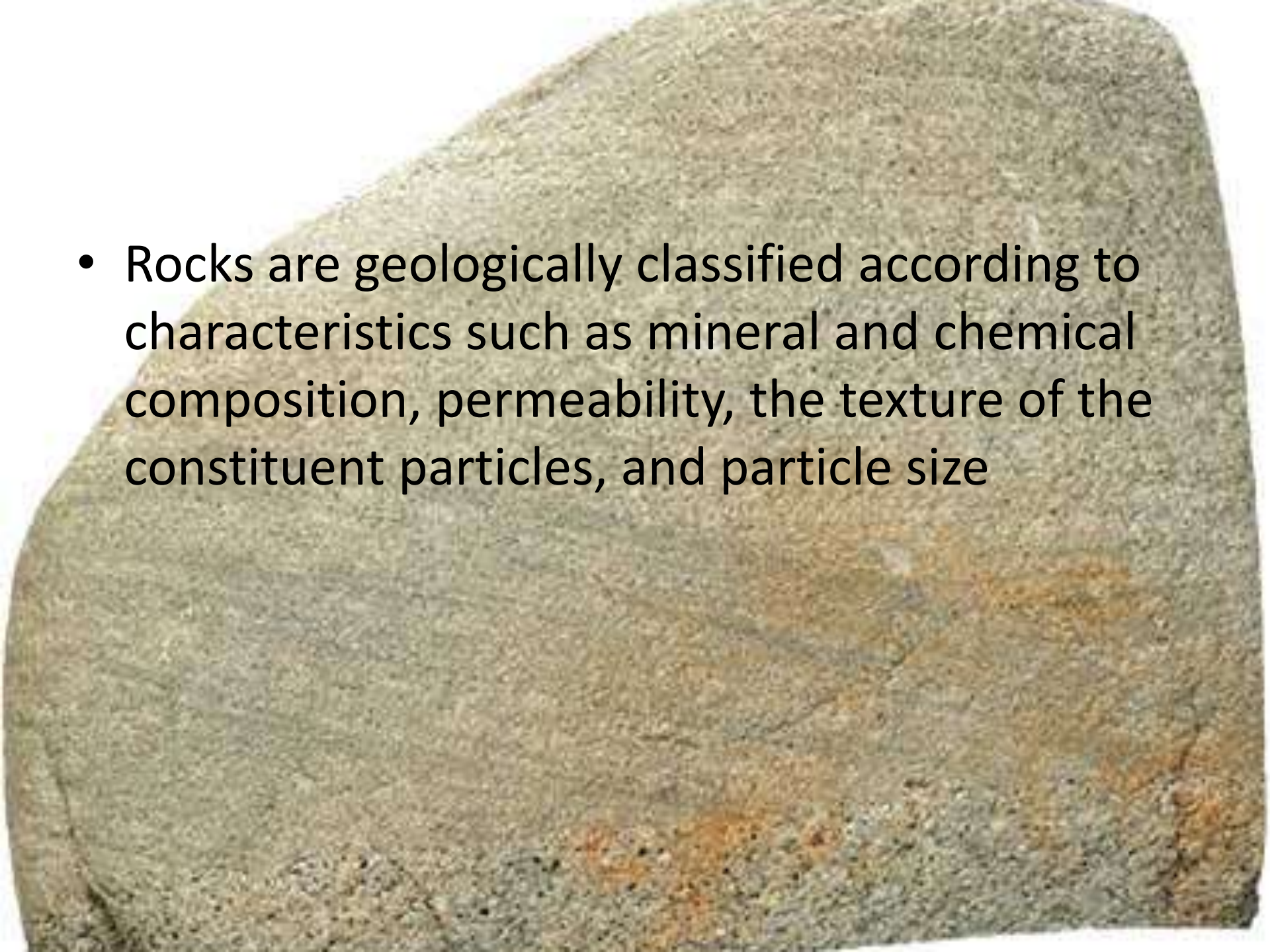


Rocks

- Rocks are composed of grains of minerals, which, in turn, are homogeneous solids formed from an orderly arranged chemical compound, mostly Silica (SiO_2). The aggregate minerals forming the rock are held together by chemical bonds.
- The types and abundance of minerals in a rock are determined by the manner in which the rock was formed. Silica forms 74.3% of the Earth's crust.

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- Rocks are geologically classified according to characteristics such as mineral and chemical composition, permeability, the texture of the constituent particles, and particle size

The rock cycle

- Over the course of time, rocks can transform from one type into another, as described by the geological model called the rock cycle. These events produce three general classes of rock: igneous, sedimentary, and metamorphic.

