

CLASSIFYING MINERALS

Minerals are divided into nine (9) broad classifications. They are typically classified based on the negatively charged (anionic) portion of their chemical composition. For example, copper oxide (CuO) consists of copper (Cu^{++}) and oxygen (O^-) ions, and the negatively charged oxygen ion puts it in the “Oxide” classification (which also includes iron oxide, titanium dioxide, etc).

The classifications are:

Silicate class

The largest group of minerals by far, the silicates are mostly composed of silicon and oxygen, combined with ions like aluminum, magnesium, iron, and calcium. Some important rock-forming silicates include the feldspars, quartz, olivines, pyroxenes, garnets, and micas.

Carbonate class

The carbonate minerals contain the anion $(\text{CO}_3)^{2-}$. They are deposited in marine settings from accumulated shells of marine life and also in evaporitic areas like the Great Salt Lake and karst regions where they form caves, stalactites and stalagmites. Typical carbonates include calcite and aragonite (both calcium carbonate), dolomite (magnesium/calcium carbonate) and siderite (iron carbonate). The carbonate class also includes the nitrate and borate minerals.

Sulfate class

Sulfate minerals all contain the sulfate anion, SO_4^{2-} . Sulfates commonly form in evaporitic settings where highly saline waters slowly evaporate, in hydrothermal vein systems as gangue minerals and as secondary oxidation products of original sulfide minerals. Common sulfates include anhydrite (calcium sulfate), celestine (strontium sulfate), barite (barium sulfate), and gypsum (hydrated

calcium sulfate). The sulfate class also includes the chromate, molybdate, selenate, sulfite, tellurate, and tungstate minerals.

Halide class

The halide minerals form the natural salts and include fluorite (calcium fluoride), halite (sodium chloride) and sylvite (potassium chloride). Halides, like sulfates, are commonly found in evaporitic settings such as salt lakes and landlocked seas like the Dead Sea and the Great Salt Lake. The halide class also includes the fluoride, chloride, bromide and iodide minerals.

Oxide class

Oxide minerals commonly occur as precipitates close to the Earth's surface, oxidation products of other minerals in the near surface weathering zone, and as accessory minerals in igneous rocks of the crust and mantle. They form many of the ores from which valuable metals can be extracted and carry recorded changes in the earth's magnetic field. Common oxides include hematite (iron oxide), magnetite (iron oxide), chromite (iron chromium oxide), spinel (magnesium aluminium oxide – a common mantle component), ilmenite (iron titanium oxide), rutile (titanium dioxide), and ice (dihydrogen oxide). The oxide class includes the hydroxide minerals.

Sulfide class

Many sulfide minerals are economically important as metal ores. Common sulfides include pyrite (iron sulfide – fools' gold), chalcopyrite (copper iron sulfide), pentlandite (nickel iron sulfide), and galena (lead sulfide). The sulfide class also includes the selenides, the tellurides, the arsenides, the antimonides, the bismuthinides, and the sulfosalts (sulfur and a second anion such as arsenic).

Phosphate class

The phosphate mineral group actually includes any mineral with a tetrahedral unit AO_4 where A can be phosphorus, antimony, arsenic or vanadium. By far the most common phosphate is apatite which is an important biological mineral found in teeth and bones of many animals. The phosphate class includes the phosphate, arsenate, vanadate, and antimonate minerals.

Element class

The elemental group includes native metals and intermetallic elements (gold, silver, copper), semi-metals and non-metals (antimony, bismuth, graphite, sulfur). This group also includes natural alloys, such as electrum (a natural alloy of gold and silver), phosphides, silicides, nitrides and carbides (contained naturally in a few rare meteorites).

Organic class

The organic mineral class includes biogenic substances in which geological processes have been a part of the genesis or origin of the existing compound. Minerals of the organic class include various oxalates, mellitates, citrates, cyanates, acetates, formates, hydrocarbons and other miscellaneous species. Examples include whewellite, moolooite, mellite, fichtelite, carpathite, evenkite and abelsonite.