



Earth Sciences Glossary

Date: 03/05/2023 Rev 2 Added new terms & Linked Index

Ken Jones

Glossary Linked - Index Pdf format - (click link), for MS Word - (Ctrl +click)

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[Acknowledgements](#)

[Other 'useful' information](#)

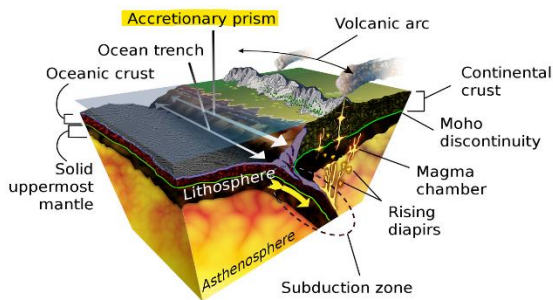
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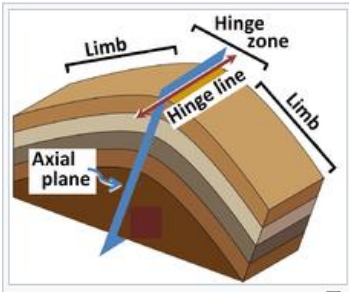
A

- ✚ **Accretionary wedge** or **accretionary prism**: forms from [sediments accreted](#) onto the non-[subducting tectonic plate](#) at a [convergent plate boundary](#). Most of the material in the accretionary wedge consists of marine sediments scraped off from the down going [slab of oceanic crust](#), but in some cases the wedge includes the erosional products of volcanic [island arcs](#) formed on the overriding plate.



- ✚ **Adit**: a horizontal or near-horizontal [passage](#) driven from the Earth's surface into the side of a ridge or mountain for the purpose of working, ventilating, or removing water from a mine.
- ✚ **Aeolian (Eolian)**: wind related processes and features. Sand is an [Aeolian](#) material and a sand dune is an Aeolian structure.
- ✚ **Agglomerate** (Latin- meaning "to form into a ball") is a coarse accumulation of large blocks of [volcanic](#) material that contains at least 75% [bombs](#) [bombs: mass of molten rock ([tephra](#)) larger than 64 mm in [diameter](#), formed when a [volcano](#) ejects [viscous](#) fragments of [lava](#). They cool into solid fragments before they reach the ground].
- ✚ **Allochthon, or an allochthonous block**: is a large block of rock which has been moved from its original site of formation, usually by [low angle thrust faulting](#).
- ✚ **Alluvial fan**: is a [fan](#)- or [cone](#)-shaped [deposit](#) of [sediment](#) crossed and built up by [streams](#). If a fan is built up by [debris flows](#) it is properly called a [debris cone](#) or [colluvial fan](#). These flows come from a single point source at the [apex](#) of the fan.
- ✚ **Alluvium**: [Alluvium](#) is an unconsolidated (not cemented together into a solid [rock](#)) accumulation of stream-deposited sediments, including sands, silts, clays, or gravels.
- ✚ **Amphibole**: is the name of an important group of generally dark-colored, [silicate minerals](#), forming prism or needlelike crystals. Amphiboles can be green, black, colorless, white, yellow, blue, or brown. In rocks Amphiboles are minerals of either [igneous](#) or [metamorphic](#) origin; in the former case occurring as constituents ([hornblende](#)) of igneous rocks, such as [granite](#), [diorite](#), [andesite](#) and others.
- ✚ **Amygdules** or **amygdales** form when the gas bubbles or [vesicles](#) in [volcanic lava](#) are in-filled with a secondary [mineral](#) such as [calcite](#), [quartz](#), [chlorite](#) or one of the [zeolites](#). Rocks containing amygdules can be described as [amygdaloidal](#).
- ✚ **Andesite**: is an [extrusive igneous, volcanic rock](#), of [intermediate composition](#). In a general sense, it is the intermediate type between [basalt](#) and [granite](#), and ranges from 57 to 63% [silicon dioxide](#) (SiO₂).

- ✚ **Anticline (Anticlinal):** is a type of [fold](#) that is an arch-like shape and has its oldest [beds](#) at its core. A typical anticline is [convex](#) up in which the hinge or crest is the location where the [curvature](#) is greatest, and the limbs are the sides of the fold that [dip](#) away from the hinge.



- ✚ **Aphyric:** few or no phenocrysts. (phyric: indicates the presence of phenocrysts).
- ✚ **Aragonite:** is a [carbonate mineral](#), one of the two most common, naturally occurring, [crystal forms](#) of [calcium carbonate](#), CaCO_3 . It is formed by biological and physical processes, including precipitation from marine and freshwater environments. Aragonite's [crystal lattice](#) differs from that of calcite, resulting in a different crystal shape.
- ✚ **Asthenosphere:** (*asthenēs* 'weak' + "sphere") is the highly viscous, mechanically weak and [ductilely](#) deforming region of the upper [mantle](#) of the [Earth](#). It lies below the [lithosphere](#), at depths between approximately 80 and 200 km (50 and 120 miles) below the surface.
- ✚ **Aulocogen:** is a failed arm of a [triple junction](#). Aulacogens are a part of [plate tectonics](#) where [oceanic](#) and [continental crust](#) is continuously being created, destroyed, and rearranged on the [Earth's](#) surface. Specifically, aulacogens are a [rift zone](#), where new [crust](#) is formed, that is no longer active.
- ✚ **Autochthon:** is a large block or mass of rock which is in the place of its original formation relative to its basement or foundation rock.
- ✚ **Autotroph:** An organism that manufactures its own food from inorganic substances, such as carbon dioxide and ammonia. Most **autotrophs**, such as green plants, certain algae, and photosynthetic bacteria, use light for energy.

B

- ✚ **Back-arc basins** are geologic [basins](#), submarine features associated with [island arcs](#) and [subduction zones](#). They are found at some [convergent plate boundaries](#), presently concentrated in the western [Pacific Ocean](#). Most of them result from [tensional forces](#) caused by [oceanic trench](#) rollback and the collapse of the edge of the continent. The arc crust is under [extension](#) or rifting as a result of the sinking of the subducting slab.

- ✚ **Basalt:** basalt is an [aphanitic](#) (fine-grained) igneous rock with generally 45-55% silica (SiO₂) and less than 10% [feldspathoid](#) by volume, and where at least 65% of the rock is [feldspar](#) in the form of [plagioclase](#). It is the most common volcanic rock type on Earth, being a key component of [oceanic crust](#) as well as the principal volcanic rock in many mid-oceanic islands.
- ✚ **Bathymetry:** is the study of underwater depth of lake or [ocean floors](#). It is the underwater equivalent of [topography](#). It shows the seafloor relief or [terrain](#) as [contour lines](#) (called **depth contours** or **isobaths**).
- ✚ **Bauxite:** is a rock formed from a reddish clay material called laterite soil, it is primarily comprised of aluminum oxide compounds (alumina), silica, iron oxides and titanium dioxide.
- ✚ **Bed:** the smallest recognizable stratigraphic unit. Beds can be differentiated in various ways, including rock or [mineral](#) type and [particle size](#).
- ✚ **Bedding plane:** separate successive layers of rock. The term is generally applied to [sedimentary strata](#), but may also be used for [volcanic](#) flows or [ash](#) layers.
- ✚ **Benioff (seismic) zone:** is a planar zone of seismicity corresponding with the down-going [slab](#) in a [subduction](#) zone.
- ✚ **Benthic:** refers to anything associated with or occurring on the bottom of a body of water. The animals and plants that live on or in the bottom are known as the benthos.
- ✚ **Bentonite:** is an [absorbent aluminium phyllosilicate clay](#) consisting mostly of [montmorillonite](#). The bentonitic clays of Cyprus were deposited as deep-water sediments from the alteration of volcanic ash during the Upper Cretaceous period (approximately 90 million years ago). They were then either reworked or directly overlain by the pinkish clay and chalk of the Lefkara Formation. Bentonite expands when wet, absorbing as several times its dry [mass](#) in water – exported for cat litter and drilling mud.
- ✚ **Biocalcarenite:** any calcarenite containing fossils.
- ✚ **Biogenic substance:** is a substance produced by [life](#) processes. It may be either constituents, or secretions, of [plants](#) or [animals](#).
- ✚ **Black Smokers:** are under sea [Hydrothermal vents](#), from which [geothermally](#) heated [water](#) issues. Hydrothermal vents are commonly found near [volcanically](#) active places, areas where [tectonic plates](#) are moving apart at [spreading centers](#), ocean basins, and [hotspots](#). They form from minerals that are dissolved in the vent fluid and which precipitate out when the superheated water contacts the near-freezing sea water.
- ✚ **Boninite:** is a [mafic extrusive rock](#) high in both [magnesium](#) and [silica](#), thought to be usually formed in [fore-arc](#) environments, typically during the early stages of [subduction](#).
- ✚ **Boulder clay:** a mixture of clay, pebbles and boulders, which is formed out of the ground moraine material of [glaciers](#) and ice-sheets and deposited from the melt.

- ✚ **Bouma Sequence:** describes a classic vertical succession of [sedimentary structures](#) in [turbidite](#) beds deposited by [turbidity currents](#) at the bottoms of lakes, oceans and rivers. The layers are as follows:
 - E:** Massive, ungraded mudstone, sometimes with evidence of [trace fossils](#) (i.e., [bioturbation](#)). The Bouma E layer is often missing, or difficult to differentiate from the Bouma D layer below.
 - D:** Parallel-laminated siltstone.
 - C:** Ripple-laminated fine-grained sandstone. Often the [ripple laminations](#) are deformed into [convolute laminations](#) and [flame structures](#).
 - B:** [Planar](#)-laminated fine- to medium-grained sandstone. The base of Bouma B often has features known as [sole markings](#), such as flute casts, groove casts and parting lineation.
 - A:** Massive to normally graded, fine- to coarse-grained sandstone, often with pebbles and/or [rip-up clasts](#) of shale near the base. [Dish structures](#) may be present. The base of the sandstone, below A, is sometimes eroded into underlying strata.
- ✚ **Bowen's reaction series:** explains the crystallization sequence of typical basaltic magma undergoing [fractional crystallization](#) (i.e., crystallization wherein early-formed crystals are removed from the magma by crystal settling, say, leaving behind a liquid of slightly different composition). See *Other 'Useful' Information*, at the end of this document.
- ✚ **Breccia:** is a lithified sedimentary rock composed of angular or sub-angular fragments of [minerals](#) or rock (larger than 2 mm) [cemented](#) together by a fine-grained [matrix](#) that can be similar to or different from the composition of the fragments. It differs from a [conglomerate](#), which consists of rounded clasts.
- ✚ **Brucite:** [mineral](#) composed of [magnesium hydroxide](#), $Mg(OH)_2$. It commonly is present in serpentine and formed during [serpentinization](#) of [dunites](#).

C

- ✚ **Carbonate (Calcite) Compensation Depth (CCD):** the depth in the ocean below which calcite minerals will dissolve. The [lysocline](#) is the depth at which $CaCO_3$ begins to dissolve rapidly. If the [sea bed](#) is above the CCD, bottom [sediments](#) can consist of calcareous sediments called [calcareous ooze](#), which is essentially a type of [limestone](#) or [chalk](#). If the exposed sea bed is below the CCD, tiny [shells](#) of $CaCO_3$ will dissolve before reaching this level, preventing deposition of carbonate sediment.
- ✚ **Carbonatite:** is a type of intrusive or extrusive igneous rock defined by mineralogic composition consisting of greater than 50% carbonate minerals.

