The Chemical Composition of

Minerals

Article and photography by
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Introduction

Minerals are often referred to as the building blocks of rocks. In order to be deemed a mineral, the subject must be naturally occurring, inorganic, and have an orderly crystalline structure.

All minerals also have a specific chemical composition, where most are made up of two or more elements. However, some minerals are made up of a single element and occur in pure form in nature; for instance, silver, gold, and copper are all pure elements.

Mineral Facts

- Minerals are not rocks! Minerals are required in order for rocks to form
- There are currently almost 5,000 known minerals in the world
- Approximately 30 different minerals make up the earth's crust
- Minerals that form beautiful crystals are known as gemstones (rubies, emeralds, etc.)
- Turquoise, the first mineral ever recorded, was found in Mesopotamia in 5000 BC

Chemical Classifications

Native Elements

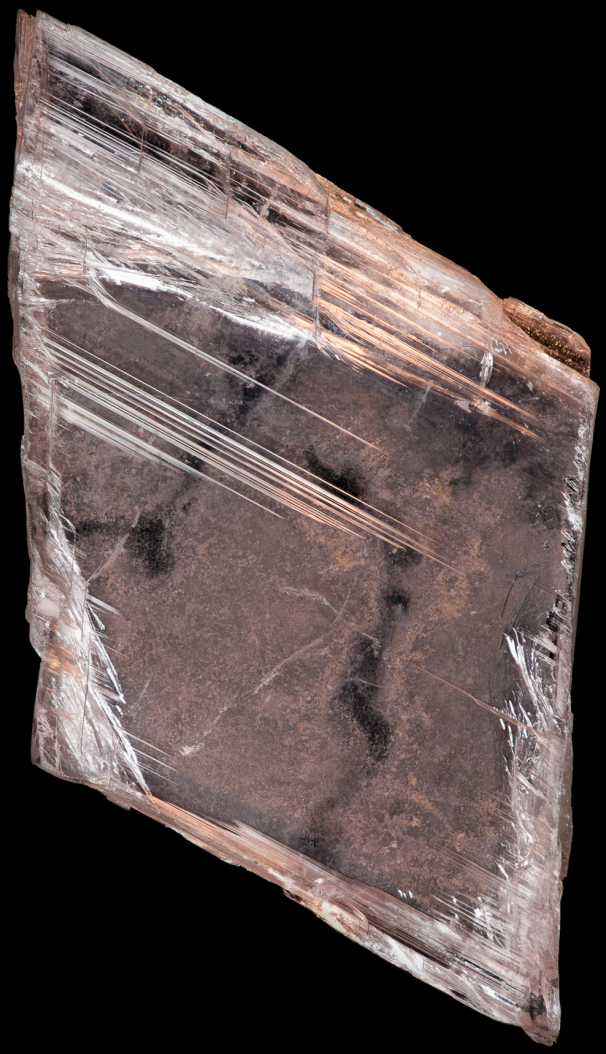
These are minerals that are made up of a single element. They are naturally occurring specimens of pure elements and can include metals, non-metals, semi-metals, and alloys. Examples of native elements include gold, copper, silver, sulfur, graphite, and platinum.

