Natural Stone:

Igneous rock (derived from the Latin word *ignis* meaning fire) 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. Igneous rock may form with or without crystallization, either below the surface as intrusive (plutonic) rocks or on the surface as extrusive (volcanic) rocks. This magma can be derived from partial melts of pre-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. Over 700 types of igneous rocks have been described, most of them having formed beneath the surface of Earth's crust.

Sedimentary rocks are types of rock that are formed by the deposition of material at the Earth's surface and within bodies of water. Sedimentation is the collective name for processes that cause mineral and/or organic particles (detritus) to settle and accumulate or minerals to precipitate from a solution. Particles that form a sedimentary rock by accumulating are called sediment. Before being deposited, sediment was formed by weathering and erosion in a source area, and then transported to the place of deposition by water, wind, ice, mass movement or glaciers which are called agents of denudation.

Metamorphic rocks arise from the transformation of existing rock types, in a process called metamorphism, which means "change in form".[1] The original rock (protolith) is subjected to heat (temperatures greater than 150 to 200 °C) and pressure (1500 bars),[2] causing profound physical and/or chemical change. The protolith may be sedimentary rock, igneous rock or another older metamorphic rock.

Metamorphic rocks make up a large part of the Earth's crust and are classified by texture and by chemical and mineral assemblage (metamorphic facies). 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 up by the intrusion of hot molten rock called magma from the Earth's interior. The study of metamorphic rocks (now exposed at the Earth's surface following erosion and uplift) provides information about the temperatures and pressures that occur at great depths within the Earth's crust. Some examples of metamorphic rocks are gneiss, slate, marble, schist, and quartzite.

Limestone – Is fossil like and very soft material –the primary background colors is solid and the secondary color has veining and clouding (99% rules is MONO tone)

Limestone - is a sedimentary rock composed largely of the minerals calcite and aragonite, which are different crystal forms of calcium carbonate ($CaCO_3$). Many limestones are composed from skeletal fragments of marine organisms such as coral or foraminifera.

Limestone makes up about 10% of the total volume of all sedimentary rocks. The solubility of limestone in water and weak acid solutions leads to karst landscapes, in which water erodes the limestone over thousands to millions of years. Most cave systems are through limestone bedrock.

Limestone has numerous uses: as a building material, as aggregate for the base of roads, as white pigment or filler in products such as toothpaste or paints, and as a chemical feedstock.

The first geologist to distinguish limestone from dolomite was Belsazar Hacquet in 1778.[1]

Like most other sedimentary rocks, most limestone is composed of grains. Most grains in limestone are skeletal fragments of marine organisms such as coral or foraminifera. Other carbonate grains comprising limestones are ooids, peloids, intraclasts, and extraclasts. These organisms secrete shells made of aragonite or calcite, and leave these shells behind after the organisms die.

Limestone often contains variable amounts of silica in the form of chert (chalcedony, flint, jasper, etc.) or siliceous skeletal fragment (sponge spicules, diatoms, radiolarians), and varying amounts of clay, silt and sand (terrestrial detritus) carried in by rivers.

Some limestones do not consist of grains at all, and are formed completely by the chemical precipitation of calcite or aragonite, i.e. travertine. Secondary calcite may be deposited by supersaturated meteoric waters (groundwater that precipitates the material in caves). This produces speleothems, such as stalagmites and stalactites. Another form taken by calcite is oolitic limestone, which can be recognized by its granular (oolite) appearance.

The primary source of the calcite in limestone is most commonly marine organisms. Some of these organisms can construct mounds of rock known as reefs, building upon past generations. Below about 3,000 meters, water pressure and temperature conditions cause the dissolution of calcite to increase nonlinearly, so limestone typically does not form in deeper waters (see lysocline). Limestones may also form in both lacustrine and evaporite depositional environments.[2][3]

Calcite can be either dissolved or precipitated by groundwater, depending on several factors, including the water temperature, pH, and dissolved ion concentrations. Calcite exhibits an unusual characteristic called retrograde solubility, in which it becomes less soluble in water as the temperature increases.

Because of impurities, such as clay, sand, organic remains, iron oxide and other materials, many limestones exhibit different colors, especially on weathered surfaces.

Limestone may be crystalline, clastic, granular, or massive, depending on the method of formation. Crystals of calcite, quartz, dolomite or barite may line small cavities in the rock. When conditions are right for precipitation, calcite forms mineral coatings that cement the existing rock grains together, or it can fill fractures.

Travertine is a banded, compact variety of limestone formed along streams, particularly where there are waterfalls, and around hot or cold springs. Calcium carbonate is deposited where evaporation of the water leaves a solution supersaturated with the chemical constituents of calcite. Tufa, a porous or cellular variety of travertine, is found near waterfalls. Coquina is a poorly consolidated limestone composed of pieces of coral or shells.

During regional metamorphism that occurs during the mountain building process (orogeny), limestone recrystallizes into marble.

Limestone is a parent material of Mollisol soil group.

Limestone in Waitomo District, New Zealand

Marble – is the most common natural stone – 99%the Primary control colors and variation and the secondary is the veining and fussers in the stone.

Most common colors are:

Botticino, Carrara, Calacatta, Dk. & Lt. Emperador, Statuary, Crema Marfil, etc…

Marble is a non-foliated metamorphic rock composed of recrystallized carbonate minerals, most commonly calcite or dolomite. Geologists use the term "marble" to refer to metamorphosedlimestone; however, stonemasons use the term more broadly to encompass unmetamorphosed limestone.[1] Marble is commonly used for sculpture and as a building material.

Construction marble is a stone which is composed of calcite, dolomite or serpentine which is capable of taking a polish.[9] More generally in construction, specifically the dimension stonetrade, the term "marble" is used for any crystalline calcitic rock (and some non-calcitic rocks) useful as building stone. For example, Tennessee marble is really a dense granular fossiliferous gray to pink to maroon Ordovician limestone that geologists call the Holston Formation

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. The resulting marble rock is typically composed of an interlocking mosaic of carbonate crystals. Primary sedimentary textures and structures of the original carbonate rock (protolith) have typically been modified or destroyed.

Pure white marble is the result of metamorphism of a very pure (silicate-poor) limestone or dolomite protolith. The characteristic swirls and veins of many colored marble varieties are usually due to various mineral impurities such as clay, silt, sand, iron oxides, or chert which were originally present as grains or layers in the limestone. Green coloration is often due to serpentine resulting from originally high magnesium limestone or dolostone with silica impurities. These various impurities have been mobilized and recrystallized by the intense pressure and heat of the metamorphism.

a block of marble

Ancient marble columns in the prayer hall of the Mosque of Uqba, in Kairouan, Tunisia

Folded and weathered marble a tGeneral Carrera Lake, Chile

Travertine: **Easy form of natural stone – have holes – comes in Filled, Honed & un-filled finishes & Polished (very little)**

- **Primary color less is veining and more in variation**
- **Secondary – will see the cross cut, vain cut and polished**

Is a form of limestone deposited by whiter, tan and cream colors – calcium carbonate – It is also used for OUT DOOR APLICATION

Travertine is a form of limestone deposited by mineral springs, especially hot springs. Travertine often has a fibrous or concentric appearance and exists in white, tan, and cream-colored varieties. It is formed by a process of rapid precipitation of calcium carbonate, often at the mouth of a hot spring or in a limestone cave. In the latter, it can form stalactites, stalagmites, and other speleothems. It is frequently used in Italy and elsewhere as a building material.

Travertine is a terrestrial sedimentary rock, formed by the precipitation of carbonate minerals from solution in ground and surface waters, and/or geothermally heated hot-springs.[1][2] Similar (but softer and extremely porous) deposits formed from ambient-temperature water are known as tufa

Travertine is often used as a building material. The Romans mined deposits of travertine for building temples, aqueducts, monuments, bath complexes, and amphitheaters such as the Colosseum, the largest building in the world constructed mostly of travertine.

Other notable buildings using travertine extensively include the Sacré-Cœur Basilica in Paris and the 20th-century Getty Center in Los Angeles, California, and Shell-Hausin Berlin. The travertine used in the Getty Center and Shell-Haus constructions was imported from Tivoli and Guidonia.[13]

Travertine is one of several natural stones that are used for paving patios and garden paths. It is sometimes known as travertine limestone or travertine marble; these are the same stone, although travertine is classified properly as a type of limestone, not marble. The stone is characterised by pitted holes and troughs in its surface. Although these troughs occur naturally, they suggest signs of considerable wear and tear over time. Some installers use a grout to fill the holes, whereas others leave them open — travertine can be purchased "filled" or "unfilled." It can also be polished to a smooth, shiny finish, and comes in a variety of colors from grey to coral-red. Travertine is most commonly available in tile sizes for floor installations.

Travertine is one of the most frequently used stones in modern architecture. It is commonly used for façades, wall cladding, and flooring. The lobby walls of the modernist Willis Tower (1970) (formerly Sears Tower) in Chicago are made of travertine.[14] Architect Welton Becket frequently incorporated travertine into many of his projects. The first floor of the Becket-designed UCLA Medical Center has thick travertine walls. Architect Ludwig Mies van der Rohe used travertine in several of his major works, including the Toronto-Dominion Centre, S.R. Crown Hall and theFarnsworth House.

The relative softness of the stone, combined with its holes and troughs, make travertine flooring difficult to finish and maintain. Aggressive grinding — sometimes called honing — can reveal previously hidden air pockets that significantly change the look of the floor.

Supply

A decade ago[when?], Italy had a near-monopoly on the world travertine market; now significant supplies are quarried in mainly Turkey, Iran, Mexico and Peru.

Two or three small travertine producers operate in the western United States. U.S. demand for travertine is about 0.85 million tons per year, almost all of it imported.

Travertine in a 400-year-old wall.

