Quadrant II – Transcript and Related Materials

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Notes

What are Sedimentary Rocks?

Sedimentary rocks are those, which have been derived from consolidation of sediments. They are composed mainly of fragments and particles which result from the weathering of pre-existing rock masses. The weathered materials are transported by water, wind or glaciers. Water is by far the main agent of transport and deposition of sediments, which may be carried either in suspension or solution.

They are deposited in a basin like lakes and more commonly in seas and oceans. In the case of marine deposits, remains of marine animals and plants also contribute to the mass accumulation on the seafloor. These sediments are then hardened by compaction and cementation.The finer sediments are compacted by the pressure of overlying sediments while the coarser grains are cemented by materials deposited in the interstices. The cementing material is called the **Matrix** and usually consists of calcium carbonate, clay or iron oxide.

This hardening of sediments produces sedimentary rocks. Sedimentary rocks constitute a relatively thin surface layer of the earth's crust, covering the underlying igneous and metamorphic rocks. It has been estimated that the sedimentary rocks make up about 5% of the crustal rocks but constitute 75% of all the rocks exposed at the earth's surface. Some

sedimentary rocks contain the fossil remains of past life, which tell us much about how the planet has evolved through its history.

Economic Importance

- Sedimentary rocks are the principle source of coal, oil and natural gas and much of iron and aluminium ores.
- They also store nearly all fresh underground water.
- They are source for cement and other natural building materials

What is weathering?

Weathering is defined as the mechanical fracturing or chemical decomposition of rocks in situ by natural agents at the surface of the earth.Under the influence of the various agents of denudation the minerals and rocks of the earth's crust tend to break up into finer and finer particles, and also partly to go into solution.

The breaking down is accomplished by the process of decomposition and disintegration. Both disintegration and decomposition may act side-by side and assist one another.

Types of Weathering

- Weathering processes may be divided into two types:
    - Physical / Mechanical Weathering
    - Chemical Weathering
    - Generally, these two processes operate side-by-side, one assisting the other.
- Which of these types predominates, as well as the rate of action depends upon the climate, relief and composition of rocks**.**

1) Physical / Mechanical Weathering

Mechanical weathering is also referred to as **disintegration**, which is a process by which rocks are reduced to smaller units by mechanical action of external agents. Rocks are

disintegrated by temperature changes, frost action and by the physical activity of plants and animals.

2) Chemical Weathering

Chemical weathering sometimes called **decomposition**, rock decay or rock rotting is a more complex process than mechanical weathering. Chemical weathering actually converts the original material into some new.

Chemical weathering involves a number of processes like Hydration, Oxidation, Hydrolysis and Carbonation

Disintegration and decomposition usually occur together, but one process is generally dominant. Decomposition is more active in moist, warm, low lying areas and disintegration occurs mainly in the drier, higher and colder regions of the earth's surface. The sum total of the results of decomposition and disintegration is known as **Weathering**. The products of weathering are boulders, cobbles, gravel, sand, silt and clays.

Erosion

Erosion is the geological process in which materials/ surface rocks are worn away and transported by natural forces such as wind or water. In weathering there is break down or dissolution of the rock, but does not involve movement. While in erosion – there is movement of the material.

Transportation

Sediments are transported by different agents in Four ways

- Suspended load
- Saltation load
- Traction load
- Solution

Detrital material i.e. material consisting mineral and rock fragments gets deposited when the agent of transportation has no enough energy for transportation to move it further.

For example, when a river flows into a lake or ocean it drops its load (sediment) as it gradually loses its speed. The first sediments to be dropped are the heavy gravels, which settle to the bottom in the shallow waters of the continental shelves nearest to the shore. Next to deposit is the sand and finally the silts and clays.

This separation of sediments by size due to change in the velocity of deposition is called as **assortment.** The effect is much the same when wind carrying sediments across a desert suddenly loses velocity. The loss of velocity creates a fall of energy and sediments drop to the desert floor. The deposition of material that has been carried along in solution takes place through a quite different process. This is the chemical or biochemical process of precipitation by which dissolved material is converted into a solid and separated from the liquid solvent.

Lithification and Diagenesis

When a sediment layer is deposited, it buries all previous layers deposited at the location, so that a sedimentary pile may become thousands of meters deep. Sediments buried several meters or more beneath the earth's surface retain heat (produced largely by the decay of radioactive elements) and are compressed by the accumulation of the overlying burden. They are also invaded by the circulating underground water, which carries dissolved ions. Together, the heat, pressure and the ions in water change the physical and chemical nature of both detrital and chemical sediments by a set of processes known as **diagenesis** sometimes this results in the conversion of loose sediments into solid sedimentary rock or referred to as **lithification.**

The effects of diagenesis are more extensive in some environments, than the other. However, the most visible effect is lithification. During lithification, the loose, soft and unconsolidated sediment grains are packed more tightly together; the water between the grains is squeezed out and binds the grain together. This is chiefly due to two processes.

(a) Compaction **(b) Cementation**

a. **Compaction:** Compaction is a diagenetic process by which the volume of the sediment is reduced by the application of pressure. As sediments accumulate, pressure

from the increased weight of the overlying material expels water and air from the spaces between deeply buried sediment grains and packs the grains more closely together. When fine muds particularly those composed of the clay minerals, are compacted, weak attractive forces between the grains cause them to adhere to each other, converting loose sediments into a more cohesive sedimentary rock.

(b) Cementation: It is a diagenetic process by which sediment binds gains together by materials originally dissolved during chemical weathering of pre-existing rocks. The cementing material, which acts as a bond and brings about compaction of sediment, is called as "**matrix**".

When these dissolved materials eventually precipitate from water circulating through sediment, they cement the sediment grains together. The most common cementing agents include calcium carbonate, silica and several iron compounds.