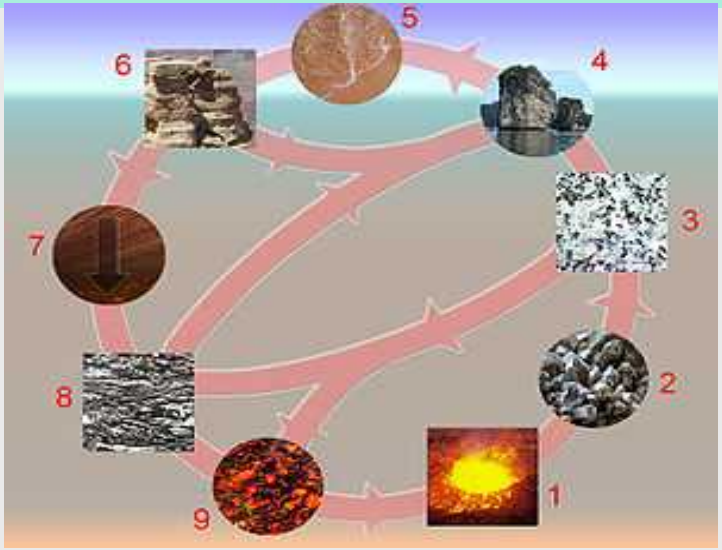
Lecture # 4



Geological Cycle Rock Formation and Types of Rock

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Outlines of the Presentation

1. Geological Cycle: Rock formation
2. Types of Rocks

The Geological Cycle: Rock formation

Geological cycle includes many processes acting simultaneously. The most important of these begin with molten magma from within the earth forming into rock, then continue with rocks being broken down into soil, and that soil being converted back into rock. It is sometimes called as Rock cycle as well.

The **rock cycle** is a fundamental concept in geology that describes the dynamic transitions through geologic time among the three main rock types:

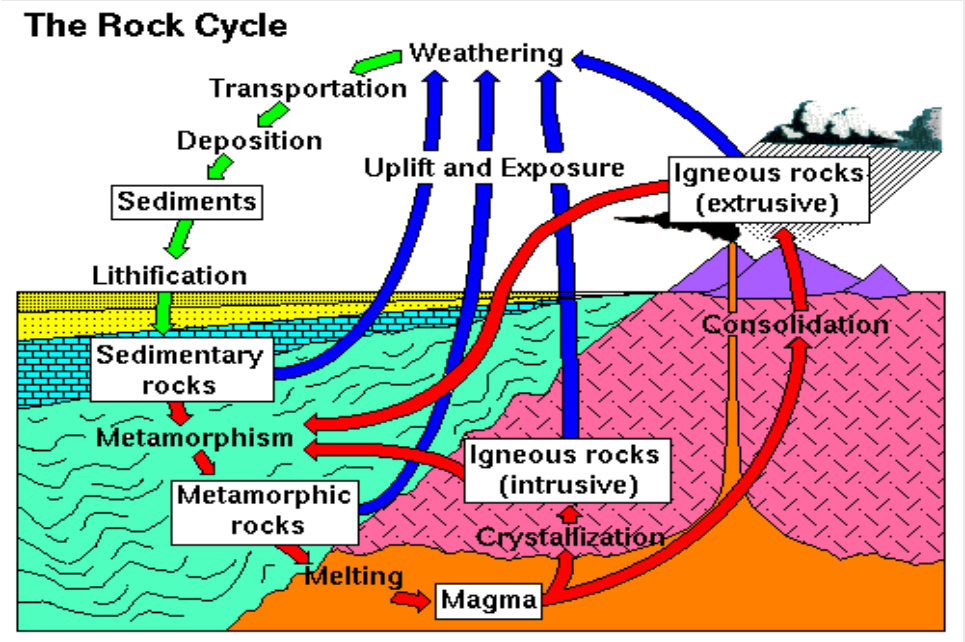
- Sedimentary,
- Metamorphic, and
- Igneous.

