Stone

Lecture - 1

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Content

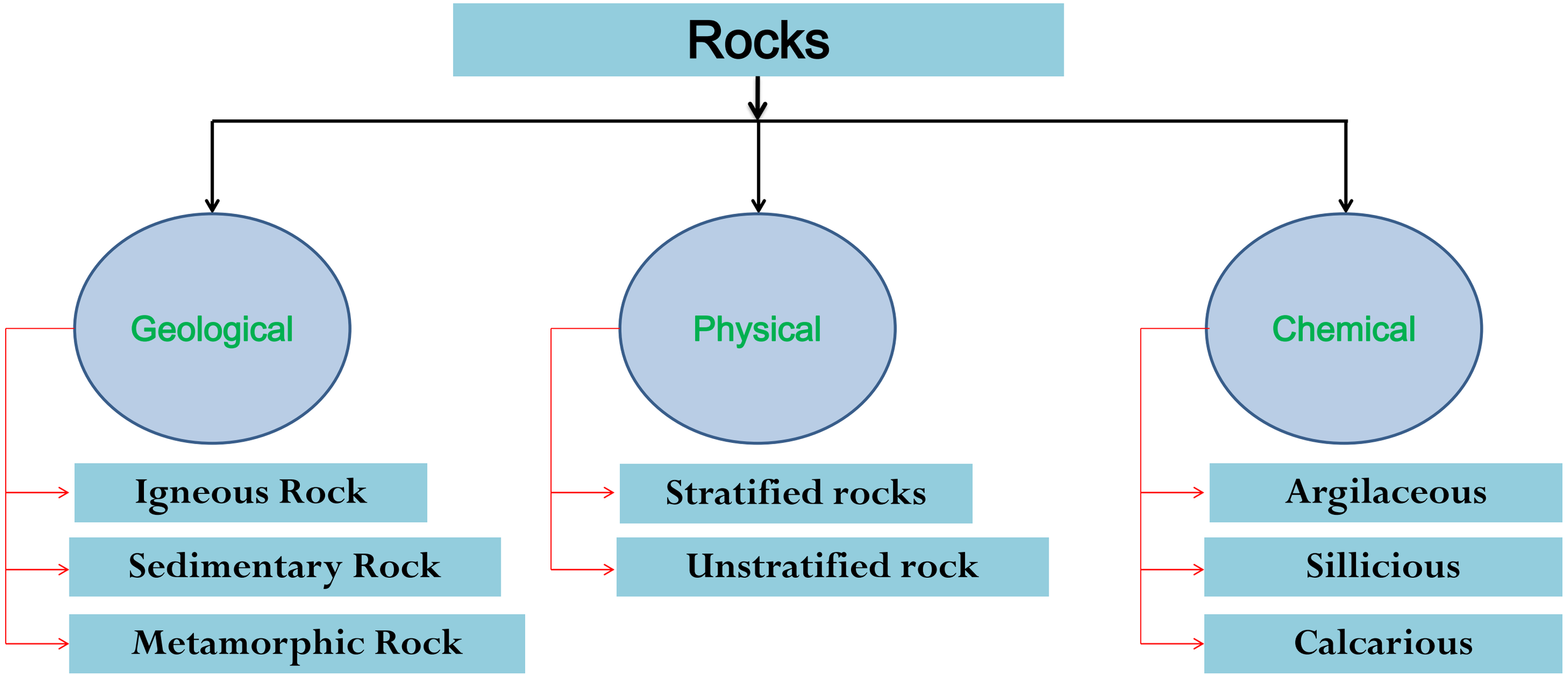
Introduction

- Stone has been defined as the natural, hard substance formed from minerals and earth material which are present in rocks.
- Rock may be defined as the portion of the earth's crust having no definite shape and structure. 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, felspar, mica, dolomite, etc.
- The various types of rocks from which building stones are usually derived are granite, basalt, trap, marble, slate, sandstone and limestone.
- 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 but a few examples.

Introduction

- Stone has also been extensively used in almost all the elements of building structures, as load carrying units as well as for enhancing the beauty and elegance of the structure. As building material stone has gradually lost importance with the advent of cement and steel. Secondly, the strength of the structural elements built with stones cannot be rationally analysed. Other major factors in overshadowing its use are the difficulties in its transportation and dressing which consume a lot of time resulting in slow pace of construction.

Classification of Rocks



Classification of Rocks

On the basis of Geological Origin

Igneous Rock

These are formed by cooling of the molten magma or lava at the surface of the crest (trap and basalt)or deep beneath the crest. The classification of the igneous rock can be done on the following bases;

Type	% of Silica	Example
Acid Rock	70-80	Granite, rhyolite
Intermediate Rocks	60-70	Syenite, andesite
Basic Rocks	45-60	Gabbro or some varieties of dolerite
Ultra-basic Rocks	30-45	peridotite and some varieties of basalt & dolerite

Classification of Rocks

On the basis of Geological Origin

Sedimentary Rock

The various weathering agencies, e.g. rain, sun, air, frost, etc. break up the surface of earth. Rain water carries down these broken pieces to the rivers. As the rivers descend down to the plains, the velocity decreases gradually and the sediments (disintegrated rock pieces, sand, silt, clay, debris, etc.) in the water settle. Due to the seasonal variation, sedimentation takes place in layers. With time, the sediments get consolidated in horizontal beds due to the pressure exerted by overlying material.

