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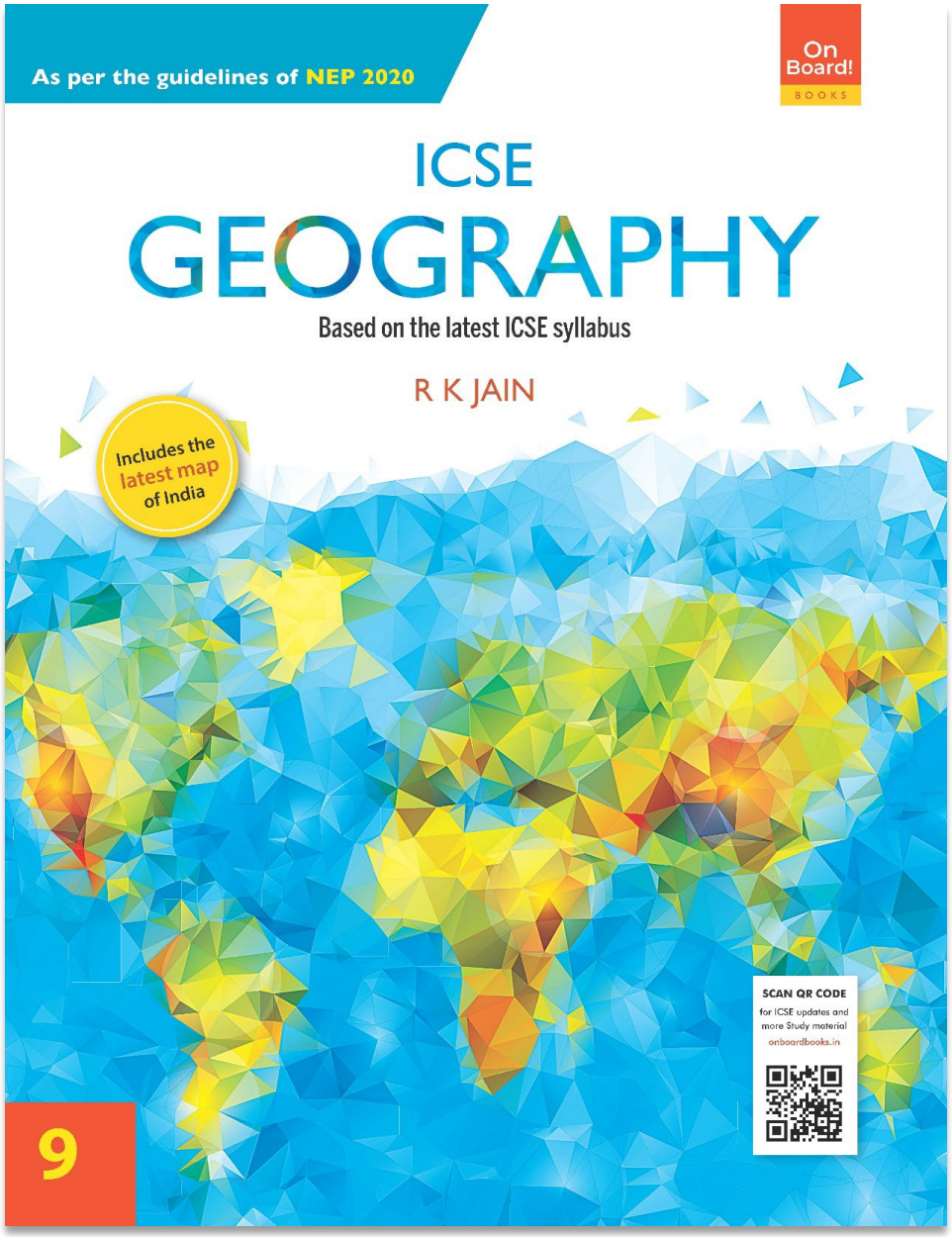
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Class 9

Chapter 6: Rocks

The thin outermost layer of the Earth is called the crust or the **lithosphere**. The word lithosphere stands for **rocksphere**, as the literal meaning of the word **lithos** is rock.

