18 Minerals and Rocks

A group of grade 7 students collected some stones when they went on a field trip with their teacher. The teacher said that there are rocks as well as minerals among those stones. It was a problem for students to classify them as rocks and minerals.

The figures 18.1a and 18.1b show a piece of granite and a piece of quartz they collected.

Figure 18.1 a ▲ A piece of granite

Figure 18.1 b ▲ A piece of quartz

Let us do Activity 18.1 to inspect the nature of granite and quartz.

Activity 18.1

You will need :- A piece of granite, a piece of quartz, a hammer, a hand lens

Method:-

- Wrap the piece of granite in a cloth. Keep it on a big stone and hit it with the hammer until it is broken into small pieces.
- Check the nature of the pieces with the hand lens.
- Follow the same method with the piece of quartz as well.
- Discuss whether there are any differences according to your observations.

Granite is a type of a rock. Quartz is a mineral. Let us find out the differences between rocks and minerals.

18.1 Features of minerals and rocks

A mineral is a solid made up of one component. Rock is a mixture of several components. Minerals exist naturally in the earth in a crystalline form with a definite geometrical shape. Graphite, dolemite, feldspar, ilmenite, mica and quartz are some minerals found in Sri Lanka.The Figure 18.2 shows some crystalline shapes.

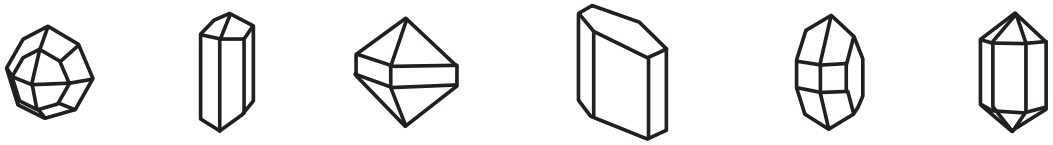


Figure 18.2 ▲ Minerals with different crystalline forms

But, rocks do not have definite geometrical shapes. Granite and gneiss are examples for rocks.

Assignment 18.1

With the help of your teacher get a collection of minerals in your school and fill in the following grid.

Name of the mineral	Colour	Special features

Show the grid to your teacher.

18.2 Kinds of rocks and minerals

You have learnt about the structure of the earth in Unit 08. The outermost surface of the earth which is called crust is made up of rocks.

Types of rocks

Rocks can be divided into three categories according to the way they had been naturally formed on the earth.

- Igneous rocks
- Sedimentary rocks
- Metamorphic rocks

Igneous rocks

About 30 km below the earth's crust, the temperature is more than 5000 °C. Because of this high temperature, the rocks get molted and exist in liquid form. This liquid form of rocks is called magma. During a volcanic eruption magma flows out. This magma is called "lava". Lava gets cool and solidifies to form igneous rocks. Igneous rocks are hard. Granite and Basalt are examples for igneous rocks.

Figure 18.3 a ▲ Flow of lava during a volcanic eruption

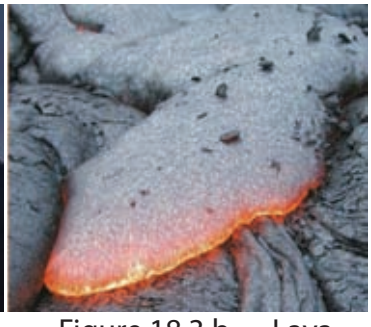


Figure 18.3 b ▲ Lava solidifies forming rocks

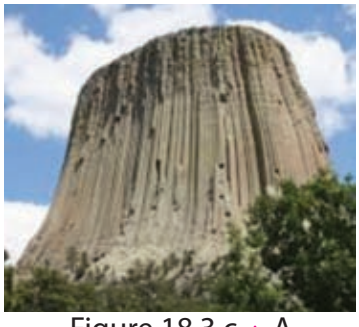


Figure 18.3 c ▲ A mountain of Basalt

Sedimentary rocks

Sun light, rain, and wind affect rocks and they break into small pieces. This process is called rock weathering. The rain and wind carry these pieces of rocks to other places and they settle on land, in rivers or sea as layers. Many other things get deposited on these layers. Because of the weight of the upper layers, the lower layers get tighten and the sedimentary rocks are formed.

e.g. :-

- Mudstone
- Conglomerate
- Siltstone
- Sandstone

Figure 18.4 ▲ Sandstone

Figure 18.5 ▲ Limestone

Sedimentary rocks are not as hard as igneous rocks. The skeletons of marine animals such as oyster deposit on bottom of the sea. These get subjected to pressure and limestone is made. Limestone is also a sedimentary rock.