Travertine terraces at Mammoth Hot Springs, Yellowstone National Park

Granite the is most dense material in natural stone, the primary color is speckle, with finishes in Polished, Leathered, Brushed and Honed as the secondary

Granite /ˈɡrænɨt/ is a common type of intrusive, felsic, igneous rock which is granular and phaneritic in texture. This rock consists mainly of quartz, mica, and feldspar. Occasionally some individual crystals (phenocrysts) are larger than the groundmass, in which case the texture is known as porphyritic. A granitic rock with a porphyritic textureis sometimes known as a porphyry. Granites can be pink to gray in color, depending on their chemistry and mineralogy. By definition, granite is an igneous rock with at least 20% quartz by volume. Granite differs from granodiorite in that at least 35% of the feldspar in granite is alkali feldspar as opposed to plagioclase; it is the alkali feldspar that gives many granites a distinctive pink color. Outcrops of granite tend to form tors and rounded massifs. Granites sometimes occur in circular depressions surrounded by a range of hills, formed by the metamorphic aureole or hornfels. Granite is usually found in the continental plates of the Earth's crust.

Granite is nearly always massive (lacking internal structures), hard and tough, and therefore it has gained widespread use as a construction stone. The average density of granite is between 2.65[1] and 2.75 g/cm^3, its compressive strength usually lies above 200 MPa, and its viscosity near STP is 3-6 • 10^{19} Pa·s.[2] Melting temperature is1215 - 1260 °C.[3]

The word "granite" comes from the Latin *granum*, a grain, in reference to the coarse-grained structure of such a crystalline rock.

Granitoid is a general, descriptive field term for light-colored, coarse-grained igneous rocks. Petrographic examination is required for identification of specific types of granitoids.[4]

Granite is classified according to the QAPF diagram for coarse grained plutonic rocks and is named according to the percentage of quartz, alkali feldspar (orthoclase, sanidine, ormicrocline) and plagioclase feldspar on the A-Q-P half of the diagram. True granite according to modern petrologic convention contains both plagioclase and alkali feldspars. When a granitoid is devoid or nearly devoid of plagioclase, the rock is referred to as **alkali granite**. When a granitoid contains less than 10% orthoclase, it is called tonalite; pyroxene andamphibole are common in tonalite. A granite containing both muscovite and biotite micas is called a binary or *two-mica* granite. Two-mica granites are typically high in potassium and low in plagioclase, and are usually S-type granites or A-type granites. The volcanic equivalent of plutonic granite is rhyolite. Granite has poor primary permeability but strong secondary permeability.

Occurrence

Granite is currently known only on Earth, where it forms a major part of continental crust. Granite often occurs as relatively small, less than 100 km² stock masses (stocks) and inbatholiths that are often associated with orogenic mountain ranges. Small dikes of granitic composition called aplites are often associated with the margins of granitic intrusions. In some locations, very coarse-grained pegmatite masses occur with granite.

Granite has been intruded into the crust of the Earth during all geologic periods, although much of it is of Precambrian age. Granitic rock is widely distributed throughout the continental crust and is the most abundant basement rock that underlies the relatively thin sedimentary veneer of the continents.

Quartzite: it is harder and denser than granite but has the characteristic of marble with the primary and secondary

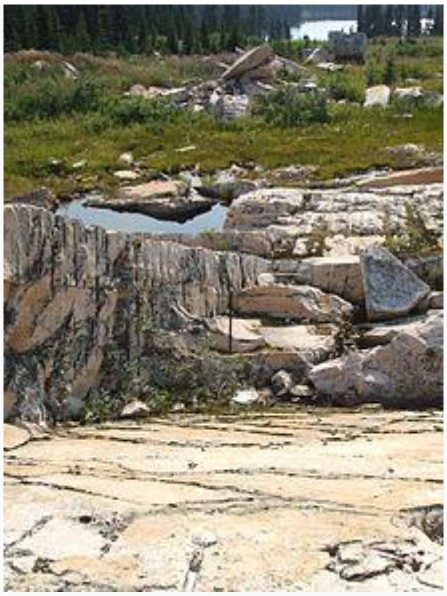
Quartzite (from German Quarzit[1]) is a hard, non-foliated metamorphic rock which was originally pure quartz sandstone.[2][3] Sandstone is converted into quartzite through heating and pressure usually related to tectonic compression within orogenic belts. Pure quartzite is usually white to gray, though quartzites often occur in various shades of pink and red due to varying amounts of iron oxide (Fe_2O_3). Other colors, such as yellow and orange, are due to other mineral impurities.

When sandstone is metamorphosized to quartzite, the individual quartz grains recrystallize along with the former cementing material to form an interlocking mosaic of quartz crystals.[2] Most or all of the original texture and sedimentary structures of the sandstone are erased by the metamorphism.[2] The grainy, sandpaper-like surface becomes glassy in appearance.[2] Minor amounts of former cementing materials, iron oxide, silica, carbonate and clay, often migrate during recrystallization and metamorphosis. This causes streaks and lenses to form within the quartzite.

Orthoquartzite is a very pure quartz sandstone composed of usually well rounded quartz grains cemented by silica. Orthoquartzite is often 99% SiO_2 with only very minor amounts of iron oxide and trace resistant minerals such as zircon, rutile and magnetite. Although few fossils are normally present, the original texture and sedimentary structures are preserved.

The term is also traditionally used for quartz-cemented quartz arenites,[4] and both usages are found in the literature. The typical distinction between the two (since each is a gradation into the other) is a metamorphic quartzite is so highly cemented, diagenetically altered, and metamorphosized so that it will fracture and break across grain boundaries, not around them. Quartzite is very resistant to chemical weathering and often forms ridges and resistant hilltops. The nearly pure silica content of the rock provides little for soil, therefore, the quartzite ridges are often bare or covered only with a very thin layer of soil and (if any) little vegetation.

Uses



Abandoned quartzite mine in Kakwa Provincial Park, British Columbia, Canada   Quartzite

Biface in quartzite – Stellenbosch, South Africa

Because of its hardness and angular shape, crushed quartzite is often used as railway ballast.[5] Quartzite is a decorative stone and may be used to cover walls, as roofing tiles, as flooring, and stair steps. Crushed quartzite is sometimes used in road construction.[3] High purity quartzite is used to produce ferrosilicon, industrial silica sand, silicon and silicon carbide.[6] During the Stone Age quartzite was used as an inferior alternative to flint.[7]

Onyx: is the oldest form of natural stone – is has lots of crushed and fussers formation in the stone – the primary color whiter and very translucent. It is more susceptible to stains

Onyx is a banded variety of chalcedony. The colors of its bands range from white to almost every color (save some shades, such as purple or blue). Commonly, specimens of onyx contain bands of black and/or white.

It has a long history of use for hardstone carving and jewellery, where it is usually cut as a cabochon or into beads. It has also been used for intaglio and hardstone cameo engraved gems, where the bands make the image contrast with the ground.[10] Some onyx is natural but much of the material in commerce is produced by the staining of agate.[11]

Onyx was used in Egypt as early as the Second Dynasty to make bowls and other pottery items.[12] Use of sardonyx appears in the art of Minoan Crete, notably from the archaeological recoveries at Knossos.[13] Onyx is also mentioned in the Bible at various points, such as in Genesis 2:12 "and the gold of that land is good: there is bdellium and the onyx stone", and such as the priests' garments and the foundation of the city of Heaven in Revelation.[14]

Onyx was known to the Ancient Greeks and Romans.[15] The first-century naturalist Pliny the Elder described both type of onyx and various artificial treatment techniques in his *Naturalis Historia*.[7]

Slabs of onyx (from the Atlas Mountains) were famously used by Mies van der Rohe in Villa Tugendhat at Brno (completed 1930) to create a shimmering semi-translucent interior wall.[16

Onyx is formed of bands of chalcedony in alternating colors. It is cryptocrystalline, consisting of fine intergrowths of the silica minerals quartzand moganite. Its bands are parallel to one another, as opposed to the more chaotic banding that often occurs in agates.[2]

Sardonyx is a variant in which the colored bands are sard (shades of red) rather than black. Black onyx is perhaps the most famous variety, but is not as common as onyx with colored bands. Artificial treatments have been used since ancient times to produce both the black color in "black onyx" and the reds and yellows in sardonyx. Most "black onyx" on the market is artificially colored.[3][4

Slate:

Slate is a fine-grained, foliated, homogeneous metamorphic rock derived from an original shale-type sedimentary rock composed of clay or volcanic ash through low-grade regional metamorphism. It is the finest grained foliated metamorphic rock.[1] Foliation may not correspond to the original sedimentary layering, but instead is in planes perpendicular to the direction of metamorphic compression.[1]

The very strong foliation is called "slaty cleavage".[1] It is caused by strong compression causing fine grained clay flakes to regrow in planes perpendicular to the compression.[1] When expertly "cut" by striking parallel to the foliation, with a specialized tool in the quarry, many slates will form smooth flat sheets of stone which have long been used for roofing and floor tiles and other purposes.[1] Slate is frequently grey in color, especially when seen, en masse, covering roofs. However, slate occurs in a variety of colors even from a single locality; for example, slate from North Wales can be found in many shades of grey, from pale to dark, and may also be purple, green or cyan. Slate is not to be confused with shale, from which it may be formed, or schist. Ninety percent of Europe's natural slate used for roofing originates from Spain.[2]

The word "slate" is also used for certain types of object made from slate rock. It may mean a single roofing tile made of slate, or a writing slate. This was traditionally a small smooth piece of the rock, often framed in wood, used with chalk as a notepad or noticeboard, and especially for recording charges in pubs and inns. The phrases "clean slate" and "blank slate" come from this usage.

Slate is mainly composed of the minerals quartz and muscovite or illite, often along with biotite, chlorite, hematite, and pyrite and, less frequently apatite, graphite, kaolinite, magnetite, tourmaline, or zircon as well as feldspar. Occasionally, as in the purple slates of North Wales, ferrous reduction spheres form around iron nuclei, leaving a light green spotted texture. These spheres are sometimes deformed by a subsequent applied stress field to ovoids, which appear as ellipses when viewed on a cleavage plane of the specimen.

Fossils

Fine slate tile work, Saint Leonhard's Church, Frankfurt am Main, Germany.

Because slate was formed in low heat and pressure, compared to a number of other metamorphic rocks, some fossils can be found in slate; sometimes even microscopic remains of delicate organisms.[1

Sandstone: is very porous

Sandstone (sometimes known as arenite) is a clastic sedimentary rock composed mainly of sand-sized minerals or rock grains.

