

Igneous Rocks:

Igneous rocks are formed by crystallization from magma. They include two types; Volcanic or extrusive igneous rocks form when magma cools and crystallizes on the surface of the Earth. Plutonic or intrusive igneous rocks form magma crystallizes at depth in the Earth Crust.

Magma is a mixture of liquid rock, crystals, and gas. Magma forms when mantle/crustal material melts. Magmas are characterized by a wide range of chemical compositions. Magmas are less dense than surrounding rocks and behave buoyantly, and will therefore move upward. If magma makes it to the surface it will erupt, cool fast and later crystallize to form an extrusive or volcanic rock. On the other hand, if magma crystallizes before it reaches the surface, it will cool slowly and it will form an igneous rock at depth called intrusive or plutonic igneous rock.

Fast cooling on the surface results in many small crystals or quenching to a glass which gives rise to an aphanitic texture (crystals cannot be distinguished with the naked eye), or obsidian (volcanic glass).

Slow cooling at depth in the earth results in fewer much larger crystals, gives rise to phaneritic texture.

Porphyritic texture develops when slow cooling is followed by rapid cooling.

Phenocrysts are larger crystals, and matrix or groundmass are smaller crystals.

Types of Magma:

Chemical composition of magma is controlled by the abundance of elements in the Earth. Eight (Si, Al, Fe, Ca, Mg, K, Na, H, and O) of the ninety-two naturally occurring elements; make up 99.9% by weight (see table). Since oxygen and silicon are so abundant, chemical analyses are usually given in terms of oxides. SiO₂ is the most abundant oxide.

Basaltic or gabbroic magmas have SiO₂ content between 45-55 wt%, high in Fe, Mg, Ca, low in K, Na

Andesitic or Dioritic magmas have SiO₂ content between SiO₂ 55-65 wt%, intermediate. in Fe, Mg, Ca, Na, K

Rhyolitic or Granitic magmas have SiO₂ content between SiO₂ 65-75%, low in Fe, Mg, Ca, high in K, Na.