Metamorphic rocks

Because of many reasons such as earthquakes igneous rocks and sedimentary rocks may deposit deep down the earth. These igneous and sedimentary rocks get subjected to extreme pressure and temperature and turn into metamorphic rocks.

e.g. :-

- Limestone which is a sedimentary rock undergoes metamorphism and marble is formed.
- Granite, an igneous rock undergoes metamorphism and gneiss rock is formed.

Figure 18.6 ▲ shist rock

The figure shows a metamorphic rock called "shist". An igneous rock has undergone metamorphism to form the shist. The change of the layers is an evidence for it.

Types of minerals

A lot of types of minerals can be found in Sri Lanka. The following figure shows some minerals.

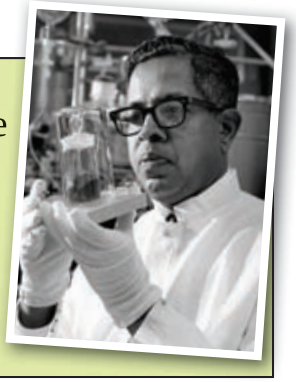
Figure 18.7 ▲ A collection of minerals

e.g. :- 1. Feldspar 2. Dolomite
3. Quartz 4. Ilmenite
5. Mica 6. Graphite

Assignment 18.2

Collect some rocks and minerals. Compare them with the collection of rocks and minerals in your school. Name them and show the collection to your teacher

For extra knowledge



There are rocks not only on earth but also on the moon and on the planets such as Mars and Venus.
The Sri Lankan scientist Dr.Siril Ponnamperuma was the person in charge in checking the rocks and soil brought from the moon during the space voyages of Apollo.

18.3 Rock weathering

When the earth is drilled at one point you will find that it is difficult to drill further because of a rock. It is the bedrock. Therefore, we can imagine that this rock has participated in creating soil.

Due to many reasons the rocks on earth break into pieces and form soil. This process is known as **rock weathering**.

Rock weathering occurs in three ways.

- Physical/mechanical weathering
- Chemical weathering
- Biological weathering

Physical/mechanical weathering

Physical weathering is the process of breaking the rocks into small pieces due to physical factors like heat, wind and flowing water. Physical weathering occurs in many ways.

During the daytime rocks get heated because of the heat of the sunlight and during the night time they get cooled. Also, sudden rains will cool down these heated rocks. Rocks break into pieces because of this heating and cooling process. Let us do Activity 18.2 to understand it.

Activity 18.2

You will need :- A glass marble, forceps, a burner, a container with water

Method :-

- Use the forceps and heat the glass marble.
- When it gets heated put it into the water basin.
- Take out the marble and check it.

You will see that the marble has been cracked.

Because of heating and cooling minerals in rocks get expanded and contracted. These expansions and contractions do not happen in to a same extent. Therefore, the pieces in the rock get loosen and removed.

When water flows through rocks they get weathered. Beacuse of this, the rough edges of stones in flowing water streams are softened and shaped.
Also, when sand which flows with wind hits the rocks, they get weathered.

There might be water inside the cavities of rocks. In countries where the atmospheric temperature is less than the freezing point 0 °C, this water turns into ice. Then the volume increases and rocks can break into pieces.