Most sandstone is composed of quartz and/or feldspar because these are the most common minerals in the Earth's crust. Like sand, sandstone may be any colour, but the most common colours are tan, brown, yellow, red, gray, pink, white and black. Since sandstone beds often form highly visible cliffs and other topographic features, certain colors of sandstone have been strongly identified with certain regions.

Rock formations that are primarily composed of sandstone usually allow percolation of water and other fluids and are porous enough to store large quantities, making them valuable aquifersand petroleum reservoirs. Fine-grained aquifers, such as sandstones, are more apt to filter out pollutants from the surface than are rocks with cracks and crevices, such as limestone or other rocks fractured by seismic activity.

Quartz-bearing sandstone is converted into quartzite through heating and pressure usually related to tectonic compression within orogenic belts.

Sandstone has been used for domestic construction and housewares since prehistoric times, and continues to be used.

Sandstone was a popular building material from ancient times. It is relatively soft, making it easy to carve. It has been widely used around the world in constructing temples, cathedrals, homes, and other buildings. It has also been used for artistic purposes to create ornamental fountains and statues.

Some sandstones are resistant to weathering, yet are easy to work. This makes sandstone a common building and paving material. However, some that have been used in the past, such as the Collyhurst sandstone used in North West England, have been found less resistant, necessitating repair and replacement in older buildings.[1] Because of the hardness of individual grains, uniformity of grain size and friability of their structure, some types of sandstone are excellent materials from which to make grindstones, for sharpening blades and other implements. Non-friable sandstone can be used to make grindstones for grinding grain, e.g., gritstone.

Coral Stone: Fossil like materials with lots of movement in the secondary color

Coral Stone

Coral Stone invites the past into your home. Formed from our ancient oceans and reveled during the continental shifts, this unique stone showcases fossilized marine and plant life at its very best. Used in both interior and exterior living spaces, it is an ideal choice for the sophisticated consumer.

New products are added regularly; please visit our showroom to view our entire coral stone collection.

- 

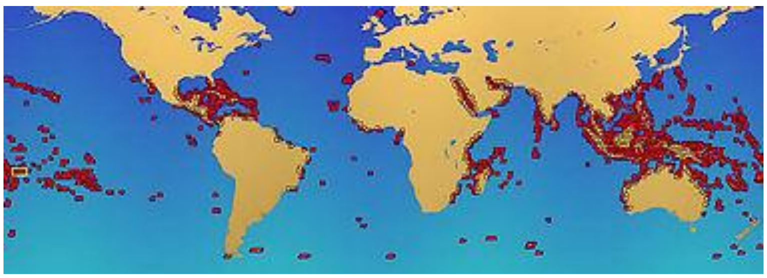
Caribbean Coral Stone

- 

Shells Reef

Corals are marine invertebrates in class Anthozoa of phylum Cnidaria typically living in compact colonies of many identical individual "polyps". The group includes the important reef builders that inhabit tropical oceans and secrete calcium carbonate to form a hard skeleton.

Reefs[edit source | editbeta]



Locations of coral reefs

Main article: Coral reef

The hermatypic, stony corals are often found in coral reefs, large calcium carbonate structures generally found in shallow, tropical water. Reefs are built up from coral skeletons, and are held together by layers of calcium carbonate produced by coralline algae. Reefs are extremely diverse marine ecosystems hosting over 4,000 species of fish, massive numbers of cnidaria,mollusks, crustacea, and many other animals.[24]

Available in Dominica republic (not very expensive) Florida – most expensive, Mexico and Pure – medium

Whole colonies can reproduce asexually, forming two colonies with the same genotype.[citation needed]

- **Fission** occurs in some corals, especially among the family Fungiidae, where the colony splits into two or more colonies during early developmental stages.
- **Bailout** occurs when a single polyp abandons the colony and settles on a different substrate to create a new colony.
- **Fragmentation** involves individuals broken from the colony during storms or other disruptions. The separated individuals can start new colonies.

Shellstone

Basalt: **is a younger state of granite – volcanic form – colors are gray or black – as an appearance like limestone**

Basalt (/bəˈsɔːlt/, /ˈbæsɒlt/, /ˈbæsɔːlt/, or /ˈbeɪsɔːlt/)[1][2][3] is a common extrusive igneous (volcanic) rock formed from the rapid cooling of basaltic lava exposed at or very near the surface of a planet or moon. By definition, basalt is an aphanitic igneous rock with less than 20% quartz and less than 10% feldspathoid by volume, and where at least 65% of the feldspar is in the form of plagioclase. (In comparison, granite has more than 20% quartz by volume.) Basalt is usually grey to black in colour, but rapidly weathers to brown or rust-red due to oxidation of itsmafic (iron-rich) minerals into rust. It almost always has a fine-grained mineral texture due to the molten rock cooling too quickly for large mineral crystals to grow, although it can sometimes be porphyritic, containing the larger crystals formed prior to the extrusion that brought the lava to the surface, embedded in a finer-grained matrix. Basalt with a vesicular or frothy texture is called scoria, and forms when dissolved gases are forced out of solution and form vesicles as the lava decompresses as it reaches the surface.

On Earth, most basalt magmas have formed by decompression melting of the mantle. Basalt commonly erupts on Io, the third largest moon of Jupiter, and has also formed on Earth'sMoon, Mars, Venus, and the asteroid Vesta. Source rocks for the partial melts probably include both peridotite and pyroxenite (e.g., Sobolev et al., 2007). The crustal portions of oceanictectonic plates are composed predominantly of basalt, produced from upwelling mantle below ocean ridges.

The term basalt is at times applied to shallow intrusive rocks with a composition typical of basalt, but rocks of this composition with a phaneritic (coarse) groundmass are generally referred to as diabase (also called dolerite) or gabbro.

The word "basalt" is ultimately derived from Late Latin *basaltes,* misspelling of L. *basanites* "very hard stone," which was imported from Ancient Greek βασανίτης (basanites), from βάσανος (basanos, "touchstone") and originated in Egyptian *bauhun* "slate".[4] The modern petrological term *basalt* describing a particular composition of lava-derived rock originates from its use by Georgius Agricola in 1556 in his famous work of mining and mineralogy *De re metallica, libri XII*. Agricola applied "basalt" to the volcanic black rock of the Schloßberg(local castle hill) at Stolpen, believing it to be the same as Pliny the Elder's "very hard stone".

Uses

Basalt is used in construction (e.g. as building blocks or in the groundwork), making cobblestones (from columnar basalt) and in making statues. Heating and extruding basalt yieldsstone wool, an excellent thermal insulator.

Types

Large masses must cool slowly to form a polygonal joint pattern.

- Tholeiitic basalt is relatively rich in silica and poor in sodium. Included in this category are most basalts of the ocean floor, most large oceanic islands, and continental flood basaltssuch as the Columbia River Plateau.
- *MORB* (Mid Ocean Ridge Basalt), is characteristically low in incompatible elements. MORB is commonly erupted only at ocean ridges. MORB itself has been subdivided into varieties such as *NMORB* and *EMORB* (slightly more enriched in incompatible elements).[5][6]
- *High alumina basalt* may be silica-undersaturated or -oversaturated (see normative mineralogy). It has greater than 17% alumina (Al_2O_3) and is intermediate in composition between tholeiite and alkali basalt; the relatively alumina-rich composition is based on rocks without phenocrysts of plagioclase.
- Alkali basalt is relatively poor in silica and rich in sodium. It is silica-undersaturated and may contain feldspathoids, alkali feldspar and phlogopite.
- Boninite is a high-magnesium form of basalt that is erupted generally in back-arc basins, distinguished by its low titanium content and trace element composition

Metamorphism

Basalt structures in Namibia

Basalts are important rocks within metamorphic belts, as they can provide vital information on the conditions of metamorphism within the belt. Various metamorphic facies are named after the mineral assemblages and rock types formed by subjecting basalts to the temperatures and pressures of the metamorphic event. These are:

- Blueschist facies

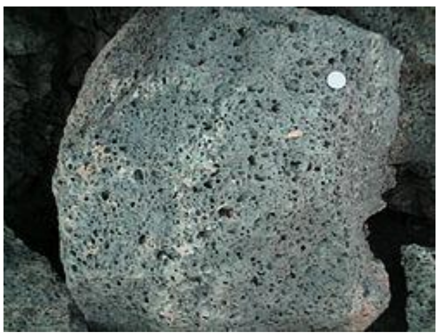
- Eclogite facies
- Granulite facies
- Greenschist facies
- Zeolite facies

Metamorphosed basalts are important hosts for a variety of hydrothermal ore deposits, including gold deposits, copper deposits, volcanogenic massive sulfide ore deposits and others.

Weathering

Compared to other rocks found on Earth's surface, basalts weather relatively fast. The typically iron-rich minerals oxidise rapidly in water and air, staining the rock a brown to red colour due to iron oxide (rust). Chemical weathering also releases readily water-soluble cations such as calcium, sodium and magnesium, which give basaltic areas a strong buffer capacity againstacidification. Calcium released by basalts binds up CO_2 from the atmosphere forming $CaCO_3$ acting thus as a CO_2 trap. To this it must be added that the eruption of basalt itself is often associated with the release of large quantities of CO_2 into the atmosphere from volcanic gases.

Carbon sequestration in basalt has been studied as a means of removing carbon dioxide, produced by human industrialization, from the atmosphere. Underwater basalt deposits, scattered in seas around the globe, have the added benefit of the water serving as a barrier to the re-release of CO_2 into the atmosphere.



Glass:

- Nano 3 **Nano-** (symbol n) is a prefix meaning a billionth . Used primarily in the metric system , this prefix denotes a factor of 10−9 or 0.000 | **...**

  1 KB (189 words) - 21:51, 25 August 2013

- **Nano**

  Nano may refer to: **Nano-** , a prefix in the SI and other systems of units denoting a factor of 10−9 (one billionth) **Nano** , an Arduino model **..**

Glass is an amorphous (non-crystalline) solid material that exhibits a glass transition, which is the reversible transition in amorphous materials (or in amorphous regions within semicrystalline materials) from a hard and relatively brittle state into a molten or rubber-like state. Glasses are typically brittle and can be optically transparent. The most familiar type of glass, used for centuries in windows and drinking vessels, is soda-lime glass, composed of about 75% Silicon dioxide (SiO_2) plus sodium oxide (Na_2O) from soda ash, lime (CaO), and several minor additives. Often, the term *glass* is used in a restricted sense to refer to this specific use.