- ✚ **Calcarenite:** a type of limestone or dolomite composed of coral or shell sand or of sand formed by erosion of older limestones, with particle size ranging up to 2 mm. Calcarenite is the carbonate equivalent of a sandstone.
- ✚ **Calclutite** (cementstone) is a type of limestone that is composed of predominantly, more than 50 percent, of either clay-size or both silt-size and clay-size detrital (transported) [carbonate](#) grains. These grains can contain [fossil](#) fragments.
- ✚ **Celadonite:** is a [mica](#) group [mineral](#).
- ✚ **Cementation:** involves the precipitation of mineral matter in the pore spaces between sedimentary grains. It is the last stage in the formation of a [sedimentary rock](#). The new pore-filling minerals form "bridges" between original sediment grains, thereby binding them together. In this way *sand* becomes "sandstone", and *gravel* becomes "conglomerate" or "breccia".
- ✚ **Clastic [sedimentary rocks](#):** are rocks composed predominantly of broken pieces or *clasts* of older [weathered](#) and [eroded](#) rocks. Clastic sedimentary rocks are named according to the grain size of the sediment particles.
 - Conglomerate** = coarse (64 mm to >256 mm), rounded grains
 - Breccia** = coarse (2mm to 64 mm), angular grains
 - Sandstone** = grains ranging in size from 2mm to 0.0625 mm
 - Shale** = grains ranging in size from 0.062 and .0039 mm.
- ✚ **Clinopyroxene:** a member of the [pyroxene](#) group of minerals having a [monoclinic](#) crystal structure (having three [unequal axes](#), one [pair](#) of which are not at [right angles](#) to each other). See **Orthopyroxene**.
- ✚ **Chalk:** [chalk](#) is a soft, white, porous, [sedimentary carbonate rock](#), a form of [limestone](#) composed of the [mineral calcite](#). It forms under reasonably deep marine conditions from the gradual accumulation of minute [calcite](#) shells ([coccoliths](#)) shed from micro-organisms called [coccolithophores](#). (calcareous nannofossils).
- ✚ **Chert:** [chert](#) is a fine-grained sedimentary rock which forms in limestone formations by replacement of calcium carbonate with [microcrystalline](#) or [cryptocrystalline](#) silica.
- ✚ **Chromitite:** is an [igneous cumulate rock](#) composed mostly of the mineral [chromite](#). It typically forms in [peridotite](#) rocks.
- ✚ **Chrysotile asbestos:** is obtained from [serpentine](#) rocks which are common throughout the world. Its idealized [chemical formula](#) is $Mg_3(Si_2O_5)(OH)_4$. Chrysotile appears under the microscope as a white fiber. Chrysotile is more flexible than amphibole types of asbestos, and can be spun and woven into fabric.
- ✚ **Competent:** refers to the degree of resistance to erosion.
- ✚ **Concomitant:** Occurring or existing concurrently
- ✚ **Conglomerate:** a coarse-grained sedimentary rock composed of rounded fragments (larger than 2mm), embedded in a cementing matrix of finer grained [sediment](#), e.g., either [sand](#), [silt](#), [clay](#) or combination of them.



- ✚ **Contact:** a [contact](#) is the surface over which two solid geological bodies, usually rocks, are in touch.
 - ✚ **Craton:** is an old and stable part of the [continental lithosphere](#). Having often survived cycles of merging and [rifting](#) of [continents](#), cratons are generally found in the interiors of [tectonic plates](#). The term *craton* is used to distinguish the stable portion of the [continental crust](#) from regions that are more geologically active and unstable.
 - ✚ **Cross Bedding:** [Cross Bedding](#) is layering at an angle to the main bedding plane.
 - ✚ **Crust:** is the outermost solid shell of the Earth. It is usually distinguished from the underlying [mantle](#) by its chemical makeup. The Earth's crust was formed via [igneous](#) processes and later modified by [erosion](#), [impact cratering](#), volcanism, and sedimentation. The Earth, has two distinct crust types: [continental crust](#) and [oceanic crust](#). These two types have different chemical compositions and physical properties, and were formed by different geological processes.
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D

- ✚ **Diabase:** or **dolerite** or **microgabbro** is a [mafic](#), [sub-volcanic rock](#) equivalent to [volcanic basalt](#) or [plutonic gabbro](#). *Diabase* is the preferred name in North America, yet *dolerite* is the preferred name in most of the rest of the world, where sometimes the name *diabase* is applied to altered dolerites and basalts. Many petrologists prefer the name *microgabbro* to avoid this confusion.
- ✚ **Diapir:** is a type of geologic [intrusion](#) in which a more mobile and ductily deformable material is forced into brittle overlying rocks. (think lava lamp).
- ✚ **Diatoms:** are a major group of [algae](#), found in the oceans, waterways and soils of the world. Living diatoms makeup a significant portion of the Earth's biomass: they generate about 20 percent of the [oxygen](#) produced on the planet each year. Diatom cell walls are ornamented by intricate and striking patterns of opaline silica.
- ✚ **Dike** or **dyke:** is a sheet of rock that formed in a [fracture](#) in a pre-existing rock body. Dikes can be either [magmatic](#) or [sedimentary](#) in origin. Magmatic dikes form when [magma](#) intrudes into a crack then crystallizes as a [sheet intrusion](#), either cutting across layers of rock or through a contiguous mass of rock. [Clastic dikes](#) are formed when [sediment](#) fills a pre-existing crack.
- ✚ **Diorite:** is an [intrusive igneous rock](#) composed principally of the [silicate minerals](#) [plagioclase feldspar](#) (typically [andesine](#)), [biotite](#), [hornblende](#), and/or [pyroxene](#). The [chemical composition](#) of diorite is [intermediate](#), between that of [mafic gabbro](#) and [felsic granite](#). Diorite is usually grey to dark-grey in colour, but it can also be black or bluish-grey. Diorite has an often speckled, [texture](#) of coarse grain size.

- ✚ **Discontinuity:** is a break in the normal progression of deposits; i.e. deposition stopped for a considerable period of time or existing rocks were eroded prior to deposition of newer younger sediments. Term can also be used to indicate a distinct boundary between materials e.g. Mohorovicic Discontinuity, or "Moho," is the boundary between the crust and the mantle.
- ✚ **Distal:** means away or farther from the point of reference and the opposite is 'Proximal' meaning near or close to.
- ✚ **Drumlin:** drumlin (*droimnín* -"littlest ridge"), is an elongated hill in the shape of an inverted spoon or half-buried egg, formed by glacial ice acting on underlying unconsolidated till or ground moraine.
- ✚ **Dunite:** is an igneous, plutonic rock, of ultramafic composition, with coarse-grained texture. It is greater than 90% olivine, with minor amounts of other minerals.
- ✚ **Dyke (Dike):** a sheet intrusion injected into the crust during its subjection to tension, the dyke being thin with parallel sides

E

- ✚ **Epidote:** a green mineral consisting of hydrated calcium iron aluminium silicate in monoclinic crystalline form, common in metamorphic rocks rich in Ca.
- ✚ **Erosion:** The action of surface processes, such as water flow and wind, which removes rock, soil and dissolved material from one location and transports it to another, (not to be confused with weathering which involves no movement).
- ✚ **Exfoliation:** Physical weathering at the surface, of course grained igneous rocks which leads to slab detachment. The processes leading to exfoliation are not fully understood. (See Foliation).



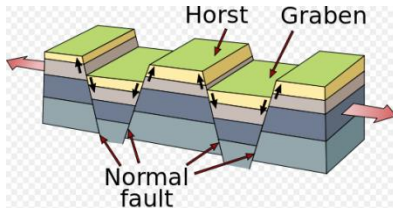
F

- ✚ **Facies:** A body of [rock](#) with specified [characteristics](#) reflecting the way it was [formed](#).
 - ✚ **Fault:** a [fault](#) is where movement in a joint has taken place.
 - **Normal Fault** - when the hanging wall drops down in relation to the footwall. Extensional forces, those that pull the plates apart, and gravity are the forces that create normal faults.
 - **Reverse Fault** - the hanging wall moves up. The forces creating reverse faults are compressional, pushing the sides together.
 - **Strike slip Faults** - have walls that move sideways along the strike, not up or down. In these faults, the fault plane is usually vertical so there is no hanging wall or footwall.
- Sinistral (left-lateral) strike-slip fault Dextral (right-lateral) strike-slip fault

NB: This is a plan view of the Earth's surface
- ✚ **Feldspars:** ($\text{LiAlSi}_3\text{O}_8$ – $\text{NaAlSi}_3\text{O}_8$ – $\text{CaAl}_2\text{Si}_2\text{O}_8$) are a group of rock-forming [tectosilicate minerals](#) that make up about 41% of the [Earth's continental crust](#) by weight. Feldspars [crystallize](#) from [magma](#) as [veins](#) in both [intrusive](#) and [extrusive igneous](#) rocks and are also present in many types of [metamorphic rock](#).
 - ✚ **Flexure:** see 'Lithospheric flexure'.
 - ✚ **Flute casts:** are scours dug into soft, fine sediment which typically get filled by an overlying bed (hence the name cast).
 - ✚ **Fluvial:** are processes associated with [rivers](#) and [streams](#) and the [deposits](#) and [landforms](#) created by them.
 - ✚ **Flysch:** is a sequence of [sedimentary rock](#) layers that progress from deep-water and [turbidity flow](#) deposits to shallow-water [shales](#) and [sandstones](#). It is deposited when a deep basin forms rapidly on the continental side of a mountain building episode. They can be found in the 'Kalogrea-Ardana **Flysch**' (Bellapais Formation) and Kythrea **Flysch**.
 - ✚ **Fissile:** [fissile](#) is the tendency of a rock to split along planes of weakness e.g. shale.
 - ✚ **Foliation:** in geology refers to repetitive layering in [metamorphic rocks](#). Each layer may be as thin as a sheet of paper, or over a meter in thickness.
 - ✚ **Foraminifera.** Most foraminifera are marine, the majority of which live on or within the seafloor sediment (i.e., are [benthic](#)), while a smaller variety float in the water column at various depths (i.e., are [planktonic](#)). Foraminifera typically produce a [test](#), or shell, which can have either one or multiple chambers, some becoming quite elaborate in structure. These shells are commonly made of [calcium carbonate](#) (CaCO_3) or [agglutinated](#) sediment particles. Over 50,000 species are recognized, both living (10,000) and [fossil](#) (40,000). They are usually less than 1 mm in size, but some are much larger, the [largest species](#) reaching up to 20 cm.

G

- ✚ **Gabbro:** refers to a large group of dark, often [phaneritic](#) (coarse-grained), [mafic intrusive igneous rocks](#) chemically equivalent to [basalt](#). It forms when molten [magma](#) is trapped beneath the [Earth's](#) surface and slowly cools into a [holocrystalline](#) (having a high degree of Structural order) mass.
- ✚ **Gabbro-Norite:** Intermediate rocks between Gabbro (gabbro: [monoclinic clinopyroxene/s](#) is more than 95% of the total pyroxene content) and Norite (norite: orthopyroxene is more than 95% of the total pyroxene content).
- ✚ **Gondwana:** or **Gondwanaland**, was a [supercontinent](#) that existed from the about 550 million years ago until about 320 million years ago. It was formed by the [accretion](#) of several [cratons](#). During the Carboniferous, it merged with [Euramerica](#) to form a larger supercontinent called [Pangaea](#).
- ✚ **Graben** is a [depressed](#) block of the Earth's [crust](#) bordered by parallel [faults](#).