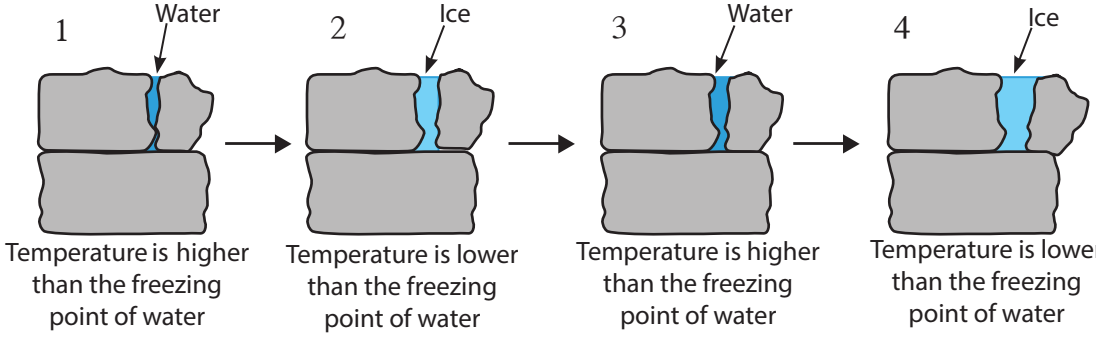


Figure 18.8 ▲ Rocks breaking due to water turning into ice

Chemical weathering

The chemicals in the environment cause rock weathering. Let us do Activity 18.3 to find out about it.

Activity 18.3

Test whether acids cause rock weathering

You will need :- A limestone, vinegar, a glass container

Method :-

- Fill the glass container with vinegar.
- Put the piece of limestone into that container.
- Record your observations.

You will see that the piece of limestone in the container with vinegar dissolves emitting air bubbles.

The conclusion is, limestone got weathered because of acids.

Chemical weathering is the transformation of rocks into other forms by reacting with water, acids and oxygen.

When carbondioxide dissolves in water it becomes acidic. At present the percentage of sulphur dioxide in atmosphere has been increased. When **sulphur dioxide** dissolves in water it becomes very acidic. Rocks get weathered when they react with acidic rain water.

Biological rock weathering

Rocks get weathered because of plant and animal activities.

When a root of a tree enters inside an opening of a rock it grows bigger and bigger and the rock can get cracked.

a b

Figure 18.9 ▲ Rock weathering by a plant root

Activity 18.4

Observing how a rock weathers naturally

Method :-

- Find a big rock near your house or school.
- Find a place where a lichen can be seen on it.
- Check the texture of things near that lichen (check with your fingertips) once in two weeks for about six months.
- Observe them with a hand lens.

Figure 18.10 ▲ Lichen on a rock

With time you can observe that the substances tested have small rock particles. Thus, you can conclude that the rock is weathered.

On big rocks you can see white and light green patches which are called lichens. Lichens are a combination of algae and fungus. The chemicals and acids produced by lichens are also reasons for rock weathering.

Man uses different methods to break rocks. This is another reason for rock weathering. Due to thudding of hoofs and horn fighting, rock weathering occurs.

The soil on the earth's crust is made of these physical, chemical and biological weathering of rocks.

18.4 Rock cycle

Continuous process, in which the three types of rocks are created, changing from one form to another is known as the rock cycle.

The steps of the rock cycle are given below,

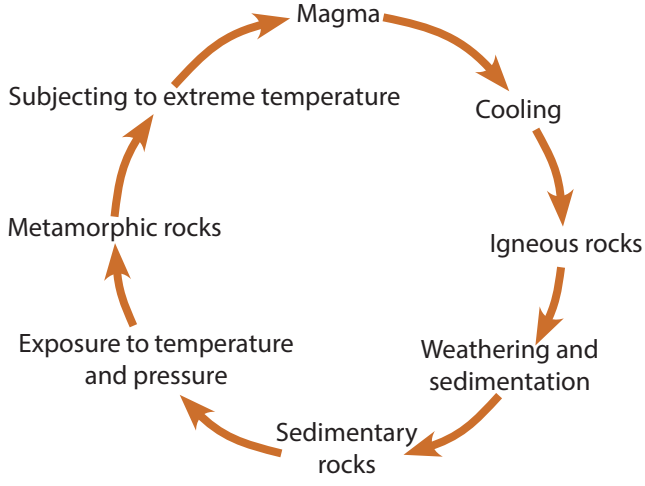
1) Magma, released from volcanic eruptions gets cool and igneous rocks are formed.

2) Igneous rocks weather and get deposit in many places of the earth to form sedimentary rocks.

3) The sedimentary rocks go deep down the earth because of earthquakes and they become metamorphic rocks.

4) Metamorphic and igneous rocks are subjected to extreme temperature and turn into magma.

Following is the summary of the rock cycle



A picture depicting the rock cycle is given below.