From the 19th century, various types of fancy glass started to become significant branches of the decorative arts. Objects made out of glass include not only traditional objects such as vessels (bowls, vases, bottles, and other containers), paperweights, marbles, beads, but an endless range of sculpture and installation art as well. Colored glass is often used, though sometimes the glass is painted, innumerable examples exist of the use of stained glass.

In science, however, the term *glass* is usually defined in a much wider sense, including every solid that possesses a non-crystalline (i.e. amorphous) structure and that exhibits a glass transition when heated towards the liquid state. In this wider sense, glasses can be made of quite different classes of materials: metallic alloys, ionic melts, aqueous solutions, molecular liquids, and polymers. For many applications (bottles, eyewear) polymer glasses (acrylic glass, polycarbonate, polyethylene terephthalate) are a lighter alternative to traditional silica glasses.

Ingredients[edit source | editbeta]

Quartz sand (silica) is the main raw material in commercial glass production

While fused quartz (primarily composed of SiO_2) is used for some special applications, it is not very common due to its high glass transition temperature of over 1200 °C (2192 °F).[6]Normally, other substances are added to simplify processing. One is sodium carbonate (Na_2CO_3, "soda"), which lowers the glass transition temperature. However, the soda makes the glasswater soluble, which is usually undesirable, so lime (calcium oxide [CaO], generally obtained from limestone), some magnesium oxide (MgO) and aluminium oxide (Al_2O_3) are added to provide for a better chemical durability. The resulting glass contains about 70 to 74% silica by weight and is called a soda-lime glass.[7] Soda-lime glasses account for about 90% of manufactured glass.

Most common glass contains other ingredients added to change its properties. Lead glass or flint glass is more 'brilliant' because the increased refractive index causes noticeably morespecular reflection and increased optical dispersion. Adding barium also increases the refractive index. Thorium oxide gives glass a high refractive index and low dispersion and was formerly used in producing high-quality lenses, but due to its radioactivity has been replaced by lanthanum oxide in modern eye glasses.[citation needed] Iron can be incorporated into glass to absorbinfrared energy, for example in heat absorbing filters for movie projectors, while cerium(IV) oxide can be used for glass that absorbs UV wavelengths.[8]

The following is a list of the more common types of silicate glasses, and their ingredients, properties, and applications:

1. **Fused silica glass, vitreous silica glass**: silica (SiO_2). Has very low thermal expansion, is very hard and resists high temperatures (1000–1500 °C). It is also the most resistant against weathering (alkali ions leaching out of the glass, while staining it). It is used for high temperature applications such as furnace tubes, melting crucibles, etc.
2. **Soda-lime-silica glass, window glass**: silica 72% + sodium oxide (Na_2O) 14.2% + magnesia (MgO) 2.5% + lime (CaO) 10.0% + alumina (Al_2O_3) 0.6%. Is transparent, easily formed and most suitable for window glass. It has a high thermal expansion and poor resistance to heat (500–600 °C). Used for windows, containers, light bulbs, tableware.
3. **Sodium borosilicate glass, Pyrex**: silica 81% + boric oxide (B_2O_3) 12% + soda (Na_2O) 4.5% + alumina (Al_2O_3) 2.0%. Stands heat expansion much better than window glass. Used for chemical glassware, cooking glass, car head lamps, etc. Borosilicate glasses (e.g. Pyrex) have as main constituents silica and boron oxide. They have fairly low coefficients of thermal expansion (7740 Pyrex CTE is 3.25×10^{-6}/°C[9] as compared to about 9×10^{-6}/°C for a typical soda-lime glass[10]), making them more dimensionally stable. The lower CTE also makes them less subject to stress caused by thermal expansion, thus less vulnerable to cracking from thermal shock. They are commonly used for reagent bottles, optical components and household cookware.

4. **Lead-oxide glass, crystal glass**: silica 59% + soda (Na_2O) 2.0% + lead oxide (PbO) 25% + potassium oxide (K_2O) 12% + alumina 0.4% + zinc oxide (ZnO) 1.5%. Has a high refractive index, making the look of glassware more brilliant (crystal glass). It also has a high elasticity, making glassware 'ring'. It is also more workable in the factory, but cannot stand heating very well.
5. **Aluminosilicate glass**: silica 57% + alumina 16% + boric oxide (B_2O_3) 4.0% + barium oxide (BaO) 6.0% + magnesia 7.0% + lime 10%. Extensively used for fiberglass, used for making glass-reinforced plastics (boats, fishing rods, etc.). Also for halogen bulb glass.
6. **Oxide glass**: alumina 90% + germanium oxide (GeO_2) 10%. Extremely clear glass, used for fiber-optic wave guides in communication networks. Light loses only 5% of its intensity through 1 km of glass fiber.[11]

Another common glass ingredient is "cullet" (recycled glass). The recycled glass saves on raw materials and energy; however, impurities in the cullet can lead to product and equipment failure. Fining agents such as sodium sulfate,sodium chloride, or antimony oxide may be added to reduce the number of air bubbles in the glass mixture.[7] Glass batch calculation is the method by which the correct raw material mixture is determined to achieve the desired glass composition.

'Semi-Precious Stone'

- 

White Quartz

- 

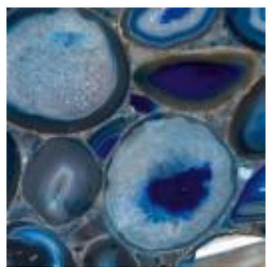
Light Smokey Quartz

- 

Convetto Rose

- 
    - Hermatite
- 

Gray Agate

- 

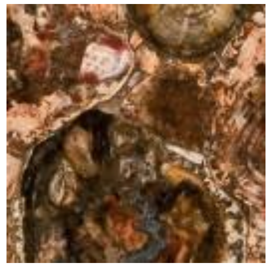
Blue Agate

- 

Brown Agate

- 

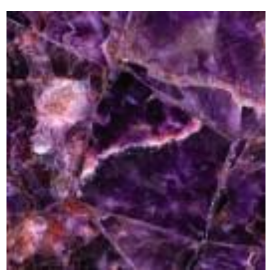
Picture Jasper

- 
- Petrified Wood
- 

Apple Jasper

- 

Ice Quartz

- 

Amethyst

- 

Durmortierite

- 
  - Yellow Quartz
- 

Tiger Eye

- 

Petrified Wood Classic

Semi-Precious Stone:

A **gemstone** or **gem** (also called a **precious** or **semi-precious stone**, a **fine gem**, or **jewel**) is a piece of mineral, which, in cut and polished form, is used to make jewelry or other adornments.[1][2] However certain rocks (such as lapis lazuli), or organic materials that are not minerals (such as amber or jet), are also used for jewelry, and are therefore often considered to be gemstones as well. Most gemstones are hard, but some soft minerals are used in jewelry because of their luster or other physical properties that have aesthetic value. Rarity is another characteristic that lends value to a gemstone. Apart from jewelry, from earliest antiquity until the 19th century engraved gems and hardstone carvings such as cups were major luxury art forms; the carvings of Carl Fabergé were the last significant works in this tradition.

Characteristics and classification

A selection of gemstone pebbles made by tumbling rough rock with abrasive grit, in a rotating drum. The biggest pebble here is 40 mm long (1.6 inches).

The traditional classification in the West, which goes back to the Ancient Greeks, begins with a distinction between **precious** and **semi-precious stones**; similar distinctions are made in other cultures. In modern usage the precious stones are diamond, ruby, sapphire and emerald, with all other gemstones being semi-precious.[3] This distinction reflects the rarity of the respective stones in ancient times, as well as their quality: all are translucent with fine color in their purest forms, except for the colorless diamond, and very hard, with hardnesses of 8 to 10 on the Mohs scale. Other stones are classified by their color, translucency and hardness. The traditional distinction does not necessarily reflect modern values, for example, while garnets are relatively inexpensive, a green garnet called Tsavorite, can be far more valuable than a mid-quality emerald.[4] Another unscientific term for semi-precious gemstones used in art history and archaeology is hardstone. Use of the terms 'precious' and 'semi-precious' in a commercial context is, arguably, misleading in that it deceptively implies certain stones are intrinsically more valuable than others, which is not the case.

In modern times gemstones are identified by gemologists, who describe gems and their characteristics using technical terminology specific to the field of gemology. The first characteristic a gemologist uses to identify a gemstone is its chemical composition. For example, diamonds are made of carbon (C) and rubies of aluminium oxide (Al_2O_3). Next, many gems are crystals which are classified by their crystal system such as cubic or trigonal or monoclinic. Another term used is habit, the form the gem is usually found in. For example diamonds, which have a cubic crystal system, are often found as octahedrons.

Gemstones are classified into different *groups*, *species*, and *varieties*. For example, ruby is the red variety of the species corundum, while any other color of corundum is considered sapphire. Other examples are the Emerald (green), aquamarine (blue), red beryl (red), goshenite (colorless), heliodor (yellow), and morganite (pink), which are all varieties of the mineral species beryl.

Gems are characterized in terms of refractive index, dispersion, specific gravity, hardness, cleavage, fracture, and luster. They may exhibit pleochroism or double refraction. They may have luminescence and a distinctive absorption spectrum.

Material or flaws within a stone may be present as inclusions.

Gemstones may also be classified in terms of their "water". This is a recognized grading of the gem's luster and/or transparency and/or "brilliance".[5] Very transparent gems are considered "first water", while "second" or "third water" gems are those of a lesser transparency.[6]

Value

Spanish emerald and gold pendant at Victoria and Albert Museum

Enamelled gold, amethyst and pearl pendant, about 1880, Pasquale Novissimo (1844–1914), V&A Museum number M.36-1928

There is no universally accepted grading system for gemstones. Diamonds are graded using a system developed by the Gemological Institute of America (GIA) in the early 1950s. Historically, all gemstones were graded using the naked eye. The GIA system included a major innovation: the introduction of 10x magnification as the standard for grading clarity. Other gemstones are still graded using the naked eye (assuming 20/20 vision).[7]

A mnemonic device, the "four Cs" (color, cut, clarity and carats), has been introduced to help the consumer understand the factors used to grade a diamond.[8] With modification, these categories can be useful in understanding the grading of all gemstones. The four criteria carry different weight depending upon whether they are applied to colored gemstones or to colorless diamonds. In diamonds, cut is the primary determinant of value, followed by clarity and color. Diamonds are meant to sparkle, to break down light into its constituent rainbow colors (dispersion), chop it up into bright little pieces (scintillation), and deliver it to the eye (brilliance). In its rough crystalline form, a diamond will do none of these things; it requires proper fashioning and this is called "cut". In gemstones that have color, including colored diamonds, it is the purity and beauty of that color that is the primary determinant of quality.

