**The Photo-Atlas of Minerals Glossary**Note: This glossary does not include geological terms used in the Environment data field. For recommended on-line references on geological terms, see the [Photo-Atlas of Minerals Links Page](http://www.nhm.org/photo-atlas#geoterms)

**Acicular:** Needle-like [crystal habit.](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal%20habit)

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| Artinite exhibiting acicular habit |

**Acid:** An acid is a chemical compound that produces hydrogen [ions](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "cation) when dissolved in water. Strong or weak indicate the concentrations of hydrogen ions produced. Common strong acids include hydrochloric acid (HCl), nitric acid (HNO3), and sulfuric acid (H2SO4). A common weak acid is acetic acid (CH3COOH or HC2H3O2); vinegar is a 3% solution of acetic acid. Another weak acid important in geology is carbonic acid (H2CO3) which forms whenever atmospheric - or other - carbon dioxide (CO2) dissolves in water (H2).  
     Stronger acids will attack many minerals and can be used to help identify them. For example, acids attack carbonate minerals, such as calcite, causing carbon dioxide bubbles to be given off in an affect known as [effervescence](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Effervescent).  
     Strong acids are dangerous and should be handled with care, only while wearing safety glasses and with plenty of water available.

**Adamantine:** Hard brilliant [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster); like that of a diamond.

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| Diamond exhibiting adamantine luster |

**Adularescence, Adularescent:** Strong pearly-to-blue floating sheen seen in the moonstone varieties of the feldspars Orthoclase, Albite, and Oligoclase.

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| Oligoclase, variety moonstone |

**Aggregate:** A combination of minerals joined in irregular fashion to form a material similar to concrete

**Albite law twin:** Type of [lamellar twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "lamellar%20twin) on the {010} plane typical of albite and exhibited by other members of the plagioclase series.

**Aliphate:** Hydrocarbon in which carbon atoms are linked into chains.

**Alloy:** Homogeneous mixture of two or more metals in variable proportions.

**Alteration:** Change in the [chemical composition](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "chemical%20composition) and/or atomic structure of a mineral brought about by chemical attack or changing physical conditions.

**Alumino-:** Compound containing aluminum usually in combination with an anionic group (e.g. aluminosilicate).

**Amalgam:** [Alloy](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Alloy) of mercury with another metal.

**Amide:** Organic compound containing the amino group (NH2 or NH).

**Amorphous, Metamict:** Amorphous materials are non-crystalline, that is they lack long-range regularity in their [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure). By definition they cannot be minerals. Nevertheless, some natural amorphous substances have been accepted as minerals.

Some minerals containing [radioactive](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Radioactivity) atoms have become amorphous as a result of radiation damage to their atomic structures; they are called metamict.

**Analogue:** A mineral which is identical to another, usually with respect to both chemical composition and atomic structure with the exception of a single attribute, typically one of the elements essential to its composition. For example, Calcite, Magnesite, and Strontianite are analogues, containing respectively calcium, magnesium, and strontium.

**Anastomosing:** Network of branching and rejoining veins.

**Ångstrom Å:**   
       One ten billionth of a meter (0.0000000001 m);  
       One hundred millionth of a centimeter (0.00000001 cm);  
       One tenth of a nanometer

While the Ångstrom is not a metric system unit, it remains in use because it is such a convenient unit for specifying interatomic distances and [unit cell](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "unit%20cell) dimensions. A typical unit cell dimension for minerals is between 2 and 30 Å.

**Anhedral:** [Crystal](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal) with no well-formed external [faces.](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Face)

**Anhydrous:** Mineral with no water (H 2O) in its [formula](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Chemical%20Formula).

**Anisotropic:** Crystal which affects light differently when light passes through the crystal in different directions. See [index of refraction](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "index%20of%20refraction).

**Arborescent:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) of crystals in the shape of slender divergent branches like a plant.

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| Arborescent copper |

**Archeotype:** General type of atomic structure; used to indicate similarities in the [atomic structures](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) of minerals with differing [chemical compostions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Chemical%20Composition). SnS-archeotype refers to the atomic structure of the mineral herzenbergite. PbS-archeotype refers to the atomic structure of the mineral galena.

**Arcuate:** Curved or bent.

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| Arcuate crystals of pyromorphite |

**Arsenate:** Compound containing the arsenate group (AsO4-3).

**Arsenite:** Compound containing the arsenite group (AsO3-3).

**Asbestiform:** Crystal [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth), similar to that commonly exhibited by asbestos, consisting of fibers generally aligned in a single direction, often at right (90º) angles to the walls of a [vein](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#vein). See [cross-fiber](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#cross-fiber).

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| Riebeckite, variety crocidolite (cross-fiber asbestos) |

**Atom, Element, Electron, Proton, Neutron, Nucleus, Ion, Antion, Cation:** An atom is the smallest particle of matter impervious to attack with energies short of nuclear reactions. There are only 90 chemically distinct kinds of atoms found in all of nature. Thus atoms are the building blocks on which we base our understanding of the composition of and the formation of minerals under geological conditions; atoms are rearranged - but not changed - during geological processes.  
     At the center of an atom is the nucleus, a combination of positively-charged protons and uncharged neutrons. The outside the nucleus are negatively-charged electrons. The number of protons in the nucleus determines the chemical behavior of the atom.  
     An atom has the same number of electrons as protons (thus; electrically neutral). Most atoms, when mixed with atoms of a different element, lose or gain electrons to form ions. Negatively charged ions (atoms with extra electrons) are anions; positively charged ions (atoms with a deficit of electrons) are cations.

**Atomic bonding:** It is useful to classify the bonds that hold [atoms](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atom) to one another in chemical compounds and [crystals](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal) into three types - ionic, covalent and metallic.  
     As the name implies, ionic bonding is due to the attractions between positively and negatively charged [ions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#ion). Some atoms are not able to retain all their electrons in competition with other electron greedy atoms. Under these conditions they lose a few electrons forming [cations](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#cation), ions with a positive charge; the electron greedy atoms gain electrons to become [anions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#anion), ions with a negative charge. Oppositely charged ions attract one another forming ionic bonds. The optimum arrangement is one which surrounds each charged ion with several charged ions with the opposite charge.  
     When the different atoms are almost equal competitors for [electrons](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#electron), neither can take an extra away from the other, and so such atoms bond together by sharing electrons. This kind of bonding is called covalent bonding. It holds two partners together in a very precise geometrical arrangement. The two bonded atoms can be thought of as an ellipsoid with nuclei at the two foci. Discreet covalently bonded atom groups are found in many minerals. These usually have a net negative charge and are called [anionic groups](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#anionic%20group) or polyatomic ions. An example is the phosphate ion in which four oxygen atoms surround a central phosphorous atom; the whole unit behaves like an anion with a charge of -3. Many of these groups form the basis for the common mineral classification schemes ([Dana](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Dana), [Strunz](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Strunz)).  
     Atoms in [metals](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#metal) bind together by electron sharing, but in these compounds the electrons are shared between large numbers of atoms and are essentially free to move from atom to atom throughout the material. This type of bonding is weaker. Shear forces can cause the atoms to slip with respect to one another and then re-bond in the new position. This explains the [malleability](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Malleable) of many metals. The relatively free flow of electrons explains the electrical and heat conductivity of metals.

**Atomic group, Anionic group, Polyatomic ions:** Certain atoms form especially tightly [bonded](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Atomic%20Bonding) atomic groups. In minerals, these usually consist of an covalently bonded to three or four surrounding oxygens. These groups usually have a net negative charge, in which case they are called anionic groups. An example is the phosphate ion, (PO4-3), in which four oxygen atoms surround a central phosphorous atom and the whole unit behaves like an anion with a charge of -3.

**Atomic structure:** Atomic structure refers to the orderly, repetitive, 3-dimensional arrangement of [atoms](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atom) in a [crystalline](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystalline) substance such as a mineral. Nowhere is the orderliness and perfection of nature more apparent than in atomic structure. In an atomic structure, atoms come together into stable configurations by forming networks of [bonds](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Atomic%20Bonding) between one another. Knowledge of the atomic structure of a mineral helps us to understand all of the mineral's properties.

**Barrel-shaped:** [Habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Habit) of a stout [prismatic](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Prismatic) crystal in which the prism faces are bowed so that the crystal has a greater diameter at its center than at either end. The crystal usually also has flat [terminations](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#termination).

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| Barrel-shaped vanadinite crystal |

**Basal pinacoid:** [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of the two parallel faces, (001) and (00-1), which transect the c axis.

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| Basal pinacoid (red) |

**Base:** Compound that when dissolved in water yields free hydroxyl (OH-) anions.

**Baveno law twin:** Type of simple [contact twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "contact%20twin) on the {021} plane exhibited by orthoclase, microcline and other members of the feldspar group.

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| Orthoclase Baveno law twin |

**Beryllo-:** Compound containing beryllium usually in combination with an anionic group (e.g. beryllosilicate).

**Birefringent:** Having different [indicies of refraction](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "index%20of%20refraction) along different crystal directions.

**Bladed:** [Habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Habit) of a crystal that is flat and long; like a knife blade. Also an [intergrowth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#intergrowth) of blades stacked together.

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| Strengite exhibiting bladed habit |

**Bleb:** A rounded crystal grain of one mineral imbedded in another.

**Blocky:** [Habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Habit) in which a crystal roughly block-shaped and nearly [equidimensional](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#equidimensional).

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| Anorthoclase exhibiting blocky habit |

**Borate:** Compound containing the borate group (BO3-3) or linked borate groups.

**Boro-:** Compound containing boron usually in combination with an [anionic group](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Anionic%20Group) (e.g. borosilicate).

**Botryoidal, Reniform:** Crystalline [intergrowth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Intergrowth) with smooth, rounded surfaces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image022.jpg |
| Botryoidal smithsonite |

**Brazil law twin:** Type of penetration twin in quartz in which right- and left-handed crystal segments are twinned across the {11-20} plane. It is usually only possible to detect Brazil twinning under special polarized light.

**Brittle:** Breaks or powders easily. A type of [tenacity](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "tenacity).

**Butterfly twin:** Simple [contact twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "contact%20twin) consisting of two wedge-shaped individuals, exhibiting no prominent re-entrant angle, and having an overall shape resembling a butterfly.

