Earth Science

different types of rocks

Rocks are naturally occuring solids which are composed of minerals and have been used by humans since ages. From stone age, rocks are used for various purposes. Also, the metals and minerals found in rock play an important role in our life

1. Igneous Rocks

discovered by Georgius Agricola

Basalt is a comman extrusive igneous rock formed by the rapid cooling basaltic lava exposed at or very near the surface of earth, it is available in black, brown, light to dark grey colors. From late latin basaltes (variant of basanites), very hard stone, which was imported from Ancient Greek Basanites. The texture is glassy, massive, porphyritic, scoriaceous, and vesicular. Acid Resistant, Stain Resistant, Scratch Resistant, and belongs to volcanic family.

There are different types of Basalt, Alkaline Basalt, Boninite, High Alumina Basalt, Mid Ocean Ridge Basalt (MORB), Tholeiitic Basalt, Basaltic trachyandesite, Mugearite and Shoshonite.

Features -has high structural resistance against erosion and climate
-very fine grained rock

Formation -basalts forms when lava reaches the earth's surface near an active volcano (temperature of lava is between 1100 to 1250'C when it gets to surface)

Composition -Olivine, Plagioclase, Pyroxene

discovered by Hutton

Origin: Granite forms from silica-rich (felsic) magmas. Felsic magmas are thought to form by addition of heat or water vapor to rock of the lower crust, rather than by decompression of mantle rock, as is the case with basaltic magmas.

Granite is very hard, granular, crystalline igneous rock which consist mainly of quartz, mica, and feldspar and is often used as building stone. From Italian granito, which means grained rock, from grano grain, and from Latin granum. Durable Rock, Hard Rock, Coarse Grained Rock, Opaque Rock, and belongs to plutonic family.
It is Granular, and Phaneritic. It is available in Black, Grey, Orange, Pink, and White colors. Water Resistant, Scratch Resistant, Stain Resistant, Wind Resistant. The appearance is Veined or Pebbled

Igneous Protolith Granite, Sedimentary Protolith Granite, Mantle Granite, Anorogenic Granite, Hybrid Granite, Granodiorite and Alkali Feldspar Granite are the types of rocks.

Features -available in lots of colors and patterns, it is one of the oldest, strongest and hardest rock

Formation -crystalline and is visibly homogeneous in texture and forms by melting of continental rocks.

Composition -Amphibole, Biotite, Feldspar, Hornblade, Micas, Muscovite or Illite, Plagioclase, Pyroxene, Quartz

discovered by Kutkhiny Baty

Origin: Spain/ formed from volcanic eruptions. Deep underground, molten rock incorporates water and other gases flash off, leaving behind a frothy, vesicle-riven structure that quickly cools, solidifying the foamy structure.

Pumice is a volcanic rock that consists of highly vesicular rough textured volcanic glass, which may or may not contain crystals, it is from Old French pomis, from a Latin dialect variant of pumex.
Durable Rock, Medium Hardness Rock and belongs to Volcanic family, the texture is vesicular and it is available in Beige, Colorless, Grey, Light Green, Light Grey, Pink, White, Yellow-grey colors
Water Resistant, Scratch Resistant, Stain Resistant, Acid Resistant

Medical Industry -as an abrasive in skin exfoliating products, in chemical and pharmaceutical industry, medicines and cosmetics.

Types -scoria

Features -host rock for lead

Formation -pumice rock forms when the magma cools so quickly that atoms in the melt are not able to arrange themselves into a crystalline structure.

Composition -Aluminum Oxides, Calcite, Carbonate, Iron Oxides, Silica

discovered by Ferdinand von Richthofen

Origin:Rhyolite is produced by violent volcanic eruptions. During these eruptions, the silica-rich magma is so viscous that it does not flow in a river of lava. Instead, the volcano is more likely to explosively eject material. While granite forms when magma crystallizes beneath the surface (intrusive), rhyolite forms when lava or ejected magma crystallizes (extrusive). In some cases, magma partially solidified into granite may be ejected from a volcano, becoming rhyolite. The eruptions that produce rhyolite have occurred throughout geologic history and all over the world. Given the devastating nature of such eruptions, it is fortunate that they have been rare in recent history. Only three rhyolite eruptions have occurred since the beginning of the 20th century: the St. Andrew Strait volcano in Papua New Guinea (1953-1957), the Novarupta volcano in Alaska (1912), and Chaitén in Chile (2008). Other active volcanoes capable of producing rhyolite include those found in Iceland, Yellowstone in the United States, and Tambora in Indonesia.

