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Rocks

Rocks are any hard, solid material derived from earth's crust in general. More scientifically, it is the aggregates of minerals.

Types of rocks

Rocks are natural material made of grains of one or more minerals. A mineral is a natural compound that usually exists in rocks as crystals. Geologists classify rocks into three groups according to how they were formed: igneous, sedimentary and metamorphic. We use rocks from each group as natural resources.

C

Igneous rock
This is formed from molten rock often linked to volcanoes. The molten rock may cool slowly, allowing time for minerals to form large crystals, which lock together. Granite and basalt are types of igneous rock.
Igneous rocks are very hard and durable. In the UK they form mountainous areas. People use igneous rocks to construct some buildings. Crushed granite is often used to surface roads. Igneous rocks are also important sources of minerals like diamonds.

D

Sedimentary rocks
Most of these types of rocks are formed under the sea. Rock particles carried by rivers were washed out to sea, and settled on the sea floor. On the sea bed they were buried by newer sediment, squeezed and cemented together over thousands of years to form new rock. These rocks also include the fossilised remains of sea creatures. Chalk and limestone are examples of sedimentary rocks that are made up almost entirely from fossils.
Sedimentary rocks include valuable rocks such as coal and iron ore. Salt and potash are also important raw materials for the chemical industry. Sand and gravel are used for making concrete and cement. Clay is used to make house bricks.

E

Metamorphic rocks
These rocks form from existing rocks that are transformed by great heat or pressure. These changes lead to the existing minerals melting and forming new minerals. Marble and slate are examples of metamorphic rocks. The sedimentary rock, mudstone, is transformed into slate, and limestone into marble.
Slate is very durable and is formed in thin layers, which can be cut into thin, strong tiles, ideal for making roof tiles. Marble is used as a building stone, and to make sculptures.

Types of weathering

Rocks on the lithosphere are exposed to the Earth's other spheres. Air, water, changing temperatures, plants and animals all attack rocks causing them to break down and rot away. This process is called **weathering**. There are three types:

Freeze-thaw weathering occurs when water gets into a crack in a rock and freezes. As the water turns to ice it expands and causes the crack to widen. Repeated freezing and thawing weakens the rock, which eventually splits into pieces.

Chemical weathering occurs when rainwater, which is slightly acidic, comes into contact with rock. The acid attacks the rock, causing it to rot and crumble.

Biological weathering is when plants and animals break down rock. The roots of plants and trees can get into cracks in rocks, causing them to split. Burrowing animals and worms can also weaken rock.

You will learn more about weathering and erosion in Unit 9.

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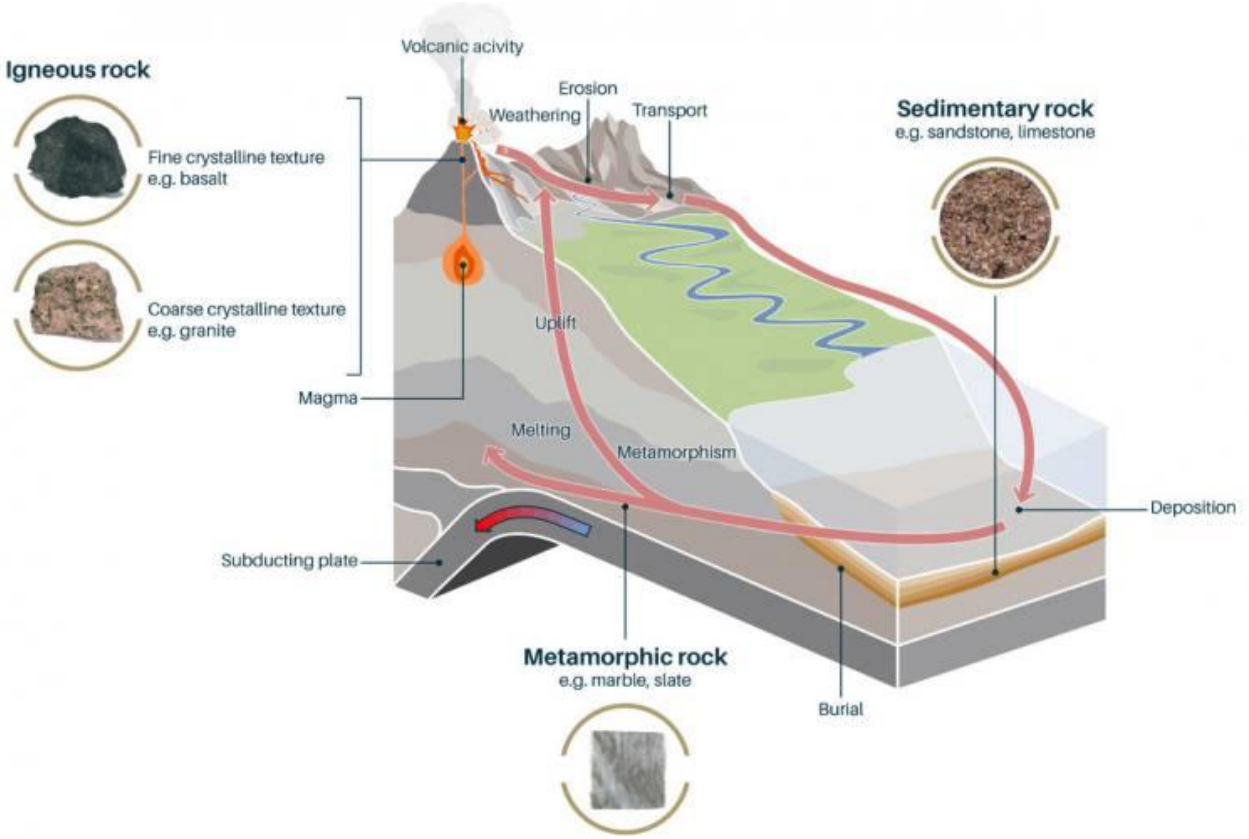