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| Calcite butterfly twin with copper inclusions |

**Capillary:** Very thin, hair-like crystal [habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Habit).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image026.jpg |
| Capillary millerite on quartz |

**Carbide:** Compound of a metal with carbon and nothing else.

**Carbocycle, Cyclic hydrocarbon:** Hydrocarbon in which carbon atoms are linked into rings.

**Carbonate:** Compound containing the carbonate group (CO3-3).

**Carlsbad law twin:** Type of [penetration twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "penetration%20twin) about the {001} axis exhibited by orthoclase, sanidine and other members of the feldspar group.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image028.jpg |
| Orthoclase Carlsbad law twin |

**Cathodoluminescence:** Emission of visible light by a mineral when it is bombarded by [electrons](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "electron).

**Chalky:** Having the [color](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "color), [luster](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#luster), [fracture](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#fracture), or general appearance of chalk.

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| Kaolinite |

**Chemical formula, Chemical composition:** The chemical formula the standard way of stating the chemical composition of a mineral, that is, the relative numbers of atoms of each element contained in that mineral. The formula is given as a series of [element symbols](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Element%20Symbols), often followed by subscripts. The subscript indicates the number of atoms of that element in the formula. The presence of the element symbol indicates the presence of at least one atom, so subscripts of 1 are considered redundant and are omitted.  
     With the exception of the native metals and carbon, minerals are usually composed of positively and negatively charged units called [ions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#ion) (often uncharged water molecules are part of the composition). Many ions have only one typical charge state, e.g. oxygen is always -2 (O-2) in minerals, and sodium is always +1 (Na+1). If an atom is capable of forming ions with more than one charge state, e.g. iron which can form both a +2 or +3 ion (Fe+2or Fe+3), a superscript may be used to indicate the charge. (Standard chemical notation is to use a Roman numeral in parentheses for this purpose.) Notice that only some of the ions in a formula will have their charges indicated. The total of all the ionic charges in the formula must equal 0; positive and negative charges must exactly balance.  
     Parentheses in chemical formulas are used either to indicate [atomic groups](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Atomic%20Group), e.g. the carbonate group (CO3-2), or to indicate a [solid solution](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#solid%20solution) relationship between two or more atoms, e.g. (Fe,Mg).

**Chromate:** Compound containing the chromate group (CrO4-2).

**Cleavable:** Able to be easily split into smaller fragments, especially along [cleavages](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "cleavage). The term is usually used in reference to massive [intergrowths](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#intergrowth) of a mineral.

**Cleavage, Parting:** Cleavage and parting are ways in which certain minerals to break along flat surfaces. The tendency to cleave is a characteristic feature of all crystals of a particular [mineral species](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#mineral%20species). Cleavage occurs parallel to planes in the [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure) that correspond to relatively weak [bonds](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Atomic%20Bonding) between [atoms](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atom). For example, a mineral is likely to cleave along a plane which leaves equal numbers of + and - charges on the two new surfaces, but it unlikely to cleave along a plane which leaves all + charges on one and all - charges on the other. If the bonds in the structure are of nearly equal strength in all directions, the mineral will [fracture](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#fracture), but not cleave.  
     Parting differs from cleavage in that parting is only developed in certain samples of a mineral along [exsolution](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Exsolution) lamellae or in response to applied pressure. The planes along which cleavage and parting occur are designated by [Miller indices](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Miller%20indices). The perfection with which cleavage and parting are seen in a mineral is usually described with the following terms:  
     perfect  
     imperfect  
     distinct  
     indistinct  
     excellent  
     good  
     fair  
     poor

**Coarse-grained:** Consisting of an [aggregate](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "aggregate) of relatively large crystals or grains.

**Cockscomb:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) of long, slightly offset crystals in semi-circular fans.

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| Cockscomb marcasite |

**Cogwheel twin:** [Penetration twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Penetration%20twin) with a circular pattern of protruding crystal edges resembling the teeth of a gear or cogwheel.

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| Bournonite cogwheel twins |

**Colloform:** Crystalline [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) with smooth, rounded surfaces.

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| Colloform rockbridgeite |

**Colloidal:** [Aggregates](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Aggregate) of extremely small grains thought to have formed from a gel.

**Color, Streak:** Color is one of the most obvious of mineral properties, but as a guide to recognition it must be used with caution. Some minerals always exhibit the same color, while others can be found in many different colors. Trace color impurities can produce dark color when viewed through a large thickness of a mineral, thereby masking the true color of the mineral.  
     By scraping the mineral against a piece of white unglazed porcelain, the streak of the finely powdered mineral is obtained. The color of the streak can be much more reliable characteristic of the mineral.  
     Light absorption related to position changes of [electrons](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "electron) within minerals causes most of the colors we see in minerals. While all minerals absorb light, only some absorb those frequencies of light which are visible to the human eye, and thus appear to be colored. The electrons involved may be associated with transition elements, charge transfers, or color centers.  
     Transition elements, such as iron, copper and manganese, contain electrons that can absorb visible light, selectively absorbing certain wavelengths. A mineral that contains a certain transition element as an essential constituent will always have color imparted by that element. The exact color is dependent on the neighbors of the transition element (e.g. all iron-containing minerals will be colored, but not all will be the same color).  
     A mineral that in pure form is colorless may exhibit any of a variety of colors if it contains small amounts of various transition elements. A good example is beryl, which in pure form is colorless. Various impurities impart color to form a variety of colored gemstones.  
     Some very intense colors in minerals are the result of light absorption by electrons that jump between atoms in the mineral, a charge transfer. An example is the blue color of the sapphire variety of corundum which results from an electron jumping from Fe+2 to Ti+4.  
     A variety of processes including mistakes made in the rush of forming a crystal or mistakes introduced during irradiation by natural or artificial [radioactive](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Radioactivity) sources of the crystal after initial formation leave atoms out of position. These defects, called color centers, result in the absorption of visible light.

**Columnar:** [Subparallel](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Subparallel) intergrowth of [crystals.](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Crystal)

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| Manganite exhibiting columnar habit |

**Compact:** Dense, close-packed [crystalline](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystalline) texture in which individual crystals cannot be distinguished without magnification.

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| Compact intergrowth of goethite crystals |

**Complex:** Group of tightly bonded atoms behaving as unit.

**Conchoidal:** Manner in which certain minerals [fracture](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "fracture) along smoothly curved surfaces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image042.jpg |
| Quartz exhibiting conchoidal fracture |

**Concretion:** A hard, rounded mineral mass that usually forms in sedimentary rocks surrounding a fragment of organic material. In a general sense, any spherical crystal [aggregate](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "aggregate).

**Contact twin:** Twin in which the crystals meet along a well-defined plane (composition plane).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image044.jpg |
| Chrysoberyl contact twin |

**Cross-fiber:** Consisting of parallel fibers oriented at right (90º) angles to the walls of a [vein](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#vein). See [asbestiform](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#asbestiform).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image011.jpg |
| Riebeckite, variety crocidolite (cross-fiber asbestos) |

**Cruciform twin:** [Penetration twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Penetration%20twin) consisting of two prismatic crystals assuming the configuration of a cross.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image046.jpg |
| Harmotome cruciform twin |

**Cryptocrystalline:** Consisting of [crystals](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal) too small to see under an ordinary microscope.

**Crystal, Crystalline:** When people talk about crystals, they usually are referring to solid pieces of matter that are bounded by regularly arranged flat faces. Crystal faces result as the solid grows by adding [atoms](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atom) in a completely orderly, repetitive, 3-dimensional array called its [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure). A substance is crystalline if it has this orderly atomic structure, even if it lacks the regular faces (which are dependent on the growth environment and the history since formation). A crystal formed as the result of geological processes is a mineral.

**Crystal face:** The flat exterior surfaces of a crystal are called crystal faces. Obviously an infinite variety of planes pass through a given point, only a tiny number of these are observed to bound or define a crystal. Once scientists were able to determine crystals' [atomic structures](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure), they found that the few planes used were those that were oriented to include the highest density of atoms. Because of this connection with atomic structure, specimens of different minerals exhibit different faces. The result may be a characteristic crystal shape which can be used for identification purposes, even without understanding of the underlying connection with the atomic structure of the mineral.  
     Crystal faces (and forms) are indexed by notations known as [Miller indices](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Miller%20indices). By studying the geometrical relationships between crystal faces, one may be able to determine the symmetry of the crystal and its [crystal class](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20class).

**Crystal form:** The [symmetry](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "symmetry) that relates the atoms within the crystal also relates the [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face) on the crystal. Thus if the atoms within a crystal are related by a mirror plane, there will also be pairs of external faces on the crystal related by that same mirror plane. A crystal form is a group of crystal faces that are equivalent to one another because they are related by the crystal's symmetry.  
     Observation that serveral crystal faces on specimens of a mineral form a crystal form may aid one in identifying the symmetry of the crystal and its [crystal class](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20class).

**Crystal growth:** A crystal begins to form when the proper atoms/ions arrange themselves in a pattern (the [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) of that mineral). Crystal growth continues as various identical atoms/ions [bond](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Atomic%20Bonding) themselves to the original cluster following the same pattern. Crystal growth may take place from molten rock, from a water solution, or from a gas. Depending upon natural conditions during growth, atoms/ions will deposit upon one plane more quickly than another, causing growth to occur more rapidly in the favored direction. The faces that we observe on crystals are the atomic planes to which atoms/ions have been added most slowly. (If you grow fast, you get covered)

**Crystal habit:** Crystal habit refers to the general shape of a crystal. The crystal habit is determined both by the [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) of the crystal and by the environment in which the crystal grows. Because of variability in the growth environment, natural crystals rarely grow in ideal geometric shapes. Nevertheless the angular relationships between crystal faces will always provide evidence of the symmetrical relationships between crystal faces. Some of the terms used to describe crystal habits are:  
       Acicular: needle-like  
       Fibrous, capillary, filiform: very thin; hair-like  
       Prismatic: longer than wide, surrounded by parallel faces; like a column  
       Bladed, lath-shaped: flat and long; like a knife blade  
       Platy, lamellar: in very thin sheets  
       Tabular: like a tablet of paper  
       Equant: nearly equal in all three dimensions

**Crystallite:** Minute incompletely [crystalline](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystalline) particle.