Physical characteristics that make a colored stone valuable are color, clarity to a lesser extent (emeralds will always have a number of inclusions), cut, unusual optical phenomenawithin the stone such as color zoning (the uneven distribution of coloring within a gem) and asteria (star effects). The Greeks, for example, greatly valued asteria in gemstones, which were regarded as powerful love charms, and Helen of Troy was known to have worn star-corundum.[9]

Aside from the diamond, the ruby, sapphire, emerald, pearl (not, strictly speaking, a gemstone) and opal[10] have also been considered to be precious. Up to the discoveries of bulkamethyst in Brazil in the 19th century, amethyst was considered a *precious stone* as well, going back to ancient Greece. Even in the last century certain stones such as aquamarine,peridot and cat's eye (cymophane) have been popular and hence been regarded as precious.

Nowadays such a distinction is no longer made by the gemstone trade.[11] Many gemstones are used in even the most expensive jewelry, depending on the brand name of the designer, fashion trends, market supply, treatments, etc. Nevertheless, diamonds, rubies, sapphires, and emeralds still have a reputation that exceeds those of other gemstones.[*citation needed*]

Rare or unusual gemstones, generally meant to include those gemstones which occur so infrequently in gem quality that they are scarcely known except to connoisseurs, includeandalusite, axinite, cassiterite, clinohumite and red beryl.

Gem prices can fluctuate heavily (such as those of tanzanite over the years) or can be quite stable (such as those of diamonds). In general per carat prices of larger stones are higher than those of smaller stones, but popularity of certain sizes of stone can affect prices. Typically prices can range from US$1/carat for a normal amethyst to US$20,000–50,000 for a collector's three carat pigeon-blood almost "perfect" ruby.

Grading

There are a number of[11] laboratories which grade and provide reports on gemstones.

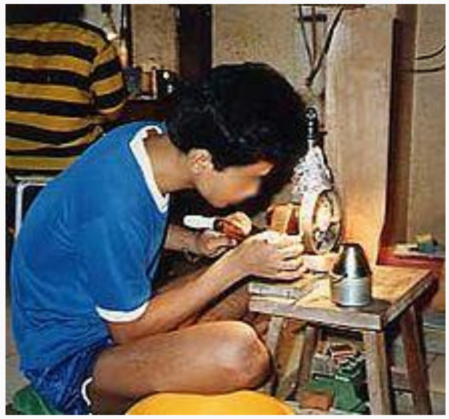
- International Gemological Institute (IGI), independent laboratory for grading and evaluation of diamonds, jewelry and colored stones.
- Gemological Institute of America (GIA), the main provider of education services and diamond grading reports.
- Hoge Raad voor Diamant (HRD Antwerp), The Diamond High Council, Belgium is one of Europe's oldest laboratories. Its main stakeholder is the Antwerp World Diamond Centre.
- American Gemological Society (AGS) is not as widely recognized nor as old as the GIA.
- American Gem Trade Laboratory which is part of the American Gem Trade Association (AGTA), a trade organization of jewelers and dealers of colored stones.
- American Gemological Laboratories (AGL), owned by Christopher P. Smith.
- European Gemological Laboratory (EGL), founded in 1974 by Guy Margel in Belgium.
- Gemmological Association of All Japan (GAAJ-ZENHOKYO), Zenhokyo, Japan, active in gemological research.
- Gemmological Institute of Thailand (GIT) is closely related to Chulalongkorn University
- Gemmology Institute of Southern Africa, Africa's premium gem laboratory.
- Asian Institute of Gemmological Sciences (AIGS), the oldest gemological institute in South East Asia, involved in gemological education and gem testing.
- Swiss Gemmological Institute (SSEF), founded by Henry Hänni, focusing on colored gemstones and the identification of natural pearls.
- Gübelin Gem Lab, the traditional Swiss lab founded by Eduard Gübelin.

Each laboratory has its own methodology to evaluate gemstones. A stone can be called "pink" by one lab while another lab calls it "Padparadscha". One lab can conclude a stone is untreated, while another lab might conclude that it is heat-treated.[11] To minimise such differences, seven of the most respected labs, AGTA-GTL (New York), CISGEM (Milano), GAAJ-ZENHOKYO (Tokyo), GIA (Carlsbad), GIT (Bangkok), Gübelin (Lucerne) and SSEF (Basel), have established the Laboratory Manual Harmonisation Committee (LMHC), for the standardization of wording reports, promotion of certain analytical methods and interpretation of results. Country of origin has sometimes been difficult to determine, due to the constant discovery of new source locations. Determining a "country of origin" is thus much more difficult than determining other aspects of a gem (such as cut, clarity, etc.).[12]

Gem dealers are aware of the differences between gem laboratories and will make use of the discrepancies to obtain the best possible certificate.[11]

Cutting and polishing

Raw gemstones



A rural Thai gem cutter

A few gemstones are used as gems in the crystal or other form in which they are found. Most however, are cut and polished for usage as jewelry. The picture to the right is of a rural, commercial cutting operation in Thailand. This small factory cuts thousands of carats of sapphire annually. The two main classifications are stones cut as smooth, dome shaped stones called cabochons, and stones which are cut with a faceting machine by polishing small flat windows called facets at regular intervals at exact angles.

Stones which are opaque such as opal, turquoise, variscite, etc. are commonly cut as cabochons. These gems are designed to show the stone's color or surface properties as in opal and star sapphires. Grinding wheels and polishing agents are used to grind, shape and polish the smooth dome shape of the stones.[13]

Gems which are transparent are normally faceted, a method which shows the optical properties of the stone's interior to its best advantage by maximizing reflected light which is perceived by the viewer as sparkle. There are many commonly used shapes for faceted stones. The facets must be cut at the proper angles, which varies depending on the optical properties of the gem. If the angles are too steep or too shallow, the light will pass through and not be reflected back toward the viewer. The faceting machine is used to hold the stone onto a flat lap for cutting and polishing the flat facets.[14] Rarely, some cutters use special curved laps to cut and polish curved facets.

Color

Nearly 300 variations of diamond color exhibited at the Aurora display at the Natural History Museum in London.

The color of any material is due to the nature of light itself. Daylight, often called white light, is actually all of the colors of the spectrum combined. When light strikes a material, most of the light is absorbed while a smaller amount of a particular frequency or wavelength is reflected. The part that is reflected reaches the eye as the perceived color. A ruby appears red because it absorbs all the other colors of white light (green and blue), while reflecting the red.

The same material can exhibit different colors. For example ruby and sapphire have the same chemical composition (both are corundum) but exhibit different colors. Even the same gemstone can occur in many different colors: sapphires show different shades of blue and pink and "fancy sapphires" exhibit a whole range of other colors from yellow to orange-pink, the latter called "Padparadscha sapphire".

This difference in color is based on the atomic structure of the stone. Although the different stones formally have the same chemical composition, they are not exactly the same. Every now and then an atom is replaced by a completely different atom (and this could be as few as one in a million atoms). These so-called impurities are sufficient to absorb certain colors and leave the other colors unaffected.

For example, beryl, which is colorless in its pure mineral form, becomes emerald with chromium impurities. If manganese is added instead of chromium, beryl becomes pink morganite. With iron, it becomes aquamarine.

Some gemstone treatments make use of the fact that these impurities can be "manipulated", thus changing the color of the gem.

Treatment

Gemstones are often treated to enhance the color or clarity of the stone. Depending on the type and extent of treatment, they can affect the value of the stone. Some treatments are used widely because the resulting gem is stable, while others are not accepted most commonly because the gem color is unstable and may revert to the original tone.[15]

Heat

Heat can improve gemstone color or clarity. The heating process has been well known to gem miners and cutters for centuries, and in many stone types heating is a common practice. Most citrine is made by heating amethyst, and partial heating with a strong gradient results in ametrine—a stone partly amethyst and partly citrine. Much aquamarine is heated to remove yellow tones and change the green color into the more desirable blue or enhance its existing blue color to a purer blue.[16]

Nearly all tanzanite is heated at low temperatures to remove brown undertones and give a more desirable blue/purple color. A considerable portion of all sapphire and ruby is treated with a variety of heat treatments to improve both color and clarity.

When jewelry containing diamonds is heated (for repairs) the diamond should be protected with boracic acid; otherwise the diamond (which is pure carbon) could be burned on the surface or even burned completely up. When jewelry containing sapphires or rubies is heated, it should not be coated with boracic acid or any other substance, as this can etch the surface; they do not have to be "protected" like a diamond.

Calcite is a carbonate mineral and the most stable polymorph of calcium carbonate ($CaCO_3$). The other polymorphs are the minerals aragonite and vaterite. Aragonite will change to calcite at 380–470°C,[5] and vaterite is even less stable.

Use and applications

High-grade optical calcite was used in World War II for gun sights, specifically in bomb sights and anti-aircraft weaponry.[8] Also, experiments have been conducted to use calcite for a cloak of invisibility.[9] Microbiologically precipitated calcite has a wide range of applications, such as soil remediation, soil stabilization and concrete repair.

Natural occurrence

The largest documented single crystals of calcite originated from Iceland, measured 7×7×2 m and 6×6×3 m and weighed about 250 tons.[10][11]

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.

Calcite is the primary mineral in metamorphic marble. It also occurs as a vein mineral in deposits from hot springs, and it occurs in caverns as stalactites and stalagmites.

Lublinite is a fibrous, efflorescent form of calcite.[12]

Calcite may also be found in volcanic or mantle-derived rocks such as carbonatites, kimberlites, or rarely in peridotites.