ROCK AND MINERALS

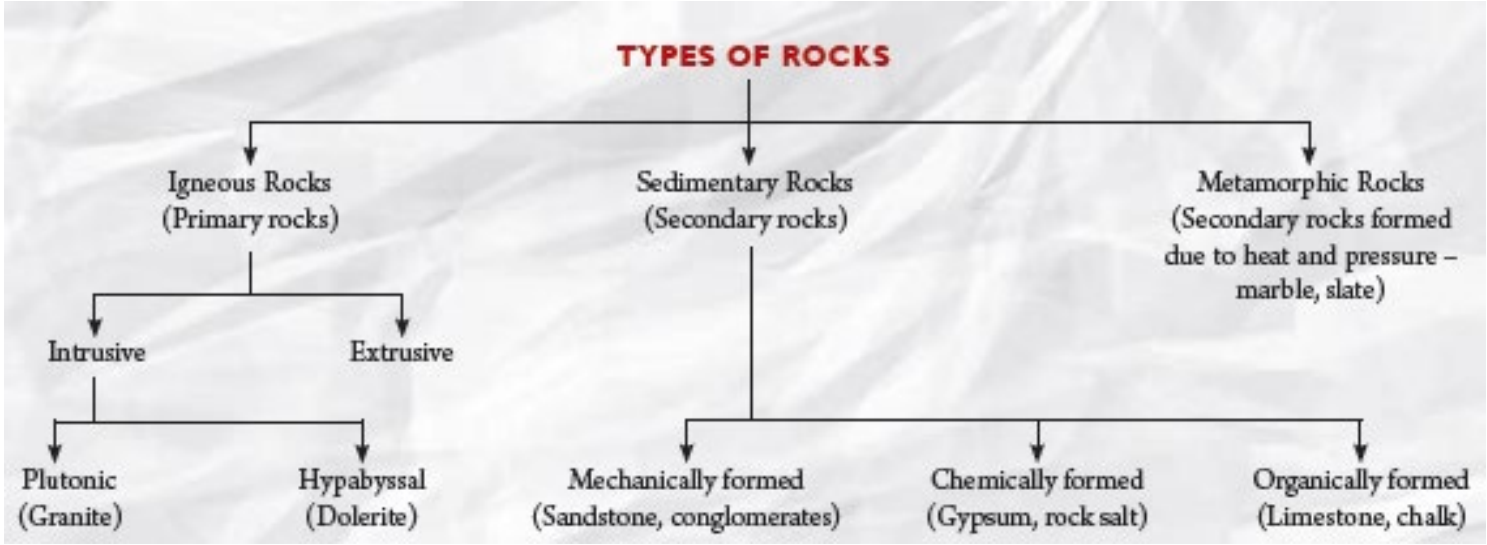
Rocks and minerals make up the crust of the Earth. The hard materials of the crust are called **rocks**. Rocks include not only hard materials, such as granite, marble, sandstone, etc. but also soft and loose materials such as chalk, clay, sand, etc.

Minerals are a combination of elements which occur naturally in rocks. These are solid inorganic substances which have a definite chemical composition. More than 2000 types of minerals have already been identified, but only a few of them are rock-forming.

TYPES OF ROCKS

Rocks are divided into three categories on the basis of their origin and mode of formation. These are:

1. Igneous Rocks
2. Sedimentary Rocks
3. Metamorphic Rocks



IGNEOUS ROCKS

The word igneous has been derived from the Latin word **ignis** meaning fire. These rocks are of thermal origin and are associated with volcanic eruptions.

The igneous rocks have been formed due to the cooling and solidification of hot and molten material called magma (below the Earth's surface) and lava (on the Earth's surface).

Important igneous rocks are granite, basalt, dolerite, gabbro, feldspar, pumice, obsidian, etc.

Classification of Igneous Rocks

The igneous rocks are mostly found in the volcanic regions. On the basis of mode of occurrence, the igneous rocks are classified into (i) extrusive igneous rocks, and (ii) intrusive igneous rocks.