- ✚ **Graded Bedding:** characterized by a systematic change in grain or clast size from one side of the bed to the other. In '[normal grading](#)' larger grains are deposited first followed by finer material.
- ✚ **Greywacke:** is a variety of [sandstone](#), a sedimentary rock consisting of angular fragments of quartz, feldspar, and other minerals set in a muddy base. It is generally characterized by its hardness, dark color, and poorly sorted angular grains.

H

- ✚ **Halobia:** a bivalve mollusk, a bottom-dweller of deep sea environments.
- ✚ **Hanging Wall and Foot Wall:** the two sides of a non-vertical fault. The hanging wall occurs above the fault plane and the footwall occurs below it.

- ✚ **Harzburgite:** an [ultramafic](#), [igneous](#) rock, is a variety of [peridotite](#) consisting mostly of the two [minerals](#), [olivine](#) and low-[calcium](#) (Ca) [pyroxene](#). Harzburgite typically forms by the [partial melts](#) from the more pyroxene-rich peridotite called [lherzolite](#). The molten [magma](#) extracted from harzburgite may then erupt on the surface as [basalt](#). If partial melting of the harzburgite continues, all of the pyroxene may be extracted from it to form magma, leaving behind the pyroxene-poor peridotite called [dunite](#).
- ✚ **Hemipelagic or Hemipelagite sediment:** is a type of [marine sediment](#) of clay or silt sized grains that consists of [biogenic](#) (produced by life processes) and [terrigenous material](#) (those derived from the erosion of rocks) derived from the landmass nearest the deposits or from organisms living in the water. Hemipelagic sediments are deposited on [continental shelves](#) and [continental rises](#), and differ from [pelagic sediment](#) compositionally. Pelagic sediment is composed of primarily biogenic material from organisms living in the water column or on the seafloor and contains little to no terrigenous material.
- ✚ **Heterogeneous:** a mixture of poorly sorted differing sized materials.
- ✚ **Heterotroph:** An organism that cannot manufacture its own food and instead obtains its food and energy by taking in organic substances, usually plant or animal matter.
- ✚ **Homogenous:** a mix of well sorted similar sized materials.
- ✚ **Hyaloclastite:** is a hydrated [tuff-like breccia](#) rich in black [volcanic glass](#), formed during volcanic eruptions [under water](#), [under ice](#) or where flows on the surface of the land (sub-aerial) reach bodies of water. It has the appearance of angular flat fragments sized between a millimeters to few centimeters. The fragmentation occurs by the force of the volcanic explosion or by thermal shock during rapid cooling.

I

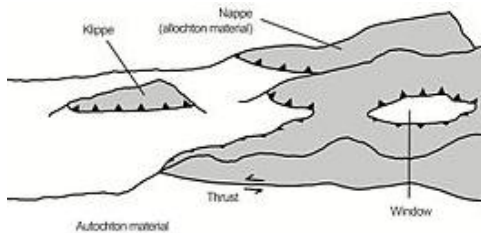
- ✚ **Igneous rock:** or **magmatic rock**, is one of the three main [rock types](#), it is formed through the cooling and solidification of [magma](#) or [lava](#). The other rock types are [sedimentary](#) and [metamorphic](#).
- ✚ **Intercalated:** [interleaved](#), formed in distinctly [alternating layers](#).
- ✚ **Intratelluric:** Relating to or situated in the [interior](#) of the [Earth](#), (beneath the lithosphere).
- ✚ **Isocline:** a tightly folded [syncline](#) or [anticline](#) in which the two sides are almost [parallel](#).
- ✚ **Isostasy:** is the state of [gravitational](#) equilibrium between [Earth's crust](#) and [mantle](#) such that the [crust](#) "floats" at an elevation that depends on its thickness and density.
- ✚ **Isotropic:** uniform in all orientations.

J

- ✚ **Joint:** is a fracture that lacks any visible or measurable movement parallel to the surface (plane) of the fracture.

K

- ✚ **Klippe:** is the remnant portion of a [nappe](#) after erosion has removed connecting portions of the nappe. This process results in an outlier of exotic, often nearly horizontally translated strata overlying [autochthonous](#) strata. An example of a Klippe is the Rock of Gibraltar.



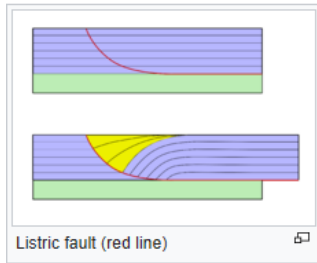
- ✚ **Knockers:** Large boulder or shaped outcrop of bedrock in an otherwise low lying landscape chiefly associated with a Mélange and generally exposed by erosion of the surrounding material.

L

- ✚ **Laterite:** is a soil and rock type rich in iron and aluminium and is commonly considered to have formed in hot and wet tropical areas. Nearly all **laterites** are of rusty-red coloration, because of high iron oxide content.
- ✚ **Lava:** is molten rock (**magma**) generated by [geothermal energy](#) that has been 'expelled' through fractures in planetary [crust](#) or in an [eruption](#), usually at temperatures from 700 to 1,200 °C. Once solidified it is also referred to as Lava.
- ✚ **Leucocratic**, meaning 'light-coloured'
- ✚ **Lherzolite** is a type of [ultramafic igneous rock](#). It is a coarse-grained rock consisting of 40 to 90% [olivine](#) along with significant [orthopyroxene](#) and lesser calcic [chromium](#)-rich [clinopyroxene](#).

✚ **Liesegang rings:** are colored bands observed in [sedimentary rocks](#) that typically cut-across [bedding](#). These [sedimentary structures](#) exhibit bands of ([authigenic](#)) minerals that are arranged in a regular repeating pattern. Liesegang rings are distinguishable from other sedimentary structures by their concentric or *ring-like* appearance.

✚ **Listric fault:**



Listric faults are similar to normal faults but the fault plane (marked in red) curves, the dip being steeper near the surface, then shallower with increased depth. The dip may flatten resulting in horizontal slip on a horizontal plane.

✚ **Lithification:** is the process in which [sediments](#) compact under [pressure](#), expel trapped liquids and gradually become solid rock. In the process destroying a sediment's porosity.

✚ **Lithology:** of a [rock](#) unit is a description of its physical characteristics visible at [outcrop](#), in hand or [core samples](#) or with low magnification microscopy, such as colour, texture, grain size, or composition.

✚ **Lithosphere:** [*lithos*]-"rocky", and [*sphaira*] "sphere") is the rigid outermost shell, defined by its rigid mechanical properties. It is composed of the [crust](#) and the portion of the upper [mantle](#) that behaves elastically on time scales of thousands of years or greater. The crust is defined on the basis of its chemistry and mineralogy.

✚ **Lithospheric flexure** (also called **regional isostasy**) is the process by which the [lithosphere](#) (rigid, thin outer layer of the Earth) bends under the action of forces such as the weight of a growing [orogeny](#) or changes in ice thickness related to [glaciation](#).

✚ **Load cast:** A bulbous depression formed on the base of a bed of [sediment](#). Load casts develop by the differential sinking of denser sediment, while still soft, into less dense sediment below.

✚ **Longshore drift** is a geological process that consists of the transportation of [sediments](#)

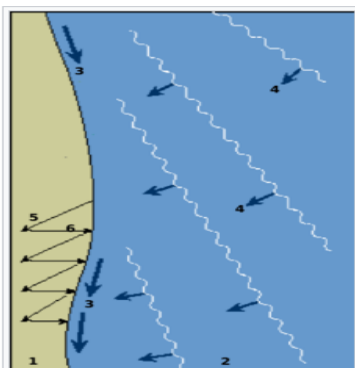


Diagram demonstrating longshore drift
 1=beach
 2=sea
 3=longshore current direction
 4=incoming waves
 5=swash
 6=backwash

(clay, silt, sand and shingle) along a coast parallel to the shoreline, which is dependent on oblique incoming wind direction. Oblique incoming wind squeezes water along the coast, and so generates a water current which moves parallel to the coast. Longshore drift is simply the sediment moved by the longshore current. This current and sediment movement occurs within the surf zone.

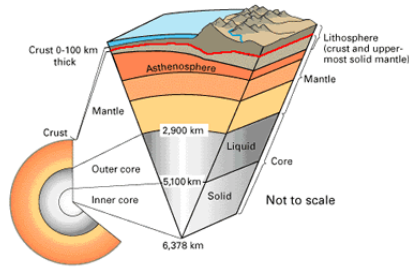
- ✚ **Lutite:** fine-grained, [sedimentary](#) rocks, which are composed of [silt](#)-size [sediment](#), [clay](#)-size sediment, or a mixture of both.

M

- ✚ **Magma:** is a mixture of molten or semi-molten [rock](#), [volatiles](#) and solids that is found 'beneath' the surface of the [Earth](#). Magma may also contain suspended crystals, dissolved gas and sometimes gas bubbles. Magma often collects in [magma chambers](#) that may feed a [volcano](#) or solidify underground to form an [intrusion](#). Magma is capable of intruding into adjacent rocks (forming [igneous dikes](#) and [sills](#)), extrusion onto the surface as [lava](#), and explosive ejection as [tephra](#).
- ✚ **Magma series:** the various processes by which [magmas](#) undergo bulk chemical change during the [partial melting](#) process, cooling, [emplacement](#), or [eruption](#) are termed *igneous differentiation* or *magmatic differentiation*. The sequence of (usually increasingly silicic) magmas produced by igneous differentiation is known as a **magma series**.
- ✚ **Magnetite:** is a [mineral](#) and one of the main iron ores. With the chemical formula [Fe₃O₄](#), it is one of the [oxides of iron](#). Magnetite is [ferrimagnetic](#); it is attracted to a [magnet](#) and can be [magnetized](#) to become a [permanent magnet](#) itself. Small grains of magnetite occur in almost all [igneous](#) and [metamorphic rocks](#).
- ✚ **Malpas Kilometre:** Symbol M_k, often quoted with values ≤2kl but in reality, values are ≥5kl but <∞.
- ✚ **Mantle:** is a layer between the [crust](#) and the [outer core](#). Earth's mantle is a [silicate](#) rocky shell with an average thickness of 2,886 kilometres (1,793 mi). The mantle makes up about 84% of Earth's volume. It is predominantly solid but in [geological time](#) it behaves as a [viscous fluid](#). See 'Other Useful Information' at the end of this document for diagrams.
- ✚ **Mantle Solidus:** At any one pressure, the mantle melts over a temperature range of several hundred degrees. The boundary between melt absent and melt present is called the mantle solidus. See 'Other Useful Information' at the end of this document for diagrams.
- ✚ **Marine Terrace:** *raised beach, coastal terrace, or perched coastline* is a relatively flat, horizontal or gently inclined surface of marine origin, mostly an old abrasion platform which has been lifted out of the sphere of wave activity. Thus, it lies above or under the current [sea level](#), depending on the time of its formation.
- ✚ **Marl:** A crumbly mixture of clays, calcium and magnesium carbonates, and remnants of shells that is sometimes found under desert sands and used as fertilizer for lime-deficient soils.