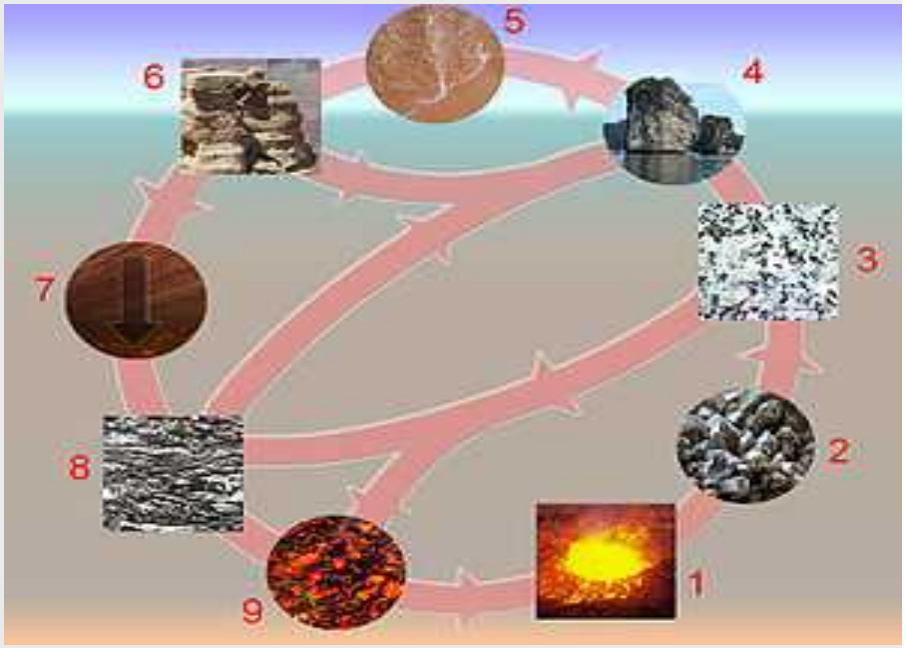
The Geological Cycle: Rock formation

Rocks are classified according to their place in the geologic cycle.

The three major categories are:

1. Igneous,
2. Sedimentary and
3. Metamorphic





A diagram of the rock cycle. Legend:
1 = magma;
2 = crystallization (freezing of rock);
3 = igneous rocks;
4 = erosion;
5 = sedimentation;
6 = sediments & sedimentary rocks;
7 = tectonic burial & metamorphism;
8 = metamorphic rocks;
9 = melting.

Types of Rocks

Igneous Rock: **Igneous rock** (derived from the Latin word "Igneus" meaning of fire, from "Ignis" meaning fire) is one of the three main rock types (the others being sedimentary and metamorphic rock).

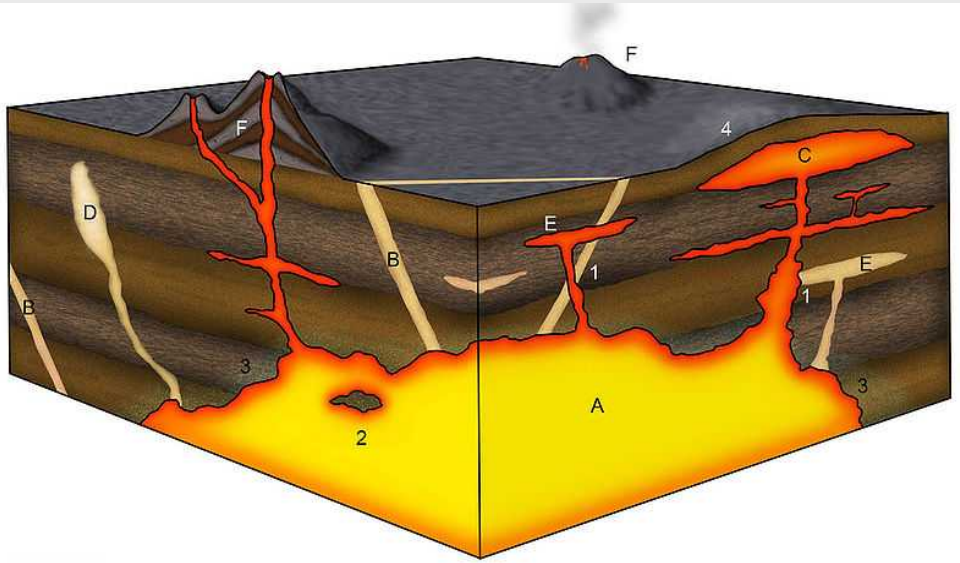
The geologic cycle begins with magma, a molten rock deep inside the earth. This magma cools as it moves upward toward the ground surface, forming igneous rocks.