Extrusive Igneous Rocks

These rocks are formed due to the cooling and solidification of hot and molten lava on the surface of the Earth. These are also called **volcanic rocks**. These rocks are generally fine grained, such as basalt. The lava after reaching the surface of the Earth, cooled and solidified quickly. On cooling the lava can form polygonal columns, such as in the Giant's Causeway in Northern Ireland.

Giant's Causeway, N. Ireland

Extrusive igneous rocks

Intrusive Igneous Rocks

When the rising magma during the volcanic activity is not able to reach the surface of the Earth and gets cooled and solidified below the surface of the Earth, the rocks thus formed are called intrusive igneous rocks. The rate of cooling is slow inside the Earth. Thus, the rocks formed are coarse textured, hard and have large crystals.

The intrusive igneous rocks are further subdivided into plutonic igneous rocks and hypabyssal igneous rocks. The **plutonic igneous rocks** are formed due to the cooling of magmas very deep inside the Earth, while the **hypabyssal igneous rocks** are formed due to the cooling of magma in cracks, pores, crevices, etc. just beneath the Earth's surface.

The most **traditional method** of classification of the igneous rocks is based on the amount of silica. There are two broad categories: the **acidic igneous rocks** have more silica (granite), while the **basic igneous rocks** have lower amount of silica (gabbro).

Characteristics of Igneous Rocks

- The igneous rocks are hard and compact.
- They do not have strata like sedimentary rocks.
- These rocks are generally granular and crystalline.
- These rocks are less affected by chemical weathering.
- They do not have fossils or traces of plants and animals.
- These rocks are mostly weathered by mechanical processes.
- Water can percolate only along the joints or cracks.
- Most of the igneous rocks consist of silicate minerals.

SEDIMENTARY ROCKS

The word sedimentary has been derived from the Latin word **sedimentum**, which means settling down. The processes of weathering and erosion constantly break the igneous and other rocks into fragments of all shapes and sizes. These agents provide the raw materials needed to form the sedimentary rocks.

The broken rock material is carried away by running water, glaciers, wind, sea waves, etc. and deposited in water bodies or in the depressions. The deposited materials are called **sediments**. The sediments are generally deposited in horizontal layers or stratas. Thus, the sedimentary rocks are also called the **stratified rocks**.

Classification of Sedimentary Rocks

On the basis of the character of the material and the process that led to their deposition, the sedimentary rocks can be divided into the following three types:

1. Mechanically formed Sedimentary Rocks,
2. Chemically formed Sedimentary Rocks, and
3. Organically formed Sedimentary Rocks.

Mechanically formed Sedimentary Rocks

The pre-existing rocks are broken into fragments of different sizes by the processes of weathering and erosion. These materials are transported and deposited at suitable places by different agents like running water (rivers), wind, glacier and sea waves. In this process the lower layers come under the pressure of the upper layers. These are mechanically formed rocks or **clastic rocks**. The main examples are sandstones, conglomerates, shale, loess, siltstone, clay, etc.

Chemically formed Sedimentary Rocks

The running water contains chemical materials in suspension. When this chemically active water comes in contact with rocks, it is able to remove the soluble materials from the rocks. These chemical materials after settling down are compacted and cemented to form rocks.

Sedimentary rocks

The deposition generally takes place in lakes and lagoons. The water evaporates and the rocks are compacted. The main examples are gypsum, rock salt, dolomite, etc.

Organically formed Sedimentary Rocks

The organic sediments are derived from the disintegration or decomposition of plants and animals. They contain large quantities of lime. These materials after being settled down, compacted and cemented to form organic sedimentary rocks. The main examples are limestone, corals, chalk, etc.

The Argillaceous Rocks

This type of rocks are also called the **aqueous rocks** as these are formed in water bodies. There is dominance of clay in these rocks. The argillaceous rocks are further divided into three types.

a. The **Riverine sedimentary rocks** are those which are formed due to deposition of sediments in the riverine environment. The deposition can take place in the bed of rivers or in the flood plains.

b. The **Lacustrine sedimentary rocks** are formed due to deposition and consolidation of sediments in the lake environment. Mostly the sediments are deposited on the floor of the lakes.

c. The **Marine sedimentary rocks** are formed due to deposition and consolidation of sediments on the floor of oceans and seas. The size of particles deposited decreases from coastal areas towards the open oceans and seas.