**Cubic:** See [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic).

**Cuboidal:** Similar to a cube in shape.

**Cubo-octahedron:** A crystal shape which combines the shape of a cube and the shape of an octahedron.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image047.jpg |
| Carrollite exhibiting cubo-octahedral habit |

**Cuneiform:** Wedge-shaped.

**Cyclic twin:** Repeated twin in which the crystals are related by two or more symmetry equivalent planes or axes ideally resulting in a complete circular array, such as a disk, ring, or star-like group.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image048.jpg |
| Cubanite cyclic twins |

**Cyclo-:** Applied to minerals containing anion groups linked into rings (e.g. cyclosilicate)

**Cyclosilicate:** Mineral characterized by rings of silicate groups: 3-membered rings (Si3O9-6), 4-membered rings (Si4O12-8), 6-membered rings (Si6O18-12).

**Dana System, Dana number:** Scientists have developed various schemes for classifying minerals in order to better visualize and understand the relationships between them. One of the most popular schemes, known as the Dana System, is based on chemical composition and atomic structure. This classification was originally published by James Dwight Dana in *A System of Mineralogy* (1837). The system was most recently updated in *Dana's New Mineralogy* (8th edition, 1997) by  Richard V. Gaines, H. Catherine Skinner, Eugene E. Foord, Brian Mason, and Abraham Rosenzweig.  
     The Dana number is composed of four parts. The first three parts correspond to the class and subclass, type and group. The 4th part of the number is an integer specific to an individual mineral species.  
     For example, in the Dana classification, almandine is assigned the number 51.4.3a.2, which can be decoded as follows:  
        51. Silicate class and Nesosilicate subclass  
              4. Cations in 6 or greater coordination    
                  3a. Garnet group  
                        2  Almandine

**Dauphin law twin:** Type of [penetration twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "penetration%20twin) in quartz in which two [right-handed](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Left-handed) (or two [left-handed](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Left-handed)) crystals are rotated by 60º to one another about the [0001] axis. The twin regions are separated by irregular internal boundaries, which can be observed on the crystal surface as interruptions in the horizontal striations on the prism faces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image049.jpg |
| Hematite selectively coating Dauphin law twinned quartz |

**Deliquescent:** Dissolves and become liquid by absorbing moisture from the air.

**Deltoid:** Used to refer to a four-sided polygon with two adjacent and equal long sides and two adjacent and equal short sides, which consequently is somewhat similar in appearance to a triangle (the Greek letter "delta").

**Dendritic:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) of crystals in the shape of slender divergent branches like a plant.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image050.jpg |
| Dendritic gold crystals |

**Density, Specific gravity:** The same volume of two different minerals will not have the same weight. This is because the minerals contain different atoms and/or because their atoms are packed together more or less closely. A sophisticated collector will spot an error on labeling a Calcite specimen, labeled "Barite", because it "feels too light for its size".

Density is a measure of the weight of a given volume of a material, usually expressed in grams per cubic centimeter (gm/cm3). Commonly we report the ratios of mineral densities to the density of water which is 1 gm/cm3 at 4ºC. Such relative measurements give the specific gravity, which is the same numerically as the density, but is a dimensionless number. One way to measure a mineral's density is to weigh it suspended by a thread in air and then to weigh it immersed in water. It will weigh less in water by an amount equal to the weight of the water that its volume displaces. The volume of the mineral is equal to the difference between the two weights because each cubic centimeter of displaced water weighs 1 gram. Finally divide the weight of the mineral by its volume to obtain the density.  
     Seldom does one have a crystal of a mineral unadlerated by matrix. None of the measurement procedures cope with tiny specimens. Thus density/specific gravity measurements are useful, but limited to macro specimens of pure materials.

**Devitrified:** Changed from [glass](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "glass) to [crystalline](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystalline).

**Dihexagonal:** Literally double-hexagonal, this indicates a form in which the faces are related by a 6-fold rotational axis combined with parallel mirror planes and/or perpendicular 2-fold axes.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image051.gif |
| Dihexagonal Prism (red) |

**Dimorphism, Dimorphous:** Two minerals that have the same [chemical composition](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "chemical%20composition), but different [atomic structures](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure). See [polymorphism](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#polymorphism).

**Dioctahedral:** Type of layered [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) in which only two of three possible octahedrally coordinated sites are occupied by [cations](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#cation). An octahedrally-coordinated site is a position in the structure in which a cation can form bonds to six anions. The anions can be thought of as positioned at the corners of an [octahedron](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#octahedron). See also [trioctahedral](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#trioctahedral).

**Diploid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of 24 nonparallel faces related by the combined symmetry of the 2/m B3 (diploidal) crystal class.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image052.gif |
| Diploid |

**Dipyramid, Dipyramidal:** A [crystal form](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal%20form) consisting of two identical [pyramids](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#pyramid) joined base to base.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image053.jpg |
| Anatase exhibiting dipyramidal habit |

**Discredited:** Term used for a once accepted [mineral species](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "mineral%20species) that has been determined not to meet the requirements of a mineral species. A mineral species is often discredited by proving that it actually corresponds to another known mineral species or that it is a mixture of two or more known mineral species.  
     The almost universal application of x-ray diffraction analysis has lead to the discrediting of a number of older mineral names, but the insistence on such analysis for new minerals has made future discrediting of newly approved species unlikely.

**Dispersion:** The color of light depends upon its wavelength. Normal white light contains a mix of all visible wavelengths and includes red, orange, yellow, green, blue, and violet (from longer to shorter wavelength). When a beam of light enters a transparent solid at an angle, it is refracted (the angle of the beam is changed). Longer wavelengths of light are refracted more than shorter wavelengths, so the material separates white light into its component colors. This phenomenon is called dispersion. Minerals differ in their ability to create dispersion. Diamond produces strong dispersion, which is the reason that one is able to see distinct flashes of color in an otherwise colorless diamond gem.

**Disphenoid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of four nonparallel faces related either by three 2-fold rotational axes or by one 4-fold rotational-inversion axis.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image054.gif |
| Disphenoid |

**Disseminated:** Scattered as small particles throughout a rock.

**Ditetragonal:** Literally double-tetragonal, this indicates a form in which the faces are related by a 4-fold rotational axis combined with parallel mirror planes and/or perpendicular 2-fold axes.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image055.gif |
| Ditetragonal prism (red) |

**Ditrigonal:** Literally double-trigonal, this indicates a form in which the faces are related by a 3-fold rotational axis combined with parallel mirror planes and/or perpendicular 2-fold axes.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image056.gif |
| Ditrigonal pyramid |

**Divalent:** Cation having a charge (valence) of 2.

**Divergent:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) in which crystals radiate from a common center.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image057.jpg |
| Divergent intergrowth of mesolite crystals |

**Dodecahedron:** A three-dimensional shape bounded by 12 diamond-shaped faces. The dodecahedron is a [crystal form](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal%20form) in the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) crystal system.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image058.png |
| Dodecahedron |

**Dome:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of two nonparallel faces related by mirror symmetry.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image060.gif |
| Dome form (red) |

**Double refraction:** When light enters or leaves a transparent crystal at an angle, it is refracted (bent). If the crystal is of low enough symmetry, light traveling along different axes of the unit cell is refracted to different angles. An image viewed through such a crystal appears to come from two sources. It is doubled, as shown in the picture below.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image061.jpg |
| Calcite exhibiting double refraction |

**Doublet twin:** Two crystals intergrown in a twin relationship

**Druse, Drusy:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) of small projecting crystals that line the walls of a cavity in rock. Usually only the terminations of the crystals are visible.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image062.jpg |
| Drusy quartz, variety amethyst |

**Ductile:** Able to be drawn into a wire without breaking (e.g. Copper). See [tenacity](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Tenacity).

**Dull:** Lowest mineral [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster) typified by no reflectance; light disperses in all directions from rough granular surface.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image030.jpg | |
| Kaolinite exhibiting dull luster | |

**Earthy:** Used to describe a dull [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster) or a slightly rough [fracture](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#fracture) like that of hard clay.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image063.jpg |
| Carnotite exhibiting earthy luster |

**Effervescence, Effervescent:** Giving off small bubbles. Carbonate minerals usually effervesce by giving off carbon dioxide bubbles when they are treated with [acid](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "acid).

**Efflorescence, Efflorescent:** Formation of a fluffy or powdery crystalline coating on the surface of a rock or mineral that occurs as the result of loss of water from the mineral.

**Eightling twin:** Group of eight crystals intergrown in a twin relationship.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image064.jpg |
| Dachiardite eightling twin |

**Elastic:** Able to return to original shape when released after bending. See [tenacity](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "tenacity).

**Element symbols:** The one and two letter abbreviations for the elenemts used in chemical formulas. The first letter is always upper case; the second, if one is part of the abbreviation. For example:  
       Ag = silver  
       Al = aluminum  
       As = arsenic  
The symbol is an abbreviation of the element name, but the element name used in defining the symbol may be in English, Latin, German, or French, so that information is not always helpful.

**Environment:** As it is used in The Photo-Atlas of Minerals, environment refers to the geologic conditions or the type of deposit in which a mineral occurs. This glossary does not include geological terms used in the Environment data field.

**Epitactic, Epitaxy:** The growth of a crystal of one mineral on the surface of a crystal of a different mineral in a definite orientation determined by the atomic structures of the two minerals. Compare twinning.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image066.jpg |
| Goedkenite epitactic on palermoite |

**Equant, Equidimensional:** [Crystal habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Habit) in which a crystal is about the same size in all directions.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image067.jpg |
| Equant crystals of fluorapophyllite |

**Equigranular:** Consisting of grains of roughly equal size.

**Euhedral:** [Crystal](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal) completely surrounded by well-formed [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face).

**Exsolution:** The separation of a mineral [solid solution](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Solid%20Solution) into two separate mineral components. Exsolution generally occurs when the mineral cools because the two components are no longer stable in solid solution. Exsolution usually results in oriented [lamellae](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Lamellae) of one mineral within another.

**Faden:** A descriptive term applied to [tabular](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Tabular) quartz crystals containing a white thread-like zone at their centers. The thread-like zone consists of fluid and gas [inclusions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Inclusion) trapped during [crystal growth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Crystal%20Growth) as a result of repeated breaking and healing. Faden quartz usually occurs in Alpine vein environments.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image068.jpg |
| Faden quartz |

**Feldspathoid:** Group of minerals chemically related to the feldspars, but containing relatively less silicon.

**Felted,Felt-like:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) consisting of interwoven fibers.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image069.jpg |
| Felted fibers of cacoxenite |

**Fibroid:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) resembling fibrous tissue.

**Fibrolamellar:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) consisting of layers of flattened fibers.

**Fibrous, Filiform:** Very thin, hair-like [crystal habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal%20habit). Also an [aggregate](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#aggregate) of fibers.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image070.jpg |
| Cacoxenite exhibiting fibrous habit |

**Fine-grained:** Consisting of an [aggregate](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "aggregate) of relatively small crystals or grains.