When rocks are pushed deep under the Earth's surface, they may melt into magma. If the conditions no longer exist for the magma to stay in its liquid state, it will cool and solidify into an igneous rock.

Types of Rocks

Classification of Igneous Rock: On the basis texture (size, shape and arrangement of mineral grains in a rock) and mode of occurrence, Igneous rock is divided broadly into two types:

1. Intrusive (also called plutonic rocks): form below the ground surface, where they cool slowly,
2. Extrusive (also called volcanic rocks) arrive at the ground surface in a molten state, such as through volcanic eruption. This type of igneous rock cool very rapidly.



Structures of Igneous Rock.
Legend: A = magma chamber (batholith); B = dyke/dike;
C = laccolith;
D = pegmatite;
E = sill;
F = stratovolcano;
processes: 1 = newer intrusion cutting through older one;
2 = xenolith or roof pendant;
3 = contact metamorphism;
4 = uplift due to laccolith emplacement.

Igneous Rocks

Hypabyssal Rock: Hypabyssal rocks are formed when consolidation of magma takes place very close to the earth's surface in the form of smaller sheet like bodies (known as sills and dykes) that fill cracks inside other rocks.

Some extrusive generally have finer grained, smoother surfaces. Some extrusive materials, such as volcanic ash, bypasses the rock stage and forms directly into sediment

Close-up of granite (an intrusive igneous rock) exposed

Basalt (an extrusive igneous rock in this case); light colored tracks show the direction of lava flow.

Gabbros Specimen

Granite containing potassium feldspar, plagioclase feldspar, quartz, and biotite and/or amphibole

Common Igneous Rocks

Some common igneous rocks include:

Granite: is coarse grained, an intrusive rock. It is the most common and familiar igneous rocks. Granite contains primarily orthoclase feldspar and quartz, with some biotite and amphibole. It is mostly light in color with a white or pink tint according to the color of the feldspar.

Engineering properties:

- Granite have absorption as low as 0.24 per cent.
- It has an excellent frost resistance.
- Because of the minerals composition and interlocking of crystals, granite is hard and abrasion resistant.
- The compressive strength of granite is on average 24,500 psi.
- It can be concluded that granite can be used to support any load of ordinary structures.

Common Igneous Rocks

Diorite: is coarse grained, an intrusive rock. It is mainly composed of plagioclase feldspar (more than 50 %) and horn blends. However, in some varieties augite and biotite may be present. It is more abundant than syenites but less abundant than granite.

Diorite has been used for crushed stone for monumental and decorative purposes than for structural purposes.

Syenite: is grained igneous rocks composed essentially of potassium felspare (80-85 %). Biotite and hornblende are commonly present. Quartz is present in small amount. The general properties of syenites is similar to granite. Because of the rarity of syenite, it is of little commercial use as structural material.

Common Igneous Rocks

Some other types of igneous rocks are: Rhyolite, Pumice (can be used as pozzolanic materials with cement), Dolerite, Basalt and Gabbro.

