What are minerals?

Scientists have been refining the definition of a mineral for the past 150 years since they were first studied scientifically. Here are two recent definitions:

“A mineral is a substance with these characteristics:
• It is crystalline - it has an ordered and predictable arrangement of atoms
• It has a definite chemical composition
• It is naturally occurring
• It is inorganic. Minerals have never lived.
These 4 criteria together cause each type of mineral to have its own unique set of properties.”

“Minerals are naturally-occurring inorganic substances with a definite and predictable chemical composition and physical properties. They are always crystalline, but the crystals may be so tiny that they are only visible using a microscope.”

What is a crystal?

The word crystal is often used to describe very beautiful mineral specimens, or mineral samples used for healing and meditation. A crystal is defined as “a solid material made from atoms and molecules organised in an ordered 3-dimensional pattern”. As well as having a distinctive pattern at microscopic scale, large crystals usually have a distinct and recognisable geometric shape, made up of flat faces which intersect with each other in a consistent way - the amethyst crystal in the picture is a good example of this.

Different types of minerals

Minerals are divided into groups by similarities in their composition, properties and how and where they are formed. Individual types of mineral within these groups are sometimes referred to as “mineral species” and classified in a way that is similar to the way we classify living things.

Mineral crystals can form in 4 main ways.

• New minerals crystallise out of hot magma which is a mixture of chemicals (molten rock) Minerals such as quartz, feldspar and mica commonly form this way. This forms new rock.

• New minerals crystallise out of hot water in which chemicals are dissolved. These are called hydrothermal minerals. Calcite, pyrite, malachite and gold are examples of these minerals. Many
important metal ores found in the UK were formed in this way. These minerals often form in existing rock.

- An existing mineral can change into a new type of mineral when it reacts with other chemicals in the environment around it. This is known as alteration. eg iron goes rusty because it reacts with oxygen.

- An existing mineral can change into a new type of mineral if it is heated or compressed so much that it becomes chemically unstable. This is known as recrystallisation. Rubies and many other precious minerals are formed in this way.

**Scientists who study and investigate minerals are called mineralogists.**

The word mineral comes from “*minerale*”, the Medieval Latin word which means “something mined”.

**Why do we study minerals?**

- Minerals are the chemical building blocks that rocks are made from, so are the basic materials that form the Earth
- Minerals are the building blocks of us! Our skeletons are made of minerals, and many of the complex processes that keep us alive require minerals to work properly.
- Minerals are the basis of raw materials we use to build our homes and make them comfortable, keep our teeth healthy and make computers work...
- Having a better understanding of how minerals form can help us to find more of what we want either for industrial applications or because they are beautiful and covetable.
- Some minerals are the key to working out the age of the rock they are found in, which in turn helps us to learn more about the Earth

**Mineral facts**

The oldest minerals found on Earth are older than the oldest rocks! They are about 4.4 billion years old. Zircon crystals have a very high melting temperature, and these ones have possibly survived several episodes of being recycled without being changed by the processes of metamorphism. The ancient rocks that contain these crystals are found in Western Australia.

Minerals are different colours because of the chemicals they contain. Their structure will determine how they interact with light. Some minerals that have the same composition overall will have different colours because of a tiny chemical difference. Ruby and sapphire are precious varieties of the same mineral (corundum) but tiny differences in their composition make them look completely different colours. Ruby contains tiny amounts of chromium which makes it look red, blue sapphire gets its colour from the presence of iron and titanium.

Some minerals can “glow” when exposed to ultra-violet radiation! This happens because the structure of the mineral is such that it can store and emit the energy provided by the UV source as visible light. This property is called fluorescence. Washing powder contains fluorite, the mineral that this property is named after. It helps to make your whites look whiter because the fabric fibres pick up tiny amounts of the mineral which responds to the UV energy in sunlight.