The properties of the sedimentary rocks vary considerably depending upon the nature of the sediment and type of bond between the sediment and grains. Usually, the rocks are well stratified and show well defined bedding planes. The rocks are soft and can be easily split up along the bedding as well as normal planes. The examples of sedimentary rocks resulting from the precipitation of salts in drying water basin (chemical deposits) are gypsum, anhydrite, magnesite, dolomite, lime tufas. Sedimentary rocks resulting from the accumulation of plant or animal remains (organogenous rocks) are limestone, shale, chalk, diatomite and tripoli. The examples of rocks resulting from the deterioration of massive magmatic or sedimentary rocks (fragmental rocks) are sandstone, sand, gravel, carbonate conglomerate and breccia.

Classification of Rocks

On the basis of Geological Origin

Metamorphic Rock

These are are formed from igneous or sedimentary rocks as a result of the action of the earth movements, temperature changes, liquid pressures, etc. The resultant mass may have a foliated structure, e.g. slate, gneiss, schist and phyallite or non-foliated structure, e.g. marble, quartzite and serpentine. Examples of transformation of some of the rocks to metamorphic rocks are given in Table

S. No.	Original Rock	Metamorphic Rock
1	Granite	Gneiss
2	Synite	Gneiss
3	Sandstone	Quartzite
4	Limestone	Marble, Schist
5	Mari	Msrble
6	Shale	Slate, Schist, Phyallite
7	Mudstone	Slate
8	Dolomite	Msrble
9	Dolerite, basalt	Schist
10	Felsite, tuff	Schist, Slate
11	Conglomerate	Gneiss, Schist

Classification of Rocks

On the basis of Physical Classification

Stratified Rock

These show distinct layers along which the rocks can be split. The examples are sandstone, limestone, shale, slate, marble, etc.

Unstratified Rock

This do not show any stratification and cannot be easily split into thin layers.The examples of such rocks are granite, basalt, trap, etc.

Foliated Rock

These have a tendency to split up only in a definite direction. Most of the metamorphic rocks have a foliated structure, except for quartzite and marble which have granulose structure.

Classification of Rocks

On the basis of Chemical Characteristics

Argillaceous

The principal constituent is clay. The rocks are hard and brittle, e.g. slate, laterite, etc.

Silicious

The principal constituent is silica (SiO_2), i.e. sand. The rocks are very hard and durable, e.g. granite, basalt, trap, quartzite, gneiss, syenite, etc.

Calcarious

The principal constituent is lime, e.g. limestone, marble, dolomite, etc.

Characteristics of Good Building Stone

- Appearance- For face work it should have fine, compact texture; light-coloured stone is preferred as dark colours are likely to fade out in due course of time.
- Structure - A broken stone should not be dull in appearance and should have uniform texture free from cavities, cracks, and patches of loose or soft material. Stratifications should not be visible to naked eye.
- Strength - A stone should be strong and durable to withstand the disintegrating action of weather. Compressive strength of building stones in practice range between 60 to 200 N/mm^2.
- Weight - It is an indication of the porosity and density. For stability of structures such as dams. retaining walls, etc. heavier stones are required, whereas for arches, vaults, domes, etc. light stones may be the choice.

Characteristics of Good Building Stone

- Hardness - This property is important for floors, pavements, aprons of bridges, etc. The hardness is determined by the Mohs scale
- Toughness - The measure of impact that a stone can withstand is defined as toughness. The stone used should be tough when vibratory or moving loads are anticipated.
- Porosity and Absorption - Porosity depends on the mineral constituents, cooling time and structural formation. A porous stone disintegrates as the absorbed rain water freezes, expands, and causes cracking.
- Seasoning - The stone should be well seasoned
- Weathering - The resistance of stone against the wear and tear due to natural agencies should be high.

Characteristics of Good Building Stone

- Workability- Stone should be workable so that cutting, dressing and bringing it out in the required shape and size may not be uneconomical.
- Fire Resistance - Stones should be free from calcium corbonate, oxides of iron, and minerals having different coefficients of thermal expansion. Igneous rock show marked disintegration principally because of quartz which disintegrates into small particles at a temperature of about 575°C. Limestone, however, can withstand a little higher temperature; i.e. up to 800°C after which they disintegrate.
- Specific Gravity - The specific gravity of most of the stones lies between 2.3 to 2.5.

Summary

- ✓ Introduction of Rock
- ✓ Types of Rock
- ✓ Characteristics of Building Stone

THANK YOU