

Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (First Year)

Subject: Geology

Paper Code: GEG- 101

Paper Title: Minerals and Rocks

Unit: 3

Module Name: Metamorphic rocks- Agents of Metamorphism

Module No: 21

Name of the Presenter: Dr. Ankeeta Amonkar

Notes

Metamorphic rocks- Metamorphism is the solid-state recrystallization of pre-existing rocks due to changes in physical and chemical conditions, primarily heat, pressure, and the introduction of chemically active fluids. Mineralogical, chemical as well as crystallographic changes can occur during this process. When a bedrock in the earth's crust is subjected to greatly increased pressure, very high temperatures, or chemical action within the earth, it may change the composition of rock in many respects while still remaining in the form of solid bedrock. When metamorphism of bedrock takes place over a large area, it is called as **Regional Metamorphism** and is usually caused by movement of the earth's crust. When metamorphism affects only a small area it is called **Local Metamorphism**.

The main factors that control metamorphic processes are:

- The chemical composition of the parent rock
- The temperature at which metamorphism takes place
- The pressure applied, and whether the pressure is equal in all directions or not
- The amount and type of fluid (mostly water) that is present during metamorphism

- The amount of time over which metamorphic conditions are sustained

Agents of Metamorphism

Metamorphism is caused by mainly one of these or all three agents

- ❖ The chemical active fluids (CAF)
- ❖ The temperature
- ❖ The pressure

The chemical active fluids (CAF)

Liquids, particularly water on and in the earth, are often effective agents of alteration of rock material, which is dissolved and subsequently crystallizes in new mineral combinations. Various gases and vapours, especially those which escape from molten magma into surrounding rocks, often bring about important chemical changes and re-arrangement of mineral matter in rocks.

Temperature

Heat is an important metamorphic agent. It renders liquids and gases much more active chemically. It helps to alter the composition of many minerals and thus to bring new ones into existence. A sedimentary rock mass may be metamorphosed by heat along the contact with a magma which is intrusive into it. A rock mass may be heated not only by a hot igneous body, but also by deep burial within the generally heated crust of the earth. Some heat may also result from friction between adjacent parts of the crust moving past one another.

Pressure

Pressure may be resolved into two kinds:

- (a) Lateral pressure

Lateral pressure is a very important agent in the metamorphism of igneous as well as sedimentary rocks. The crust of the earth is in many places subjected to tremendous stresses and compressive forces causing rocks to be bent, sheared, fractured and often locally

crumpled into mountain ranges. Mineral grains or rocks fragments may thus be crushed or flattened; rearrangement of minerals may take place and the rock structure and texture may be greatly changed.

(b) Downward pressure

- Downward pressure exerted upon deeply buried rocks, particularly sediments, aided by the heat of the earth's interior and often by water and other liquids.