The Aeolian Sedimentary Rocks

This type of rocks are formed due to the deposition of sand brought down by the winds. The existing rocks are broken by the agents of mechanical weathering in the hot and dry areas. This results in the formation of large amount of sand. Winds pick up the sand particles and deposit them at various places. Loess deposits is an important example.

The Glacial Sedimentary Rocks

The materials deposited by the glaciers are called glacial drifts. These deposits are also known as **moraines**, which are of four types – lateral, medial, ground and terminal moraines.

Characteristics of Sedimentary Rocks

- The sedimentary rocks are comparatively softer than the igneous rocks.
- These rocks have layers horizontally arranged one above the other.
- The raw material for the sedimentary rocks is derived from the older rocks, plants and animal remains. Thus these rocks have fossils of plants and animals between the layers.
- The sedimentary rocks are found over the largest surface area (about 75 per cent) of the earth.
- These rocks have been mostly formed under water and therefore have mud cracks or marks of ripples and wave

METAMORPHIC ROCKS

The rocks originating at or near the Earth's surface are sometimes subjected to tremendous heat and pressure. This can change the original characteristics of rocks, such as their colour, hardness, texture and mineral composition. Such changed rocks are called the metamorphic rocks.

Metamorphic rocks

The word **metamorphic** means the changed form. Both igneous and sedimentary rocks can change into the metamorphic rocks.

Types of Metamorphic Rocks

The metamorphic rocks can possibly be divided into two types (i) rocks due to **thermal metamorphism**, and (ii) rocks due to **dynamic metamorphism**.

1. In the case of **thermal metamorphism**, the parent rocks are changed under the influence of high temperatures prevailing in the Earth's crust. For example: Limestone is converted into marble; sandstone into quartzite; shale into slate and coal into graphite.

2. In the case of **dynamic metamorphism**, the original rocks are changed under the influence of pressure at great depths inside the Earth's crust. For example: granite is converted into gneiss and shale into schist.

Characteristics of Metamorphic Rocks

- The metamorphic rocks are generally more compact, harder and bulkier than the original rocks.
- They may have layers, but these are highly compressed.
- Most of the metamorphic rocks are impermeable or non-porous.

- These rocks do not have fossils of animals or plants.
- These rocks have a high specific gravity.
- These rocks are associated with valuable minerals, such as gold and silver.

USES OF ROCKS

Rocks and minerals are extremely useful for human beings as most of their economic activities are dependent on them. The main benefits are as under:

- The characteristics of rocks influence the relief and drainage of the area.
- Rocks and stones were widely used in the making of tools and implements.
- Rocks provide us building stones which are used in the construction of houses, roads, dams, etc.
- Potash, nitrates, phosphates, etc. are widely used in the manufacturing of chemical fertilizers.
- Silica and clay are used in the making of glass and pottery.
- Metals and chemicals in the rocks form the basis of the development of modern industries.
- Coal, petroleum and natural gas are important sources of power and energy.
- Soil is the main product of rocks. All agricultural activities depend upon the quality and fertility of soils.