Calcite is often the primary constituent of the shells of marine organisms, e.g., plankton (such as coccoliths and planktic foraminifera), the hard parts of red algae, somesponges, brachiopods, echinoderms, some serpulids, most bryozoa, and parts of the shells of some bivalves (such as oysters and rudists). Calcite is found in spectacular form in the Snowy River Cave of New Mexico as mentioned above, where microorganisms are credited with natural formations. Trilobites, which became extinct a quarter billion years ago, had unique compound eyes that used clear calcite crystals to form the lenses.[13]

Calcite formation processes

Calcite forms from a poorly ordered precursor (amorphous calcium carbonate, ACC).[14] The crystallization process occurs in two stages; firstly, the ACC nanoparticles rapidly dehydrate and crystallize to form individual particles of vaterite; secondly, the vaterite transforms to calcite via a dissolution and reprecipitation mechanism with the reaction rate controlled by the surface area of calcite.[15] The second stage of the reaction is approximately 10 times slower than the first. However, the crystallization of calcite has been observed to be dependent on the starting pH and presence of Mg in solution.[16] A neutral starting pH during mixing promotes the direct transformation of ACC into calcite. Conversely, when ACC forms in a solution that starts with a basic initial pH, the transformation to calcite occurs via metastable vaterite, which forms via a spherulitic growth mechanism.[17] In a second stage this vaterite transforms to calcite via a surface-controlled dissolution and recrystallization mechanism. Mg has a noteworthy effect on both the stability of ACC and its transformation to crystalline CaCO3, resulting in the formation of calcite directly from ACC, as this ion unstabilizes the structure of vaterite.

Calcite in Earth history

Calcite seas existed in Earth history when the primary inorganic precipitate of calcium carbonate in marine waters was low-magnesium calcite (lmc), as opposed to the aragonite and high-magnesium calcite (hmc) precipitated today. Calcite seas alternated with aragonite seas over the Phanerozoic, being most prominent in the Ordovician and Jurassic. Lineages evolved to use whichever morph of calcium carbonate was favourable in the ocean at the time they became mineralised, and retained this mineralogy for the remainder of their evolutionary history.[18] Petrographic evidence for these calcite sea conditions consists of calcitic ooids, lmc cements, hardgrounds, and rapid early seafloor aragonite dissolution.[19] The evolution of marine organisms with calcium carbonate shells may have been affected by the calcite and aragonite sea cycle.[20]

Gallery

- 

Doubly terminated calcite crystal.

- 

Trilobite eyes employed calcite.

- 

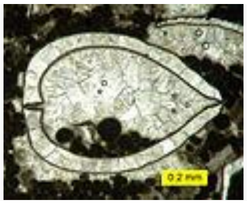
Calcite crystals inside a test of the cystoid*Echinosphaerites aurantium* (MiddleOrdovician, northeasternEstonia).

- 

Calcite rhomb from Iceberg claim, Dixon,New Mexico showingdouble refraction.

- 

Mississippian marble (made of calcite) in Big Cottonwood Canyon,Wasatch Mountains,Utah.

- 

Thin section view of calcite crystals inside a recrystallized bivalveshell in a biopelsparite.

Schist is a medium-grade metamorphic rock[1] with medium to large, flat, sheet-like grains in a preferred orientation (nearby grains are roughly parallel). It is defined by having more than 50% platy and elongated minerals,[2] often finely interleaved with quartz and feldspar.[3] These lamellar (flat, planar) minerals include micas, chlorite, talc, hornblende,graphite, and others. Quartz often occurs in drawn-out grains to such an extent that a particular form called quartz schist is produced. Schist is often garnetiferous. Schist forms at a higher temperature and has larger grains than phyllite.[4] Geological foliation (metamorphic arrangement in layers) with medium to large grained flakes in a preferred sheetlike orientation is called *schistosity*.[4]

The names of various schists are derived from their mineral constituents. Schists rich in mica are called mica schists, and include biotite or muscovite.[1]

The individual mineral grains in schist, drawn out into flaky scales by heat and pressure, can be seen by the naked eye. Schist is characteristically *foliated*, meaning the individual mineral grains split off easily into flakes or slabs. The word schist is derived ultimately from the Greek word *σχίζειν schízein* meaning "to split",[5] which is a reference to the ease with which schists can be split along the plane in which the platy minerals lie.

Most schists have been derived from clays and muds which have passed through a series of metamorphic processes involving the production of shales, slates and phyllites as intermediate steps. Certain schists have been derived from fine-grained igneous rocks such as basalts and tuffs. Most schists are mica schists, but graphite and chlorite schists are also common.

Schists are named for their prominent or perhaps unusual mineral constituents, such as garnet schist, tourmaline schist, glaucophane schist, etc.

Schists are frequently used as dimension stone. Dimension stone is stone that has been selected and fabricated to specific shapes or sizes.

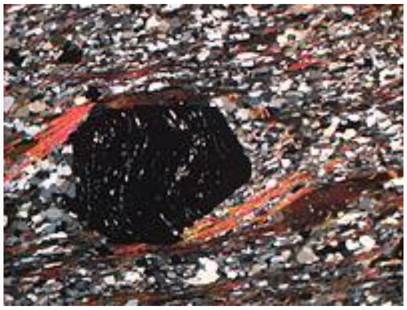
Historical mining terminology

Before the mid 18th century, the terms slate, shale and *schist* were not sharply differentiated.[6] In the context of underground coal mining, shale was frequently referred to as slate well into the 20th century.[7]

Formation

During metamorphism, rocks which were originally sedimentary, igneous or metamorphic are converted into schists and gneisses. If the composition of the rocks was originally similar, they may be very difficult to distinguish from one another if the metamorphism has been great. A quartz-porphyry, for example, and a fine grained feldspathic sandstone, may both be converted into a grey or pink mica-schist. Usually, however, it is possible to distinguish between sedimentary and igneous schists and gneisses. If the whole district, for example, occupied by these rocks have traces of bedding, clastic structure, or unconformability then it may be a sign that the original rock was sedimentary. In other cases intrusive junctions, chilled edges, contact alteration or porphyritic structure may prove that in its original condition a metamorphic gneiss was an igneous rock. The last appeal is often to the chemistry, for there are certain rock types which occur only as sediments, while others are found only among igneous masses, and however advanced the metamorphism may be, it rarely modifies the chemical composition of the mass very greatly. Such rocks, for example, as limestones, dolomites, quartzites and aluminous shales have very definite chemical characters which distinguish them even when completely recrystallized.

The schists are classified principally according to the minerals they consist of and on their chemical composition. For example, many metamorphic limestones, marbles, and calc-schists, with crystalline dolomites, contain silicate minerals such as mica, tremolite, diopside, scapolite, quartz and feldspar. They are derived from calcareous sediments of different degrees of purity. Another group is rich in quartz (quartzites, quartz schists and quartzose gneisses), with variable amounts of white and black mica, garnet, feldspar, zoisite and hornblende. These were once sandstones and arenaceous rocks. The graphitic schists may readily be believed to represent sediments once containing coal or plant remains; there are also schistose ironstones (hematite-schists), but metamorphic beds of salt or gypsum are exceedingly uncommon. Among schists of igneous origin there are the silky calc-schists, the foliated serpentines (once ultramafic masses rich in olivine), and the white mica-schists, porphyroids and banded halleflintas, which have been derived from rhyolites, quartz-porphyries and felsic tuffs. The majority of mica-schists, however, are altered claystones and shales, and pass into the normal sedimentary rocks through various types of phyllite and mica-slates. They are among the most common metamorphic rocks; some of them are graphitic and others calcareous. The diversity in appearance and composition is very great, but they form a well-defined group not difficult to recognize, from the abundance of black and white micas and their thin, foliated, schistose character. A subgroup is the andalusite, staurolite, kyanite and sillimanite-schists which usually make their appearance in the vicinity of gneissose granites, and have presumably been affected by contact metamorphism.[8]

- 

Thin section of Garnet-Mica-Schist

- 

View of cut Garnet-Mica-Schist

- 

Manhattan schist, from Southeastern New York

- 

Chlorite schist forms from shale ormudstone.

- 

Schist

- 

Manhattan schist outcropping in

New York City's Central Park

The **Serpentine group** are greenish, brownish, or spotted minerals commonly found in serpentinite rocks. They are used as a source of magnesium and asbestos, and as a decorative stone.[1] The name is thought to come from the greenish color being that of a serpent.[2]

The serpentine group describes a group of common rock-forming hydrous magnesium iron phyllosilicate ($(Mg, Fe)_3Si_2O_5(OH)_4$) minerals; they may contain minor amounts of other elements including chromium, manganese, cobalt or nickel. In mineralogy and gemology, serpentine may refer to any of 20 varieties belonging to the serpentine group. Owing to admixture, these varieties are not always easy to individualize, and distinctions are not usually made. There are three important mineral polymorphs of serpentine: antigorite,chrysotile and lizardite.

The chrysotile group of minerals are polymorphous, meaning that they have the same chemical formulae, but the molecules are arranged into different structures, or crystal lattices.[3] Chrysotile with a fiberous habit is one type of asbestos. Other minerals in the chrysotile group may have a platy habit.

Many types of serpentine have been used for jewellery and hardstone carving, sometimes under the name *false jade* or *Teton jade*.[4][5]

Their olive green color and smooth or scaly appearance is the basis of the name from the Latin *serpentinus*, meaning "serpent rock," according to Best (2003). They have their origins in metamorphic alterations of peridotite and pyroxene. Serpentines may also pseudomorphously replace other magnesium silicates. Alterations may be incomplete, causing physical properties of serpentines to vary widely. Where they form a significant part of the land surface, the soil is unusually high in clay.

Antigorite is the polymorph of serpentine that most commonly forms during metamorphism of wet ultramafic rocks and is stable at the highest temperatures—to over 600 °C at depths of 60 km or so. In contrast, lizardite and chrysotile typically form near the Earth's surface and break down at relatively low temperatures, probably well below 400 °C. It has been suggested that chrysotile is never stable relative to either of the other two serpentine polymorphs.

