



## Chapter 5

# Types of Rocks

### Learning Outcomes

- Identifying the differences between rocks and minerals
- Recognising types of rocks
- Learning about the formation of the different types of rocks
- Understanding the uses of rocks

### Thinking Cap

Do all rocks have the same size, texture and colour? Discuss with your partner the different types of rocks you have seen.

21<sup>st</sup> communication

### Minerals and Rocks

The Earth's crust, formed of rocks and minerals, is about 4.5 billion years old. It is made up of rocks and minerals. **Minerals** are composed of chemicals. A mineral can contain only one chemical or a combination of chemicals. All minerals have definite chemical and physical properties. Gold, copper, silver, nickel, mica, gypsum and iron are some examples of minerals.

#### Minerals

- Minerals have definite chemical composition.
- These usually have the same colour, shape or texture.
- These are made up of chemicals.
- These do not contain organic matter.

**Rocks** are aggregates of one or more and exist in many forms. They can exist in different forms. Mountains, riverbeds and canyons are made up of rocks that are a combination of minerals compressed together. About 2,000 known minerals in different combinations have led to the formation of rocks. Other than minerals, rocks also contain mineral oils and organic remains of plants and animals.

### Did you know?

Meteorites are rocks from space, and they can help scientists learn about outer space.

21<sup>st</sup> information literacy

#### Rocks

- Rocks do not have definite chemical composition.
- Shape, colour or texture varies across rocks.
- These are made up of minerals.
- These may contain organic matter.

## Rock Type and Formation

The rocks found at or near the Earth's surface can broadly be divided into three types—**igneous rocks**, **sedimentary rocks** and **metamorphic rocks**.

There are many varieties of each of these three main types of rock and the exact type of rock formed depends on factors such as temperature, pressure and the minerals present at the time of its formation.



Igneous rocks comprise the Earth's first crust. All other rocks are derived from them. Hence, they are also called the 'parents of all rocks' or 'primary rocks'.

### Igneous Rocks

Igneous (derived from the Latin word 'ignis' which means 'fire') rocks are the first-formed rocks of the Earth. These are formed by the cooling of molten materials called magma, that flow out from the Earth's crust during a volcanic eruption. This magma cools and solidifies to form igneous rocks. A wide variety of rocks are formed as a result of differing cooling rates and varied chemical composition of the original magma. Igneous rocks are the most abundant rocks on the Earth's surface.

Based on their mode of existence, igneous rocks can be classified as:

#### Intrusive or Plutonic Rocks

These rocks are formed when magma solidifies below the surface of the Earth. Since the rate of cooling is very slow, large mineral crystals are formed on the rocks. Granite and dolerite are examples of plutonic rocks.

#### Extrusive or Volcanic Rocks

Unlike intrusive rocks, these rocks are formed by the rapid cooling of molten lava

on the Earth's surface. Extrusive rocks may contain small crystals. Some examples are gabbro, basalt and rhyolite.

Igneous rocks are also classified as acidic or basic. Acidic rocks contain 65 per cent of silica and low percentage of oxides. Such rocks are light-coloured and are less dense. Basic rocks contain a lower percentage of silica and high amounts of oxides. These rocks are dark-coloured and dense. Graphite is an example of an acidic rock and basalt is an example of a basic rock.



*Rhyolite*



*Granite*



*Gabbro*

### Sedimentary Rocks

Sedimentary rocks are formed by the process of 'lithification', which means cementation, compaction and consolidation of sediments to form rocks. Sedimentary is derived from the Latin word 'sedimentum' which means to settle down. These rocks are also known as secondary rocks, since they are formed by the accumulation of small pieces of pre-existing rocks or parent rocks.

Based on the source of the sediment that forms the rock, sedimentary rocks can be classified as:

#### Classic or Mechanically Formed Sedimentary Rocks

These are basic sedimentary rocks formed by the cementing of small pieces of broken rocks. Examples include sandstone and breccia.