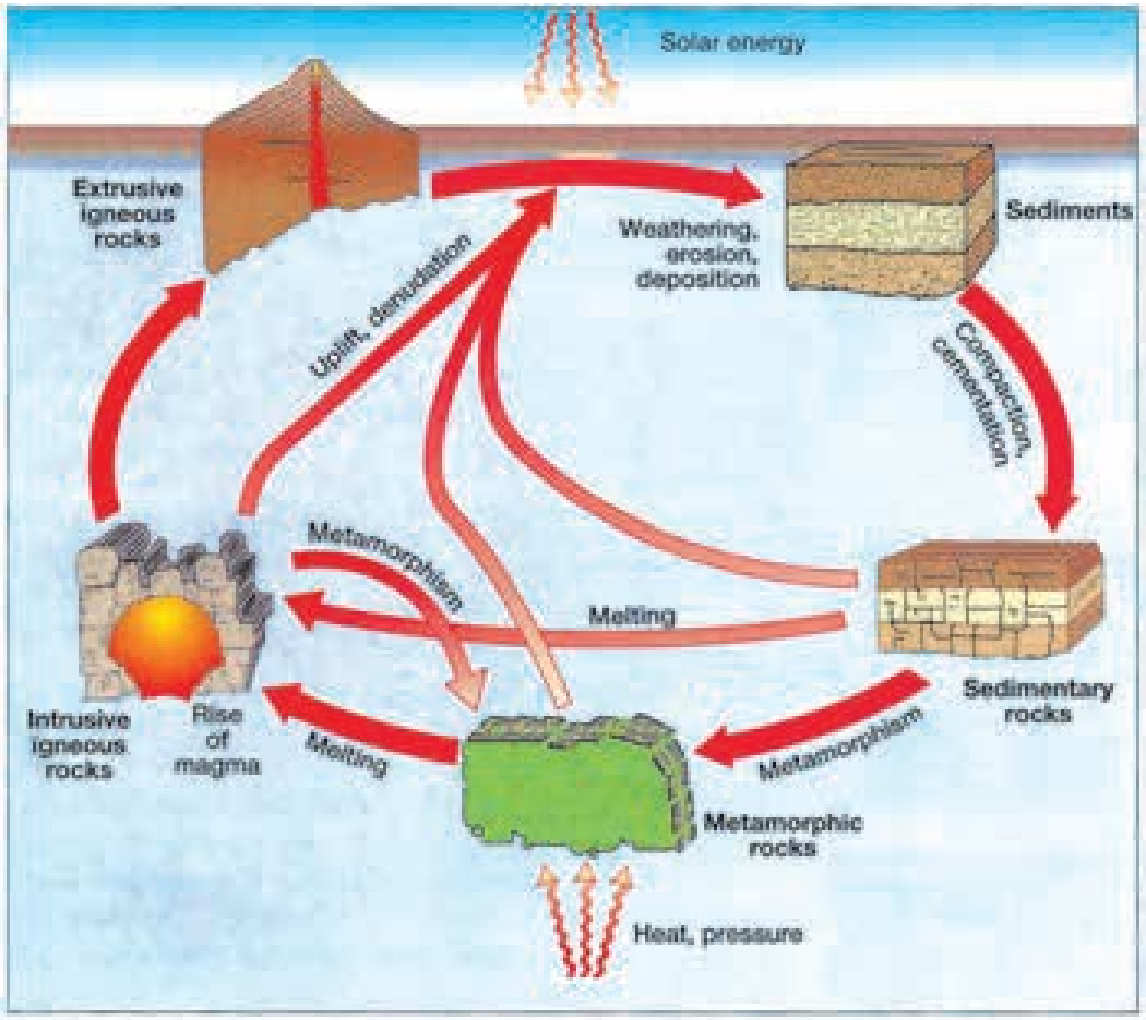
ROCK CYCLE

The continuous change of one type of rock into another type under different conditions is called the **rock cycle**. The rock cycle is actually the intimate relationship and mutual interdependence between igneous, sedimentary and metamorphic rocks.

The energy required for the working of rock cycle comes from two main sources, which are:

a. The heat inside the Earth, which can melt the existing rocks, and

b. The solar energy responsible for weathering and erosion, and finally converting the rocks into sedimentary rocks.



Rock cycle

- The first part of the rock cycle takes place on the surface of the earth. At the Earth's surface, the igneous or primary rocks are exposed to various agents of weathering and erosion.

- The broken rocks are transported and deposited in the basins or depressions. Here, the sediments are compressed and cemented to form the sedimentary rocks.
- The leftover igneous rocks and the newly formed sedimentary rocks can possibly change into metamorphic rocks due to heat and pressure in course of time.
- The formation of sedimentary rocks on the surface of the Earth and their conversion into the metamorphic rocks takes place within the crust of the earth.
- The sedimentary rocks may be buried again and may melt to form the igneous rocks.

The materials of the Earth's crust are not lost during the course of rock cycle. For millions of years, the rocks and the mineral matter of the Earth have been undergoing changes due to the working of rock cycle.

THANK YOU