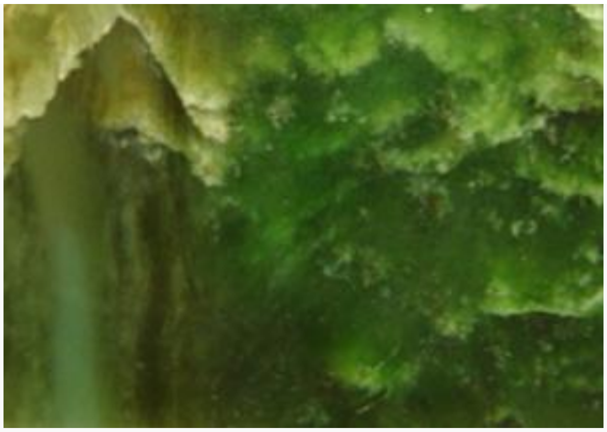
Samples of the oceanic crust and uppermost mantle from ocean basins document that ultramafic rocks there commonly contain abundant serpentine. Antigorite contains water in its structure, about 13 percent by weight. Hence, antigorite may play an important role in the transport of water into the earth in subduction zones and in the subsequent release of water to create magmas in island arcs, and some of the water may be carried to yet greater depths.

Soils derived from serpentine are toxic to many plants, because of high levels of nickel, chromium, and cobalt; growth of many plants is also inhibited by low levels of potassium andphosphorus and a low ratio of calcium/magnesium. The flora is generally very distinctive, with specialised, slow-growing species. Areas of serpentine-derived soil will show as strips ofshrubland and open, scattered small trees (often conifers) within otherwise forested areas; these areas are called serpentine barrens.

Most serpentines are opaque to translucent, light (specific gravity between 2.2–2.9), soft (hardness 2.5–4), infusible and susceptible to acids. All are microcrystalline and massive in habit, never being found as single crystals. Luster may be vitreous, greasy or silky. Colours range from white to grey, yellow to green, and brown to black, and are often splotchy or veined. Many are intergrown with other minerals, such as calcite and dolomite. Occurrence is worldwide; New Caledonia, Canada (Quebec), USA (northern California, Rhode Island, Connecticut,Massachusetts, Maryland and southern Pennsylvania),[6] Afghanistan, Britain (Cornwall and Ireland), Greece (Thessaly), China, Ural Mountains (Russia), France, Korea, Austria (Styriaand Carinthia), India (Assam, and Manipur), Myanmar (Burma), New Zealand, Norway and Italy are notable localities.

Serpentines find use in industry for a number of purposes, such as railway ballasts, building materials, and the asbestiform types find use as thermal and electrical insulation (chrysotileasbestos). The asbestos content can be released to the air when serpentine is excavated and if it is used as a road surface, forming a long term health hazard by breathing. Asbestos from serpentine can also appear at low levels in water supplies through normal weathering processes, but there is as yet no identified health hazard associated with use or ingestion. In its natural state, some forms of serpentine react with carbon dioxide and re-release oxygen into the atmosphere.

The more attractive and durable varieties (all of antigorite) are termed "noble" or "precious" serpentine and are used extensively as gems and in ornamental carvings. The town of Bhera in the historic Punjab province of the Indian subcontinent was known for centuries for finishing a relatively pure form of green serpentine obtained from quarries in Afghanistan into lapidarywork, cups, ornamental sword hilts, and dagger handles.[5] This high-grade serpentine ore was known as *sang-i-yashm* or to the English, *false jade*, and was used for generations by Indian craftsmen for lapidary work.[5][7] It is easily carved, taking a good polish, and is said to have a pleasingly greasy feel.[8] Less valuable serpentine ores of varying hardness and clarity are also sometimes dyed to imitate jade.[8] Misleading synonyms for this material include "Suzhou jade", "Styrian jade", and "New jade".



Polished slab of bowenite serpentine, a variety of antigorite. Typical cloudy patches and veining are apparent.

New Caledonian serpentine is particularly rich in nickel. The Māori of New Zealand once carved beautiful objects from local serpentine, which they called *tangiwai*, meaning "tears".

The *lapis atracius* of the Romans, now known as verde antique, or verde antico, is a serpentinite breccia popular as a decorative facing stone. In classical times it was mined at Casambala, Thessaly, Greece. Serpentinite marbles are also widely used: Green *Connemara marble* (or *Irish green marble*) from Connemara, Ireland (and many other sources), and red *Rosso di Levanto marble* from Italy. Use is limited to indoor settings as serpentinites do not weather well.

Antigorite

Lamellated antigorite occurs in tough, pleated masses. It is usually dark green in colour, but may also be yellowish, gray, brown or black. It has a hardness of 3.5–4 and its lustre is greasy. The monoclinic crystals show micaceous cleavage and fuse with difficulty. Antigorite is named after its type locality, the Geisspfad serpentinite, Valle Antigorio in border region Italy/ Switzerland.

Bowenite is an especially hard serpentine (5.5) of a light to dark apple green colour, often mottled with cloudy white patches and darker veining. It is the serpentine most frequently encountered in carving and jewellery. The name *retinalite* is sometimes applied to yellow bowenite. The New Zealand material is called *tangiwai*.

Although not an official species, bowenite is the state mineral of Rhode Island: this is also the variety's type locality. A bowenite cabochon featured as part of the "Our Mineral Heritage Brooch", was presented to First Lady Mrs. Lady Bird Johnson in 1967.

Williamsite is a local varietal name for antigorite that is oil-green with black crystals of chromite or magnetite often included. Somewhat resembling fine jade, williamsite is cut into cabochons and beads. It is found mainly in Maryland and Pennsylvania, USA.[9]

Gymnite is an amorphous form of antigorite.[10] It was originally found in the Bare Hills, Maryland, and is named from the Greek, gymnos meaning bare or naked.

The **density** of a substance is its mass per unit volume. The symbol most often used for density is ***ρ*** (the lower case Greek letter rho). Mathematically, density is defined as mass divided by volume:[1]

$$\rho = \frac{m}{V},$$

Calculate the density of Natural stone:

12x12x5/8

P=m/v

V=12x12x5/8

=144x.065

v=90in^3

Summary of mass concepts and formalisms

In classical mechanics, mass has a central role in determining the behavior of bodies. Newton's second law relates the force ***F*** exerted in a body of mass *m* to the body's acceleration ***a***:

$$\boldsymbol{F} = m\boldsymbol{a}.$$

Additionally, mass relates a body's momentum ***p*** to its linear velocity ***v***:

$$\boldsymbol{p} = m\boldsymbol{v},$$

and the body's kinetic energy *K* to its velocity:

$$K = \frac{1}{2}m|\boldsymbol{v}|^2.$$

In special relativity, relativistic mass is a formalism which accounts for relativistic effects by having the mass increase with velocity.

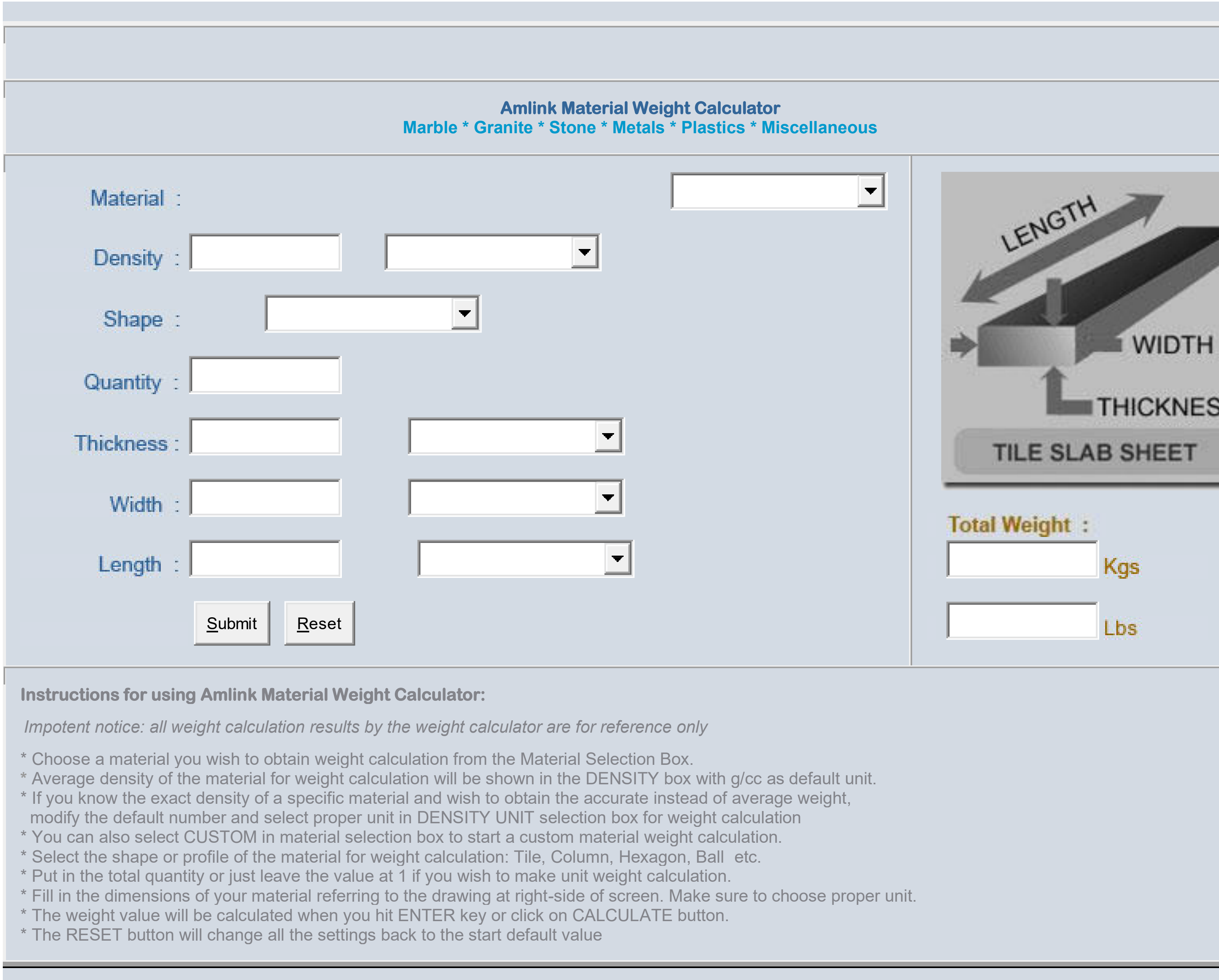
$$M = \gamma m_0$$

$$E = Mc^2$$

Since energy is dependent on reference frame (upon the observer) it is convenient to formulate the equations of physics in a way such that mass values are invariant (do not change) between observers, and so the equations are independent of the observer. For a single particle, this quantity is the rest mass; for a system of bound or unbound particles, this quantity is the invariant mass. The invariant mass *M* of a body is related to its energy *E* and the magnitude of its momentum ***p*** by

$$Mc^2 = \sqrt{E^2 - (|\boldsymbol{p}|c)^2},$$

where ***c*** is the speed of light.