**Fishtail twin:** See [swallow-tail twin](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Swallow-tail%20Twin).

**Fiveling twin:** Group of five crystals intergrown in a twin relationship.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image071.jpg |
| Pentagonite fiveling twin |

**Flexible:** Bends without breaking but does not return to its original shape. See [tenacity](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "tenacity).

**Fluorescence, Phosphorescence:** When some minerals are subjected to invisible ultraviolet (UV) radiation, they emit visible light, seeming to "glow-in-the-dark." This effect, called fluorescence, was named after the mineral fluorite, which often spectacularly displays the effect. Relatively few mineral species exhibit fluorescence, and those that do are usually not invariably fluorescent; they often require a certain impurity ion which serves as an activator. Some minerals may fluoresce under short- wave (SW) ultraviolet radiation, but not under long-wave (LW), or vice-versa. Many different fluorescent colors have been observed in minerals, and the same mineral species may exhibit different fluorescent colors depending on its chemical impurities. If the emission continues after the ultraviolet radiation has been turned off, the mineral is said to be phosphorescent.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image072.jpg |
| Calcite twin exhibiting fluorescence (bottom) |

**Foliated, Lamellae, Lamellar, Micaceous:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) consisting of thin, leaf-like layers.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image073.jpg |
| Foliated crystal intergrowths of meta-autunite |

**Fourling:** Group of four crystals intergrown in a [twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Twinning) relationship.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image074.jpg |
| Harmotome fourling twin |

**Fracture:** The manner in which a mineral breaks along relatively irregular or non-flat surfaces. The following terms are used to describe fracture:  
       Conchoidal: smoothly curved surfaces  
       Subconchoidal: more irregular curved surfaces  
       Hackly: jagged surface like that of broken metal  
       Uneven, irregular: more or less flat surfaces with some roughness  
       Even, regular: relatively flat surface, but not [cleavage](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "cleavage)  
       Splintery, fibrous: surface composed of slender fragments or fibers  
       Earthy: slightly rough, irregular surface like that of hard clay

**Friable:** Crumbly; easily broken or pulverized.

**Front pinacoid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of the two parallel faces, (100) and (-100), which transect the a axis.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image075.gif |
| Front pinacoid (red) |

**Fusible:** Capable of being melted by heating.

**Geniculated twin:** Repeated [contact twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "contact%20twin) consisting of prismatic crystals in a back-and- forth configuration yielding knee-shaped forms.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image076.jpg |
| Rutile geniculated twin |

**Glass:** An [amorphous](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "amorphous) substance that is actually a highly viscous (slow- flowing) liquid.

**Globular, Nodular:** Crystalline [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) with smooth, rounded surfaces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image077.jpg |
| Globular conichalcite |

**Granular:** Consisting of grains of roughly equal size.

**Greasy:** Poorly reflective mineral [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster); similar in appearance to the surface of grease.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image078.jpg |
| Calomel exhibiting greasy luster |

**Gwindel:** A descriptive term applied to groups of stacked, twisted quartz crystals, which generally occur in Alpine vein environments.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image079.jpg |
| Gwindel quartz |

**Gyroid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of 24 nonparallel faces related by the combined symmetry of the 432 (gyroidal) crystal class.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image080.gif |
| Gyroid |

**Hackly:** Type of mineral [fracture](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "fracture) that produces a jagged surface.

**Halide:** Compound of a metal with a halogen (F, Cl, Br, I)

**Hardness:** Hardness is the resistance of a mineral to scratching. This property is indicative of the strength of [bonds](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Atomic%20Bonding) within crystals because it requires the breaking of bonds between atoms. Hardness varies greatly from species to species and it can, therefore, be a very useful property for identification.  
     The most common way of determining a mineral's hardness is to try to make a scratch on it using another material whose hardness is known. If you are able to make the scratch, then the mineral has a hardness less than that of the material used to scratch it. The test may, of course, be reversed by trying to scratch the material of known hardness with the mineral.  
     A German mineralogist Friedrich Mohs (1773-1839) developed a scale of hardness based upon 10 common minerals:  
       (1) talc  
       (2) gypsum  
       (3) calcite  
       (4) fluorite  
       (5) apatite  
       (6) orthoclase  
       (7) quartz  
       (8) topaz  
       (9) corundum  
       (10) diamond  
By successively testing the unknown mineral with each of the minerals in the list, you can determine its Mohs hardness. For example, a mineral of hardness 6½ can be scratched by quartz, topaz, corundum and diamond, but not by orthoclase or any of the minerals of lesser hardness. Common non-mineral materials are often useful for hardness testing: fingernail (2½), copper penny (3), pocket knife (5-5½), window glass (5½), and steel file (6½). A few cautions are in order. The best results are obtained by using sharp corners (points) to scratch smooth even surfaces. The difference in hardness between successive minerals in the Mohs scale is not equal. In some minerals hardness varies with direction. Intergrowths of small crystals may appear harder or softer than the surfaces on individual crystals of the same mineral.

**Heart-shaped twin:** Simple [contact twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "contact%20twin) consisting of two wedge-shaped individuals, exhibiting a prominent re-entrant angle, and having an overall shape resembling a heart (Valentine's Day type, not real).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image081.jpg |
| Rutile heart-shaped contact twin |

**Hemihedral:** Exhibiting only half of the [faces](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "face) corresponding to the maximum [symmetry](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#symmetry) possible for that [crystal system](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20system).

**Hemimorphic:** Lacking a center of [symmetry](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "symmetry) such that identical [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face) are not found on directly opposite sides of crystals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image082.jpg |
| Wurtzite exhibiting hemimorphic habit |

**Hemispherical:** In the shape of half a sphere; usually in reference to a [radial](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Radial) [intergrowth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Intergrowth) of crystals.

**Hexagonal:** The hexgonal unit cell can be defined by three axes. Two of them, labeled a, are equal in length and at an angle of 120º to one another. The third axis, labeled c, is perpendicular to the a axes and of a different length. The c axis corresponds to a 3-fold or 6-fold symmetry axis.  
     To highlight the presence of 3-fold or 6-fold symmetry, usual practice is to include a third a axis at 120° to the other two, and correspondingly to use a redundant 4th integer in the Miller index. (The extra integer is placed in the 3rd position and equals the negative of the sum of the first two.).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image083.gif |
| Hexagonal unit cell |

**Hexahedron:** A three-dimensional shape bounded by 6 equivalent [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face).

**Hexoctahedron:** A three-dimensional shape bounded by 48 triangular [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face). The trapezohedron is a [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) in the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) crystal system.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image084.gif |
| Hexoctahedron |

**Holohedral:** Exhibiting all of the [faces](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "face) corresponding to the maximum symmetry possible for that [crystal system](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20system).

**Hopper:** [Crystal habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20habit) in which the [growth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Crystal%20Growth) of [crystal faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face) has been quicker along their edges than at their centers, so that the centers of the faces are depressed.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image085.jpg |
| Hopper crystals of aguilarite |

**Hydrate:** Compound containing water (H2O).

**Hydrocarbon:** Organic compound composed entirely of carbon and hydrogen.

**Hydrous:** Mineral with water (H2O) in its [formula](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Chemical%20Formula).

**Hydroxide:** Compound containing the hydroxyl group (OH-).

**Hygroscopic:** Readily absorbing moisture, as from the atmosphere.

**Idiomorphic:** As individual [euhedral](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "euhedral) crystals.

**Igneous:** Pertaining to [rocks](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "rock) formed by solidifaction from molten material.

**Imide:** Organic compound containing nitrogen with two attached carbonyl groups (CO).

**Inclusion:** A foreign body within a [crystal](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal). Inclusions usually represent material trapped during [crystal growth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20growth). They commonly are earlier-formed crystals of other minerals or remnants of the fluid from which the crystal grew.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image086.jpg |
| Rutile and liquid/gas inclusions in corundum, variety sapphire |

**Incrustation, Crust:** A coating of minerals formed on a surface.

**Index of refraction, Double refraction, Birefringence:** When a beam of light strikes the surface of a transparent material at an angle, part will be reflected away and part will penetrate the material. The part of the beam that enters the material will be bent or refracted by an amount related both to the angle at which the beam strikes the material (the angle of incidence), to the density of the material, and to the light absorbing properties of the material. In general, the denser a material, the more the light entering it will be bent, but because additional factors affect the bending, this determination is not the same as a measurement of the density. Also the amount of bending may vary with wavelength of the light. By measuring the angles of incidence and refraction, a quantity called the index of refraction can be determined. This index can be used as an identifying characteristic for the material.  
     The atomic structures of many mineral crystals are quite different in different directions. A light beam entering such a crystal will be split into two beams - each bent at a different angle. This is called double refraction or birefringence. An image viewed through a birefringent crystal will appear to be two images.

**Ino-:** Applied to minerals containing anion groups linked into chains (e.g. inosilicate)

**Inosilicate:** Mineral characterized by chains of silicate groups: single chains (Si2O6-4), double chains (Si4O11-6).

**Intergrowth, Aggregate:** Most natural crystals form as intergrowths or aggregates. Where crystals come in contact with one another as they are growing, they form irregular contacts rather than regular [crystal faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Face). The term massive refers to intergrowths in which the mineral crystals have grown in contact with other crystals on all sides leaving no empty space in between. Most [rocks](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#rock) are massive intergrowths of one or more different minerals. Many minerals grow in distinctively shaped aggregates. Crystal faces are sometimes present at the periphery of such an aggregate. Some of the terms used to describe crystal aggregates are:  
       Drusy: surface covered with a layer of intergrown crystals with terminal faces  
       Fibrous, felted, asbestiform: aggregate of slender fibers  
       Botryoidal, colloform, mammillary, globular, reniform: large rounded masses  
       Radiate, divergent: crystals radiating from a common center  
       Lamellar, foliated: thin plates stacked together  
       Bladed: blades stacked together  
       Dendritic, arborescent: in slender divergent branches like a plant  
       Cockscomb: long, slightly offset crystals in semi-circular fans  
       Rosette: numerous platy crystals overlapping like flower petals

**Intermetallic:** Refers to a compound composed of two or more metals in definite proportions. (An alloy is a mixture of two or more metals in variable proportions.)