- ✚ **Mass wasting (deposits):** also known as **slope movement** or **mass movement**, is the [geomorphic](#) process by which [soil](#), [sand](#), [regolith](#), and [rock](#) move downslope, typically as a mass, largely under the force of [gravity](#), but frequently affected by water and water content as in submarine environments and [mudflows](#).
- ✚ **Massif:** is a section of a planet's [crust](#) that is demarcated by [faults](#) or [flexures](#). In the [movement of the crust](#), a massif tends to retain its internal structure while being displaced as a whole. The term also refers to a group of [mountains](#) formed by such a structure.
- ✚ **Mélange:** is a large-scale [breccia](#), a body of rock characterized by a lack of continuous bedding and the inclusion of fragments of rock of all sizes, contained in a fine-grained deformed matrix. The *mélange* typically consists of a jumble of large blocks of varied [lithologies](#). Large-scale melanges formed in [active continental margin](#) settings generally consist of altered [oceanic crustal](#) material and blocks of [continental slope sediments](#) in a sheared [mudstone matrix](#).
- ✚ **Mercalli intensity scale:** is a [seismic intensity scale](#) used for measuring the intensity of an [earthquake](#). It measures the *effects* of an earthquake.
- ✚ **Messinian Salinity Crisis (MSC):** was a geological event during which the [Mediterranean Sea](#) went into a cycle of partly or nearly complete [desiccation](#) throughout the latter part of the [Messinian](#) age of the [Miocene](#) epoch, from 5.96 to 5.33 [Ma](#) (million years ago). It ended with the [Zanclean flood](#), when the Atlantic reclaimed the basin.
- ✚ **Metamorphic rocks:** arise from the transformation of existing [rock](#) types, in a process called [metamorphism](#). The original rock ([protolith](#)) is subjected to heat (temperatures greater than 150 to 200 °C) and pressure ([1,500 bar](#)), causing profound physical or chemical change. The protolith may be a [sedimentary](#), [igneous](#), or existing metamorphic rock.
- ✚ **Metasedimentary rock:** is a type of [metamorphic rock](#) formed through the deposition and solidification of [sediment](#). The rock was then buried underneath subsequent rock and was subjected to high pressures and temperatures, causing the rock to [recrystallize](#).
- ✚ **Meteoric water:** is the water derived from [precipitation](#) (snow and rain). This includes water from lakes, rivers, and ice-melts, which all originate from precipitation indirectly.
- ✚ **Micas** are a group of silicate [minerals](#) whose individual mica [crystals](#) can easily be split into extremely thin plates. This characteristic is described as perfect [basal cleavage](#). Mica is common in [igneous](#) and [metamorphic rock](#) and is occasionally found as small flakes in [sedimentary rock](#).
- ✚ **Microgabbro:** see Diabase.

✚ **Mohorovicic Discontinuity** or "**Seismic Moho**": is the discontinuity (boundary) between the crust and the mantle. The red line in the diagram shows its location. In geology the word "discontinuity" is used for a surface at which seismic waves change velocity. One of these surfaces exists at an average depth of 8 kilometers beneath the ocean basin and at an average depth of about 32 kilometers beneath the continents. At this discontinuity, seismic waves accelerate. The **Petrological Moho** is where the 'chemistry' of the rocks changes. Usually defined as transition from felsic-mafic crustal rocks to ultramafic rocks (typically, with high olivine content).



The Moho: Image of Earth's internal structure by USGS - Mohorovicic Discontinuity (red line) added by Geology.com.

✚ **Molasse**: refers to [sandstones](#), [shales](#) and [conglomerates](#) that form as terrestrial or shallow [marine](#) deposits in front of rising mountain chains.

✚ **Moment Magnitude Scale (MMS)**: is used to measure the size of [earthquakes](#). The scale succeeds the 1930s-era [Richter magnitude scale](#). Under suitable assumptions, an increase of one step on this [logarithmic scale](#) corresponds to a $10^{1.5}$ (about 32) times increase in the amount of energy released, and an increase of two steps corresponds to a 10^3 (1,000) times increase in energy. Thus, an earthquake of 7.0 releases about 32 times as much energy as one of 6.0 and nearly 1,000 times that of 5.0.

✚ **Moraine**: A mound, ridge, or ground covering of unstratified and unsorted till, deposited by ice action or by melting away of a [glacier](#). Many different types of moraines are distinguished: terminal, ground, lateral, ablation, medial, push, and recessional. The photo shows a push moraine.




N

✚ **Nappe**: or **thrust sheet** is a large sheet-like body of [rock](#) that has been moved more than 2 km above a [thrust fault](#) from its original position. Nappes form in compressional tectonic settings like [continental collision](#) zones or on the overriding plate in active [subduction](#) zones. Nappes form when a mass of rock is forced (or "[thrust](#)") over another rock mass, typically on a low angle fault plane.

✚ **Neritic**: The [neritic zone](#) is the relatively shallow part of the ocean above the drop-off of the [continental shelf](#), approximately 200 meters (660 ft) in depth.

- ✚ **Noritic Rock:** Norite is a variety of [gabbro](#) composed mainly of [hypersthene](#) (a [green](#), [brown](#), or black [pyroxene](#) mineral consisting of [magnesium iron silicate](#)) and [labradorite feldspar](#) (a [blue](#), [green](#), or reddish-brown [feldspar](#) mineral of the [plagioclase](#) series: used as a [decorative](#) stone.)

O

- ✚ **Olistolith:** An exotic block or other rock mass that has been transported by submarine gravity sliding or slumping and is included in the binder of an olistostrome. Limestone olistoliths are found in the eastern part of the Hilarion Formation, part of the Pentadaktylos Zone.
- ✚ **Olistostrome:** A sedimentary deposit composed of a chaotic mass of heterogeneous material that is intimately mixed; accumulated in the form of a semi-fluid body by submarine gravity sliding or slumping of unconsolidated sediments.
- ✚ **Olivine:** is the name of a group of rock-forming [minerals](#) that are typically found in mafic and ultramafic [igneous rocks](#) such as [basalt](#), [gabbro](#), [dunite](#), [diabase](#), and [peridotite](#). They are usually green in color and have compositions that typically range between Mg_2SiO_4 and Fe_2SiO_4 . Many people are familiar with olivine because it is the mineral of a very popular green [gemstone](#) known as peridot. It usually crystallizes in the presence of [plagioclase](#) and pyroxene to form gabbro or basalt. These types of rocks are most common at divergent plate boundaries and at hot spots within the centers of tectonic plates.


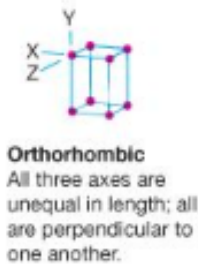
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Olivine in basalt: Lherzolite (a variety of [peridotite](#)) nodules in a xenolith collected from a [basalt](#) flow at Peridot Mesa, Arizona. These xenoliths often contain crystals of olivine with a color and clarity that is suitable for use as a peridot gemstone.
- ✚ **Ooze:** deposit of soft mud on the ocean floor containing at least 30% skeletal remains. [Ooze](#) does not refer to a sediment's consistency, but to its composition.
- ✚ **Opal Silica Saturation State:** Opal silica [Si\(O₂\)](#) is highly under-saturated in the ocean. As a result of the low [saturation state](#) of opal silica, the mineral is thermodynamically favored to dissolve everywhere in the ocean.
- ✚ **Ophiolite:** is a section of the Earth's [oceanic crust](#) and the underlying upper [mantle](#) that has been uplifted and exposed above sea level and often emplaced onto [continental crustal](#) rocks. *Ophio* is Greek for *snake*, and *lite* means *stone* from the Greek *lithos*, after the often-green-color rocks that make up many ophiolites.
- ✚ **Orogeny:** is an event that leads to a large structural deformation of the Earth's [lithosphere](#) ([crust](#) and uppermost [mantle](#)) due to the interaction between [tectonic plates](#). An **orogen** or **orogenic belt** develops when a continental plate crumples and is

pushed upwards to form one or more [mountain ranges](#); this involves many geological processes collectively called **orogenesis**.

✚ **Orthogonal:** at right angles to.

✚ **Orthopyroxene:** any of a series of common silicate minerals in the pyroxene family. Orthopyroxenes typically occur as fibrous or lamellar (thin-plated) green masses in igneous and metamorphic rocks and in meteorites. The orthopyroxene series crystallizes in the [orthorhombic system](#) (three crystallographic axes unequal in length and at right angles to each other).



P

✚ **Palaeomagnetism:** is the study of the record of the [Earth's magnetic field](#) in rocks, sediment, or archeological materials. Certain minerals in rocks lock-in a record of the direction and intensity of the magnetic field when they form. This record provides information on the past behavior of Earth's magnetic field and the past location of [tectonic plates](#).

✚ **Pangaea:** was a [supercontinent](#) that existed approximately 335 million years ago, and it began to break apart about 175 million years ago. In contrast to the present [Earth](#) and its distribution of continental mass, much of Pangaea was in the [southern hemisphere](#).

✚ **Passive margin:** is the transition between [oceanic](#) and [continental lithosphere](#) that is not an active plate [margin](#). A passive margin forms by [sedimentation](#) above an ancient [rift](#), now marked by transitional lithosphere.

✚ **Pegmatite (Pegmatitic):** a rock should be composed almost entirely of crystals that are at least one centimeter in diameter. The name “pegmatite” has nothing to do with the mineral composition of the rock.

✚ **Pelagic:** relating to the open seas or oceans, rather than water adjacent to land or inland waters. [Pelagic sediment](#) or *pelagite* is a fine-grained sediment that consists primarily of either the microscopic, calcareous or siliceous shells of phytoplankton or zooplankton and settles on the floor of the open ocean, far from land. See Hemipelagic.

✚ **Pelite** (Greek-clay) is a [metamorphosed](#) fine-grained [sedimentary rock](#), i.e. [mudstone](#) or [siltstone](#). It was equivalent to the now little-used [Latin](#)-derived term [lutite](#).

