Igneous Rock

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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.

What are igneous rocks?

Igneous rocks (from the Greek word for fire) form from when hot, molten rock crystallizes and solidifies. The melt originates deep within the Earth near active plate boundaries or hot spots, then rises toward the surface. Igneous rocks are divided into two groups, intrusive or extrusive, depending upon where the molten rock solidifies.

Intrusive Igneous Rocks:
Intrusive, or plutonic, igneous rock forms when magma is trapped deep inside the Earth. Great globs of molten rock rise toward the surface. Some of the magma may feed volcanoes on the Earth's surface, but most remains trapped below, where it cools very slowly over many thousands or millions of years until it solidifies. Slow cooling means the individual mineral grains have a very long time to grow, so they grow to a relatively large size. Intrusive rocks have a coarse grained texture.

Extrusive Igneous Rocks:
Extrusive, or volcanic, igneous rock is produced when magma exits and cools above (or very near) the Earth's surface. These are the rocks that form at erupting volcanoes and oozing fissures. The magma, called lava when molten rock erupts on the surface, cools and solidifies almost instantly when it is exposed to the relatively cool temperature of the atmosphere. Quick cooling means that mineral crystals don't have much time to grow, so these rocks have a very fine-grained or even glassy texture. Hot gas bubbles are often trapped in the quenched lava, forming a bubbly, vesicular texture.

Igneous Rock Facts

Enjoy our igneous rock facts for kids. Find interesting information and a range of examples that help explain what igneous rocks are and what makes them different from other kinds of rocks.

- Igneous rock is formed when magma cools and solidifies, it may do this above or below the Earth's surface.

- Magma can be forced into rocks, blown out in volcanic explosions or forced to the surface as lava.

- The atoms and molecules of melted minerals are what make up magma.

- These atoms and molecule rearrange themselves into mineral grains as the magma cools, forming rock as the mineral grains grow together.

- There are over 700 different types of igneous rocks.

- Examples of igneous rocks include basalt, granite, pumice, obsidian, tuff, diorite, gabbro and andesite.

- Basalt forms the metamorphic rock granulite when subjected to extreme heat and pressure over time (metamorphism).

- Granite is a common rock that contains at least 25% quartz and is sometimes used in construction because of its strength.

Igneous rock types

Igneous rocks can be divided up into four groups, based on how they were formed and what they are made of.

These groups include plutonic, subvolcanic and volcanic rocks, which are all formed at different depths and have different grain sizes, mineral and chemical compositions.

The four main groups of igneous rocks are:

1. Plutonic rocks
2. Subvolcanic rocks
3. Volcanic rocks
4. Other igneous rocks

Common plutonic rocks

Plutonic rocks are igneous rocks that are formed deep under the Earth's surface and have a coarse grain size. They can be separated into acidic, basic and ultrabasic types, according to their mineral and chemical composition.

Acidic plutonic rocks

- Granite: the most common igneous plutonic rock. Contains essential quartz, plagioclase and alkali feldspar, usually with hornblende and/or biotite and/or muscovite.
- Granodiorite: a plutonic rock with essential quartz and plagioclase, with lesser amounts of alkali feldspar and small amounts of hornblende and biotite.
- Tonalite: a plutonic rock with essential quartz and sodic plagioclase, usually with lesser biotite and amphibole.
- Aplite: fine-grained, composed mostly of quartz and feldspars.
- Pegmatite: a very coarse-grained, usually plutonic granitic rock.

Basic plutonic rocks

- Diorite: a plutonic rock composed of sodic plagioclase, commonly hornblende, and/or biotite or augite.
- Gabbro: a coarse-grained plutonic rock with essential calcic plagioclase, pyroxene and opaque minerals, and/or hornblende or olivine. The plutonic equivalent of basalt.
- Monzonite: a plutonic rock with equal amounts of plagioclase and alkali feldspar, along with lesser amphibole and/or pyroxene.
- Syenite: a plutonic rock composed mainly of alkali feldspar, with subordinate sodic plagioclase, biotite, pyroxene, and amphibole.

Ultrabasic plutonic rocks

- Anorthosite: a plutonic rock with mostly calcic plagioclase and small amounts of pyroxene.
- Dunite: a plutonic rock composed mostly of olivine.
- Clinopyroxenite: a plutonic rock composed mostly of clinopyroxene.
- Harzburgite: a plutonic rock composed of essential olivine and orthopyroxene.
- Hornblendite: a plutonic rock composed mostly of hornblende.
- Lherzolite: a plutonic rock composed largely of olivine, along with lesser clinopyroxene and orthopyroxene, and sometimes spinel.
- Orthopyroxenite: a plutonic rock composed mostly of orthopyroxene.
- Peridotite: a plutonic rock composed of olivine with lesser pyroxene and/or amphibole.
- Pyroxenite: a plutonic rock composed largely of pyroxene.

Common subvolcanic rocks

Subvolcanic rocks are igneous rocks that are formed at medium depths and have a medium grain size.

- Dolerite: a subvolcanic rock with essential plagioclase, pyroxene and opaque minerals. The subvolcanic equivalent of basalt.
- Porphyry: a general term for igneous rocks that contain phenocrysts in a finer-grained groundmass.

Common volcanic rocks

Volcanic rocks are igneous rocks that are formed near the Earth's surface and have a fine grain size. They can be separated into acidic, basic and ultrabasic types, according to their mineral and chemical composition.