Rhyolite is a felsic igneous extrusive rock and it is a fine-grained and dominated by quartz (>20%) and alkali feldspar (>35%). Due to the high silica content, rhyolite lava is very viscous. It is often difficult to identify rhyolites without chemical analysis due to their glassy groundmasses. Many rhyolites consist mainly of glass, and are termed obsidian, or are partially devitrified, and termed pitchstones.

It is Aphanitic, Glassy, Porphyritic and belongs to Volcanic family. Available in variable and light colors

Formation-Rhyolites erupt from the Earth's surface at temperatures of 1382 to 1562 degrees Fahrenheit. The crystals are formed depending on the speed of the lava as well as the cooling period when it reaches the surface. Most rhyolites are uniform in texture, and their color ranges from gray to light-pink, depending on the striations made by the lava flow. These rocks have many shapes, ranging from pumice to porphyritic.

Composition -The mineralogical composition of rhyolite is defined as containing mostly quartz and feldspar with a total silica content of more than 68%. Quartz in rhyolite may be as low as 10% but is usually present in amounts of 25% to 30%. Feldspars often comprise 50% to 70% of rhyolite, with potassium feldspar present in at least twice the amount of plagioclase feldspar. Ferromagnesian, or dark, minerals are rare as phenocrysts, being mostly biotite when present. Trace accessory minerals may also include muscovite, pyroxenes, amphiboles, and oxides. Rhyolite has composition similar to that of granite but with much smaller grains. It is composed of light colour silicates. Generally composition is quartz and plagioclase with less amount of orthoclase, biotite, amphibole, pyroxene and glass.

discovered by Jacques and Pierre Curie

Origin: Quartz is the one of the most abundant minerals, second only to feldspars. About 12% of the mass of the earth's crust is made of quartz. Among the reasons for its abundance are: its stability in a wide pressure and temperature range its chemical and physical resistance to weathering Once it has formed and appeared at the surface, it will only slowly weather away, if at all. Most of the weathering is due to physical forces: changes in temperature, erosion, cracking by ice-wedges, and grinding.

Quartz, widely distributed mineral of many varieties that consists primarily of silica, or silicon dioxide (SiO_2). Minor impurities such as lithium, sodium, potassium, and titanium may be present. Quartz has attracted attention from the earliest times; water-clear crystals were known to the ancient Greeks as krystallos—hence the name crystal, or more commonly rock crystal, applied to this variety. The name quartz is an old German word of uncertain origin first used by Georgius Agricola in 1530.

Quartz has great economic importance. Many varieties are gemstones, including amethyst, citrine, smoky quartz, and rose quartz. Sandstone, composed mainly of quartz, is an important building stone. Large amounts of quartz sand (also known as silica sand) are used in the manufacture of glass and ceramics and for foundry molds in metal casting. Crushed quartz is used as an abrasive in sandpaper, silica sand is employed in sandblasting, and sandstone is still used whole to make whetstones, millstones, and grindstones. Silica glass (also called fused quartz) is used in optics to transmit ultraviolet light. Tubing and various vessels of fused quartz have important laboratory applications, and quartz fibres are employed in extremely sensitive weighing devices.

Composition -Quartz is our most common mineral. Quartz is made of the two most abundant chemical elements on Earth: oxygen and silicon. Atoms of oxygen and silicon join together as tetrahedrons (three sided pyramids). These stack together to build crystals.

Formation -Most quartz forms in either igneous rocks or environments with geothermal waters. In igneous rocks, quartz forms as magma cools. Like water turning into ice, silicon dioxide will crystallize as it cools. Slow cooling generally allows the crystals to grow larger.

2. Sedimentary Rocks

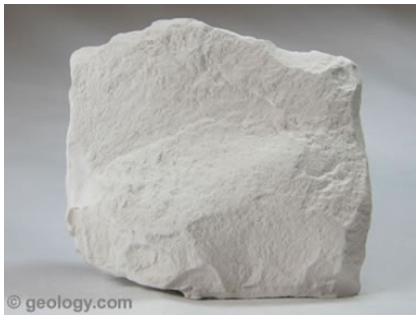
discovered by Middle Paleolithic Neanderthals

ORIGIN-THIS NATURAL ROCK COMES IN A COTTON SPECIMEN COLLECTION BAG WITH AN INFORMATION CARD INCLUDING DETAILS ON THE ROCK FORMATION, CHARACTERISTICS AND USES. SPECIMEN SIZE RANGES FROM 1-2 INCHES.

Bituminous Coal is a black and shiny sedimentary rock with no grains. Coal is formed from plant material.