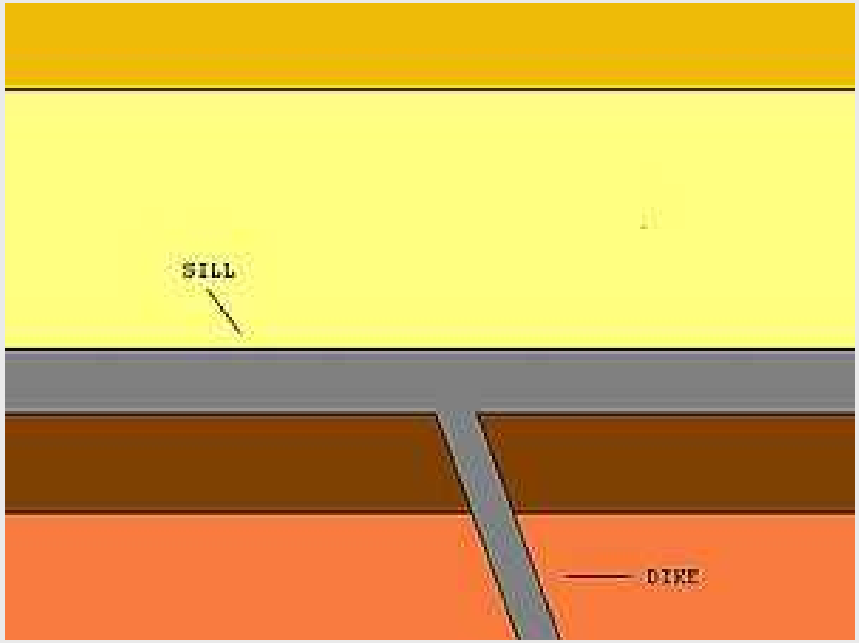
Texture: Texture is size, shape and arrangement of mineral grains in a rock. Texture of rock can either of coarse-crystalline or it can be glassy or amorphous. The texture of the rock is governed by the cooling time of the magma. Crystallization is governed by slow cooling, however, glassy texture or amorphous form is the result of rapid cooling.

Types of rock: Holocrystalline, Coarse grained, fine grained, cryptocrystalline and glassy (amorphous)

Dike and sill

Sill: A sill is igneous rock which vary in thickness from a few centimeter to several hundred meters. The sill is parallel to the bedding of rock and may be horizontal, inclined or vertical depending upon the strata.

Dike: A dike is vertical wall-like igneous body that cuts the bedding of the rock. The thickness of the dike may vary from a few centimeters to a hundred meter or more.



Geological significance of Igneous Rocks

The upper 16 kilometers (10 mi) of Earth's crust is composed of approximately 95% igneous rocks with only a thin, widespread covering of sedimentary and metamorphic rocks.

Igneous rocks are geologically important because:

- **Their minerals and global chemistry give information about the composition of the mantle, from which some igneous rocks are extracted, and the temperature and pressure conditions that allowed this extraction, and/or of other pre-existing rock that melted;**

- **Their absolute ages can be obtained from various forms of radiometric dating and thus can be compared to adjacent geological strata, allowing a time sequence of events;**

- **Their features are usually characteristic of a specific tectonic environment, allowing tectonic reconstitutions.**

Geological significance of Igneous Rocks

In some special circumstances they host important mineral deposits (ores): for example, tungsten, tin, and uranium are commonly associated with granites and diorites, whereas ores of chromium and platinum are commonly associated with gabbros.

Uses of Igneous Rocks (granites)

Because they are so hard, Igneous rocks make useful road building materials.

When sheets of igneous rock are cut and polished, they are used inside buildings such as banks and offices, and are also used as gravestones.

There are different types of igneous rock, therefore each type has its own uses, such as:
Granite: Used for long lasting monuments, for trim and decoration on buildings.

Pumice: Because they are so light, it is used quite often as a decorative landscape stone. If grounded to a powder, it is used as an abrasive in polish compound.

Crystalline Igneous rocks can be used for jewelry and other similar things. Countertops and building stone.