



...going one step further



Collection of 24 rocks

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These rocks are organised into three groups depending on how they were formed:

Igneous rocks arise due to solidification of magma inside (plutonic/intrusive) or upon (volcanic/extrusive) the earth's crust.

Sedimentary rocks: Such minerals are exposed to exogenetic forces on the surface of the earth, where they are comminuted, transported and deposited and can also be recompacted.

Metamorphic rocks arise due to metamorphosis of igneous or sedimentary rocks under high pressure and temperature.

Rock cycle

Magma rising from inside the earth cools, either while still inside the crust or after it has erupted to the surface. This results in the creation of igneous rocks. These rocks are exposed to exogenetic forces on the surface of the earth (erosion, weathering), they may be transported from place to place and can later be recompacted (sedimentary rocks) or can be subjected to high pressure and temperature and thereby transformed into metamorphic rocks. Sedimentary rocks can also be subjected to exogenetic forces or can be subducted into the earth as a result of tectonic movements where they too can be fused or converted by pressure and temperature into metamorphic rocks. Metamorphic rocks can also be subjected to exogenetic forces or can be subducted into the earth as a result of tectonic movements and fused there.

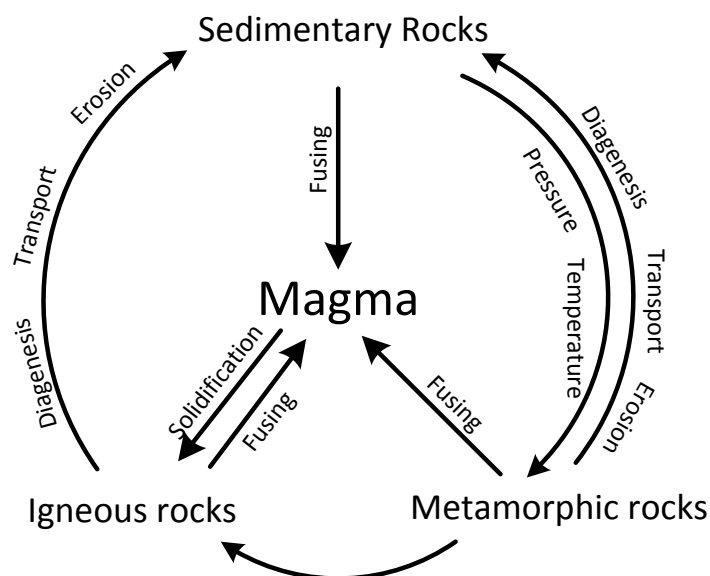


Figure 1: Rock cycle

Igneous rocks

Igneous rocks are minerals, which have solidified due to cooling of liquid magma either within the earth's crust (plutonic/intrusive rocks) or on the surface (volcanic/extrusive rocks).

Plutonic/intrusive rocks

1. Foyaite

Composition

Alkali feldspar 20-70%, nepheline, leucite and sodalite 20-40%, pyroxenes 5-50%

Characteristics

Medium- to coarse-grained, light-coloured rock

Incidence

Khibiny Mountains, Kola Peninsula in Russia, Telemark in Norway, Canada etc.

2. Gabbro

Gabbro is an alkaline intrusive rock.

Composition

Usually such minerals do not contain any quartz but plagioclase 40-70%, pyroxenes 15-45%, olivine and amphiboles 0-40%

Characteristics

Gabbro is medium- to coarse-grained, dark-to greenish grey or blue-grey

Incidence

Worldwide, e.g. Erz and Harz Mountains and the Black Forest in Germany, also South Africa, USA.

3. Granite

Granite is an intrusive quartz-feldspar rock which is the most common plutonic rock in the continental crust.

Composition

Quartz 10-50%, alkali feldspar 40-80%, mica, hornblende, tourmaline 5-25%

Characteristics

Granite has a randomly aligned, coarse-grained structure. Its colour varies widely from light-coloured to dark grey or reddish.

Incidence

Worldwide, e.g. Erz Mountains and the Black Forest in Germany, also Scandinavia etc.

4. Granodiorite

There is no clear boundary between granodiorite and granite, but rather a continuous spectrum between the two.

Composition

Plagioclase 30-50%, potassium feldspar 10-30%, quartz 15-30%, biotite and hornblende 5-20%

Characteristics

Granodiorites are often light- to dark-grey, coarse-grained, intrusive rocks.