Composition -Bituminous coal has a composition of about 84.4% carbon, 5.4% hydrogen, 6.7% oxygen, 1.7% nitrogen, and 1.8% sulfur, on a weight basis. This implies that chemical processes during coalification remove most of the oxygen and much of the hydrogen, leaving carbon, a process called carbonization.

Formation -Bituminous coal is formed when a sub bituminous coal is subjected to increased levels of organic metamorphism. It has a carbon content of between 77 and 87% on a dry ash-free basis and a heating value that is much higher than lignite or sub bituminous coal.



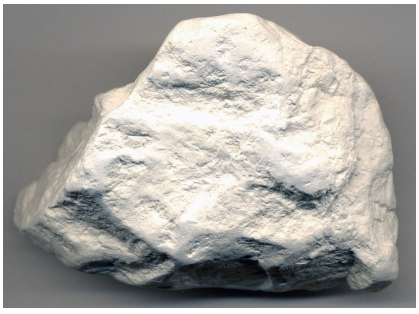
discovered by James Pillans

ORIGIN: THEY'RE FORMED FROM THE SKELETAL REMAINS OF MINUTE PLANKTONIC GREEN ALGAE THAT LIVED FLOATING IN THE UPPER LEVELS OF THE OCEAN. WHEN THE ALGAE DIED, THEIR REMAINS SANK TO THE BOTTOM OF THE OCEAN AND COMBINED WITH THE REMAINS OF OTHER CREATURES TO FORM THE CHALK THAT SHAPES THE CLIFFS TODAY

Chalk is a soft, white, porous, sedimentary carbonate rock. It is a form of limestone composed of the mineral calcite and originally formed deep under the sea by the compression of microscopic plankton that had settled to the sea floor.

Composition -Calcite is an ionic salt called calcium carbonate or $CaCO_3$. It forms under reasonably deep marine conditions from the gradual accumulation of minute calcite shells (coccoliths).

Formation -a form of limestone composed of the mineral calcite.



discovered by Peter Kasten

ORIGIN: MAINLY OF THE FOSSILISED SKELETAL REMAINS OF DIATOMS.

The properties which make diatomite valuable include low density, high porosity, high surface area, abrasiveness, insulating properties, inertness, absorptive capacity, brightness, and high silica content.

Composition -Diatomite is a siliceous sedimentary rock composed mainly of the fossilised skeletal remains of diatoms, which are single-celled organisms related to algae.

Formation -Diatomite deposits formed when the skeletons of dead diatoms accumulated in either marine or freshwater environments and were subsequently compressed and lithified.

discovered by Marquis Deodat de Dolomieu

Formation

-Dolomite is formed by the replacement of the calcite ions by the magnesium ions. Depending upon the ratio of the Mg ions in the crystal lattice they have different names (Figure 1). Modern dolomite formation has been found to occur under anaerobic conditions in supersaturated saline lagoons in Brazil

The Dolomites are therefore the extraordinary result of an ongoing geological process, which is still in progress today.

The ancient **history** of the Dolomites began in the Triassic Period, about 250 million years ago. It may seem unimaginable, but where the majestic peaks of the "Monti Pallidi" (Pale Mountains) rise today, in that period there was a warm, shallow, calm tropical sea. Over millions of years, the shells, corals and calcareous algae that slowly accumulated on the sea floor created atolls and coral reefs. It was very similar to the sea we see today around the Bahamas or eastern Australia, although the landscape was often ravaged by terrifying volcanic eruptions. In the Jurassic Period, when large dinosaurs dominated the Earth, the sediment that accumulated on the seabed formed a layer of hundreds of metres that was compacted due to its weight, which then became solid limestone rock, starting from about 60 million years ago, the collision of the African and European tectonic plates deformed these ancient rocky sea floors, creating mountains even more than 3.000 metres high.

It is in fact the particular **composition** of these sedimentary rocks, composed primarily of calcium and magnesium carbonate, that is the dolomite mineral, which causes the fascinating enrosadira(alpenglow) phenomenon.

Beryl is a mineral **composed** of beryllium aluminium silicate with the chemical formula $Be_3Al_2Si_6O_{18}$. Well-known varieties of beryl include emerald and aquamarine. Naturally occurring, hexagonal crystals of beryl can be up to several meters in size, but terminated crystals are relatively rare.

It is available in Green, Red, Yellow, White, Pink, Purple, Brown and Orange colors

Formation -it is formed by crystallizing under low pressure and high temperature from a pneumatolytic phase along fractures or within near-surface miarolitic cavities of the rhyolite

Origin: Beryl is sometimes found in metasomatic contacts of igneous intrusions with gneiss, schist, or carbonate rocks. Common beryl, mined as beryllium ore, is found in small deposits in many countries, but the main producers are Russia, Brazil, and the United States.