**Interstitial:** Between grains or in pores in rock.

**Iodate:** Compound containing the iodate group (IO3-).

**Iridescent:** Exhibiting rainbow-like colors in the interior or on the surface of a mineral.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image087.jpg |
| Iridescent hematite |

**Iron cross twin:** Twin consisting of two penetrating pyritohedra related by rotation about the [110] axis; typical of pyrite.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image088.jpg |
| Pyrite iron cross penetration twin |

**Isometric, Cubic:** The isometric (=cubic) unit cell is defined by three axes of equal length, all labeled a. All angles between axes are 90°. Because of the equivalence of all axes and angles.  
     The isometric system can contain combinations of many different types of symmetry elements: 2-, 3-, and 4-fold rotation axes, 3- and 4-fold rotation-inversion axes, mirror planes, and centers of symmetry.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image089.gif |
| Isometric or cubic unit cell |

**Isomorphism:** Two different minerals that possess the same [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) are called isomorphs. The minerals may be related chemically through the replacement of the atoms of one element for those of another. An example is the olivine series consisting of the minerals fayalite, Fe2SiO4, and forsterite, Mg2SiO4. Isomorphous minerals may have nothing in common chemically. For example halite, NaCl, and galena, PbS, have identical atomic structures.

**Isostructural:** Having the same [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) (but different [chemical composition](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#chemical%20composition))

**Japan-law twin:** Type of [contact twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "contact%20twin) on the {11-22} plane of quartz. The two crystals are at a nearly right angle (84º33') forming a "V". Both crystals are usually flattened parallel to their front-facing prism faces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image090.jpg |
| Quartz Japan law twin |

**Lamellar twin:** [Polysynthetic twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Polysynthetic%20twin) in which the individual crystals are thin plates.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image091.jpg |
| Copper exhibiting polysynthetic twinning |

**Lath-like:** [Habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Habit) of a crystal that is flat and long; like a knife blade.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image092.jpg |
| Lath-like crystals of uranophane |

**Lenticular:** [Habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Habit) of a crystal that resembles a double-convex lens in cross-section.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image093.jpg |
| Lenticular crystals of siderite |

**Lozenge:** Rhombus or diamond (as in one of the four suits in a deck of cards).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image094.jpg |
| Lozenge-shaped crystal of barite |

**Luminescence:** A general term which describes any process in which energy is emitted from a material at a different wavelength from that at which it is absorbed. It is an umbrella term covering [fluorescence](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Fluorescence), [phosphorescence](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Phosphorescence), and [triboluminescence](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Triboluminescence).

**Luster, Sheen:** Luster refers to the appearance of a mineral surface as a result of light reflecting from it. To a trained eye luster can be one of the most important clues for the sight-identification of minerals. Minerals with higher [indices of refraction](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "index%20of%20refraction) reflect more of the light that strikes them and, therefore, have a higher or brighter luster. The following terms are often used to describe luster:  
       Dull, earthy: no reflectance; light disperses in all directions from rough granular surface  
       Waxy: slightly reflective; typical of minutely granular surfaces  
       Greasy, oily: poorly reflective; similar in appearance to the surface of grease or oil  
       Vitreous: brightly reflective; similar to the luster of freshly broken glass  
       Resinous: very reflective; like the luster of broken resin or shellac  
       Adamantine: hard brilliant luster; like that of a diamond  
       Submetallic: silvery or nearly metallic luster  
       Metallic: brilliant, highly reflective luster of metals; material is always opaque  
Characteristics just below a mineral's surface can affect the way it reflects light and give the mineral an unusual sheen. Examples include:  
       Pearly: caused by tiny partly-developed cleavages parallel to the surface  
       Silky: caused by reflections from a fibrous growth structure or from parallel hair-like inclusions

**Magnetism:** Very few minerals are noticeably attracted to a magnet. Certain elements, most notably iron, have nuclei that tend to align themselves in the same direction in a magnetic field. When the atomic structure of an iron-rich mineral allows most of its iron atoms to align their electron fields in the same direction, it will be attracted by a magnet. Under certain conditions, the iron nuclei can be locked in place, thereby producing a magnet. Magnetite, an iron oxide, is attracted to magnets and can itself be naturally magnetized. Many meteorites are attracted by magnets because they contain native iron.

**Malleable:** Able to be hammered into thin sheets without breaking. See [tenacity](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "tenacity).

**Mammillary:** Crystalline [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) with smooth, rounded surfaces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image095.jpg |
| Mammillary rosasite |

**Manebach law twin:** Type of simple [contact twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "contact%20twin) on the {001} plane exhibited by orthoclase, microcline and other members of the feldspar group.

**Massive:** Uniform [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) of crystals.

**Mealy:** Resembling meal in texture or consistency; granular.

**Metal:** Element whose atoms have outer electron shells which are less than half full. Metals tend to lose electrons to form positively charged ions (cations) in the presence of electron greedy elements or polyatomic ions. When no electron greedy species are nearby, metals form metallic bonds by sharing with adjacent metal atoms.

**Metallic:** Brilliant, highly reflective [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster) of metals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image096.jpg | |
| Gold exhibiting metallic luster | |

**Metalloid:** Non-metallic element that exhibits some metallic characteristics.

**Metamict:** [Amorphous](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Amorphous) as the result of radiation damage.

**Metamorphic:** Pertaining to [rocks](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "rock) that have been significantly modified by heat and pressure, for the most part without melting.

**Microcrystalline:** Made up of [crystals](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal) so small that they can only be seen with a microscope.

**Micron, Micrometer, µm:**       One-millionth of a meter (0.000001 m);  
       one-thousandth of a millimeter (0.001 mm).

**Miller indices:** Three integers (sometimes four in the hexagonal crystal system) used to indicate the orientation of a plane or direction in a crystal such as those corresponding to a crystal face or cleavage. The three numbers are related to the three (or four) axes that define the unit cell. The three numbers are enclosed in parentheses, as (111), to indicate a single face or plane. They are enclosed in braces, as {111}, to indicate a [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) (set of planes related by symmetry). They are enclosed in brackets, as [111], to indicate a direction.

**Mimetic:** Appearing to have a higher degree of [symmetry](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "symmetry) as the result of [twinning](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#twinning).

**Mineral, Mineral species:** A mineral is a chemical [element](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "element) or combination of chemical elements that is normally [crystalline](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystalline) and which has formed by natural geological processes. Being crystalline means having an [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure). For the mineral to be a distinct mineral species, it must differ from every other mineral species either in its combination of chemical elements or in its atomic structure.

**Mineral class, Mineral group:** Minerals are usually classified according to aspects of their [chemical composition](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Chemical%20Composition) and [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure). Most classification systems ([Dana](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Dana), [Strunz](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Strunz)) are based principally upon the major [anions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#anion) and [anionic groups](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#anionic%20group) in minerals. This leads to the following major classes:  
       native elements  
       sulfides and sulfosalts  
       oxides and hydroxides  
       halides  
       carbonates  
       borates  
       sulfates and chromates  
       phosphates, vanadates and arsenates  
       tungstates and molybdates  
       silicates  
The silicates are further divided into the following subclasses depending on different types of silicate linkages:  
       nesosilicates  
       sorosilicates  
       cyclosilicates  
       inosilicates  
       phyllosilicates  
       tectosilicates  
These classes are then split into groups of more closely related minerals.

**Mineral name:** Each distinct mineral species is given a distinct name. Names are chosen in many ways. Minerals have been named after persons, places, properties, and similarities with other minerals. The discoverer usually proposes a name as part of the submission for approval. Current practice is to not approve self-naming.

**Modified:** Term used to describe a crystal shape or [form](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Form) that varies from another. For example, a cubo-octahedron is an octahedron modified by a cube.

**Molybdate:** Compound containing the molybdate group (MoO4-2).

**Monoclinic:** The monoclinic unit cell is defined by three axes, a, b, and c, of unequal lengths. The angles between the a and b axes and between the c and b axes are exactly 90°.  
     The b axis is chosen to correspond to a 2-fold axis of rotational symmetry axis or to be perpendicular to a mirror symmetry plane. The standard convention for assigning the other axes is c < a. The unit cell is also chosen so that the angle beta, lying between the a and c axes, is obtuse (between 90º and 180º).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image097.gif |
| Monoclinic unit cell |

**Monovalent:** Ion having a charge (valence) of 1.

**Morphology:** Crystal shape.

**Myrmekitic:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) consisting of blebs, drops, or [vermicular](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#vermicular) grains of one mineral in another.

**Nanometer, nm:**       One billionth of a meter (0.000000001 m);  
       One-millionth of a millimeter (0.000001 mm).  
       Ten Ångstroms (10 Å)

**Neso-:** Applied to minerals containing individual isolated anion groups (e.g. nesosilicate)

**Nesosilicate:** Mineral characterized by single isolated silicate groups of general formula SiO4-4.

**Nitrate:** Compound containing the nitrate group (NO3-).

**Nitride:** Compound of a metal with nitrogen and nothing else.

**Nodular:** In the form of or consisting of nodules (small rounded lumps).

**Non-metal:** Element whose atoms have their outer electron shells more than half full. Such atoms can form only covalent bonds with one another. Non-metals (except the noble gases) tend to take electrons from metals to form negatively charged ions (anions).

**Ocherous:** Resembling ochre, an earthy, pulverulent, red, yellow, or brown iron oxide (hematite).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image063.jpg |
| Ocherous carnotite |

**Octahedron:** A three-dimensional shape bounded by eight triangular faces and having six corners. The octahedron is a common [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) in the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) crystal system.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image098.gif |
| Octahedron |

**Oily:** Poorly reflective mineral [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster); similar in appearance to the surface of oil.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image099.jpg |
| Ettringite exhibiting oily luster |

**Oolitic:** Consisting of many spherical bodies.

**Opalescent, Opaline:** Having a milky or rather pearly [sheen](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "sheen) such as that shown by some kinds of opal.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image100.jpg |
| Opal exhibiting opalescent sheen |

**Opaque:** Impervious to visible light even in thin fragments.

**Organic:** Compound containing carbon, hydrogen, and whatever else. In an early version of creationism it was believed that compounds made by living organisms were inherently different that those made in the laboratory and that never the twain should meet. Most naturally occurring carbon-containing compounds were formed by some living organism, so organic became to mean carbon containing, although early on it was recognized that compounds containing only carbon and oxygen (e.g., carbon dioxide, carbonates, oxalates) did not fit this pattern.  
     Laboratory synthesis of urea from inorganic compounds disproved the premise, but the classification into organic and inorganic has survived as a convenient way to subdivide the huge field of chemisty. The distinctions are dying.

