

CIVIL ENGINEERING MATERIALS

COURSE CODE: CE-116

LECTURE # 2



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STONES

- **Introduction**
- **Types of Stones**
- **Applications of Stones**
- **Characteristics of good building stones**
- **Artificial stones**



Introduction

- **Stone** is defined as “hard solid non-metallic mineral matter of which rock is made, especially used as a building material”
- **Rock** can be described as a large piece of **stone** that is difficult to be carried in the hand. While **stone** is just a small piece or pebble that can be carried in the hand.
- Use of stone in building construction is traditional in the areas where it occurs naturally in abundant amount.



Introduction

- Stone has been used in the construction of most of the important structures since prehistoric age. Most of the forts world over, the Taj Mahal of India, the famous pyramids of Egypt and the great wall of China are few examples.
- The conditions which govern the selection of stone for structural purposes are cost, fashion, ornamental value and durability.
- Stone as building material has gradually lost importance with the advent of cement and steel.



Introduction

- The strength of the structural elements built with stones also cannot be rationally analyzed.
- Other factors are transportation difficulties and dressing which consume a lot of time resulting in slow pace of construction.
- In hilly areas, stones are more abundantly available than other construction material, since it occurs naturally so stone masonry may become cheaper in hilly areas.



Introduction

- Stone makes an important source of aggregate (Coarse & fine) for concrete.
- Various types of rocks from which building stones are usually derived are granite, basalt, marble, slate, sandstone and limestone.



Rock

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- **Rock** is defined as “the solid mineral material forming part of earth crust, exposed on the surface or underlying the soil.
 - Almost all rocks have a definite chemical composition and are made up of minerals and organic matter.
 - Some of the rock-forming minerals are quartz, mica, dolomite, gypsum etc.
 - E.g. **Quartz** is composed of silicon and oxygen atoms (SiO_4)
 - Chemical composition of **Gypsum** is $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.



Classification of Rocks

- Rocks can be broadly classified into 3 groups:
- **a) Igneous Rocks**
- **b) Sedimentary Rocks**
- **c) Metamorphic Rocks**



Igneous Rocks

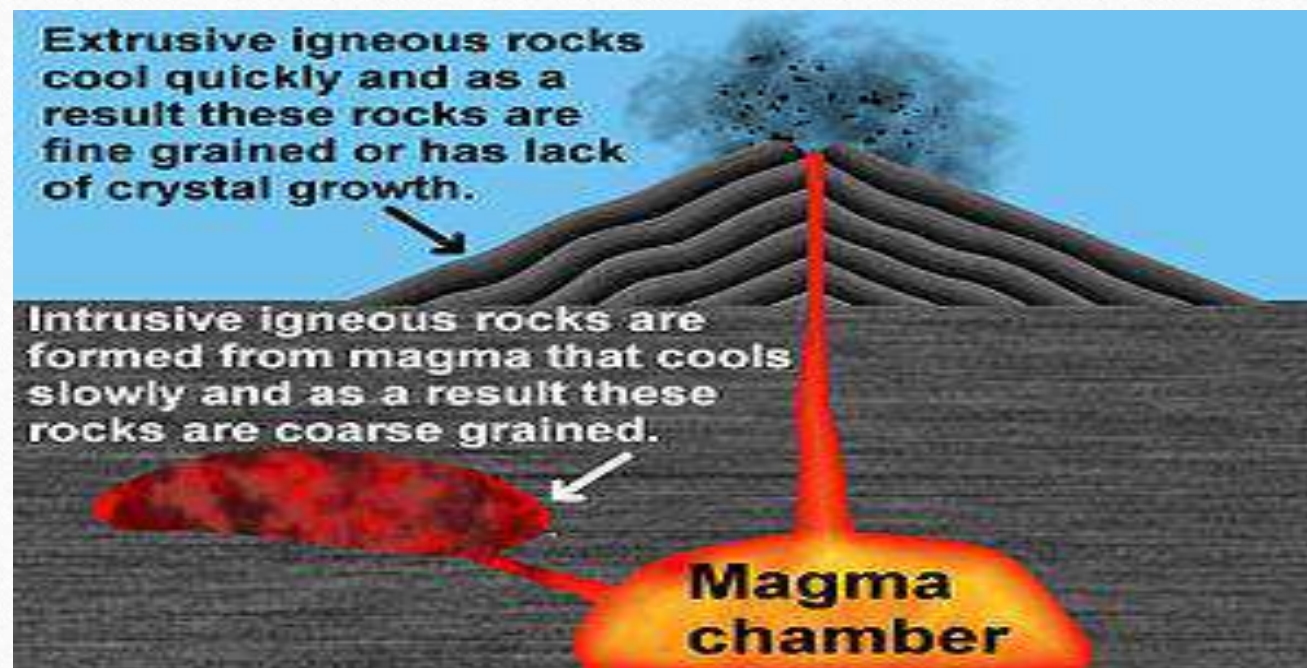
- **Igneous Rocks** are formed as a result of solidification of molten mass lying below or above the earth's surface.
- The inner layers of the earth are at a very high temperature causing the masses of silicates to melt known as **magma**.
- Magma is forced up as volcanic eruptions and spreads over the surface of earth where it solidifies forming **basalt** Rock.