- ✚ **Peridotite:** is a generic name used for dense, coarse-grained [igneous rock](#) consisting mostly of the minerals [olivine](#) and [pyroxene](#). Peridotite is [ultramafic](#), (less than 45% [silica](#)). It is high in [magnesium](#), (high proportions of magnesium-rich olivine), with appreciable [iron](#). Peridotite is derived from the [Earth's mantle](#). The compositions of peridotites vary widely, reflecting the relative proportions of [pyroxenes](#), [chromite](#), [plagioclase](#), and [amphibole](#).
- ✚ **Perapedhi Formation:** is made up of hydrothermal and deep water marine sedimentary rocks and caps the Troodos Ophiolite volcanic sequence, it is represented by umbers and radiolarian cherts.
- ✚ **Petrogenic:** Relating to or denoting hydrocarbons (such as those in petroleum), formed by the decomposition of organic matter by processes occurring in sediments at elevated temperatures and pressures.
- ✚ **Phaneritic:** an [igneous rock](#) whose [microstructure](#) is made up of [crystals](#) large enough to be distinguished with the unaided [eye](#).
- ✚ **Phenocryst:** is an early forming, relatively large and usually conspicuous [crystal](#) distinctly larger than the grains of the rock [groundmass](#) of an [igneous](#) rock.
- ✚ **Phyric:** indicates the presence of phenocrysts. (Aphyric: few or no phenocrysts)
- ✚ **Pillow lava:** are [lavas](#) that contain characteristic pillow-shaped structures that are attributed to the extrusion of the lava under water or *subaqueous extrusion*. Pillow lavas are commonly of [basaltic](#) composition. In general the more [intermediate](#) (less rich in silica) the composition, the larger the pillows, due to the increase in [viscosity](#) of the erupting lava.
- ✚ **Placer deposit** or **Placer:** is an accumulation of valuable minerals formed by gravity separation from a specific source rock during sedimentary processes.
- ✚ **Plagioclase:** is a series of [tectosilicate](#) (framework silicate) [minerals](#) within the [feldspar](#) group. Plagioclase is a major constituent mineral in the Earth's [crust](#).
- ✚ **Plagiogranite:** a rock richer in [silica](#) than gabbro.
- ✚ **Pluton:** is a body of [intrusive igneous rock](#) (called a **plutonic rock**) that is crystallized from [magma](#) slowly cooling below the surface of the [Earth](#).
- ✚ **Podiform:** Pod shaped
- ✚ **Poikilitic texture:** refers to [igneous rocks](#) where large component crystals contain smaller crystals of other minerals within them. In poikilitic rocks, the contained smaller crystals are termed '**chadacrysts**' and the larger are termed '**oikocrysts**'.
- ✚ **Polymorph:** Any substance or [mineral](#) that can exist in different [crystal](#) forms.
- ✚ **Porphyroclast:** is a [clast](#) or [mineral](#) fragment in a [metamorphic rock](#), surrounded by a [groundmass](#) of finer grained [crystals](#).
- ✚ **Porosity:** the closeness of grains in a sedimentary rock. The closer the grains the lower the % porosity. So [porosity](#) is the fraction of void space in the material, where the void may contain, for example, air or water.
- ✚ **Proximal:** means near or close to and the opposite 'Distal' means away or farther from the point of reference.

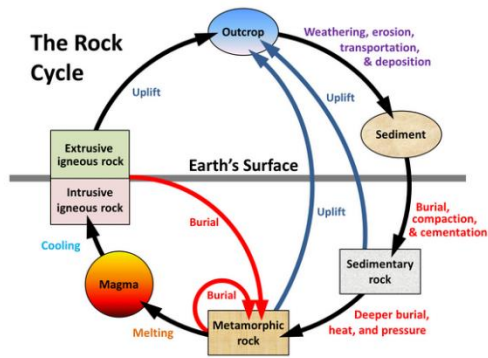
- ✚ **Psammitic:** a [metamorphosed](#) sedimentary rock unit which started out predominantly as medium texture sandstone.
 - ✚ **Pseudomorph:** is a [mineral](#) or mineral compound that appears in an atypical form ([crystal system](#)), resulting from a substitution process in which the appearance and dimensions remain constant, but the original mineral is replaced by another. The name literally means "false form".
 - ✚ **Pyroxenite:** is an [ultramafic igneous rock](#) consisting essentially of [minerals](#) of the [pyroxene](#) group. Pyroxenites are classified into [clinopyroxenites](#), [orthopyroxenites](#), and the [websterites](#) which contain both types of pyroxenes. They are often very coarse-grained, containing individual [crystals](#) which may be several inches in length. Pyroxenites can be formed as cumulates in [ultramafic intrusions](#) by accumulation of pyroxene crystals at the base of the magma chamber.
-

Q

R

- ✚ **Radiolaria, (Radiozoa):** are [protozoa](#) of diameter 0.1–0.2 mm that produce intricate [mineral skeletons](#), usually made of silica. Their skeletal remains make up a large part of the cover of the ocean floor as [siliceous ooze](#). A fraction of siliceous oozes dissolve and re-precipitate as a result of [diagenesis](#) (the transformation from sediment to rock) to form [chert](#) beds (radiolarian chert) or nodules.
- ✚ **Rare Earth Elements (REE):** are a set of seventeen metallic elements. These include the fifteen [lanthanides](#) on the [periodic table](#) plus [scandium](#) and [yttrium](#). Rare earth elements are an essential part of many high-tech devices. They are all [metals](#), and the group is often referred to as the "rare earth metals." They have many similar properties, that often causes them to be found together in [geologic deposits](#) in low concentrations, difficult to extract.
- ✚ **Recumbent:** linear, fold axial plane oriented at low angle resulting in overturned strata in one limb of the fold.
- ✚ **Regolith:** is a layer of loose, heterogeneous superficial deposits covering solid rock. It includes dust, soil, broken rock, and other related materials.

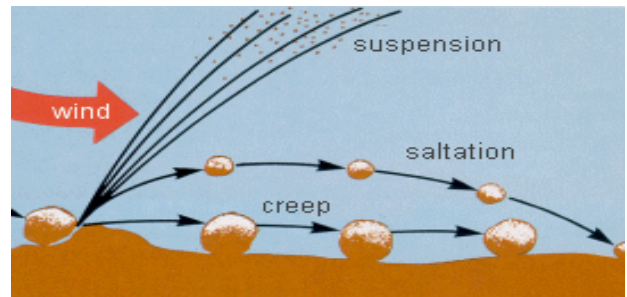
- Rock Cycle:** is a basic concept in [geology](#) that describes transitions through [geologic time](#) among the three main [rock](#) types: [sedimentary](#), [metamorphic](#), and [igneous](#). Each rock type is altered when it is forced out of its equilibrium conditions.



- Rodinite:** mostly replaces dykes or inclusions of basic rocks within serpentinized ultramafic bodies. May also replace other basic rocks, such as volcanic rocks or amphibolites associated with ultramafic bodies.

S

- Saltation:** [saltation](#) (*saltus* - "leap") a specific type of [particle](#) transport by [fluids](#) such as [wind](#) or [water](#).

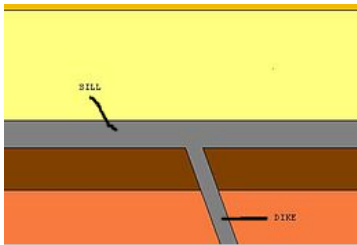


- Sanidine:** is the high temperature form of [potassium feldspar](#). Sanidine is found most typically in [felsic volcanic rocks](#) such as [obsidian](#), [rhyolite](#) and [trachyte](#).
- Sedimentation:** process of [deposition](#) of a solid material from a state of suspension or [solution](#) in a fluid (usually air or water).
- Seismic waves:** are waves of [energy](#) that travel through the [Earth's](#) layers, and are a result of [earthquakes](#), [volcanic eruptions](#), magma movement, large [landslides](#) and large man-made [explosions](#) that give out low-frequency acoustic energy.
- Selenite:** is a variety of the mineral [gypsum](#).
- Serpentinite:** is a [rock](#) formed wherever ultramafic rock is infiltrated by water poor in [carbon dioxide](#). This occurs at [mid-ocean ridges](#) and in the [forearc](#) mantle of [subduction zones](#). The name 'Serpentinite', originating from the similarity of the texture of the rock to that of the skin of a snake.



- ✚ **Serpentinization:** is a geological low-temperature metamorphic process involving heat and water in which low-silica mafic and ultramafic rocks are oxidized and hydrolyzed with water into serpentine. Peridotite, including dunite, at and near the seafloor and in mountain belts, is converted to serpentine, brucite, magnetite, and other minerals.
- ✚ **Shale:** shale is a fine grained fissile clastic rock of clay minerals and tiny fragments.
- ✚ **Silicic acid:** a compound of silicon, oxygen, and hydrogen, regarded as the parent substance from which is derived a large family—the silicates—of minerals, salts, and esters.

- ✚ **Sill:** is formed when lava has intruded between older layers of sedimentary rock, beds of volcanic lava or tuff, or along the direction of foliation in metamorphic rock. A *sill* is a *concordant intrusive sheet*, meaning that a sill does not cut across preexisting rock beds.



- ✚ **Sole marks:** are sedimentary structures found on the bases of certain strata, which indicate small-scale grooves or irregularities. This usually occurs at the interface of two differing lithologies and/or grain sizes. They are commonly preserved as casts of these indents on the bottom of the overlying bed (like flute casts). Occurring as they do only at the bottom of beds and their distinctive shapes, they can make useful way up structures.

- ✚ **Spinel:** mineral composed of magnesium aluminum oxide ($MgAl_2O_4$) or any member of a group of rock-forming minerals, all of which are metal oxides with the general composition AB_2O_4 , in which **A** may be magnesium, iron, zinc, manganese, or nickel; **B** may be aluminum, chromium, or iron; and O is oxygen.

- ✚ **Spalled:** a splinter, fragment or chip.

- ✚ **Stratum:** (plural Strata) is a layer of sedimentary rock or soil, or igneous rock that were formed at the earth's surface, with internally consistent characteristics that distinguish it from other layers. Photograph is of Chalk Layers in Cyprus



- ✚ **Stratigraphy:** is a branch of geology concerned with the study of rock layers (strata) and layering (stratification).

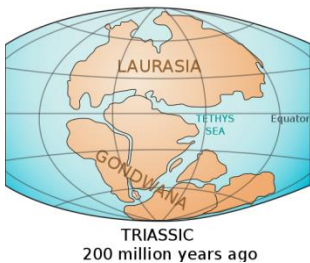
- ✚ **Subduction:** is a geological process that takes place at convergent boundaries of tectonic plates where one plate moves under another and is forced or sinks due to gravity into the mantle. Regions where this process occurs are known as *subduction zones*.

- ✚ **Superposition - “The Law of Superposition”** The rock at the bottom of a sedimentary bed is older than the rock on the top (providing it has not been overturned)

- ✚ **Supra-Subduction Zone:** Sea floor spreading above a subduction zone.
- ✚ **Suture Zone:** is a joining together along a major fault zone, of separate terranes, tectonic units that have different plate tectonic histories. Sutures are seen as the remains of subduction zones, and the terranes that are joined together are interpreted as fragments of different paleocontinents or tectonic plates.

T

- ✚ **Talus slope:** a slope formed by an accumulation of broken rock debris, as at the base of a cliff or other high place, also called scree.
- ✚ **Tectonics:** is the process that controls the structure and properties of the Earth's crust and its evolution through time. In particular, it describes the processes of mountain building and the ways in which the relatively rigid plates that constitute the Earth's outer shell interact with each other. Tectonics also provides a framework for understanding the earthquake and volcanic belts
- ✚ **Tectonostratigraphy:** The stratigraphy of large-scale strata caused by tectonic activity.
- ✚ **TENORM:** is an acronym for **T**echnologically **E**nhanced **N**aturally **O**ccurring **R**adioactive **M**aterial resulting from human activity that has concentrated the radioactivity or increased the likelihood of exposure to human contact.
- ✚ **Terrain:** or **relief** (also topographical relief) involves the vertical and horizontal dimensions of land surface. This is usually expressed in terms of the elevation, slope, and orientation of terrain features.
- ✚ **Terrane:** (in full tectonostratigraphic terrane), is used to define an area underlain by rocks of a specific age range, lithology and or structural deformation style, around which a boundary can be drawn which separates it from adjacent areas which may have distinctly different geological characteristics.
- ✚ **Terrigenous sediments:** are those derived from the erosion of rocks on land.
- ✚ **Tethys (Ocean, Sea or Neotethys):** was an ocean during much of the Mesozoic era located between the ancient continents of Gondwana and Laurasia, before the opening of the Indian and Atlantic oceans during the Cretaceous period. The western part of the Tethys Ocean is called *Tethys Sea*, *Western Tethys Ocean* or Paratethys or *Alpine Tethys Ocean*. What was once the western arm of the Tethys Sea was the ancestor of the present-day Mediterranean



Sea.

