

# Rocks and Minerals



# OVERVIEW OF THE COURSE

- Definition of rocks
- Types of rocks
  - Igneous rock
  - Sedimentary rock
  - Metamorphic rock
- Rock Cycle
- Steps of rock Cycle
- Minerals
- Hardness Scale
- Types of Minerals
- Uses of Minerals

Mineral Exploration



# Rocks

- Any material that makes up a large, natural, continuous part of Earth's crust is called a rock. Rock is a solid combination of one or more minerals found in the earth's crust.
- Some kinds of rock such as limestone (calcium carbonate, or  $\text{CaCO}_3$ ) and quartzite contain only one mineral.
- Most rocks consist of two or more minerals. For example, granite is a mixture of mica, feldspar, and quartz crystals.
- Rocks are mixtures of their component minerals
- There are 3 types of rocks:
  - Igneous rock
  - Sedimentary rock



## Igneous rock

Rocks formed by solidification of molten magma either beneath (intrusive igneous rock) or at (extrusive igneous rocks) the Earth's surface.

- Igneous rocks are roughly hard rocks and water percolates with great difficulty along joints.
- Generally, igneous rocks are granular or crystalline rock but there are much variations in the size, form and texture of grains because these properties largely depend upon the rate and place of cooling and solidification of magmas or lavas.
- Igneous rocks do not have strata like sedimentary rock
- Igneous rocks do not contain fossils
- Igneous rocks are mostly associated with the volcanic activities and thus they are also known as volcanic rocks.

## IGNEOUS ROCKS



Andesite



Basalt



Diorite



Gabbro



Granite



Obsidian



Pegmatite



Peridotite



Pumice



Rhyolite



Scoria



Tuff



## Sedimentary rock

Rock that forms from the accumulated products of erosion and in some cases from the compacted shells, skeletons, and other remains of dead organisms. e.g., sandstone, limestone, lignite etc.

- ❖ Sedimentary rocks are formed of sediments derived from older rocks, plant and animal remains, so these rocks contain fossils of plants and animals.
- ❖ Sedimentary rocks are formed over the largest surface area of the globe. It is believed that about 75% of the surface area of the globe is covered by sedimentary rocks. Whereas metamorphic and igneous rocks cover the remaining 25% area. In spite of their largest coverage, the sedimentary rocks constitute only 5 % of the composition of the crust whereas 95% of the crust is composed of igneous and metamorphic rocks.

This type of rock contains several layers or strata



## **Sedimentary Rocks**



**Sandstone**



**Limestone**



**Shale**



**Conglomerate**



**Gypsum**





## Metamorphic rock

Metamorphic rocks include rocks that have been changed either in form or composition without disintegration.

Rock that forms from igneous, sedimentary and/or other metamorphic rocks due to high pressure, high temperature, chemically active fluids, or a combination of these agents





# Rock Cycle

- The interaction of processes that changes rocks of Earth from one type to another is called the rock cycle.
- The rock cycle depends on the tectonic cycle for energy and on hydrological cycle for water.