Igneous Rocks

- If the magma solidifies below the earth's surface, the solid crystalline rock is termed as deep-seated plutonic rock. The examples are granite, and diorite.
- If the magma solidifies at a relatively shallow depth, the resultant rock possess grained crystalline structure, **Dolerite** is such a rock.
- The principal constituents of magma are quartz, mica and feldspar. The texture of the rock is greatly influenced by the rate of cooling of the magma.

Igneous Rocks



Igneous Rocks





Sedimentary Rocks

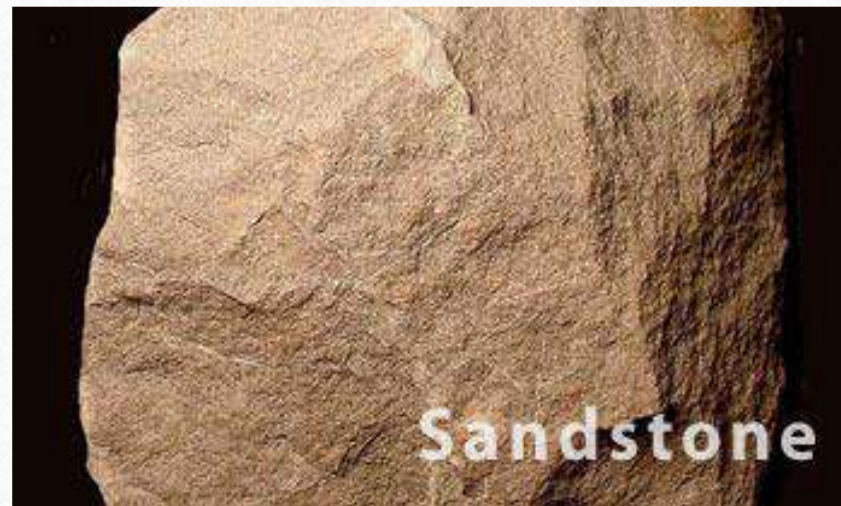
- **Sedimentary rocks** are types of **rock** that are formed by the accumulation or deposition of small particles and subsequent cementation of mineral or organic particles on the floor of oceans or other bodies of water at the earth's surface
- The properties of the sedimentary rocks vary considerably depending upon the nature of the sediment and type of bond between the sediment and grains.
- These rocks are comparatively soft and can be split easily.
- Examples are **gypsum, anhydrite, magnetite and dolomite.**



Sedimentary Rocks

- Sedimentary rocks resulting from the accumulation of plants or animals remains are **limestone, shale, chalk, diatomite and Tripoli.**
- Rocks resulting from the deterioration of massive magmatic or sedimentary rocks (fragmental rocks) are **sandstone** and **gravel** etc.