Acidic volcanic rocks

- Rhyolite: silicic volcanic rocks composed of quartz and alkali feldspar, with minor plagioclase and/or biotite. The volcanic equivalent of granite.
- Comendite: a porphyritic alkali-rich rhyolite with phenocrysts of quartz, alkali feldspar and sodic pyroxenes and/or amphiboles.
- Dacite: a common volcanic rock composed of quartz and sodic plagioclase, along with small amounts of biotite and/or hornblende, and/or pyroxene.

Basic volcanic rocks

- Basalt: the most common volcanic rock on Earth. Composed of essential calcic plagioclase and pyroxene, sometimes with olivine, feldspathoids or interstitial quartz.
- Andesite: an intermediate, commonly porphyritic volcanic rock composed of plagioclase, pyroxene, hornblende and/or biotite.
- Latite: an intermediate volcanic rock with equal amounts of sodic plagioclase and alkali feldspar.
- Trachyte: a volcanic rock composed largely of alkali feldspar.

Ultrabasic

- Komatiite: these rocks are high in magnesium and crystallised at high temperatures. They commonly display a spinifex texture consisting of intergrown skeletal and bladed olivine and pyroxene crystals in a glassy groundmass. Most are Archean in age.

Other volcanic rocks

Other common volcanic rocks include:

- Agglomerate: a rock of coarse pyroclastic material consisting dominantly of rounded fragments.
- Amygdaloidal: a volcanic rock containing mineral-filled cavities (or vesicles).
- Bomb: a volcanic projectile with an average diameter greater than 64 mm and whose shape or surface indicates that it was partially or completely molten during its formation and transport through the air.
- Ignimbrite: a pyroclastic tuff consisting of crystal and rock fragments in a matrix of glass shards that are usually welded together.
- Obsidian: a volcanic glass that is commonly dark in colour and glassy, with a water content less than 1%.
- Perlite: volcanic glass that exhibits numerous concentric cracks. Some are high in water and expand when heated.
- Pumice: a pyroclastic glassy volcanic rock containing abundant empty cavities (or vesicles), usually of rhyolitic composition.
- Scoria: a pyroclastic volcanic rock containing abundant empty cavities (or vesicles), usually of basaltic composition.

Other types of igneous rocks

- Carbonatite: volcanic or subvolcanic rocks composed mostly of primary carbonate minerals, such as calcite, dolomite or Na-carbonates.
- Kimberlite: a volcanic or subvolcanic rock composed largely of serpentinised olivine, with variable amounts of phlogopite mica, orthopyroxene, clinopyroxene, carbonate and chromite. Characteristic accessory minerals include pyrope garnet, rutile, monticellite and perovskite, and in some cases diamonds.
- Lamproite: a volcanic or subvolcanic rocks that are rich in potassium and magnesium, composed of unusual rare minerals such as K-Ti-richterite, priderite, wadeite, jeppeite, Fe-orthoclase and leucite. The hostrock for diamonds in the AK1 pipe of the Argyle diamond mine, Western Australia.
- Lamprophyre: a name for a group of subvolcanic rocks that are strongly porphyritic in mafic minerals such as biotite, amphiboles and pyroxenes in a groundmass of feldspar. They commonly occur as dykes.

Characteristics of Igneous Rocks

(1) In all, the igneous rocks are roughly hard rocks and water percolates with great difficulty along the joints. Sometimes the rocks become so soft, due to their exposure to environmental conditions for longer duration, that they can be easily dug out by a spade (e.g., basalt).

(2) Igneous rocks are granular or crystalline rocks but there are much variations in the size, form and texture of grains because these properties largely depend upon the rate and place of cooling and solidification of magmas or lavas. For example, when the lavas are quickly cooled down and solidified at the surface of the earth, there is no sufficient time for the development of grains/crystals.

(3) Igneous rocks do not have strata like sedimentary rocks. When lava flows in a region occur in several phases, layers after layers of lavas are deposited and solidified one upon another and thus there is some sort of confusion about the layers or strata but actually these are not strata rather these are layers of lavas.

(4) Since water does not penetrate the rocks easily and hence igneous rocks are less affected by chemical weathering but basalts are very easily weathered and eroded away when they come in constant touch with water. Coarse grained igneous rocks are affected by mechanical or physical weathering and thus the rocks are easily disintegrated and decomposed.

(5) Igneous rocks do not contain fossils because:

(i) when the ancient igneous rocks were formed due to cooling and solidification of molten rock materials at the time of the origin of the earth, there was no life on newly born earth and

(ii) since the igneous rocks are formed due to cooling and solidification of very hot and molten materials and hence any remains of plants or animals (fossils) are destroyed because of very high temperature.

(6) The number of joints increases upward in any igneous rock.

The joints are formed due to:

(i) Cooling and contraction,

(ii) Expansion and contraction during mechanical weathering,

(iii) Decrease in superincumbent load due to removal of materials through denudational processes and

(iv) Earth movement caused by isostatic disturbances.

Whenever these joints are plugged by minerals, the rocks become quite hard and resistant to weathering and erosion.

(7) Igneous rocks are mostly associated with the volcanic activities and thus they are also called as volcanic rocks. Igneous rocks are generally found in the volcanic zones.

Reference

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