What are minerals?

A mineral is a naturally occurring substance with distinctive chemical and physical properties, composition and atomic structure.

Rocks are generally made up of two of more minerals, mixed up through geological processes. For example granite is an igneous rock mostly made from different proportions of the minerals quartz, feldspar and mica as interlocked crystals; a sandstone is a sedimentary rock that can also contain quartz, feldspar and mica, but as grains compacted and cemented into each other. Minerals are naturally occurring, homogenous solid with definite chemical composition.

Can be valuable as –

- **Gems**
- **Ores**
- **Placer Deposits**

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Gems

A gem is a mineral which, by cutting and polishing, possesses sufficient beauty to be used in jewellery and personal adornment

Precious Gems

- Diamond
- Rubies
- Emeralds
- Sapphires

Semiprecious Gems

- Beryl
- Garnet
- Jade
- Topaz
- Zircon

Ore

Ore is a deposit in the Earths crust of one or more valuable minerals. The most valuable ore deposits
contain metals crucial to industry and trade.

Examples

- **Copper Ores (chalcopyrite (CuFeS2) chalcocite (Cu2S), covellite (CuS) etc.)**
  Copper ore is mined for a variety of industrial uses. Copper, an excellent conductor of electricity, is used as electrical wire. Copper is also used in construction. It is a common material in pipes and plumbing material.
- **Gold Ores (Calaverite AuTe2, Petzite (Ag3AuTe2)**
  For thousands of years, gold ore was mined as a basis for currency, or money. Most nations stopped valuing their money on the gold standard in

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the twentieth century. Gold is used in space helmets to be saved from radiation

- **Iron Ores (Hematite (Fe2O3) or Magnetite (Fe3O4))**
  Iron is the main component of steel. Steel is a strong, valuable building material. Iron is used in everything from glass to fertilizer to the solid rocket boosters needed for the space shuttle to leave the Earths atmosphere
- **Aluminium Ores (Bauxite (Al2O3))**
  Aluminium, for example, is usually found in the ore called bauxite. Aluminium found in bauxite is used in containers, cosmetics, and medicines.

Placer Deposits

"Placer" deposits are formed during sedimentary process by gravity action and surface weathering and ocean, river or wind action resulting in concentration of some valuable heavy resistant minerals of economic quantities.

The most common placer deposits are those of gold, platinum group minerals, magnesite, gemstones etc.

Everyday Uses of Rocks and Minerals

Gypsum, chalk, and slate

Gypsum is ubiquitous in our lives as the basis for drywall. It contains water in its mineral structure, which it loses when heated, providing an initial line of defense against building fires. In the time before dry-erase boards, all education relied upon chalkboards made from slate, which is clay that has been cooked by heat and pressure deep within the earth. Chalk is a limestone made of the skeletons of millions of microbes that once lived at the bottom of the sea, so it's really a fossil.

Clay Mudstone

Ceramics, from simple plant pots to extravagant porcelain, are made from clay mudstone. That's just

a rock that forms from the compaction of mud. If it's buried deep enough, it becomes slate.