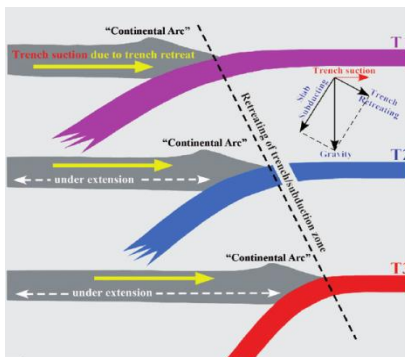
- ✚ **Tholeiite:** fine-grained extrusive igneous rock, a basalt that contains plagioclase feldspar (labradorite), clinopyroxene (augite with pigeonite), and iron ore (magnetite and ilmenite). Tholeiitic lavas often contain glass, but little or no olivine.

- ✚ **Topography:** is the study of the shape and features of the [surface](#) of the [Earth](#). It involves the recording of relief or [terrain](#), the three-dimensional quality of the surface, and the identification of specific [landforms](#). This is also known as [geomorphometry](#).
- ✚ **Trachyte:** light-coloured, very fine-grained [extrusive igneous rock](#) that is composed chiefly of [alkali feldspar](#) with minor amounts of dark-coloured minerals such as [biotite](#), [amphibole](#), or [pyroxene](#).
- ✚ **Transport:** The movement of sediment in a fluid or air.
- ✚ **Transtension:** is the state in which a rock mass or area of the Earth's [crust](#) experiences both *extensive* and *transtensive* [shear](#). As such, transtensional regions are characterised by both extensional structures ([normal faults](#), [grabens](#)) and wrench structures ([strike-slip faults](#)).



Diagram of fault geometry (in map view) that leads to transtension at the bend or step-over.

- ✚ **Trench Rollback:** Some trenches—particularly those associated with subduction zones where two oceanic plates converge—move backward into the subducting plate. This is called **trench rollback** or **hinge retreat** (also **hinge rollback**) and is one explanation for the existence of [back-arc basins](#).



- ✚ **Tuff:** is a type of [rock](#) made of [volcanic ash](#) ejected from a [vent](#) during a [volcanic eruption](#). Following ejection and deposition, the ash is [lithified](#) into a solid rock. Rock that contains greater than 75% ash is considered tuff
- ✚ **Tuffaceous:** rock made of [volcanic ash](#) ejected from a [vent](#) during a [volcanic eruption](#) containing 25% to 75% ash is described as **tuffaceous**.
- ✚ **Turbidite:** is the [geologic deposit](#) of a [turbidity current](#), which is a type of [sediment gravity flow](#) (underwater avalanche) responsible for distributing vast amounts of [clastic sediment](#) into the deep [ocean](#). This is different to material carried along by the 'frictional' drag of water on particles, as in the discharge of a river.
- ✚ **Turbidity:** an action which churns sediment and causes mixed slurries, in which the rocks may exhibit a variety of sedimentary features. A **turbidity current** is most typically an underwater current of usually rapidly moving, sediment-laden water moving down a slope.

U

- ✚ **Ultramafic:** are [igneous](#) rocks with a very low [silica](#) content (less than 45%), generally >18% [MgO](#), high [FeO](#), low [potassium](#), and are composed of usually greater than 90% [mafic minerals](#) (dark colored, high [magnesium](#) and [iron](#) content). The [Earth's mantle](#) is composed of ultramafic rocks. **Ultrabasic** is a more inclusive term that includes igneous rocks with low silica content that may not be extremely enriched in Fe and Mg, Shown in the photo is a specimen of peridotite.



- ✚ **Umber:** is a natural brown or reddish-brown [earth pigment](#) that contains [iron oxide](#) and [manganese oxide](#). Umber is a marine sediment associated with black smokers.

V

- ✚ **Vesicles:** are the pits and cavities in a [volcanic rock](#). As magma rises to the surface the pressure on it decreases. When this happens gases dissolved in the magma are able to come out of solution, forming gas bubbles (the cavities) inside it. The shape of the vesicle, as it cools, can indicate the direction of the lava flow.
- ✚ **Volcaniclastic:** a [clastic](#) rock chiefly composed of [volcanic](#) materials. Processes responsible for volcaniclastic sedimentation range from purely igneous on the one hand, to normal sedimentary processes on the other.
- ✚ **Volcanic glass** is the [amorphous](#) (uncrystallized) product of rapidly cooling [magma](#). Like all types of [glass](#), it is a [state of matter](#) intermediate between the closely packed, highly ordered array of a [crystal](#) and the highly disordered array of [liquid](#).¹

W

- ✚ **Weathering:** Is the breaking down of [rocks](#), [soil](#), and [minerals](#) through contact with the [Earth's atmosphere](#), waters, and biological organisms.
 - ✚ **Wehrlite:** A peridotite composed principally of olivine and clinopyroxene with accessory opaque oxides.
-

X

- ✚ **Xenolith:** ([Ancient Greek](#): "foreign rock") is a [rock](#) fragment which becomes enveloped in a larger rock during the latter's development and solidification. In [geology](#), the term *Xenolith* is almost exclusively used to describe inclusions in [igneous rock](#) during [magma](#) emplacement and eruption. Xenoliths may be engulfed along the margins of a [magma chamber](#), torn loose from the walls of an erupting [lava](#) conduit or picked up along the base of a flowing body of lava on the Earth's surface.
-

Y

Z

- ✚ **Zeolites:** are [microporous](#), [aluminosilicate minerals](#) which form where [volcanic](#) rocks and [ash](#) layers react with [alkaline](#) groundwater. Natural zeolites occur in mafic volcanic rocks as cavity fillings, probably as a result of [deposition](#) by fluids or vapours.
- ✚ **Zooplankton:** are a type of heterotrophic (cannot manufacture its own food and instead obtains its food and energy by taking in organic substances), plankton that range from microscopic organisms to large species, such as jellyfish. **Zooplankton** are found within large bodies of water, including oceans and freshwater systems.

Acknowledgements:

Wikipedia, Encyclopedia Britannica, Harvard University Education, Cyprusgeology.org & Geology.com

(Their information has been simplified for my understanding to the point where it may be incorrect 😊) – Ken Jones

Other 'useful' information

- https://en.wikipedia.org/wiki/Glossary_of_geology
- Volcanic vs Plutonic Igneous Rocks: Definition and Differences - Video
<https://www.youtube.com/watch?v=0OswHih-i1U>
- Sand Atlas website is very useful and refers to Cyprus in some of the items
<http://www.sandatlas.org/>

YouTube Videos – Troodos and the birth of Cyprus

Part 1

<https://www.youtube.com/watch?v=QNiSIUmW33w&feature=youtu.be>

Part 2

<https://www.youtube.com/watch?v=I2RaI7jqwKw>

Part 3

<https://www.youtube.com/watch?v=Ka3cKkGil4M>

Websites:

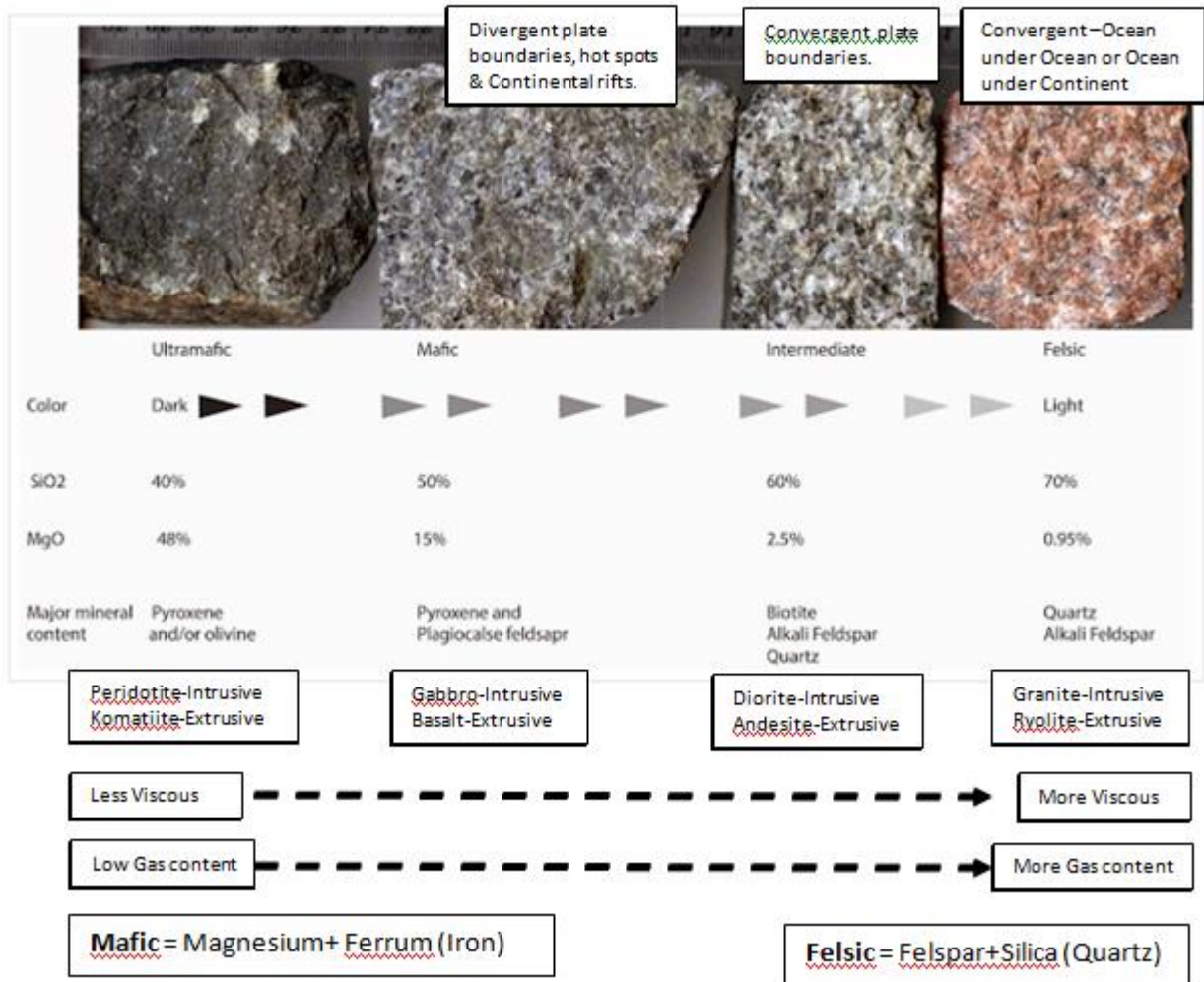


U.S. Geological Survey

<http://www.cyprusgeology.org/english/EN/index.htm>

How to Classify Igneous Rocks Into (Ultramafic, Mafic, Intermediate and Felsic)?

