcium fluoride, CaF₂. It is an isometric mineral with a cubic habit, though octahedral and more complex isometric forms are not uncommon. Crystal twinning is common and adds complexity to the observed crystal habits. Color: Colorless, white, purple, blue, green, yellow, orange, red, pink, brown, bluish black; commonly zoned. Crystal habit: Occurs as well-formed coarse sized crystals also nodular, botryoidal, rarely columnar or fibrous, granular, massive. Cleavage: Octahedral, perfect on {111}, parting on {011}. Fracture: Subconchoidal to uneven. Tenacity: Brittle. Mohs scale hardness: 4 (defining mineral). Luster: Vitreous. Streak: White. Diaphaneity: Transparent to translucent.

Sphalerite (Zn,Fe)S is a mineral that is the chief ore of zinc. It consists largely of zinc sulfide in crystalline form but almost always contains variable iron. When iron content is high it is an opaque black variety, marmatite. It is usually found in association with galena, pyrite, and other sulfides along with calcite, dolomite, and fluorite. Color: Brown, yellow, red, green, black. Crystal habit: Euhedral Crystals - Occurs as well-formed crystals showing good external form. Granular - Generally occurs as anhedral to subhedral crystals in matrix. Colloform. Crystal system: Isometric hextetrahedral (4 3m). Twinning: Simple contact twins or complex lamellar forms, twin axis [111]. Cleavage: [110] Perfect. Fracture: Uneven to conchoidal. Mohs scale hardness: 3.5-4. Luster: Adamantine, resinous, greasy. Streak: brownish white, pale yellow. Diaphaneity: Transparent to translucent, opaque when iron-rich.


**Tremolite** is a member of the amphibole group of silicate minerals with composition: Ca<sub>2</sub>Mg<sub>5</sub>Si<sub>8</sub>O<sub>22</sub>(OH)<sub>2</sub>. Tremolite forms by metamorphism of sediments rich in dolomite and quartz. A fibrous variety of tremolite is used as asbestos. Color is usually white or gray but can be greenish, colorless, yellow and violet. Luster is vitreous or silky to dull. Transparency: Specimens are translucent to transparent. Crystal Habits include flattened prismatic and elongated crystals with a dome-like termination that is actually two of the four faces of a prism. Fibrous crystals form radial aggregates, masses and hair like clusters. Also as a felted mass (asbestos and "mountain leather"). Cleavage: is perfect in two directions at close to 60- and 120-degree angles (diamond-shaped). Hardness is 5 - 6.

**Corundum** is a crystalline form of aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) with traces of iron, titanium and chromium.[1] It is a rock-forming mineral. It is one of the naturally clear transparent materials, but can have different colors when impurities are present. Transparent specimens are used as gems, called ruby if red, while all other colors are called sapphire. Color: Colorless, gray, brown; pink to pigeon-blood-red, orange, yellow, green, blue to cornflower blue, violet; may be color zoned, asteriated mainly grey and brown. Crystal habit: Steep bipyramidal, tabular, prismatic, rhombohedral crystals, massive or granular. Fracture: Conchoidal to uneven. Mohs scale hardness: 9 (defining mineral). Luster: Adamantine to vitreous. Streak: White. Diaphaneity: Transparent, translucent to opaque.

**Magnetite** is a ferrimagnetic mineral with chemical formula Fe<sub>3</sub>O<sub>4</sub>, one of several iron oxides and a member of the spinel group. Magnetite is the most magnetic of all the naturally occurring minerals on Earth.[5] Naturally magnetized pieces of magnetite, called lodestone, will attract small pieces of iron, and this was how ancient people first noticed the property of magnetism. Lodestones were used as an early form of magnetic compass. Magnetite typically carries the dominant magnetic signature in rocks, and so it has been a critical tool in paleomagnetism, a science important in discovering and understanding plate tectonics. Color: Black, gray with brownish tint in reflected light. Crystal habit: Octahedral, fine granular to massive. Mohs scale hardness: 5–6. Luster: Metallic. Streak: Black. Diaphaneity: Opaque. Specific gravity: 5.17–5.18.

**Crystals to know:** apatite, aragonite, augite, azurite, biotite, calcite, corundum, dolomite, fluorite, galena, garnet, gypsum, halite, hematite, hornblende, limonite, magnetite, malachite, muscovite, olivine, plagioclase, potassium (K) felspar, pyrite, quartz, staurolite, talc, topaz.