Origin: feldspars crystalize from magma as both intrusive and extrusive igneous rocks and are also present in many types of metamorphic rock. Rock formed almost entirely of calcic plagioclase feldspar is known as anorthosite. Feldspars are also found in many types of sedimentary rocks.

Feldspars are a group of closely related minerals that together are the most abundant mineral in the Earth's crust. A thorough knowledge of the feldspars is what separates geologists from the rest of us.

Composition -All the rock-forming feldspars are aluminosilicate minerals with the general formula AT4O8 in which A = potassium, sodium, or calcium (Ca); and T = silicon (Si) and aluminum (Al), with a Si:Al ratio ranging from 3:1 to 1:1.

Formation -Many feldspars are igneous as they commonly precipitate out in magma as it cools. They may also be formed as metamorphic minerals in veins of other rocks. This process involves both heat and pressure. Finally, over time feldspar can weather to produce sediments.

Halite forms isometric crystals. The mineral is typically colorless or white, but may also be light blue, dark blue, purple, pink, red, orange, yellow or gray depending on inclusion of other materials, impurities, and structural or isotopic abnormalities in the crystals.

Composition -Halite is a common evaporite mineral, NaCl, used as table salt worldwide. It is arguably the most well-known mineral in the world. It has a formula unit composition of NaCl, and is in the cubic crystal system. In pure form it is nearly transparent or white.

Formation -it has formed from the evaporation of seawater or salty lake water. Vast beds of sedimentary evaporite minerals, including halite, can result from the drying up of enclosed lakes and restricted seas.

ORIGIN: NOT SURPRISINGLY, THE WORD HALITE IS DERIVED FROM THE GREEK WORD HALOS MEANING "SALT." HALITE IS USUALLY FOUND IN AND AROUND SALT SPRINGS, SALT LAKES, AND IN THE OCEAN. IT CAN ALSO BE FOUND IN SALT DOMES, WITH ARE ACTUALLY QUITE COMMON IN THE MICHIGAN BASIN, AND PROVIDE IMPORTANT TRAPS FOR OIL DEPOSITS.

Sandstone is a clastic sedimentary rock composed mainly of sand-sized silicate grains. Sandstones comprise about 20–25% of all sedimentary rocks. Most sandstone is composed of quartz or feldspar because they are the most resistant minerals to weathering processes at the Earth's surface.

Composition -Sandstone is a sedimentary rock composed mostly of quartz sand, but it can also contain significant amounts of feldspar, and sometimes silt and clay. Sandstone that contains more than 90% quartz is called quartzose sandstone. When the sandstone contains more than 25% feldspar, it is called arkose or arkosic sandstone.

Formation -Sandstone, a sedimentary rock, is formed when grains of sand are compacted and cemented together over thousands or millions of years. The sand grains often are composed of the minerals quartz or feldspar that were worn off other rocks and ground down into pebbles.

Shale is a soft, brittle, fine-grained, and easily eroded sedimentary rock formed from mineral-rich silt, or mud, that was deposited in an aquatic environment, buried by other sediment, and compacted and cemented into hard rock.

Composition -Shales characteristically consist of at least 30 percent clay minerals and substantial amounts of quartz. They also contain smaller quantities of carbonates, feldspars, iron oxides, fossils, and organic matter.

Formation -Shale is a geological rock formation rich in clay, typically **derived from fine sediments,** deposited in fairly quiet environments at the bottom of seas or lakes, having then been buried over the course of millions of years.

3. Metamorphic Rocks

It is a black mica with perfect cleavage and a vitreous luster on the cleavage faces. When biotite is separated into thin sheets, the sheets are flexible but will break upon severe bending. When held up to the light, the sheets are transparent to translucent with a brown, gray, or greenish color.

Composition -Biotite is a rock-forming mineral found in a wide range of crystalline igneous rocks such as granite, diorite, gabbro, peridotite, and pegmatite. ... Physical Properties of Biotite Chemical Classification Dark mica Diagnostic Properties Dark color, perfect cleavage Chemical Composition K(Mg,Fe)3(AlSi3O10)(F,OH)2

Formation-Biotite in the majority of cases forms when clay-rich sedimentary rocks are buried deep enough for the clay minerals to metamorphose to it. Biotite also forms in impure metamorphosed carbonate rocks and in metabasic rocks.

Origin: Biotite originated by reaction of chlorite, muscovite and ilmenite, producing rutile, K-feldspar and quartz as subordinate reaction products. Chlorite composition did not change as the reaction progressed but muscovite became depleted in K and (Mg+Fe+Mn) while gaining a little Ti.