Incidence

Worldwide, e.g. Upper Lusatia in Germany, Carpathia, Scandinavia and USA.

5. Larvikite

Larvikite is a decorative stone

Composition

Alkali feldspar 80-90%, pyroxenes 5-10%, accessory minerals 5%

Characteristics

Coarse-grained rocks often with iridescent anorthoclase crystals, highly decorative stone

Incidence

Larvik, South Norway and Denmark.

6. Monzonite

Monzonite is an intrusive feldspar.

Composition

Plagioclase 40-60%, feldspar 15-35%, hornblende, pyroxenes and mica 10-20%, little or no quartz content.

Characteristics

Granite-like, frequently medium-grained rocks of reddish, greenish or grey colour.

Incidence

Examples include the Monzoni Intrusion in Italy, Plauenscher Grund in Dresden, Germany, Canada and Australia.

Volcanic/extrusive rocks

7. Basalt

Basalt is a volcanic, alkaline extrusive rock.

Composition

Basalt rocks have 40-70% mafic content (magnesium and iron-rich minerals, dark-coloured minerals), plagioclase and sometimes olivine.

Characteristics

Such rocks are almost black in colour, although brownish and reddish hues can also be found.

Main minerals: Plagioclase, pyroxenes (augite, pigeonite)

Trace minerals: Olivine, amphibole, biotite, magnetite, haematite, titanite, ilmenite, rarely quartz.

Basalt is the extrusive equivalent of gabbro.

Incidence

Basalts are the most important kinds of volcanic rock. Massive plateaux or lava flows cover areas of several hundred thousand square kilometres in India (Deccan Traps), South America (Paraná Basin) and in the northwest of the USA (Washington and Oregon). Most volcanoes are largely or entirely made of basalt. Even on the moon there are extensive lava fields, such as the Mare Imbrium which covers an area of about 200,000 km².

8. Pumice

Pumice stones are highly porous pyroclastic rocks.

Composition

Pumice is a highly vesicular (containing gas bubbles called vesicles), intermediate to acidic volcanic glass or product of volcanic ejecta. Pumice arises from acidic lava with high gas content which is ejected in explosive volcanic eruptions. The sudden reduction in pressure causes the trapped gases to swell the lava, resulting in porous aggregates in which up to 85% of the volume is occupied by the pores.

Characteristics

Pumice can be light grey, yellowish or, in rare cases, reddish or dark coloured. Pumice is very light and, due to the volume of the vesicles, it can even float.

Incidence

Worldwide, e.g. Laacher See in the Eifel region of Germany, Lipari Islands of Italy.

9. Phonolite

Phonolite is the extrusive equivalent of foyaite.

Composition

Essentially composed of alkali feldspar, nepheline and leucite or sodalite.

Characteristics

Phonolite is coloured grey to green-grey or brownish. It forms dense, splintery rocks which make a clinking sound when struck.

Incidence

Worldwide, e.g. Hammerunterwiesenthal and Schellkopf Mountain in Germany, also in Italy.

10. Rhyolite

Rhyolites are igneous rocks made from the solidification of granitic magmas.

Composition

Rhyolites may contain quartz and feldspar phenocrysts from a few millimetres up to several centimetres in size as well as small quantities of plagioclase and mica.

Characteristics

The colour varies greatly from red, brown to grey. The texture also varies from crystalline and mixed form to volcanic glasses.

Incidence

Worldwide, e.g. Erz, Harz and Eifel Mountains.

Sedimentary rocks

11. Breccia

Breccias are composed of coarse-grained, angular clastic/detrital rocks.

Composition

They are produced by physical weathering of rocks and consolidation. The diameter of the rock fragments is greater than 2 mm.

Characteristics

Coarse-grained fragments cemented together by a fine-grained matrix.

Incidence

Worldwide, e.g. mountain ranges, river valleys, volcanic regions.

12. Dolomite

Composition

Calcium magnesium carbonate rock, produced by precipitation in shallow seas or by the transformation of limestone rocks into dolomite rock

Characteristics

Grainy compacted texture in a variety of colours

Incidence

Worldwide, e.g. Dolomite Alps.

13. Rock gypsum

Composition

Essentially composed of CaSO_4 and accessory minerals.

Characteristics

Produced by the process of evaporation or by conversion of anhydrite to gypsum at the level of the groundwater table. In arid regions, it comes from the precipitation of sulphate solutions in unconsolidated rocks.

Incidence

Common throughout the world, including the southern Harz Mountains.