0 Igneous, Rocks 10:35 PM



Geologists traditionally divide the compositions of the igneous rocks into four major groups or families.

Ultramafic rocks: Their low silica and gas contents make them very fluid; i.e., they have a low viscosity, or resistance to flow. Ultramafic rocks are given names depending on whether they are intrusive or extrusive. Peridotite is the name given to intrusive ultramafic rocks, whereas komatiite is the name given to extrusive ultramafic rocks. Peridotite appears to be the dominant rock type of the upper mantle. It is very rarely exposed at the surface. Chunks of peridotite, however, are often brought up by other magmas these included chunks are called inclusions or **xenoliths** (meaning "foreign rock").

Mafic rocks: Rocks composed mostly of pyroxene, calcium-rich plagioclase, and minor amounts of olivine make up the mafic family of igneous rocks. The mafic magmas are somewhat more viscous than the ultramafic magmas, but they are still fairly fluid. Additionally, they contain somewhat more gas than do the ultramafic magmas, but not nearly so much as the felsic magmas. Gabbro is the name given to intrusive mafic rocks,

whereas basalt is the name given to extrusive mafic rocks. Mafic rocks are produced in a variety of plate tectonic settings (divergent plate boundaries) such as [mid-ocean ridges](#), continental rifts and mantle hot spots like Hawaii. Mafic rocks are all produced by partial melting of the uppermost asthenosphere. Because of their relatively low viscosity, mafic lavas may travel great distances and "flood" the landscapes over which they flow. Mafic flows erupting beneath water form bulbous masses called pillow lavas.

Intermediate rocks: Rocks composed mostly of hornblende and intermediate plagioclase feldspars make up the intermediate family of igneous rocks. Intermediate magmas are somewhat more viscous than the mafic magmas. Additionally, they contain somewhat more gas than do the mafic magmas, but not quite as much as the felsic magmas (see below). *Diorite* is the name given to intrusive intermediate rocks, whereas *Andesite* is the name given to extrusive intermediate rocks. Intermediate rocks are produced primarily in convergent plate boundaries in which an oceanic plate is subducting beneath either another oceanic plate (such as in Japan) or a continental plate (such as along the Andes).

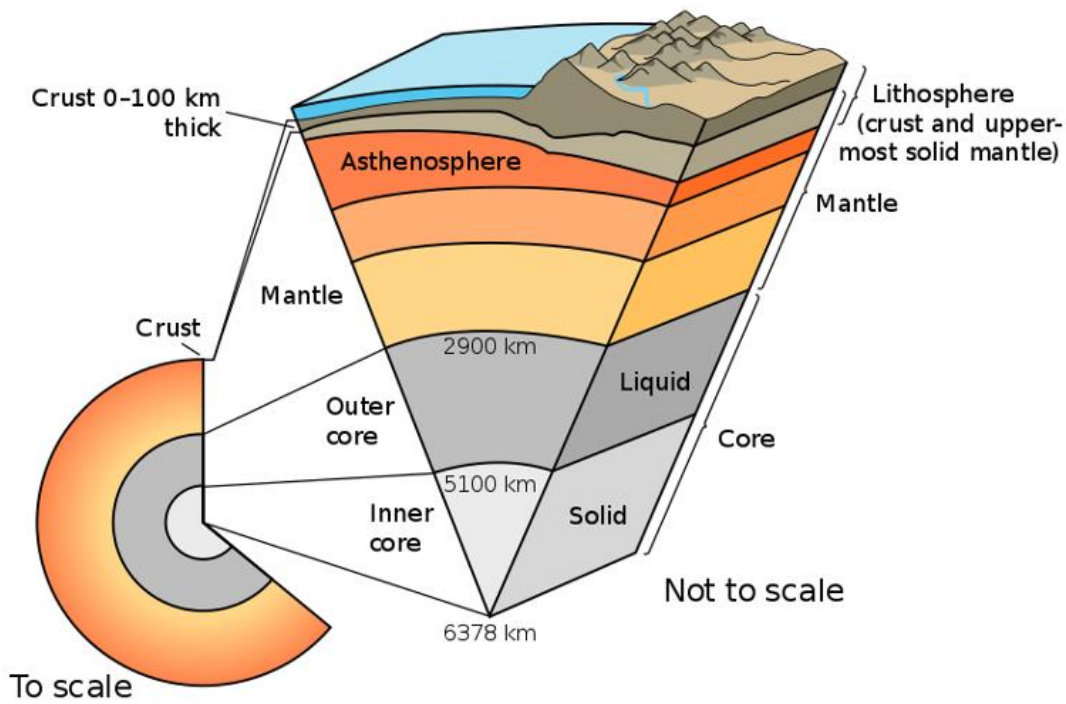
Felsic rocks: Rocks composed mostly of biotite, muscovite, sodium-rich plagioclase feldspars, potassium feldspars, and quartz make up the felsic family of igneous rocks. Felsic magmas are much more viscous than the intermediate magmas. Additionally, felsic magmas may have very high gas contents. Granite is the name given to intrusive felsic rocks, whereas rhyolite is the name given to extrusive felsic rocks. Felsic rocks are produced primarily in [convergent plate boundaries](#) in which an oceanic plate is subducting beneath either another oceanic plate (such as in Japan) or a continental plate (such as along the Andes Mountains of South America). Because of their high viscosity, felsic magmas do not reach the surface as often as do intermediate or mafic magmas. However, because of its high gas content, when felsic magma does erupt, the eruption is the most violent. The explosive eruption often results in the emplacement of ash flow tuffs and volcanic breccias. Rhyolites tend to form domes or plugs rather than extensive lava flows. In addition, the viscosity of the magma hinders crystal growth. Consequently, [obsidian](#) or volcanic glass is most common in the cooling of felsic lavas

Read more at <http://www.geologyin.com/2014/12/how-to-classify-igneous-rocks-into.html#8ll5KmoiKmUS510j.99>

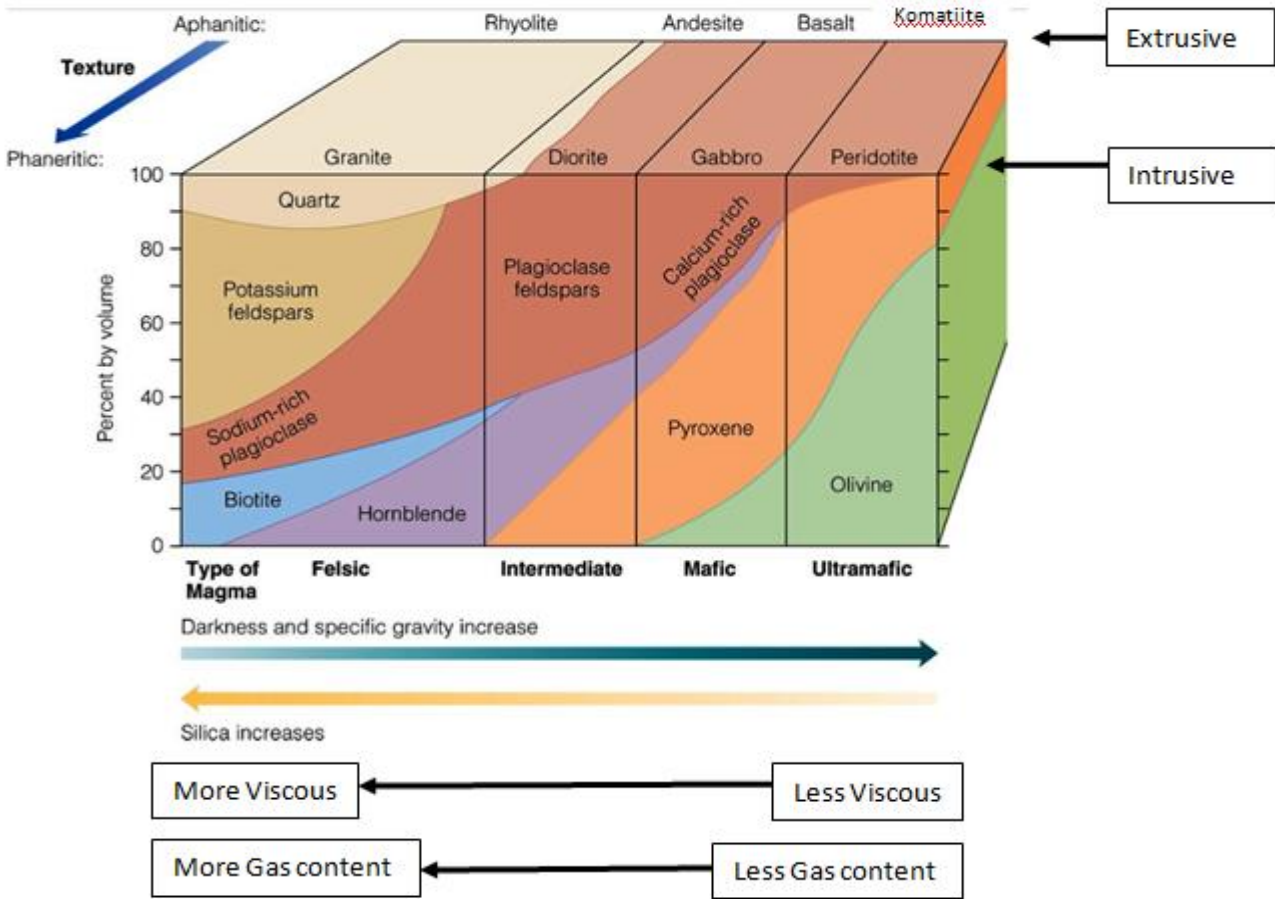
Bowen's Reaction Series: Crystallization Process & Magmatic Differentiation-Video
<https://www.youtube.com/watch?v=fPblXuz-nC8>

2- Structure of the oceanic crust

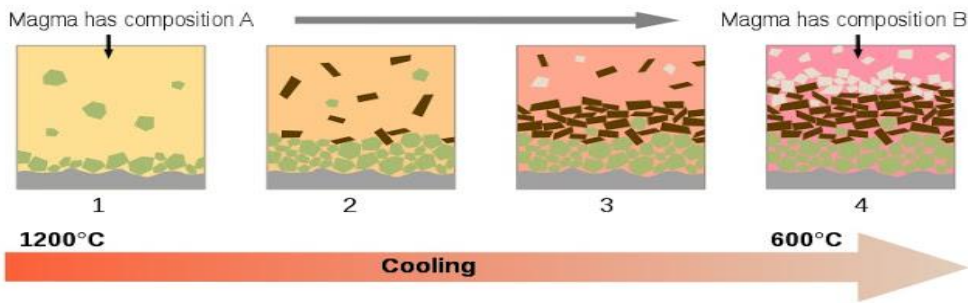
Lithology	Ocean Crustal Layers	Typical Ophiolite		Normal Ocean Crust	
		Thickness (km)	ave.	P wave vel. (km/s)	
Deep-Sea Sediment	1	~ 0.3	0.5	1.7 - 2.0	
Basaltic Pillow Lavas	2A & 2B	0.5	0.5	2.0 - 5.6	
Sheeted dike complex	2C	1.0 - 1.5	1.5	6.7	
Gabbro	3A	2 - 5	4.7	7.1	
Layered Gabbro	3B				
Layered peridotite	4	up to 7		8.1	
Unlayered tectonite peridotite					



How do different igneous rocks form from one original supply of magma?



