

Minerals

Minerals are substances that are formed naturally in the Earth. Rocks are made of minerals.

Minerals are usually solid, inorganic, have a crystal structure, and form naturally by geological processes.

The study of minerals is called mineralogy.

A mineral can be made of single chemical element or more usually a compound. There are over 4,000 types of known minerals. Two common minerals are quartz and feldspar.

Characteristics of minerals

Mineral is a substance that usually:

- Is an inorganic solid. (elemental mercury is an exception)
- Has a definite chemical make-up.
- Usually has a crystal structure; some do not.
- Is formed naturally by geological processes.

One recent definition is:

"A mineral is a homogeneous (which means composed of parts or elements that are all of the same kind) naturally occurring substance with a definite but not necessarily fixed chemical composition. Most minerals are solids with an ordered atomic arrangement, and most are inorganic in the chemical sense of that word".

Alternatively, a mineral is one listed as such by the International Mineralogical Association.

Minerals and rocks

Minerals are different from rocks. A mineral is a chemical compound with a given composition and a defined crystal structure. A rock is a mixture of one or several minerals, in varying proportions.

A rock has only two of the characteristics minerals have—it is a solid and it forms naturally. A rock usually contains two or more types of minerals. Two samples of the same type of rock may have different kinds of minerals in them. Minerals are always made up of the same materials in nearly the same proportions. A ruby is a mineral. Therefore, a ruby found in India has similar makeup as a ruby found in Australia.

Formed in nature

Minerals are formed by natural processes. A few substances with the same chemical composition as minerals can be produced by living creatures as part of their shells or bones. The shells of molluscs are composed of either calcite or aragonite, or both.

Traditionally, chemicals produced by living things are not considered minerals. However, it is difficult to see why an organic substance should not be called a mineral if its chemical nature and its crystalline structure are identical with its inorganic twin. This issue is now under debate.

Minerals form in many ways. The mineral halite, which is used as table salt, forms when water evaporates in a hot, shallow part of the ocean, leaving behind the salt it contained. Many types of minerals are made when molten rock or magma cools and turns into a solid. Talc, a mineral that can be used to make baby powder, forms deep in Earth as high pressure and temperature causes changes in solid rock.

Solid

A mineral is a solid—that is, it has a definite volume and a rough shape. Volume refers to the amount of space an object takes up. For example, a golf ball has a smaller volume than a baseball, and a baseball has a smaller volume than a basketball.

A substance that is a liquid or a gas is not a mineral. However, in some cases its solid form is a mineral. For instance, liquid water is not a mineral, but ice is.

Definite chemical makeup

Each mineral has a definite chemical makeup: it consists of a specific combination of atoms of certain elements. An element is a substance that contains only one type of atom.

Scientists can classify minerals into groups on the basis of their chemical makeup. Though there are thousands of different minerals, only about 30 are common in Earth's crust. These 30 minerals make up most rocks in the crust. For that reason, they are called rock-forming minerals.

Silicates are most common group. All the minerals in this group contain oxygen and silicon—the two most common elements in Earth's crust—joined together. Silicates may include other elements such as aluminum, magnesium, iron and calcium. Quartz, feldspar, and mica are common silicates.

Carbonates the second most common group of rock-forming minerals is the carbonates. All the minerals in this group contain carbon and oxygen joined together. Calcite, which is common in seashells, is a carbonate mineral.

Oxides include the minerals from which most metals, such as tin and copper, are refined. An oxide consists of an element, usually a metal, joined to oxygen. This group includes haematite, a source of iron.

Sulphates contain the sulphate group SO_4 . Sulphates commonly form in evaporates where highly salty waters slowly evaporate, allowing sulfates and halides to precipitate where the water evaporates. Sulphates also occur where hot waters are forced through the rock, as with geysers.

There are many other mineral groups.