14. Limestone

Composition

Mainly composed of CaCO_3 with various quantities of clay, sand, coal etc.

Characteristics

Colour and texture varies widely. In most kinds of limestone it is possible to find fossil remains. Most are close-grained or coarse-grained.

Incidence

One of the most commonly encountered types of rock throughout the world and likely to cover large areas such as the Thuringian Basin and the Franconian and Swabian Jura in Germany.

15. Chalk

Composition

Approximately 95% CaCO_3 with the rest composed of other components such as MgCaCO_3

Characteristics

White or less commonly grey highly pure limestone composed of the hard remains of microorganisms.

Incidence

Large chalk outcrops exist on Rügen, Germany or at Dover, England.

16. Quartzite

Quartzite rock can be sedimentary or metamorphic.

Composition

Almost entirely composed of quartz grains, chalcedony and sometimes opal.

Characteristics

Interlocking grains of quartz or bonded together with siliceous chalcedony and opal

Incidence

Worldwide, e.g. in the form of flint, in the Paris Basin of France or as lignite-quartzites in the Rhenish Massif.

17. Sandstone

Solid sedimentary rock with grain sizes ranging from 0.063 to 2 mm. It is defined in terms of grain size and not mineral content.

Composition

Mostly quartz, although other rock fragments may be included.

Characteristics

Rock with rounded or angular grains.

Incidence

Worldwide, e.g. Elbe Sandstone Mountains and Weser region of Germany, Colorado Plateau, USA

Metamorphic rocks

18. Amphibolite

Produced by the metamorphic transformation of rocks such as gabbro and diabase

Composition

Amphibolites consist of 30-70% amphiboles, 15-40% plagioclase and other constituents such as garnet, zoisite, epidote and quartz.

Characteristics

Green to black randomly aligned granular or schistose rock.

Incidence

Worldwide, e.g. Erz and Spessart Mountains in Germany, also in Norway.

19. Eclogite

Eclogites are some of the hardest rocks on earth

Composition

Eclogites are medium- to fine-grained, heavy and sometimes exhibit signs of schistosity. They are mainly composed of garnet and pyroxenes. They have no plagioclase content at all.

Characteristics

They are typical examples of high-grade metamorphic rocks. They form at very high pressures and medium to high temperatures.

Incidence

Worldwide, e.g. Weißenstein in Bavaria, also in Norway.

20. Mica schist

Schist is a collective name for crystalline lamellar/foliated minerals.

Composition

Primary components are quartz, mica (> 50%) and lesser amounts of various other minerals such as garnet, feldspar etc.

Characteristics

They may be slate-like or more flaky and are mostly glittery like mica.

Incidence

Worldwide, e.g. Erz Mountains of Saxony and Bohemia and in the Alps

21. Gneiss

Gneiss rocks can be categorised into two groups, paragneiss (arising from sedimentary precursors) and orthogneiss (from igneous precursors)

Composition

Main components are feldspar (>20%), quartz and mica and with secondary components such as garnet, hornblende, staurolite etc.

Characteristics

Gneisses are medium- to coarse-grained metamorphosed rocks with banded structure. The colour varies from grey to reddish or greenish

Incidence

Worldwide in eroded uplands, e.g. Thuringian Forest and Erz Mountains in Germany and in the central Alpine region.

22. Marble

Marble rocks are metamorphosed limestones and dolomites.

Composition

The main component is calcite and sometimes dolomite with other less predominant content.

Characteristics

Marbles have a grainy crystalline structure in a variety of colours including white, grey, brown, green and others

Incidence

In mountain ranges all over the world, e.g. in Carrara, Italy and Greece

23. Phyllite

Phyllites are metamorphosed clays.

Composition

Crystalline foliations with quartz and mica as the main components along with various less predominant components such as amphiboles, calcite, magnetite and others.

Characteristics

Finely foliated structure of greenish to grey colour with a silky lustre.

Incidence

All over the world in the foothills of many mountain ranges, e.g. Erz and Harz Mountains in Germany, The Alps, Vosges Mountains in France.

24. Serpentine

Arising from metamorphosis of peridotites or dolomites.

Composition

Main components are serpentine minerals such as lizardite, chrysotile and antigorite with various less prevalent components such as magnetite.

Characteristics

They form dense or schistose rocks with greenish or yellowish colours.

Incidence

Commonplace throughout the world, e.g. Erz Mountains in Germany, Norway, The Alps.