Granite, Salt, Quartz, and Marble

Granite and marble counter tops are made from stone. Granite forms when magma cools within the earth and never erupts from a volcano. The slower it cools, the larger the mineral grains that form. Marble is formed from limestone that is cooked by heat and pressure within the earth.

Salt is a mineral formed from the elements sodium and chlorine, each of which is deadly on its own. Together they make an essential nutrient. Most salt is formed by the evaporation of sea water. Sea salt is made from the evaporation of seawater today, while regular salt is mined from ancient deposits created when seawater evaporated during warm intervals in the past.

Glass is formed by melting quartz, the primary mineral found in sand. Sand is all that's left over after granite is ground down by streams, rivers, and the action of ocean waves. As the mineral quartz, silica is very hard, which is why it stays intact in sand, even as all of the other minerals from granite are destroyed. When it's melted into glass, it loses its mineral strength, but becomes clearer and can be formed while it's molten.

Copper and Zinc

Copper is used in the manufacture of electrical wire, copper pipes for water, copper cookware, and in the computer you're using to view this web gallery. Copper has low resistance to electrical charge and is relatively abundant, compared to its elemental sisters, gold and silver, which is why it's used for wiring. It can be found both in its elemental state and as an ore,

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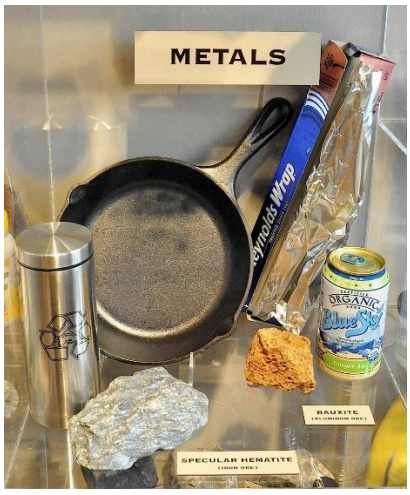
in which the copper is bonded to other elements.

Zinc has been reported as beneficial in shortening the duration of common colds, so it is often included in over the counter cold remedies. There have been no conclusive results supporting this use, but zinc is an essential element, so taking it as a supplement in reasonable doses cannot have any adverse effects. Zinc is often found naturally in sphalerite, a mineral including sulfur and iron. Zinc is also used for galvanizing, because it is relatively inert compared to steel, so it can prevent rusting when used as a coating.

Iron and Aluminum



It's hard not to experience iron and aluminum in our everyday lives. Iron ores are usually compounds of iron and oxygen, otherwise known as rust. Much of these ores were formed when the earliest photosynthesizing microbes began to pump oxygen into the earth's oceans. In a way, iron ores are fossils, so all iron and steel we use are made from fossils. Iron is commonly used in different compound with carbon and silicon. Different ratios of the other elements determine its physical properties, which vary between cast iron, as in the frying pan, and steel, as in the reusable coffee cup.

Aluminum is found naturally as bauxite, made of aluminum bonded with water. Purifying bauxite used to be expensive and slow, so aluminum was a rare and valuable metal in the 18th and 19th centuries. That's why the top of the Washington monument was covered in aluminum -- it was like covering it in silver! Since the late 1880s, aluminum ore has been purified using electricity, and it has become cheap and plentiful. Benjamin Franklin would think we all live like kings if he knew that we casually drink out of aluminum cans and use aluminum foil to save our leftovers.

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Silver and Gold

This shelf features silver and gold, sister elements to copper. On the periodic table they're all in the same column, and that reflects the similar structures of their atoms, which give them similar chemical properties. They're all good conductors of both heat and electricity. Gold and silver are actually better conductors than copper, which is why they're used in high-end electronic devices, like cell phones and some audio equipment. They're rarer than copper, too, which is why gold and silver jewelry is more valuable and why they're used more often for decoration than for their electrical properties. Gold is most often found as a pure element in nature, but silver is often found both in its pure form and in ores.

Limestone, Sand, and Gravel

The concrete that makes up most of the urban landscape is actually an artificial reconstruction of a naturally occurring rock, conglomerate. To make concrete, we mix sand and gravel, with cement. Cement is created by heating ground limestone with other minerals. When hot enough, the limestone releases carbon dioxide and becomes quicklime, the primary ingredient in cement. When the quicklime in cement reacts with water, it forms a stable crystal: this is what happens when concrete 'dries'. The process of making cement from limestone releases carbon dioxide, consequently, the cement industry is second only to power production in the release of carbon dioxide gas into the atmosphere.