Sulfur, a non-metal

Graphite, a semi-metal

Sulfates

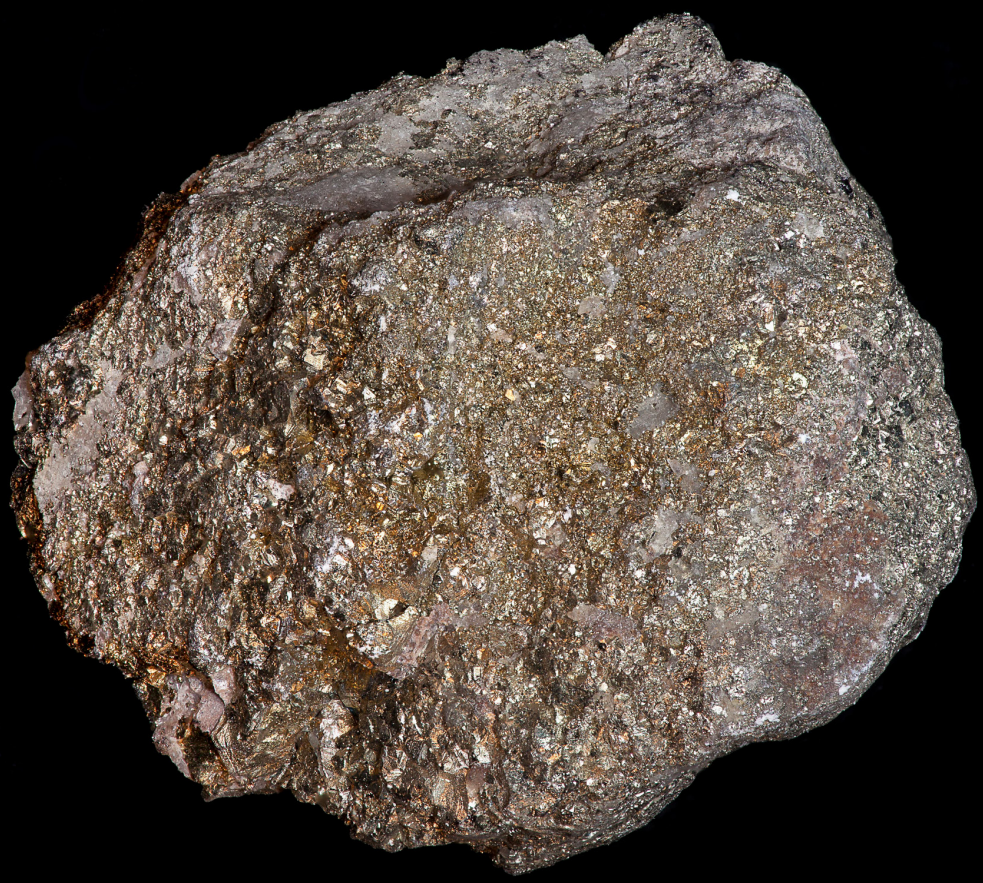
This group of minerals combines one or more metallic elements with sulfur and oxygen. The sulfates are usually soft, yet heavy, and range from transparent to translucent. This is a large group that forms from volcanically heated water, however, most are rare in occurrence. Examples of sulfates include celestite, selenite, and gypsum.



Selenite, named for the Greek goddess of the moon, Selene

Sulfides

Sulfides are a group of minerals that are compounds of the element sulfur combined with one or more other elements, usually a metal. A large number of metal ores are included in this group. Examples of sulfides include galena, cinnabar, and pyrite ("fool's gold").



Pyrite, the most common of the sulfide minerals

Oxides / Hydroxides

This group of minerals combines one or more metallic elements with either oxygen or a combination of oxygen and hydrogen. This large group is found in most geological environments and includes a wide range of variations, including physical properties that range from hard to soft, and from metal ores to precious gems. Examples of oxides/hydroxides include hematite, magnetite, corundum (produces rubies and sapphires), and rutile (used to produce titanium).

Magnetite, the most magnetic of all natuallry occurring minerals

Hematite, harder than pure iron, but more brittle

Carbonates

These minerals are made up of one or more metallic or semi-metallic elements and a combination of carbon and oxygen. They are very soft and can easily dissolve in acid. The carbonates are some of the most widely distributed minerals found in the earth's crust. Examples of carbonates include malachite, dolomite, and calcite.

Calcite, the primary mineral component of stalactites and stalagmites

Phosphates

Phosphates are a group of minerals that combine one or more metallic elements with phosphorus. This group includes specimens that are typically dull in luster, but are strongly colored. Although this is considered to be a large group of minerals, only a few kinds are considered to be relatively common. Examples of common phosphates include wavellite, apatite, and turquoise.

Apatite, a major component of tooth enamel and bone mineral

Halides

These minerals are formed by combining a metallic element with one of the five halogen elements: chlorine, bromine, fluorine, iodine, or astatine. Halides dissolve in water and are typically very soft and fragile. Examples of halides include sylvite, fluorite, and halite (rock salt).

Fluorite, phosphoresces when heated or scratched

Silicates

This group of minerals is made up of silicon and oxygen, the two most abundant elements in the earth's crust. Silicates are considered to be the largest group of minerals in the world and are the most widespread. 30% of all minerals are silicates, and 90% of the earth's crust is made up of silicates. Examples of silicates include agate, feldspar, quartz, and talc.