Sedimentary Rocks





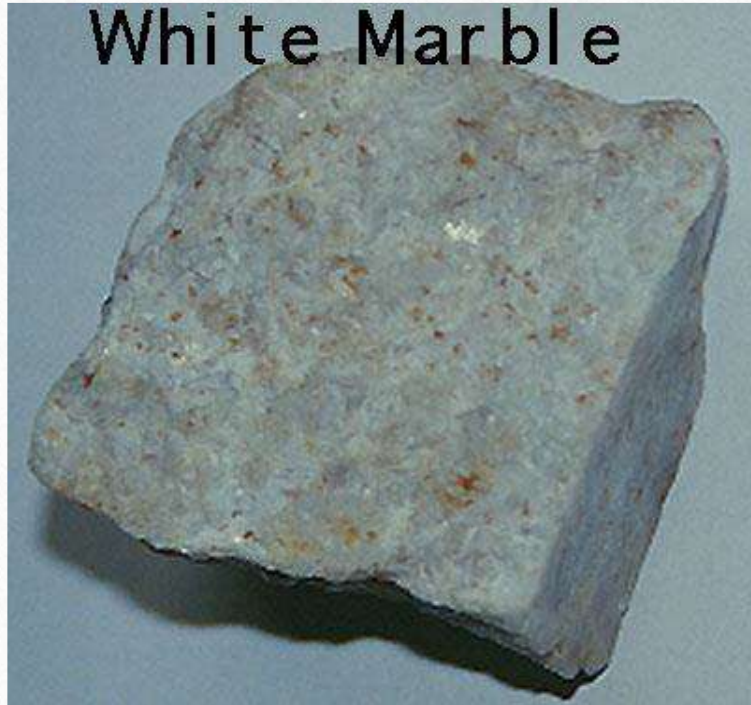
Metamorphic Rocks

- **Metamorphic rocks** are **rocks** that have become changed by intense heat or pressure while forming. In the very hot and pressured conditions deep inside the earth's crust, both sedimentary and igneous **rocks** can be changed into **metamorphic rock**.

S.No	Original Rock	Metamorphic Rock
1	Granite	Gneiss
2	Sandstone	Quartzite
3	Limestone	Marble
4	Shale	Slate
5	Dolomite	Marble
6	Mudstone	Slate

Metamorphic Rocks

White Marble





Application of Rocks / Stones

- Building foundations
- Gravity Retaining walls
- Flood Protection walls
- Construction of dams, barrages, etc.
- Crushed (powdered form): used as artificial sand.



Application of Rocks / Stones

- Raw material for manufacturing of cement.
- Used for construction of road and railway tracks.
- Used for ornamental & decorative works in buildings.
- Can be used as parts of building, such as lintels and arches, and as thin slabs for building roofing.
- Slope Protection/Stone Pitching

Applications



Building foundations



Retaining wall



Gabion wall
Flood Protection

Applications



Road Base, sub-Base and
wearing coarse Construction



Railway Track
Construction



Slope Protection



Characteristics of Good Building Stones

- Appearance and colour
- Strength
- Weight
- Hardness
- Toughness
- Porosity and Absorption
- Weathering
- Workability
- Fire resistant
- Specific Gravity
- Durability
- Disintegration
- Reliability



Artificial Stones

- **Artificial stone** also called casted stone, is constructed from cement, sand , and natural aggregate such as crushed stone. It is possible to provide certain surface textures to artificial stones.
- Sometimes, specific pigments are added to achieve certain colour. The addition of pigments shall not exceed 15% by volume.
- Artificial stone can be cast into complicated forms and various sizes can be manufactured. It can also be reinforced to increase strength.



Types of Artificial Stones

RANSOM STONE

It is also called chemical stone which is manufactured by blending silica soda with cement to provide fancy and ornamental flooring.



Types of Artificial Stones

CONCRETE BLOCK

Concrete blocks are used for the construction of steps, window sills and piers etc. Usually it is casted at the construction site.



Types of Artificial Stones

ARTIFICIAL MARBLE

Artificial marble is made of natural **marble** or granite crushed stone mixed with cement, gypsum and polyester resin. After molding, It is then grinded and polished.



THANK YOU