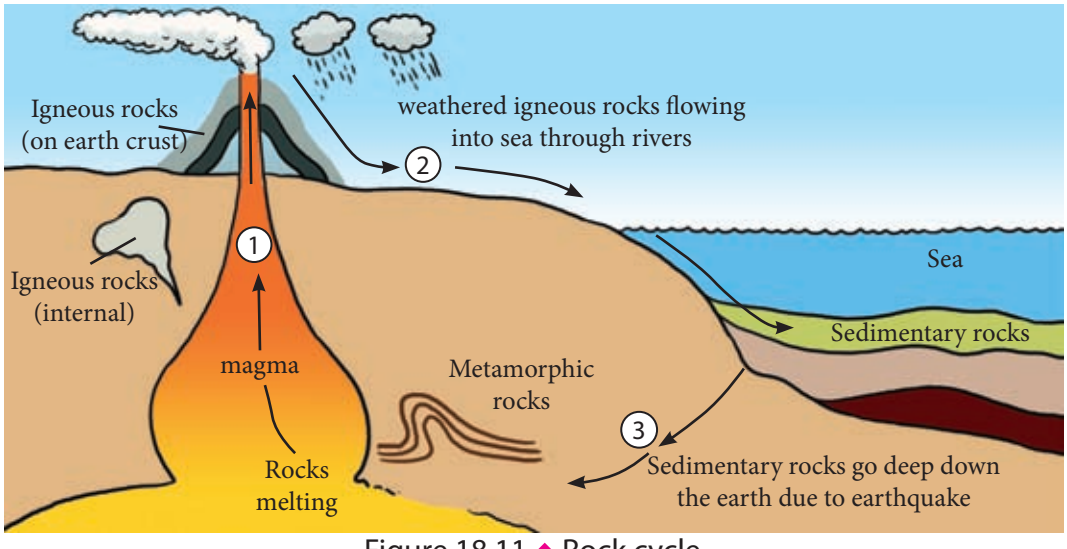


Figure 18.11 ▲ Rock cycle

It takes millions of years for a rock cycle to get completed.

Figure 18.12 explains more about the rock cycle.

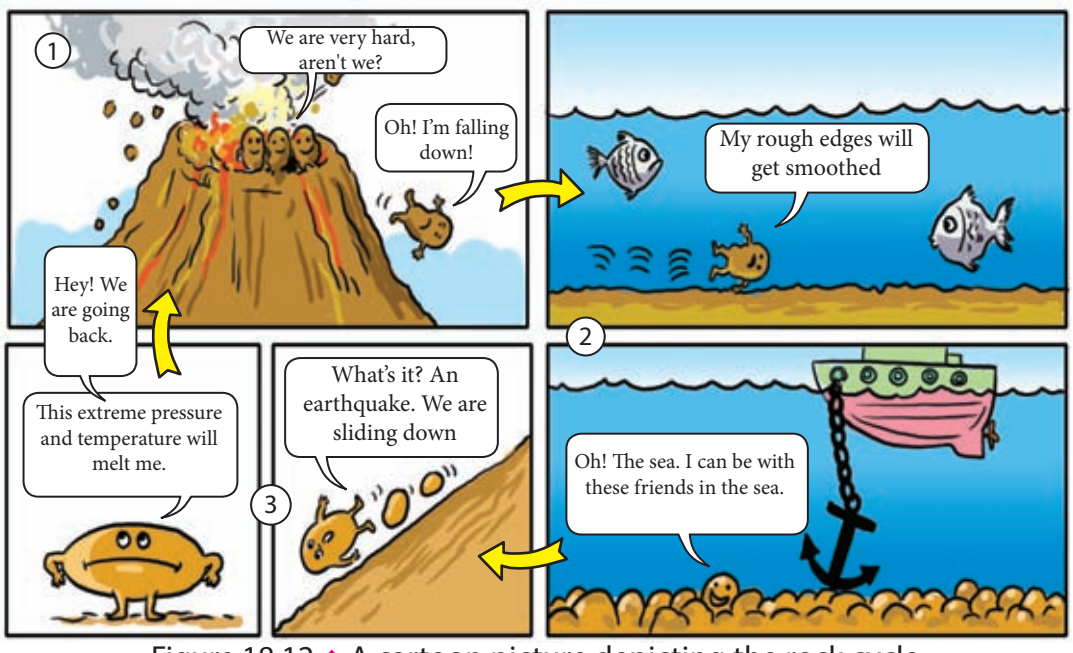


Figure 18.12 ▲ A cartoon picture depicting the rock cycle

Assignment 18.3

Making a model which depict the rock cycle

Create a model of a volcano using clay. Use paint and saw dust and make the outflaw of lava and creation of igneous rock. After making it, use gravel, sand and clay to represent the formation of soil through rock weathering from below the igneous rocks.