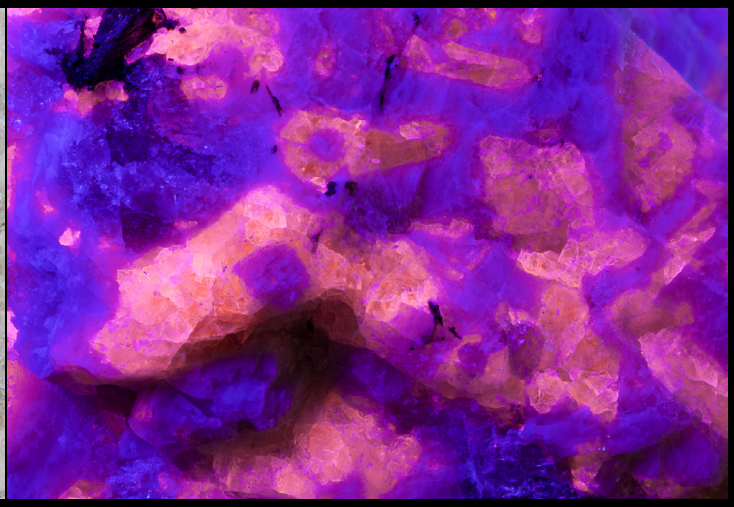
Talc, the softest known mineral

Quartz, the most varied mineral in terms of varieties, colors, and forms

Fluorescing Minerals

Some minerals possess a unique quality whereby they are able to fluoresce when exposed to ultraviolet radiation.
In order to fluoresce, they must be exposed to the ultraviolet light range of 200 to 400 nanometers (nm). Note that the visible light range that humans are capable of seeing with the naked eye ranges between 400 nm and 700 nm.
Most fluorescent minerals contain an impurity, usually called an "activator," that triggers fluorescence; many times this impurity is manganese. Different impurities, or activators, can produce different colors within the same mineral.
However, some minerals can also contain another type of impurity, usually called a "quencher," that will prevent fluorescence even with the presence of an activator. A common type of quencher is ferrous iron.
Since it was just stated that an impurity is required in order for a mineral to fluoresce, the majority of pure minerals do not fluoresce.
Nevertheless, there are "self-activated" minerals that are pure minerals that do, in fact, fluoresce. Examples of these self-activated minerals include scheelite, some types of lead minerals, and several types of uranium minerals.

Hackmanite, daylight

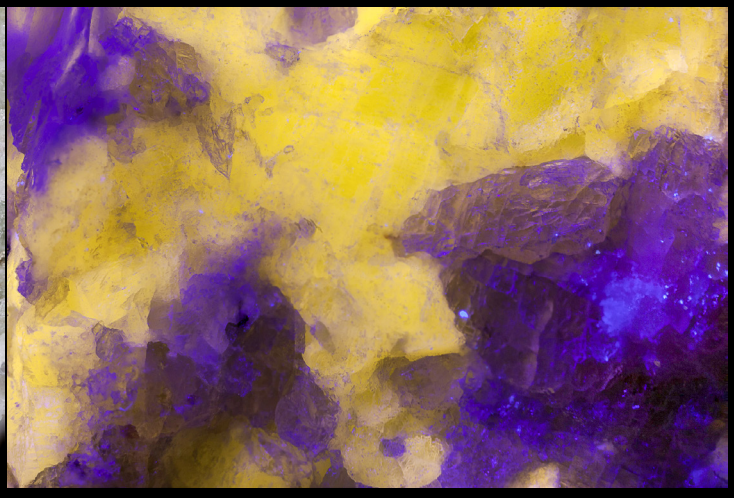


Hackmanite, ultraviolet light

Willemite, daylight

Willemite, ultraviolet light

Scapolite, daylight



Scapollite, ultraviolet light

Equipment Used

Canon 5D Mark II
Canon 65mm 1-5x macro lens
Canon 100mm macro lens
Canon Macro Ring Lite MR-14EX
Fiber Optic light
UV lamp
Lab jack

Contact

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Sources

http://www.galleries.com
http://www.rocksandminerals4u.com
http://www.rocksinmyheadtoo.com
http://www.microscopy-uk.org.uk/mag/artnov06macro/rm-macro.html
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