*Sandstone*



## Chemically Formed Sedimentary Rocks

These rocks are formed when water evaporates, leaving behind dissolved minerals.

These are usually found in hot arid lands, where repeated flooding and evaporation leave behind thick deposits of salt and gypsum over a long time. Examples include rock salt and limestone.



Rock salt

- **Calcareous** ('cal' for calcium, which comes from the bones of animals) rocks are formed due to lithification of dead animal remains in the rocks. E.g. Corals and limestone
- **Carbonaceous** ('carbon' implying derivation from plant remains that are rich in carbon) rocks make good fossil fuels as they contain high percentage of combustible carbon. E.g. Coal



Limestone



Coal

## Organically Formed Sedimentary Rocks

These may be further classified as calcareous and carbonaceous sedimentary rocks.

### ACTIVITY

Find the largest coal and salt-producing states in India. Prepare a short report of not more than 150 words on each.

21<sup>st</sup> information literacy

## Metamorphic Rocks

The word 'metamorphic' is derived from the Greek words 'meta' meaning 'change' and 'morph' meaning 'form'. Hence, metamorphic means 'to change form'.

Metamorphic rocks are formed as a result of remoulding of existing igneous or sedimentary rocks, usually buried deep under the Earth's surface. Constant heat and pressure may change the physical and chemical composition of rocks, essentially

deforming them into compact and dense rocks. These are less susceptible to erosional breakdown. Examples of these rock types include marble, slate and shale.

## The Rock Cycle

Over time, all rock types can convert into other forms, and this has often been termed as 'the rock cycle'. Igneous and sedimentary rocks become metamorphic rocks under pressure and heat. All rock types can erode to form

SVID



A group of metamorphic rocks. Left to right: Marble, gneiss, slate, schist, quartzite

### ACTIVITY

21<sup>st</sup> information literacy

India has large reserves of minerals. Find the names of these minerals and write at least three uses of each. For example, India has the fourth-largest reserves of coal in the world.

layers of sediment that can eventually become sedimentary rocks, and all rocks can be completely melted. When molten rock eventually cools and hardens, at or near the Earth's surface, it will form igneous rock.

Significance of Rocks

Economic

- 1. Rocks are a storehouse of minerals. Metallic ores give us metals like iron and aluminium. Non-metals can also be extracted from minerals.
- 2. Rocks give us fossil fuels like coal and petroleum.
- 3. Precious and semiprecious stones and crystals may be extracted, like diamonds and rubies.

- 4. Hard rocks like marble and granite are used in construction.
- 5. Rocks are used to make sculptures and other pieces of art. Corals are used for decoration.
- 6. Rocks like limestone are used in paint and cement industry.

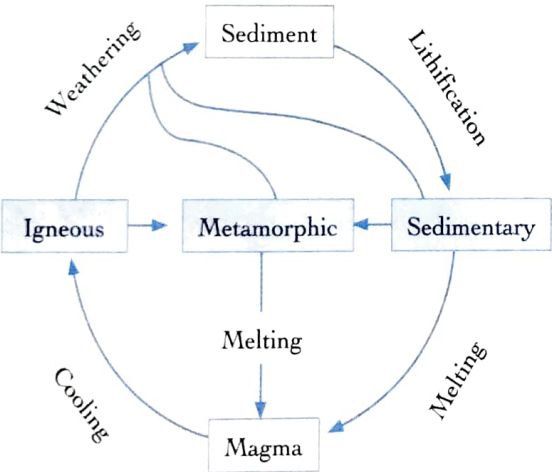
Non-economic

- 1. Rocks broken down as soil help support natural vegetation and other flora, thus conserving ecological balance.
- 2. Fossiliferous sedimentary rocks help us study and analyse the Earth's geological history.

AT A GLANCE

Classification of Rocks

Classification of rocks is based on their origin.