Factors to consider in selecting a natural stone:

Stone resources - You have made an excellent investment in new natural stone. Stone is a natural product with simple care and maintenance you can keep it looking beautiful for years to come. This guide will give you recommendations for routine care and cleaning as well as simple stain removal techniques.

Color - Natural stones are available in a beautiful spectrum of colors from soft beiges to multi colored exotics.

Finish - Natural stone is available in a number of finishes such as polished and honed.

- A polished finish has a glossy surface that reflects light and emphasizes the color and markings of the stones.
- A honed finish is a satin-smooth surface with relatively little reflection.

Usage - The harder the stone, the more it resists abrasion

Natural Stone Care and Precautions:

Stone is a product of nature. It is not possible to guarantee that all the colors and markings on a large stone deposit will be present in every small sample, nor that every characteristic of a sample will be uniformly present in other samples. A sample serves only as to indicate in a general way; the color, marking, and texture usually found in a variety of species of stone. No two installations will ever be identical because of the stone's characteristics and unique appearance. We assume no responsibility to any faulty installation of our products. We extend no guarantees, expressed or implied as to slipperiness, wear-resistance or maintenance procedures

- Many foods and drinks contain acids that will etch or dull the surfaces of many stones.
- Use coasters under all glasses, particularly those containing alcohol or citrus juices.
- Do not place hot items directly on the stone surface.
- Although we usually think of stone as hard, it is a porous material that can absorb spills and stains if left untreated.
- Sealing your stone with a quality impregnating sealer will prevent most spills from damaging your investment.
- We recommend Dry Treat or Dry Treat and Tenax Professional Heavy Duty Stone Sealer for less porous or semi-porous stone and Stone Tech Professional Dry Treat and Tenax Stone Sealer for very porous stone.

Stone Care Guide | Cleaning Procedures and Recommendations

Floor surfaces

Dust mop interior floors frequently, using a clean non-treated dry mop. Sand, dirt and grit do the most damage to natural stone surfaces due to their abrasiveness.

Do not use vacuum cleaners that are worn. The metal or plastic attachments or the wheels may scratch the surface.

Clean your natural stone on a regular basis with warm water and a clean non-abrasive cloth, sponge or mop. In addition, using a neutral cleaner specifically formulated for natural stone will help remove soils that normal dusting or damp mopping leaves behind. We recommend Dry Treat and Tenax Professional Revitalizer Stone & Tile Cleaner or revitalizer as directed on the label.

Bath and Other Wet Areas

In the bath and other wet areas, soap scum and hard water deposits can be minimized by using a squeegee after each use. Periodic use of revitalizer will remove any soap scum or hard water deposits that may have formed.

Vanities and Countertop Surfaces

Many everyday food spills, cooking, oils, drinks and toiletries contain acids and other ingredients that may damage the stone's surface. Vanities and countertops may need to have a penetrating sealer applied. For everyday removal of residues and spills, we recommend using revitalizer.

Food Preparation Areas

In food preparation areas, the stone may need to have a penetrating sealer applied. If a sealer is applied, be sure that it is non-toxic and safe for use on food preparation surfaces.

Outside Pool & Patio Areas

In outside pool, patio or hot tub areas, flush with water.

Other Surfaces

Clean stone surface with a few drops of neutral cleaner. Use a clean rag or mop on floors and a soft cloth on other surfaces for best results. Do not use products that contain lemon, vinegar or other acids on marble or other calcareous stone. Do not use scouring powders or creams.

What to do when a spill occurs

Stone resources

No matter how careful you are, spills are going to happen. A quick response and the right solutions can keep spills from damaging your stone or the sealer. Ouro Preto Stone recommends the product in our stone care guide - speak to our sales team for additional product from Dry Treat and Tenax.

Etch Marks

Substances that are highly acidic will etch most marbles, limestone and travertine, whether the stone is sealed or unsealed. Although, sealing allows you time to wipe up a spill, it cannot stop the chemical reaction that may leave a dull area or etch mark in the stone. In addition, cleaners not specifically designed for natural stone are not recommended. These may etch away the polish, discolor the surface, scratch the stone or degrade the sealer.

Food Spills

Scoop up the food with a plastic spoon. Blot away the excess with a clean, dry, white cloth. Spray the area with revitalizer and wipe off excess with a clean cloth or clean the soiled area with revitalizer wipes.

Liquid Spills

Blot away the excess with a clean, dry, white cloth, turning the cloth frequently. Spray the area with revitalizer and wipe off excess with a clean cloth or clean the soiled area with revitalizer wipes.

Mud

Let the mud stain dry completely. Remove dried mud with a soft plastic or nylon brush. Spray affected area with revitalizer, wipe dry with a clean cloth. If the stain remains, contact a professional cleaner.

Oily Stains

If you identify the stain as having an oil base, you may be able to remove the stain using a poultice. We recommend Dry Treat and Tenax Professional Oil Stain Remover. The easy-to-use poultice is designed to slowly remove oily stains from natural stone surfaces. Follow the directions on the label.

Dos and Don'ts | Stone Care Guide

- DO use coasters under glass, especially if they contain alcohol or citrus juices
- DO use trivets or mats under hot dished or cookware
- DO use place mats under china, ceramics, silver or other object that may scratch your stones surface
- DO dust countertops, islands, vanities and floors frequently
- DO blot up spills immediately to minimize permanent damage to the stone
- DO clean surfaces by wiping with clean water or by using Dry Treat and Tenax Professional Revitalizer Stone & Tile Cleaner and Protector

- DON'T use vinegar, bleach, ammonia or other general purpose cleaners
- DON'T use cleaners that contain acid such as bathroom cleaners, grout cleaners or tub and tile cleaners.
- DON'T use abrasive cleaners such as dry cleaners or soft cleaners
- DON'T use alkaline cleaners not specifically formulated for natural stone.

Stone is a product of nature.

It is not possible to guarantee that all the colors and markings on a large stone deposit will be present in every small sample or that every characteristic of a sample will be present in other samples.

A sample serves only to indicate in a general way the color, markings and texture usually found in a variety of species of stone.

Natural Stone is a beautiful and practical product for building. No two installations will ever be identical because of the stone's characteristics and unique appearance. Stone by its very nature is fragile; some stone is highly veined and will be more susceptible to cracks than other stone with very little veining.

NO CLAIM ACCEPTED AFTER THE MATERIAL IS INSTALLED

Before Installation

Lay stone tile out for the best distribution of variation and to see if there are any defective stone tiles in size or thickness. All claims MUST be made BEFORE you install the stone. Any claims made after the stone is installed will not be accepted by Ouro Preto Stone.

Open all boxes or crates in order to get an average look of the appearance of the tiles. If there is a question regarding the material, contact Ouro Preto Stone prior to installation.

Place tiles in the area to be installed, with attention to varying color shades, veins and overall structure of the material.

Arrange the tiles according to your personal taste. It is normal to find tiles of varying shades, veins and holes - the ones that stand out the most should be used for cuts, hidden corner areas or closets in order to use them.

ALWAYS use white setting materials when installing natural stone products that are light in color, translucent, porous, unfilled or filled - especially travertine. This will prevent the product from getting dark from the intrusion of dark setting materials or dust that could get into the porous surfaces which will result in a loss of the product's natural appearance.

ALWAYS use clean filtered water when mixing the setting materials. This will prevent any discoloration of rust and/or blotching caused by high iron, sulfur and other minerals found in some water supplies

The use of white adhesive to install tiles will avoid the problem of stains seeping through the bed. Green marbles MUST only use specific adhesive to avoid any problems.

ALWAYS make sure that the tile bed is completely dry before doing any installation of tile. This will avoid the possibility of mold and even sometimes micro-cracking of polished tiles.

NEVER use acids or chemicals for cleaning purposes on polished materials as this will remove the shine.

ALWAYS use clean water while cleaning the tiles. Make sure there is no residual film left on the surface.

ALWAYS take every precaution to protect the floor against sand, cement and other construction elements found during the installation process.

Summary:

If you have any questions about your materials, please contact us.

Know Your Stone:

Natural stone can be classified into two categories according to its composition; siliceous stone or calcareous stone.

Siliceous stone is composed mainly of silica or quartz-like particles. Types of siliceous stone include Quartzite, granite, slate and sandstone.

Calcareous stone is composed mainly of calcium carbonate. Types of calcareous stone include marble, travertine, limestone Calcite and onyx.

Stone is a product of nature. It is not possible to guarantee that all the colors and markings on a large stone deposit

will be present in every small sample, nor that every characteristic of a sample will be uniformly present in other samples. A sample serves only as to indicate in a general way the color, marking and texture usually found in a variety of species of stone. No two installations will ever be identical because of the stone's characteristics and unique appearance. We assume no responsibility for any faulty installation of our products. We extend no guarantees, expressed or implied as to slipperiness, wear-resistance or maintenance procedure.

Information in this document was gathered from Wikipedia, Natural Stone Institute and the owner of Ouro Preto Stone with more than 25 years' experience in the Natural Stone Industries

For more information on Natural Stone always refer to:

- **https://www.naturalstoneinstitute.org/**
- **https://en.wikipedia.org/wiki/Rock_(geology)**
- **STAIN-PROOF | FAQS**
- **https://www.Tenax4you.com/engineered-quartz-sealers-color-enhancers-protection-toner-s/1998.htm**
- **Steve Harsham - Owner of Ouro Preto Stone, LLC www.ouropretostone.com**

4424 24th Street E., Suite 101, Bradenton, FL 34203 | (941) 524 – 5809 | (941) 932 - 8830

Sales@ouropretostone.com | www.ouropretostone.com

OURO PRETO STONE