**Orthorhombic:** The orthorhombic unit cell is defined by three axes, a, b, and c, of unequal lengths. The angles between all axes are exactly 90°.  
     The axes are chosen to correspond to 2-fold axes of rotational symmetry axis or to be perpendicular to mirror symmetry planes. The standard convention is that c < a < b.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image101.gif |
| Orthorhombic unit cell |

**Ovoid:** Egg-shaped

**Oxalate:** Compound containing the oxalate group (C2O4-2).

**Oxide:** Compound of an element with oxygen.

**Oxidize:** To chemically change through contact with oxygen or oxidizing conditions typical on or near the earth's surface. This type of [alteration](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "alteration) generally results in the formation of minerals having [compositions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Chemical%20Composition) with greater amounts of oxygen or with one or more [cations](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#cation) in a higher charge state than in the original mineral.

**Paramorph:** A [pseudomorph](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "pseudomorph) with the same composition as the mineral it replaces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image102.jpg |
| Acanthite paramorph after argentite |

**Parting:** See [cleavage](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cleavage).

**Pearly:** Pearl-like sheen caused by tiny partly-developed [cleavages](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "cleavage) parallel to the surface.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image103.jpg |
| Heulandite exhibiting pearly sheen |

**Pedion:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) that consists of only one face.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image104.gif |
| Pedion (red) |

**Penetration twin:** Twin in which two or more crystals appear to interpenetrate each other with the surface between them being irregular or poorly defined.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image105.jpg |
| Fluorite penetration twin |

**Pericline law twin:** Type of [lamellar twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "lamellar%20twin) about the [010] axis exhibited by the members of the plagioclase series.

**PGE, PGM**: Used as acronyms for **P**latinum **G**roup **E**lements and **P**latinum **G**roup **M**inerals. The Platinum group elements are platinum (Pt), palladium (Pd), rhodium (Rh), iridium (Ir), osmium (Os) and ruthenium (Ru).

**Phosphate:** Compound containing the phosphate group (PO4-3).

**Phosphide:** Compound of a metal with phosphorous.

**Phosphorescence:** See [fluorescence](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "fluorescence).

**Phyllo-:** Applied to minerals containing anion groups linked into sheets (e.g. phyllosilicate)

**Phyllosilicate:** Mineral characterized by sheets of silicate groups of general formula Si4O10-4.

**Piezoelectricity, Pyroelectricity:** The atomic structures of certain minerals that lack a center of [symmetry](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "symmetry) become electrically polarized when heat or pressure is applied. When heat is involved it is called pyroelectricity. When pressure is involved it is caused piezoelectricity. The effects are generally reversible.  
     For example, by applying an alternating electrical current to opposite ends of a piece of quartz, you can make it vibrate.The piezoelectricity of quartz has proven useful for accurately tuning frequencies in radios and clocks. The pyroelectricity of tourmaline has made it useful in devices that measure high pressures. Tourmaline was used to measure the pressure of the first atomic bomb test.

**Pinacoid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) that consists of two parallel faces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image106.gif |
| Pinacoid |

**Pisolitic:** Composed of pea-like grains.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image107.jpg |
| Bauxite rock exhibiting pisolitic texture |

**Pitchy:** Rather dull [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster) similar to that of pitchblende, a massive variety of uraninite.

**Platelet:** A very small [platy](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Platy) crystal.

**Platy:** Very thin sheet-like [crystal habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal%20habit).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image108.jpg |
| Barite exhibiting platy habit |

**Pleochroism, Dichroism, Trichroism:** Pleochroism is an optical property observed in the crystals of certain minerals in which light is absorbed differently as it passes through the crystals in different directions. Differences in the [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) of a crystal in different directions account for the differential light absorption. Three distinct colors (trichroism) or two distinct colors (dichroism) may be seen as a crystal is held in front of a light and turned. Most pleochroic mineral crystals exhibit only small differences in color intensity as they are turned.

**Plumose:** An [aggregate](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "aggregate) of many small scales spreading into a formation that looks like a feathery plume.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image109.jpg |
| Plumose muscovite |

**Poikiloblast:** A large crystal of metamorphic origin that contains within it many small grains of other minerals.

**Polished section:** A slice of [rock](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "rock) that has been highly polished for viewing under the microscope. Polished sections are usually made for studying [opaque](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#opaque) minerals using light reflected from the polished surface of the mineral grains embedded in the rock.

**Polymorphism:** Two or more minerals that have the same [chemical composition](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "chemical%20composition), but different [atomic structures](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure) are called polymorphs. Such a polymorphic relationship exists between the minerals andalusite, kyanite, and sillimanite which all have the chemical formula, Al2SiO5. Typically, polymorphs form under differing conditions of temperature and/or pressure.

**Polysynthetic twin:** Repeated twin in which the crystals meet along parallel planes.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image091.jpg |
| Copper exhibiting polysynthetic twinning |

**Polytype:** Mineral that differs from another only in the stacking of similar structural units in its [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure).

**Porcelaneous:** Dull white [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster) resembling unglazed porcelain.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image030.jpg |
| Kaolinite exhibiting porcelaneous luster |

**Porphyroblast:** [Euhedral](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Euhedral) crystal formed in a [metamorphic](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#metamorphic) rock.

**Positive form, Negative form:** Terms used to distinguish symmetrically similar, but distinct forms in certain crystal classes.

**Prism, Prismatic:** [Crystal habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20habit) characterized by greater length than width, with prism faces parallel to and completely surrounding the long direction of the crystal. Also, a [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of three or more symmetry-related faces parallel to a common axis.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image110.gif |
| Hexagonal prism (red) |

**Pseudo-:** This prefix is used in combination with many roots:  
       pseudocubic  
       pseudocubo-octahedron  
       pseudododecahedral  
       pseudohexagonal  
       pseudo-isometric  
       pseudo-octahedral  
       pseudo-orthorhombic  
       pseudorhombohedral  
       pseudotetragonal  
       pseudotetrahedral  
       pseudotrigonal  
The prefix indicates that the visible shape of the sample falsely implies that the sample has more [symmetry](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "symmetry) than is indicated by the internal [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure) of the mineral.  
     For example, the distinction between an orthorhombic crystal and a lower symmetry monoclinic crystal is the value of one angle in the unit cell. If the angle is 90º, then the mineral is orthorhombic; any other value makes the mineral monoclinic. However, the angle in a monoclinic mineral may be so close to 90º that the mineral appears to be orthorhombic. Such a mineral would be termed pseudo-orthorhombic.

**Pseudomorph:** Any given mineral will form only within a specific range of conditions of heat, pressure and chemical composition. When the mineral's environment changes, the mineral will often change or alter to a different mineral. Even though the new mineral would normally form in its own distinctive crystal shape, occasionally the new mineral not only takes the place of the original, but also retains its external crystal shape. The new mineral is then said to be a pseudomorph (false form) of the original.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image111.jpg |
| Malachite pseudomorphs after azurite |

**Pseudo-spinel law twin:** Twin relationship closely resembling the [Spinel law](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Spinel%20Twin), but relating crystals not in the 4/m B3 2/m crystal class.

**Pulverulent:** Easily powdered.

**Pyramid, Pyramidal:** A [crystal form](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal%20form) consisting of 3, 4, 6, 8, or 12 nonparallel [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face) meeting at a point.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image112.jpg |
| Zincite exhibiting pyramidal habit |

**Pyritohedron:** A dodecahedron (three-dimensional shape bounded by 12 faces) with five-sided faces. The pyritohedron is so named because crystals of pyrite sometimes take this shape. It is a [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) in the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) crystal system.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image113.gif |
| Pyritohedron |

**Quatravalent:** Ion having a charge (valence) of 4.

**Radial-fibrous:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) in which [fibrous](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#fibrous) crystals radiate from a common center.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image114.jpg |
| Radial-fibrous intergrowth of cyanotrichite |

**Radiate, Radial:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) in which crystals radiate from a common center.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image115.jpg |
| Radial intergrowth of basaluminite crystals |

**Radioactivity:** Some kinds of atoms have nuclei that are unstable and break apart to form atoms of other elements. In the process of breaking apart these atoms release radiation in the form of alpha and beta particles and gamma rays. The most common radioactive elements in minerals are uranium and thorium. Minerals rich in these elements will be very radioactive, causing a Geiger counter to react strongly. Minerals containing small amounts of these elements are only slightly radioactive.  
     While the number of protons in an atomic nucleus determines what element it is, the number of neutrons in the nucleus is somewhat variable for a given element. Uranium nuclei always have 92 protons (atomic number = 92) and they most commonly have 146 neutrons, giving them an atomic weight of 92 + 146 = 238. More rarely uranium nuclei in minerals have only 143 neutrons yielding an atomic weight of 235. These are the different isotopes U238 and U235. They breakdown at different rates, known as half lives, and therefore give off radiation at different rates. Some other elements whose most common isotopes are not radioactive also exist as in the form of rarer radioactive isotopes.

**REE:** Acronym for **R**are **E**arth **E**lements used in [chemical formulas](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Chemical%20Formula) as a [element symbol](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Element%20Symbols) to represent a mixture of several different rare earth elements: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb.