The rock cycle

	Igneous	Metamorphic	Sedimentary
How it is formed	Cooled magma	Heat and pressure applied to rocks	Weathering and lithification
Examples	granite gabbro rhyolite basalt obsidian	slate schist gneiss marble quartzite	limestone sandstone conglomerate shale coal chalk

## EXERCISE



INT



### A. Fill in the blanks.

1. Rocks are made up of different minerals.
2. Sedimentary rocks are also known as parent rocks.
3. Magma cools and solidifies to form igneous rocks.
4. Igneous rocks are less susceptible to wear and tear.
5. Graphite is used for manufacturing pencils.

### B. Give two examples of each of the following.

- |                      |                  |                  |
|----------------------|------------------|------------------|
| 1. Igneous rocks     | <u>granite</u>   | <u>basalt</u>    |
| 2. Sedimentary rocks | <u>limestone</u> | <u>sandstone</u> |
| 3. Minerals          | <u>gold</u>      | <u>silver</u>    |
| 4. Metamorphic rocks | <u>marble</u>    | <u>gneiss</u>    |
| 5. Organic rocks     | <u>lignite</u>   | <u>coal</u>      |

### C. Match the following.

	Rocks		Formation
1.	Plutonic	a.	Constant heat and pressure may change the physical and chemical composition of rocks
2.	Chemical	b.	Magma solidifies below the surface of the Earth
3.	Metamorphic	c.	Magma solidifies above the surface of the Earth
4.	Organic	d.	Formed when water evaporates leaving dissolved minerals behind
5.	Volcanic	e.	Formed from organic debris

### D. State whether true or false.

1. The Earth's crust is about 4.5 million years old. true
2. Rocks have definite chemical and physical properties. false
3. Intrusive rocks contain small mineral crystals. false
4. Igneous rocks are also known as parent rocks. true
5. Rocks take millions of years to change their form and properties. true

### E. Answer in one or two sentences.

1. List two features of a mineral.
2. What is a rock cycle?

INT



INT





3. What does metamorphic mean?
4. Why are igneous rocks also called parent rocks?
5. Which is the most abundant rock on the Earth's surface?

#### F. Answer in a paragraph or two.

1. Explain the importance of rocks.
2. How is granite different from marble?
3. Explain the formation of organic rocks.



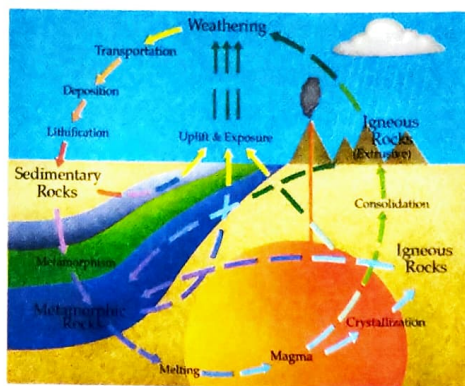
#### Picture Study

21<sup>st</sup>

media literacy

Look at the picture and answer the following questions.

1. What does the picture depict?
2. Explain the cycle shown.
3. What do you understand by the term 'weathering'?



#### Integrate



science

There are multiple methods to categorise igneous rocks. One of the important methods is based on the minerals in the rock. The magma from which igneous rocks are created determines their mineral profile. Some important minerals found in igneous rocks include feldspars, quartz or feldspathoids, olivines and pyroxenes. Find out other methods of classification for igneous rocks.



#### Life Skills

21<sup>st</sup>

environmental literacy

Many mining processes are applied to extract useful minerals from the rocks. These processes generally have negative impacts on the environment, which can be experienced even years after the mining operations have stopped.

Identify environmental issues that can arise from the mining industry. Discuss the good practices in mining, which are often recommended by governments in many countries.



#### Project



empathy



language and communication

Rock mining is a large industry in India. Prepare a report in about 200 words on the challenges that labourers face while working in mines. Add at least two pictures in the report.