Sustainable usage of rocks and minerals

Rocks and minerals are very valuable resources of a country. Therefore, minerals and rocks should be sustainably utilized in a clever and environmental friendly manner. So, that the future generations may use them too.

There are a lot of minerals that can be found naturally in Sri Lanka.

Table 18.1 shows some minerals that can be found in Sri Lanka.

Table 18.1 ▼ Minerals that can be found in Sri Lanka

Mineral	Areas it can be found	Uses
Apatite	Eppawala	Produce Phosphate manure
Dolomite	Kandy, Matale, Badulla, Habarana, Rathnapura	Produce lime Produce manure
Feldspar	Koslanda, Thalagoda	For ceramic industry Produce glass
Ilemenite	Pulmude	Produce paint To get Titanium
Graphite	Bogala, Kahatagaha, Kolonna	Produce pencils, crucibles and lubricants
Mica	Wariyapola, Haldummulla, Madampe	For electric and electronic equipment
Kaolin	Boralasgamuwa, Mitiyagoda	For ceramic industry

Some minerals are named by Sri Lankan names.

For extra knowledge

Ekanite mineral is named by the name of Sri Lankan scientist F.L.D. Ekanayake.

Exporting minerals brings a lot of foreign exchange to our country. But, somehow if we are able to use these minerals as raw materials to produce different products and exporting those products may bring more foreign exchange to the country.

Rocks and minerals are non-renewable resources. Therefore, it is our responsibility to use them very carefully and save for future generations.

Assignment 18.4

Prepare an article about the minerals that can be found in Sri Lanka and their uses. Exhibit it on your wallpaper.

Summary

- Minerals are formed with a single components while rocks are made of several components.
- Rocks can be categorized into three groups as igneous rocks, sedimentary rocks and metamorphic rocks.
- Soil is formed from physical, chemical and biological weathering of rocks.
- The process in which three types of rocks changing from one form into other form for a very long time period is known as the rock cycle.
- As rocks and minerals are very valuable resources they have to be conserved.

Exercise

1. Select the correct answer.

I. Which factors cause rock weathering from the following?

(1) Physical factors (2) Biological factors

(3) Chemical factors (4) All of the above

II. Limestone is,

(1) A mineral (2) An igneous rock

(3) A sedimentary rock (4) A metamorphic rock

2. Match A with B

A	B
Rocks	made with minerals and some other materials. Parts of dead animals and plants can be contained.
Igneous rocks	has been changed from the original form.
Sedimentary rocks	made up with magma deep in the earth.
Metamorphic rocks	made up with one material.
Minerals	made up by tightening the rock pieces.

3. State whether the following statements are True (√) or False (x).

a) Granite is a mineral ( )

b) Fossils can be seen in sedimentary rocks. ( )

c) Rocks are found near the earth's crust. ( )

d) Granite is used to build stairs because granite not easily wear away. ( )

e) Extreme pressure and temperature cause the formation of metamorphic rocks. ( )

Technical Terms

Rocks	-	පාෂාණ	-	பாறைகள்
Minerals	-	ඛනිජ	-	கனியங்கள்
Weathering of rocks	-	පාෂාණ ජීරණය	-	பாறைகள் வானிலையாழிதல்
Physical weathering	-	භෞතික ජීරණය	-	பௌதிக வானிலையாலழிதல
Chemical weathering	-	රසායනික ජීරණය	-	இரசாயன வானிலையாலழிதல்
Rock cycle	-	පාෂාණ චක්‍රය	-	பாறை வட்டம்
Crystals	-	ස්ඵටික	-	பளிங்குகள்
Acid rain	-	අම්ල වර්ෂාව	-	அமிலமழை