Igneous rock

- **Igneous rock** (derived from the Latin word *ignis* meaning fire), or **magmatic rock**, is one of the three main rock types, the others being **sedimentary** and **metamorphic**.
- Igneous rock is formed through the cooling and solidification of magma or lava. The magma can be derived from partial melts of existing rocks in either a planet's mantle or crust. Typically, the melting is caused by one or more of three processes: an increase in temperature, a decrease in pressure, or a change in composition.
- Solidification into rock occurs either below the surface as **intrusive** rocks or on the surface as **extrusive** rocks. Igneous rock may form with crystallization to form granular, crystalline rocks, or without crystallization to form natural glasses.

Igneous

- About 64.7% of the Earth's crust by volume consists of igneous rocks; making it the most plentiful category
- Igneous rocks are divided into two main categories: **plutonic rock** and **volcanic**.
- Plutonic or intrusive rocks result when magma cools and crystallizes slowly within the Earth's crust, e.g., **granite**.
- Volcanic or extrusive rocks result from magma reaching the surface either as lava or *fragmental ejecta*, forming minerals such as **pumice** or **basalt**.

Igneous rocks



Basalt



Obsidian

Rocks



Feldspar

Sedimentary rocks

- **Sedimentary rocks** are formed by the deposition and subsequent cementation of materials at the Earth's surface and within bodies of water. Sedimentation is a collective name for the processes that cause mineral or organic particles (detritus) to settle in place.
- Before being deposited, the sediment was formed by weathering and erosion from the source area, and then transported to the place of deposition by water, wind, ice, mass movement or glaciers, which are called agents of denudation. Sedimentation may also occur as minerals precipitate from water solution or shells of aquatic creatures settle out of suspension.

- Sedimentation causes clastic sediments (pieces of rock) or organic particles (detritus) to settle and accumulate, or for minerals to chemically precipitate from a solution. The particulate matter then undergoes compaction and cementation at moderate temperatures and pressures (diagenesis)

Sedimentary rock types

- Mud rocks comprise 65% (mudstone, shale and siltstone); sandstones 20 to 25% and carbonate rocks 10 to 15% (limestone and dolostone).
- About 7.9% of the crust by volume is composed of sedimentary rocks, with 82% of those being shales, while the remainder consist of limestone (6%), sandstone and arkoses (12%). Sedimentary rocks often contain fossils. Sedimentary rocks form under the influence of gravity and typically are deposited in horizontal or near horizontal layers or strata and may be referred to as stratified rocks.

- The sedimentary rock cover of the continents of the Earth's crust is extensive (73% of the Earth's current land surface), but the total contribution of sedimentary rocks is estimated to be only 8% of the total volume of the crust.
- Sedimentary rocks are only a thin veneer over a crust consisting mainly of igneous and metamorphic rocks. Sedimentary rocks are deposited in layers as strata, forming a structure called bedding.

Sedimentary stones



*Cambrian clay;
fossiliferous
limestone; Devonian
Old Red Sandstone;
rock salt (sylvine);
red variety of
chalcedony
(carnelian),
Bituminous coal;
Sandstone
(phosphorite);
Conglomerate;
Bauxite.*

Metamorphic rocks

- **Metamorphic rocks** arise from the transformation of existing rock types, in a process called metamorphism, which means "change in form". The original rock (protolith) is subjected to heat (temperatures greater than 150 to 200 °C) and pressure (150 megapascals) causing profound physical or chemical change. The protolith may be a sedimentary, igneous, or existing metamorphic rock.
- Metamorphic rocks make up a large part of the Earth's crust and form 12% of the Earth's land surface. They are classified by texture and by chemical and mineral assemblage.
- Some examples of metamorphic rocks are gneiss, slate, marble, schist, and quartzite.