**Re-entrant angle:** V-shaped depression marking the junction between two [t](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Twinning)[winned](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Twinning) crystals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image116.jpg |
| Cerussite twin exhibiting re-entrant angle |

**Reniform:** see [Botryoidal](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Botryoidal)

**Repeated twin, Multiple twin:** Twin consisting of three or more crystals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image117.jpg |
| Multiple twin of chalcopyrite |

**Resinous:** Very reflective [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster); like the luster of broken resin or shellac.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image118.jpg | |
| Jarosite exhibiting resinous luster | |

**Resorbed:** Dissolved.

**Reticulated:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) pattern consisting of criss-crossed slender crystals; often indicative of a [twin](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Twinning) relationship.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image119.jpg |
| Cerussite reticulated twin |

**Rhombic:** Having the shape of a rhombus (like the diamond in a deck of playing cards).

**Rhombohedron, Rhomb:** A three-dimensional shape that can be thought of as a cube stretched or compressed in the direction of two opposite corners. The rhombohedron is a common [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) in the hexagonal crystal system.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image120.gif |
| Rhombohedron |

**Right-handed, Left-handed:** Crystals in those crystal classes with no center of symmetry or mirror planes can occur in right-handed or left-handed variations. These variations are identical except that they are mirror images of one another in the same way that your right and left hands are related. (If you place both palms down, then thumbs are on opposite sides, and if you turn hands with both thumbs up, one palm is towards the left and the other is towards the right.) In the same way, certain crystal forms in these crystal classes can be termed right(-handed) or left(-handed).

**Rock:** An [aggregate](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "aggregate) of minerals. Most rocks fall into three general categories depending on processes by which they formed: Igneous: rocks formed by solidification from molten material. Sedimentary: rocks formed by the deposition of sediments. Metamorphic: rocks that have been significantly modified by heat and pressure, for the most part without melting.

**Rosette:** [Intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) consisting of numerous platy crystals overlapping like flower petals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image121.jpg |
| Hematite rosette |

**Saddle-shaped:** [Crystal habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20habit) with curved [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face) and edges so as to resemble a saddle.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image122.jpg |
| Saddle-shaped crystals of ankerite |

**Salt:** Compound that results when an acid reacts with a base. Note that "table salt" is sodium chloride (NaCl), the mineral halite. NaCl results from the reaction between hydrochloric acid (HCl) and the base, sodium hydroxide (NaOH); HCl + NaOH -> NaCl + H2O

**Scalenohedron:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of symmetry-related faces that are scalene triangles (three unequal sides). The tetragonal scalenohedron has 8 faces related by the combined symmetry of the B42m (tetragonal scalenohedral) crystal class. The trigonal scalenohedron has 12 faces related by the combined symmetry of the B32m (trigonal scalenohedral) crystal class.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image123.gif |
| Scalenohedron |

**Scepter:** Unusual [prismatic](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "prismatic) crystal habit in which the diameter of the prism is greater near the [termination](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#termination) of the crystal than near its base.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image124.jpg |
| Scepter quartz on pyrite |

**Schiller:** Optical effect in which flashes of bright colors appear as the mineral is turned. Schiller is caused by the diffraction of light from closely spaced layers.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image125.jpg |
| Labradorite exhibiting schiller (labradorescence) |

**Schistose:** Layered texture of an [aggregate](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "aggregate) of [fibrous](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#fibrous) or [platy](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#platy) mineral grains.

**Sectile:** Can be cut into thin shavings with a knife. See [tenacity](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "tenacity).

**Sedimentary:** Pertaining to [rocks](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "rock) formed by the deposition of sediments.

**Selenite:** Compound containing the selenite group (SeO3-2).

**Semi-metal:** Element whose atoms have outer electron shells that are one half full. They tend to form covalent bonds with one another and with non-metals. In pure form semimetals are often semiconductors.

**Semimetallic, Submetallic:** [Luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Luster) somewhat less than metallic.

**Sheaf:** Bundled [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) of fibers.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image126.jpg |
| Sheaf intrgrowths of cuprian adamite |

**Side pinacoid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of the two parallel faces, (010) and (0-10), which transect the b axis.

**Silicate:** Compound containing the silicate group (SiO4-4) or linked silicate groups.

**Silicide:** Compound of a metal with silicon.

**Silky:** Silk-like [sheen](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "sheen) caused by reflections from a fibrous growth structure or from parallel hair-like inclusions.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image127.jpg |
| Cerussite exhibiting silky luster |

**Simple twin:** [Twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Twinning) composed of only two crystals.

**Sixling:** Group of six crystals intergrown in a [twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Twinning) relationship.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image128.jpg |
| Arsenopyrite sixling twin |

**Slag:** Residual material from the refinement of a metallic ore.

**Slickensided:** Having a polished and smoothly striated surface usually the result of movement along the surface.

**Solid solution, Series, Substitution:** The [chemical formula](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "chemical%20formula) given for each mineral provides the atomic components in the pure mineral. In fact, natural minerals almost always contain atoms of some other elements in partial substitution for those provided in the formula. Certain ions, such as Fe+2 and Mg+2, are similar enough that they can take each other's place in any proportion in an [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure). The minerals fayalite, Fe2SiO4, and forsterite, Mg2SiO4, have the same atomic structure and any composition intermediate between them is possible. This is called a solid solution series (or simply a mineral series), and such a substitutional relationship can be indicated by providing the formula as, (Fe,Mg)2SiO4. The name applied to the mineral compound depends upon which element is present in greatest amount. A separate name may be applied to the series. For example, fayalite and forsterite belong to the olivine series.

**Soro-:** Applied to minerals containing finite linkages of anion groups (e.g. sorosilicate)

**Sorosilicate:** Mineral characterized by finite linkages of silicate groups: double groups (Si2O7-6), triple groups (Si3O8-4), etc.

**Sphenoid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of two nonparallel faces related by 2-fold rotational symmetry.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image129.gif |
| Sphenoid (red) |

**Spherulitic:** As spherical [i](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth)[ntergrowth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Intergrowth) of crystals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image130.jpg |
| Spherulitic rosasite |

**Spinel law twin:** Type of [twinning](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "twinning) occurring in [octahedral](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Octahedron) crystals of spinel and many other minerals of the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) system. The octahedron can be thought of as cut through its center along a plane parallel to a set of octahedral [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face) and then one of the halves of the octahedron rotated by 60º relative to the other.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image131.jpg |
| Spinel law twin of spinel |

**Splendent:** A [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster) of the highest intensity.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image132.jpg |
| Perovskite exhibiting splendent luster |

**Stalactitic:** As concentrically layered [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Intergrowth) with conical or cylindrical shapes; similar to stalactites.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image133.jpg |
| Stalactitic malachite |

**Stellate:** Star-like [intergrowth](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Intergrowth) of crystals, often resulting from [cyclic twinning](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cyclic%20Twin).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image134.jpg |
| Stellate intergrowths of muscovite crystals |

**Striated:** Marked by a series of parallel straight lines (striations). On crystals striations generally represent the oscillation between two [c](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20Form)[rystal forms](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Crystal%20Form).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image135.jpg |
| Striated pyrite crystal |

**Strunz System, Strunz number:** Scientists have developed various schemes for classifying minerals in order to better visualize and understand the relationships between them. One of the most popular modern schemes, developed by Professor Hugo Strunz, is based upon a combination of chemical composition and atomic structure.  
     The Strunz number is composed of four parts. The first three parts correspond to the class, group, and subgroup. In the complete Strunz System, the 4th part of the number is a three-digit integer specific to an individual mineral species; however, in the Photo-Atlas of Minerals we have simplified this to a one-digit integer, so that very closely related minerals often have identical Strunz numbers.  
     For example, in the full Strunz classification, almandine is assigned the number 9.AC.110, which can be decoded as follows:  
       9. Silicate class  
           A  Nesosilicate division  
              C. Garnet group  
                  110  Almandine  
In the Photo-Atlas, we assign almandine the number 9.AC.1, the same as for the closely related garnet minerals: pyrope, spessartine, grossular, hibschite, henritermierite, and katoite.

**Subadamantine:** [Luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Luster) somewhat less than [adamantine](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#adamantine).

**Subconchoidal:** [Fracture](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Fracture) along surfaces that are not quite as smoothly curving as for [conchoidal](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#conchoidal) fracture.

**Subhedral:** [Crystal](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal) partially bounded by well-formed [faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face).

**Subparallel:** Not quite parallel, usually used in reference to [intergrowths](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) of [prismatic](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#prismatic) crystals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image136.jpg |
| Subparallel valentinite crystals |

**Subresinous:** [Luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Luster) somewhat less than [resinous](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#resinous).

**Subvitreous:** [Luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Luster) somewhat less than [vitreous](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#vitreous).

**Sulfarsenites:** Compounds based on AsS3-3 groups. Sulfantimonites (SbS3-3) and sulfbismuthinites (BiS3-3) are closely related compounds.

**Sulfarsenates:** Compounds based on AsS4-5 groups.

**Sulfate:** Compound containing the sulfate group (SO4-2).

**Sulfide:** Compound of a metal or semi-metal with sulfur.

**Sulfite:** Compound containing the sulfite group (SO3-2).

**Sulfosalt:** Compound of both a metal and semi-metal with sulfur.

**Swallow-tail twin, Fishtail twin:** [Contact twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Contact%20twin) that results in a v-shaped termination similar in appearance to the tail of a swallow or fish.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image137.jpg |
| Rutile fishtail twin |

**Symmetry, Crystal class, Crystal system:** Hold up your hands side-by-side in front of your face with your fingers spread. At least in an approximate way, your hands are identical, except that they are flipped as though one were the reflection of the other in a mirror. This is a type of symmetry called mirror symmetry. Objects can exhibit rotational symmetry so that rotation around a symmetry axis repeats the object two or more times in each full rotation. If the object assumes the same appearance four times (every 90º) as it is rotated a full 360º, it is said to have four-fold symmetry. A center of symmetry is present if every point on an object has a corresponding identical point on the opposite side of the object the same distance from its center.  
     Symmetry is an important property of mineral [crystals](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal). The symmetry we see in the external shape of a crystal results from the symmetry of the mineral's [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure). The symmetry of the crystal may not be obvious because of irregular growth; however, the angles between the crystal's faces will always be related by the true symmetry of the mineral. Careful study, sometimes along with angular measurements, may be necessary to determine the symmetry of a crystal. Recognizing the symmetry of a crystal will be a big help in identifying the mineral.  
     There are ten kinds of symmetry (symmetry elements) that can be seen in the external form of crystals:  
       1: no symmetry; identity  
       2: two-fold rotation   
       3: three-fold rotation  
       4: four-fold rotation  
       6: six-fold rotation  
       B1: center of symmetry  
       m: mirror plane  
       B3: three-fold rotation with inversion  
       B4: four-fold rotation with inversion  
       B6: six-fold rotation with inversion  
There are only 32 possible ways in which the various symmetry elements can be combined. These are called the crystal classes, and they can in turn be organized into six crystal systems. The symbols used to represent the symmetry elements are combined to represent each of the crystal classes. The rules for interpreting these combined symbols are:  
       (1) if a mirror plane symbol "m" immediately follows a rotational axis symbol, the rotational axis lies in the mirror plane;  
       (2) if a slash "/" separates the rotational axis and the mirror symbol, the mirror plane is perpendicular to the axis;  
       (3) if two or three mirror plane symbols or two or three rotational axis symbols immediately follow one another, they are perpendicular to one another.  
     These conventions are not rigorously followed for the cubic system in which the symmetry relationships are more complex. The 32 crystal classes are listed below, organized according to the six crystal systems.  
       Triclinic: 1, B1  
       Monoclinic: 2, m, 2/m  
       Orthorhombic: 2/m 2/m 2/m, 222, mm2  
       Tetragonal: 4, B4, 4/m, 4mm, B42m, 422, 4/m 2/m 2/m   
       Hexagonal: 3, B3, 3m, B3 2/m, 32, 6, B6, 6/m, 6mm, B6m2, 622, 6/m 2/m 2/m  
       Isometric or cubic: 23, 2/m B3, 4/m B3 2/m, B43m, 432

