## Rocks, Minerals & Resources – Teacher Background

**Rocks are solid materials found at the Earth's crust.**
**Minerals are the building blocks of rocks. A mineral is an inorganic crystalline substance.**
**Resources are things that are useful to humans.**

Many people find these terms confusing and mistakenly use them them interchangeably. Newspapers in particular use the terms minerals and resources interchangeably.

**Rocks and minerals**

1. Minerals have a reasonably regular chemical composition
2. Minerals have regular shapes (they form crystals)
3. Minerals are inorganic crystals
4. The size of mineral crystals relates to the rate of cooling
5. Minerals are the building blocks of rocks

**NOTE!** If you do not have access to good specimens of minerals and crystals, visit the Earth Science Western Australia website www.earthsciencewa.com.au and discover how you can borrow a box of specimens with accompanying teachers guide and student activity sheets at no cost. The site will tell you where the closest kit can be accessed free.

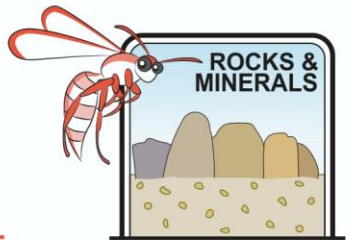
The E De C Clarke museum at University of Western Australia and the museum at the Kalgoorlie School of Mines have excellent mineral specimens.

1. **Minerals have regular chemical compositions**

All diamonds have the same chemical composition. All are pure carbon however very tiny amounts of other atoms may cause them to be different colours. The "Crystals and Minerals" activities enable students to see and measure the difference between crystals of salt (NaCl) and alum ($KAl(SO_4)_3$). Salt crystals will be cubic whilst alum forms an octahedral crystal.

***Interesting facts***: Salt has a long history of use in food preservation and the chemical industry whilst alum is used in preserving pickles as it helps the vegetables to retain their crispness.

***Interesting facts***: Many gem and industrial crystals are now made artificially in laboratories. Industrial diamonds are created for their hardness in cutting and grinding, quartz crystals are used in electronics, calcite crystals allow us to polarise light and silicon crystals are used for computers.




2. **Minerals have regular shapes**

Planes of weakness within crystals cause cleavage where they break into regular geometric shapes. Bonding between molecules controls these planes. Since both salt and pyrites are cubic, minerals cannot be identified by their symmetry alone.

**3. Minerals are inorganic crystals**

Not all crystals are minerals. Organic substances are formed from living things. Some organic materials such as urine and DNA can form crystals. You may have noticed the needle like crystals dried on the kitchen floor if your child, puppy or kitten has "made a mistake". These are organic and cannot be minerals. Inorganic substances are produced in non-living materials such as magma (molten rock), hydrothermal fluids and gasses. These cool over geological time and can form large crystals.

***Misconception***: Many students assume that "organic" means alive. The descriptor "organic" also includes anything that was alive and is now dead. Even 2.2 billion year old bacterial fossils are classified as organic.

**4. The size of minerals relates to the rate of cooling**

Crystal size is controlled by many factors. At year 8 level however the faster a magma cools the smaller its crystals are.

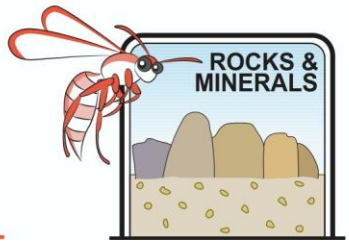
| Example rock | Place of cooling | Rate of cooling | Crystal Size |
|---|---|---|---|
| Glass (obsidian) | Volcanic (extrusive) | Instant | Cryptocrystalline – a state between crystal and gas |
| Basalt | Volcanic (extrusive) | Rapid | Small – visible by hand lens |
| Dolerite | Intrusive | Slower | Visible by eye |
| Granite | Deep intrusive | Very slow | Large |

Ancient artisans carved crystal vases out of single crystals of quartz.
Under unusual conditions crystals can become extremely large indeed! Enormous gypsum crystals up to11m long in Mexico can be seen here:
http://news.nationalgeographic.com/news/2007/04/photogalleries/giant-crystals-cave/

**5. Minerals are the building blocks of rocks**

Igneous rock is sourced from within the Earth (molten magma). These rocks are characterised by interlocking crystals (minerals) that usually make them hard and difficult to break.

Sedimentary rocks are made from weathered and eroded clasts (broken bits) of earlier rocks. Minerals from the earlier rocks are deposited, compacted and cemented to form sedimentary rock. In cold wet climates the minerals quartz (old German for "hard") and feldspar (Old German for "field rock") will not weather easily and will survive into the new sediments. In warm climates rocks weather much faster and complex minerals will be broken down to form silt and mud.




Metamorphic rock is partially melted igneous or sedimentary rock. Some original minerals will have been changed by heat and/or pressure to form new minerals which are stable at the new conditions.

***Interesting fact:*** Although the Earth became solid about 4.5 billion years ago (bya) we have no rocks we can date until about 3.8 bya. When a rock melts, radioactive materials in the minerals start to decay and we can tell how long since the rock became solid. It has been suggested that at 3.8 bya Earth was struck by an asteroid or planet about the size of Mars. At Jack Hills near Geraldton in Western Australia mineralogists have found crystals of the mineral zircon. The centres of these date to 4.2bya and have been rounded and smoothed by erosion in a flowing liquid. It is suggested that these are clasts of an earlier rock that have been included into a later one. These are currently the oldest dated minerals in the world.

**Resources**

The major resources on Earth are water, air, living things, rocks (including minerals and fossil fuels), soil and energy from the Sun. Materials will move between different reservoirs in Earth at different rates for different periods of residence. Since the biosphere, atmosphere, lithosphere and hydrosphere are all inter-connected, each is of equal importance in maintaining sustainability.