Metamorphic rocks



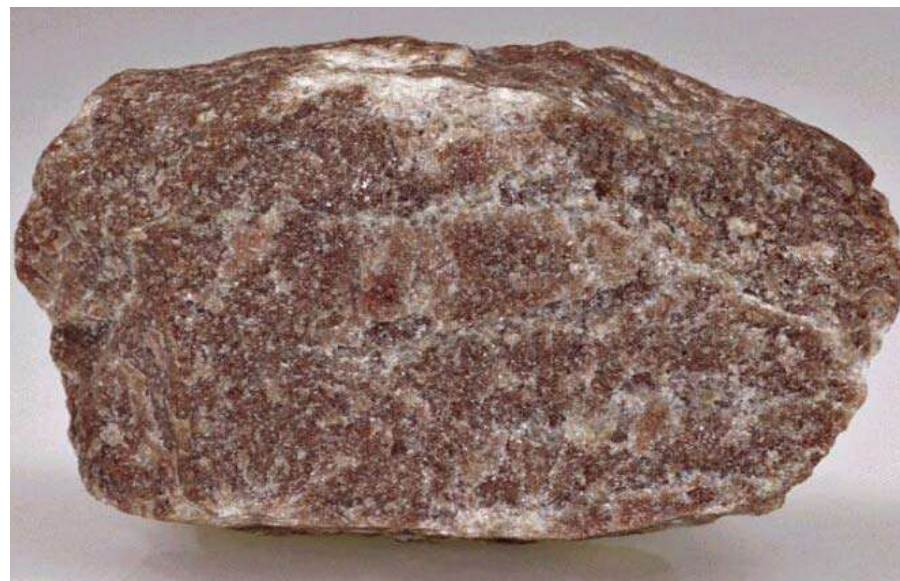
Gneiss



Slate



Schist



Quartzite

Metamorphic

- The original rock (protolith), transforms into other mineral types or other forms of the same minerals, by recrystallization.
- The temperatures and pressures required for this process are always greater than 150 to 200 °C and pressures of 1500 bars.
- Metamorphic rocks compose 27.4% of the crust by volume

Three major classes

- based upon the formation mechanism.
 1. An intrusion of magma that heats the surrounding rock causes contact metamorphism—a temperature-dominated transformation.
 2. Pressure metamorphism occurs when sediments are buried deep under the ground; pressure is dominant and temperature plays a smaller role. This is termed burial metamorphism, and it can result in rocks such as **jade**.
 3. Where both heat and pressure play a role, the mechanism is termed regional metamorphism. This is typically found in mountain-building regions

Depending on the structure

- metamorphic rocks are divided into two general categories.
 1. Those that possess a texture are referred to as **foliated**.
 2. Those do not have a well defined texture are **non-foliated**.

The name of the rock is determined based on the types of minerals present.

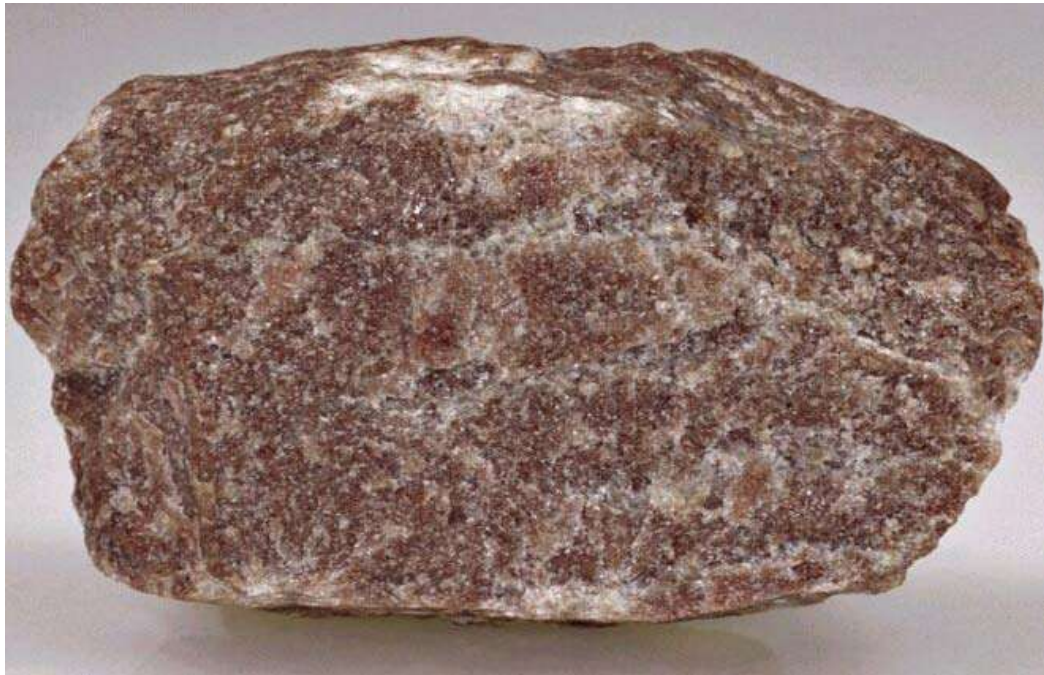
Schists are foliated rocks that are primarily composed of lamellar minerals such as **micas**.

Gneiss has visible bands of differing lightness, with a common example being the granite gneiss.

Other varieties of foliated rock include slates, phyllites, and mylonite.

Non-foliated metamorphic rocks include marble, soapstone, and serpentine.

Quartzite is a metamorphosed form of sandstone.



Formation

- They may be formed simply by being deep beneath the Earth's surface, subjected to high temperatures and the great pressure of the rock layers above it.
- They can form from tectonic processes such as continental collisions, which cause horizontal pressure, friction and distortion.
- They are also formed when rock is heated by the intrusion of hot molten rock called magma from the Earth's interior.