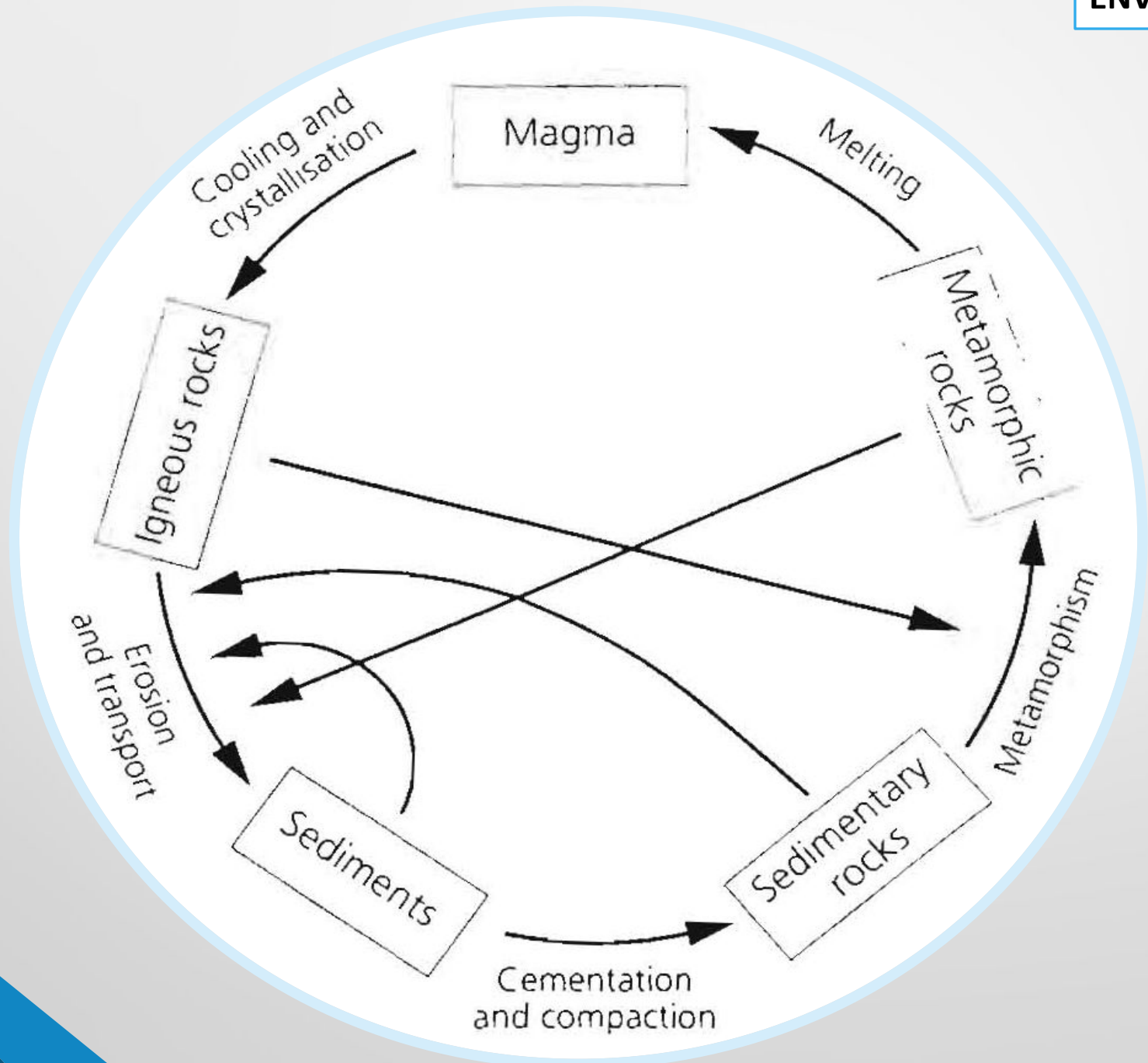


# Steps of rock cycle

- The ultimate source of all rocks on the Earth's surface is magma, hence the igneous rocks are described as primary rocks.
- Some igneous rocks are weathered and eventually buried and converted into sedimentary (secondary) rocks.
- Other igneous rocks are transformed into metamorphic (tertiary) rocks by heat, pressure and chemical change.
- Sedimentary and metamorphic rocks at the edges of the tectonic plates are sub ducted back into the mantle, where they are melted and can eventually be released as magma and form new igneous rocks.
- Sedimentary rocks can be transformed into metamorphic rocks by heat, pressure and chemical change.

Metamorphic rocks can be weathered, buried and converted into sedimentary rocks.





**Magma****Cooling & Crystallization****Igneous  
Rock****Erosion & Deposition****Melting****Temperature &  
Pressure****Melting****Sedimentary  
Rocks****Erosion & Deposition****Temperature & Pressure****Metamorphic  
Rocks****Rock Cycle**

# Minerals

- ❖ Mineral is a naturally occurring homogeneous solid with definite chemical composition and a highly ordered atomic arrangement, it is usually formed by inorganic processes. There are several thousand known mineral species, about 100 of which constitute the major mineral components of rocks; these are so called rock forming minerals
- ❖ Any material that makes up a large, natural, continuous part of Earth's crust is called a rock.



- Rocks are mixtures of their component minerals.
- The origin and distribution of mineral resources is intimately related to the history of the biosphere and to the geological cycle.
- The availability of mineral resources is one of the measures of the wealth of the society. Modern technological civilization would not be possible without the exploration of mineral resources.
- Minerals are the basic building blocks from which the Earth's crust is made & the main ingredients of all rocks, deposits & soils.

There are many different rock-forming minerals & each has

- a definite chemical composition & crystal structure
- characteristic physical properties (e.g. color, hardness, density)





# Hardness Scale

The Mohs **scale** of mineral **hardness** characterizes the scratch resistance of various minerals through the ability of a harder material to scratch a softer material.

Mineral		Hardness
	Talc	1
	Gypsum	2
	Calcite	3
	Fluorite	4
	Apatite	5
	Feldspar	6
	Quartz	7
	Topaz	8
	Corundum	9
	Diamond	



# Types of minerals

## Metallic Minerals:

- These are generally associated with igneous rocks.
- They are usually hard and have shines or luster of their own.
- They are flexible.
- When hit, they do not get broken.

Example:

- Ferrous: iron
- Non ferrous: copper, tin, lead, bauxite
- Precious metals: gold, silver



# Types of minerals

## Non metallic minerals:

- These are generally associated with sedimentary rocks.
- They are not so hard and have no shine or luster of their own.
- They are not flexible.
- When hit, they may get broken into pieces.

Examples - clay, marble



## Use of various minerals

- ❑ Electric wire, cables, batteries: Copper, Lead
- ❑ Chemical industries and Fertilizers for agriculture: sulphur, potash, nitrates, phosphates
- ❑ Jewellery: gold, silver, diamond
- ❑ Industrial use of cutting: diamond



# Mineral Exploration

- **Mineral exploration** is the process of finding ore (commercially viable concentrations of minerals) to collect by mining.





# Impacts of Mineral Exploration

The availability of mineral resources is one of the measures of the wealth of the society. Modern technological civilization would not be possible without the exploitation of mineral resources.

## Environmental impacts

- Occur different types of pollution like water, soil, air and noise pollution
- Effect hydrological conditions
- Climate change
- Change topography and rock type

## Social impacts

- Rapid population growth at mining area create housing, water supply, sewage and solid waste disposal problems.



**THANK YOU**