The color is milky white due to transparency with a yellow tint. The luster is vitreous with a white streak.

Composition -Calcite is a **rock-forming mineral with a chemical formula of CaCO3**. It is extremely common and found throughout the world in sedimentary, metamorphic, and igneous rocks. The most common form of calcium carbonate, calcite is known for the variety and beautiful development of its crystals.

Origin: Calcite is a common constituent of sedimentary rocks, limestone in particular, much of which is formed from the shells of dead marine organisms. Approximately 10% of sedimentary rock is limestone. It is the primary mineral in metamorphic marble.

Garnets are opaque, transparent to translucent minerals that can be found as individual crystals, pebbles, or clumps of inter-grown crystals. Garnets are most commonly found with reddish shades, but can be, orange, yellow, green, purple, brown, blue, black, pink, and colourless. Blue garnets are very rare.

Composition -These minerals share a common crystal structure and a generalized chemical composition of X3Y2(SiO4)3. In that composition, "X" can be Ca, Mg, Fe2+ or Mn2+, and "Y" can be Al, Fe3+, Mn3+, V3+ or Cr3+.

Formation-Most garnet forms when a sedimentary rock with high aluminium content, such as shale, is metamorphosed (subjected to heat and pressure). The high heat and pressure breaks the chemical bonds in the rocks and cause minerals to re-crystallise.

Methods of mining garnet from the earth vary. Open pit mining is common for hard rock locations, as is hand mining, depending on the mine's location. Garnet extracted from alluvial deposits is done so using backhoes and draglines.

Marble is metamorphosed limestone. Limestone is a sedimentary rock that is composed of the mineral calcite. When a drop of dilute hydrochloric acid is placed on this rock, it bubbles and fizzes as carbon dioxide is released. This reaction can occur only when a rock is composed of the mineral calcite (CaCO3).

Composition -marble, granular limestone or dolomite (i.e., rock composed of calcium-magnesium carbonate) that has been recrystallized under the influence of heat, pressure, and aqueous solutions.

Formation-Marble forms when a pre-existing limestone rock is heated to such extreme temperatures that the minerals grow larger and fuse together. The dark, foliated bands cutting through the marble are a different kind of metamorphic rock, such as slate.

Origin: Marble is a rock resulting from metamorphism of sedimentary carbonate rocks, most commonly limestone or dolomite (rock). Metamorphism causes variable recrystallization of the original carbonate mineral grains.

Pyrophyllite is a micaceous mineral formed as a result of the relatively low grade metamorphism of aluminum-rich rocks. It can also form as a hydrothermal replacement of aluminous minerals such as feldspars. The mineral may be in fine-grained aggregate and is easily mistaken for other phyllosilicates.

Composition -Pyrophyllite is a hydrous aluminum silicate with the chemical formula Al2Si4O10(OH)2 and is commonly associated with other minerals such as quartz, mica, kaolinite, epidote, and rutile [1–3]. The pure pyrophyllite is composed of 28.3% Al2O3, 66.7% SiO2, and 5% H2O on weight bases [4].

Formation -The mineral paragenesis in the pyrophyllite deposits suggests that the formation of minerals took place in two ways: (1) the transformation of kyanite into pyrophyllite and quartz through retrograde metamorphism by a high degree temperature, (2) then pyrophyllite and probably muscovite were transformed into kaolinite

Origin: pyrophyllite, very soft, pale-coloured silicate mineral, hydrated aluminum silicate, Al2(OH)2 Si4O10, that is the main constituent of some schistose rocks. The most extensive commercial deposits are in North Carolina, but pyrophyllite is also mined in California, China, India, Thailand, Japan, Korea, and South Africa.

Serpentine rock is apple-green to black and is often mottled with light and dark colored areas. Its surfaces often have a shiny or wax-like appearance and a slightly soapy feel. Serpentine is usually fine-grained and compact but may be granular, platy, or fibrous in appearance.

Composition -Serpentine rock is primarily composed of one or more of the three magnesium silicate minerals, "lizardite," "chrysotile," and "antigorite." Chrysotile often occurs as fibrous veinlets in serpentine. Chrysotile in fibrous form is the most common type of asbestos.

Formation-Serpentine is formed below 500 °C (930 °F) by the addition of water and sometimes silica to various magnesium silicates—e.g., forsterite or enstatite. It characteristically occurs along the crests and axes of great folds, such as island arcs or Alpine mountain chains.

Origin: Serpentine is considered by geoscientists to be the metamorphosed remains of magnesium-rich igneous rocks, most commonly the rock peridotite, from the earth's mantle. The mantle is a thick layer of rock just below the earth's crust.