**Symplectic:** Intimate [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) of two different minerals.

**Tabular:** [Crystal habit](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Crystal%20habit) appearing like a tablet of paper.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image138.jpg |
| Wulfenite exhibiting tabular habit |

**Tarnish:** Formation of a thin [alteration](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "alteration) film on the surface of certain minerals. The thin film, itself called tarnish, affects the mineral's [color](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#color) and [luster](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#luster).

**Tecto-:** Applied to minerals containing anion groups linked into three- dimensional frameworks (e.g. tectosilicate)

**Tectosilicate:** Mineral characterized by a three-dimensional framework of silicate groups of general formula SiO2. Aluminum commonly takes the place of some of the silicon.

**Tellurite:** Compound containing the tellurite group (TeO3-2) or linked tellurite groups (Te2O5-2, Te3O8-2).

**Tenacity:** Tenacity refers to the strength rather than the hardness of a mineral. It actually represents its resistance to breaking, crushing, bending, or tearing. The following terms are used to describe the tenacity of minerals:  
       Brittle: breaks or powders easily  
       Malleable: can be hammered into thin sheets without breaking  
       Sectile: can be cut into thin shavings with a knife  
       Ductile: can be drawn into a wire without breaking  
       Elastic: can be bent and then returns to its original shape  
       Flexible: can be bent but does not return to its original shape

**Tenebrescence:** The ability of certain minerals to change color when exposed to sunlight.

**Termination:** The tip of a [crystal](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal); ideally made up of [crystal faces](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#face).

**Tetartoid:** A [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) consisting of nonparallel faces related by the combined symmetry of the 23 (tetartoidal) crystal class.

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| Tetartoid |

**Tetragonal:** The tetragonal unit cell is defined by three axes. Two of them, labeled a, are equal in length; and the c axis is of a different length. All angles between axes are 90°.  
     The c axis corresponds to a symmetry axis of either 4-fold rotation or 4-fold rotation inversion. The c axis can be either longer or shorter than the a axes.

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| Tetragonal unit cell |

**Tetrahedron:** A three-dimensional shape bounded by four triangular faces

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image141.gif |
| Tetrahedron |

**Tetrahexahedron:** A three-dimensional shape bounded by 24 faces that are isosceles triangles (two sides equal). The tetrahexahedron is a [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) in the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) crystal system. It can be visualized as a cube with each of its six square faces split into four triangular faces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image142.gif |
| Tetrahexahedron |

**Thermoluminescence:** Emission of visible light by a material when it is heated.

**Thiosulfate:** Compound containing the thiosulfate group (S2O3-2).

**Translucent:** Capable of allowing visible light to pass through, but not clearly enough that an object can be seen looking through the material.

**Transparent:** Capable of allowing visible light to pass through clearly so that an object can be seen looking through the material.

**Trapezohedron:** A three-dimensional shape bounded by 24 faces. The trapezohedron is a [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) in the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) crystal system.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image143.gif |
| Trapezohedron |

**Triboluminescence:** Emission of visible light by a material when it is scratched, crushed or rubbed.

**Triclinic:** The triclinic unit cell is defined by three axes, a, b, and c, of unequal lengths. None of the angles, alpha, beta, and gamma, between these axes are exactly 90°.

The standard convention for assigning axes is c < a < b. The angle alpha lies between the b and c axes; beta lies between a and c, and gamma lies between a and b. The cell is usually chosen so that alpha and beta are obtuse (between 90º and 180º).

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image144.gif |
| Triclinic unit cell |

**Trigonal:** A subgroup of the [hexagonal](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "hexagonal) crystal system characterized by one three-fold [symmetry](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#symmetry) axis. The remaining crystal systems in the hexagonal crystal system have a six-fold symmetry axis.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image145.gif |
| Trigonal prism & hexagonal prism |

**Trilling:** Group of three crystals intergrown in a [twin](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Twinning) relationship.

**Trimorphous:** Three minerals that have the same [chemical composition](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "chemical%20composition), but different [atomic structures](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure). See [polymorphism](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#polymorphism).

**Trioctahedral:** Type of layered [atomic structure](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atomic%20structure) in which all three of the possible octahedrally coordinated sites are occupied by [cations](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#cation). An octahedrally-coordinated site is a position in the structure in which a cation can form [bonds](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Atomic%20Bonding) to six [anions](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#anion). The anions can be thought of as positioned at the corners of an [octahedron](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#octahedron). See also [dioctahedral](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#dioctahedral).

**Trisoctahedron:** A three-dimensional shape bounded by 24 faces that are isosceles triangles (two sides equal). The trisoctahedron is a [crystal form](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal%20form) in the [isometric](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Cubic) crystal system.

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| Trisoctahedron |

**Tristetrahedron:** A three-dimensional shape bounded by 12 three-or-four-sided faces. The tristetrahedron is a [crystal form](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#crystal%20form) in the [isometric](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Cubic) crystal system. The [trigonal](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#trigonal) tristetrahedron can be constructed by splitting each of the four faces of a [tetrahedron](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#tetrahedron) into three triangular faces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image147.gif |
| Tristetrahedron |

**Trivalent:** Ion having a charge (valence) of 3.

**Tuft:** A crystal [aggregate](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "aggregate) in the form of clumps of [fibrous](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#fibrous) crystals.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image148.jpg |
| Tufts of pectolite with aegirine |

**Tungstate:** Compound containing the tungstate group (WO4-2).

**Turbid:** Appearing cloudy or [translucent](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "translucent) because of suspended material.

**Twinning:** The [intergrowth](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "intergrowth) of two or more crystals of the same mineral in a definite orientation determined by the atomic structure of the mineral. The twin relationship is indicated by specifying the [Miller indices](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#Miller%20indices) of a plane on which the structures meet (e.g. on {100}) and/or an axis about which one structure is rotated relative to the other (e.g. about [310] axis). If a plane is specified without indicating an axis, the twinning is understood to be by reflection across that plane.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image090.jpg |
| Quartz Japan law twin |

**Uneven:** [Fracture](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "Fracture) characterized by more or less flat surfaces with some roughness.

**Unit cell:** The unit cell is the smallest group of [atoms](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "atom) in the [atomic structure](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#atomic%20structure) that if repeated in each of the three dimensions would completely generate the atomic structure. The atoms in the unit cell and their arrangement are unique to a given mineral and define its atomic structure, [chemical composition](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#chemical%20composition), external [symmetry](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#symmetry), and many of its properties.  
     The shape and dimensions of the unit cell are given by three lengths (axes), a, b, and c, and the angles between them: alpha (angle between b and c), beta (angle between a and c), and gamma (angle between a and b).  
     In the higher [symmetry](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#symmetry) crystal systems certain lengths are equal and certain angles are precisely defined so that they need not be stated:  
     Triclinic: a ≠ b ≠ c; α ≠ β ≠ γ (All dimensions need to be given.)  
     Monoclinic: a ≠ b ≠ c; α = γ = 90º ≠ β (Only a, b, c, and β need to be given.)  
     Orthorhombic: a ≠ b ≠ c; α = β = γ = 90º (Only a, b, and c need to be given.)  
     Tetragonal: a = b ≠ c; α = β = γ = 90º (Only a and c need to be given.)  
     Hexagonal: a = b ≠ c; α = β = 90º, γ = 120º (Only a and c need to be given.)  
     Isometric or cubic: a = b = c; α = β = γ = 90º (Only a needs to be given.)

**Uranyl-:** Compound containing the uranyl group (UO2-2).

**Vanadate:** Compound containing the vanadate group (VO4-3).

**Vanadin-:** Compound containing clusters of vanadium atoms surrounded by oxygen atoms (exclusive of the vanadate [VO4-3] group).

**Variety:** Variety names have traditionally been given to minerals that have some distinctive physical characteristic, such as color, that sets them apart from other minerals of the same [mineral species](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "mineral%20species). Variety names are most commonly used for minerals that have use as gems. Amethyst, for example, is the purple variety of the mineral species quartz, which has many other varieties as well.

**Vein:** A thin tabular or sheet-like body usually partially or totally filled with intergrown [crystals](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "crystal).

**Vermicular, Vermiform:** Worm-like in shape.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image149.jpg |
| Siderite exhibiting vermicular habit |

**Vicinal:** [Crystal face](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "face) that closely approximates a larger face in orientation.

**Vitreous:** Brightly reflective; similar to the [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster) of freshly broken glass.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image150.jpg |
| Quartz exhibiting vitreous luster |

**Vug:** Small cavity in rock, usually lined with crystals.

**Waxy:** Slightly reflective mineral [luster](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "luster); typical of minutely granular surfaces.

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| C:\Program Files\LACMNH\Photo-Atlas of Minerals\image151.jpg |
| Chrysocolla exhibiting waxy luster |

**Xenoblast:** A mineral grain without faces that has grown in a [metamorphic](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "metamorphic) rock.

**Xenomorphic:** Pertaining to crystals that are not bounded by [faces](file:///C:\\Program%20Files\\LACMNH\\Photo-Atlas%20of%20Minerals\\definitions.htm" \l "face); [anhedral](file:///C:\Program%20Files\LACMNH\Photo-Atlas%20of%20Minerals\definitions.htm#anhedral).

**END**