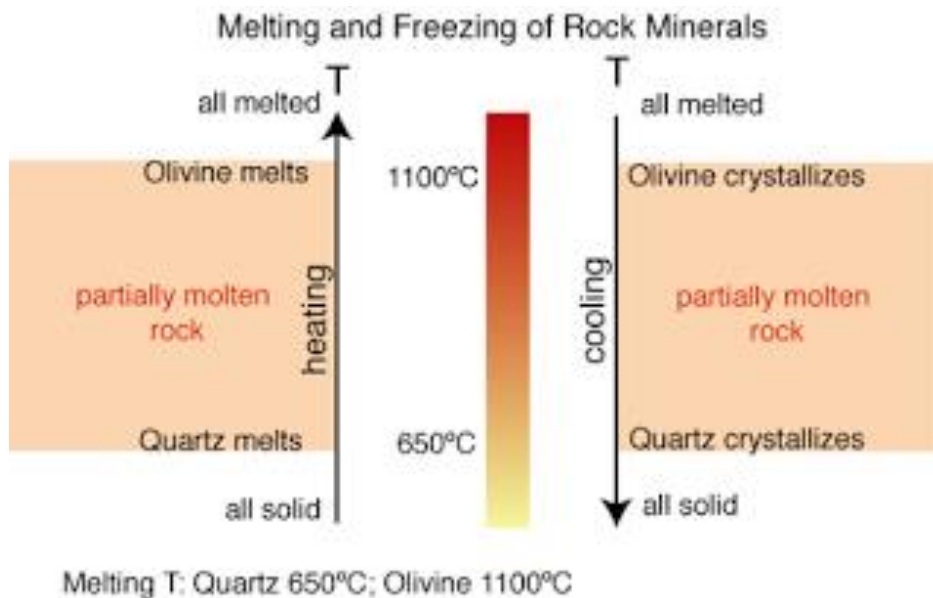
Igneous rocks form as molten material cools and crystallizes into rock. As the molten material cools, chemical compounds in the melt crystallize into minerals at different temperatures, with "high temperature" minerals crystallizing first. These high temperature minerals are denser than the molten material and tend to settle out in the bottom of a magma chamber (pluton). As the melt continues to cool, the composition of the melt changes as more crystals form and settle out. Finally the melt completely cools with the composition of the rock enriched in **low temperature minerals**. This process is called **magmatic differentiation**.



Schematic diagrams showing the principles behind fractional crystallisation in a magma. While cooling, the magma evolves in composition because different minerals crystallize from the melt. 1: olivine crystallizes; 2: olivine and pyroxene crystallize; 3: pyroxene and plagioclase crystallize; 4: plagioclase crystallizes. At the bottom of the magma reservoir, a cumulate rock forms.

The chemical composition of a magma at the time when it cools determines the identity of the minerals which crystallize from the magma and therefore the identity of the resultant igneous rock. The most prevalent component of magma by weight is typically silica (SiO_2). However, magma also contains in varying quantities ions of all the other elements (aluminum, Al, iron, Fe, calcium, Ca, sodium, Na, potassium, K, and magnesium, Mg) which compose the bulk of the earth's crust.

Magmatic differentiation involves processes by which chemically different igneous rocks, such as basalt and granite, can form from the same initial magma. High-temperature minerals can crystallize and settle out, causing the remaining molten material to be concentrated with component that may later form rock enriched in low temperature minerals (such as granite). The last rocks to crystallize in a magmatic intrusion will be enriched in low temperature minerals (quartz, mica, and potassium- and sodium-feldspars). Gases and fluids including water, carbon dioxide, nitrogen and other compounds are also dissolved in magma and will be concentrated in the remaining lava before being expelled as the last traces of magma cools into rock.



As a magma cools its constituent elements bond to form two different types of silicate minerals divided according to which metallic elements they contain. The **ferromagnesian silicates** are rich in iron and magnesium. These include olivine, the minerals of the pyroxene group and the minerals of the amphibole group. In contrast, the **non-ferromagnesian silicates** contain potassium, sodium and calcium rather than iron or magnesium. These include quartz (SiO_2), the minerals of the feldspar group.

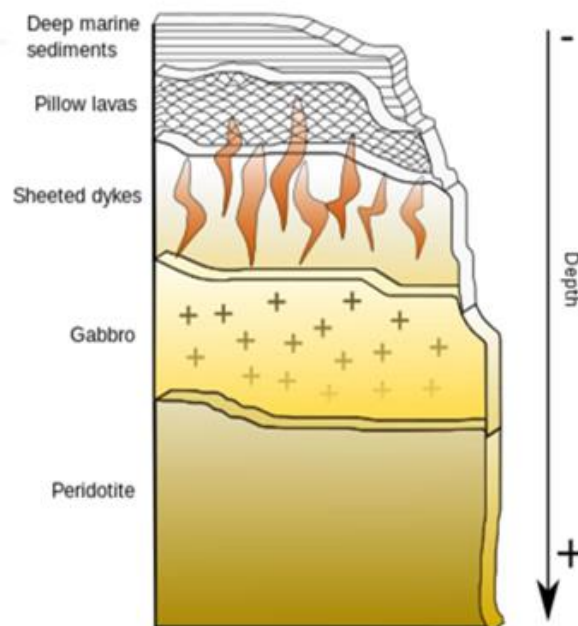
Igneous rocks which contain a high percentage of the ferromagnesian silicates tend to possess a dark colour. In contrast, those igneous rocks which contain a greater percentage of non-ferromagnesian silicates tend to have a lighter colour.

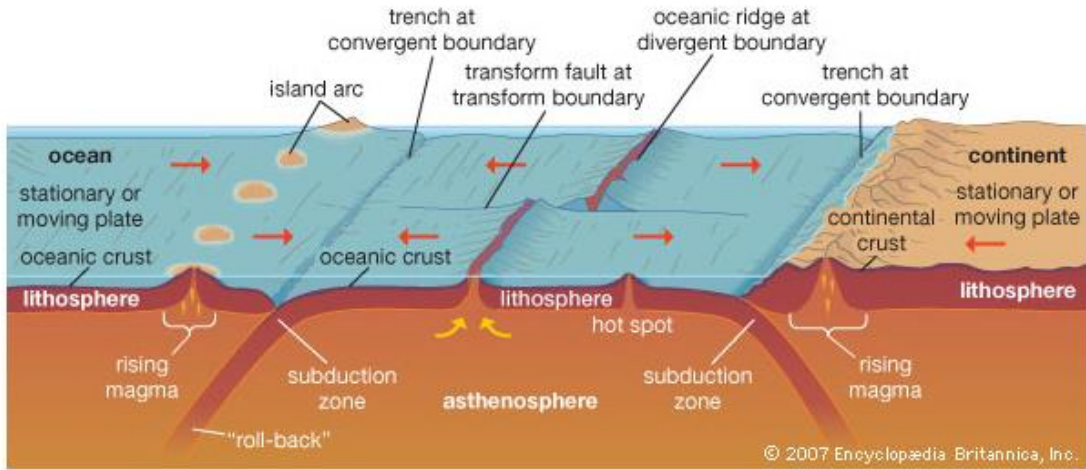
Igneous rocks can be divided into two classes according to their proportional content of ferromagnesian and non-ferromagnesian silicates. Igneous rocks composed mainly of dark, ferromagnesian silicates are said to be of **basaltic** composition. They are also called **mafic** rocks, the word mafic being derived from the first syllables of *magnesium* and *ferrum*, or iron. Because of their iron content such rocks tend to be both denser and darker in colour than those rocks composed mainly of non-ferromagnetic silicates. Igneous rocks which are composed mainly of the light-coloured, non-ferromagnesian silicates such as quartz and feldspar are said to be of **granitic** composition. Granitic rocks are also called **felsic** rocks, the word felsic being derived from the initial syllables of *feldspar* and *silica* (or quartz). Such rocks tend to contain a relatively greater percentage of silica (SiO_2); typically this is about 70% by mass. Rocks with an intermediary composition are termed **andesitic** after the volcanic rock andesite.

^ Stratigraphy and definition

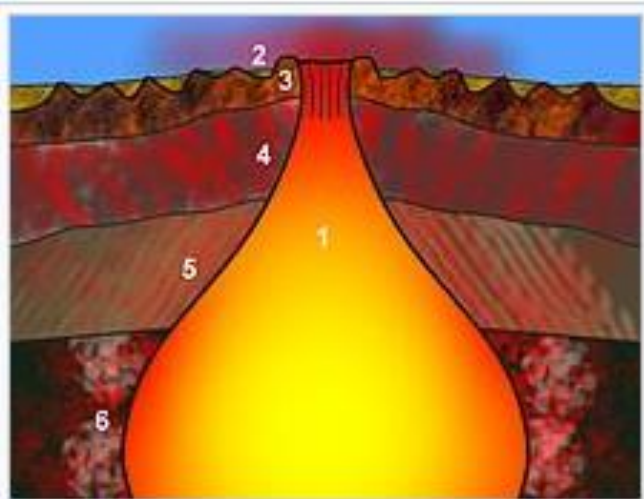
The stratigraphic sequence observed in ophiolites corresponds to the lithosphere-forming processes at mid-oceanic ridges:

- Sediments: muds (black shale) and cherts deposited since the crust formed.
- Extrusive sequence: basaltic pillow lavas show magma/seawater contact.
- Sheeted dike complex: vertical, parallel dikes that fed lavas above.
- High level intrusives: isotropic gabbro, indicative of fractionated magma chamber.
- Layered gabbro, resulting from settling out of minerals from a magma chamber.
- Cumulate peridotite: dunite-rich layers of minerals that settled out from a magma chamber.
- Tectonized peridotite: harzburgite/herzolite-rich mantle rock.





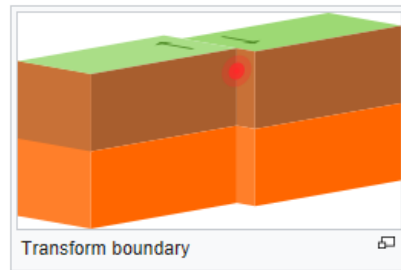
Three-dimensional diagram showing crustal generation and destruction according to the theory of ...
Encyclopædia Britannica, Inc.



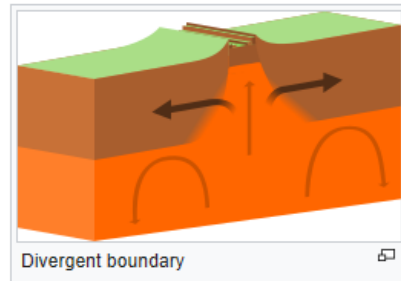
A simplified structure of an ophiolite suite:

1. axial magma chamber
2. pelagic sediments
3. pillow basalts
4. sheeted basaltic dykes
5. intrusive, layered gabbro
6. dunite/peridotite cumulates

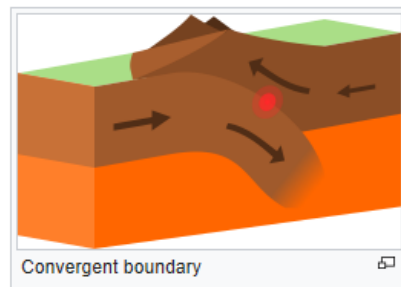
Types of Plate Boundaries



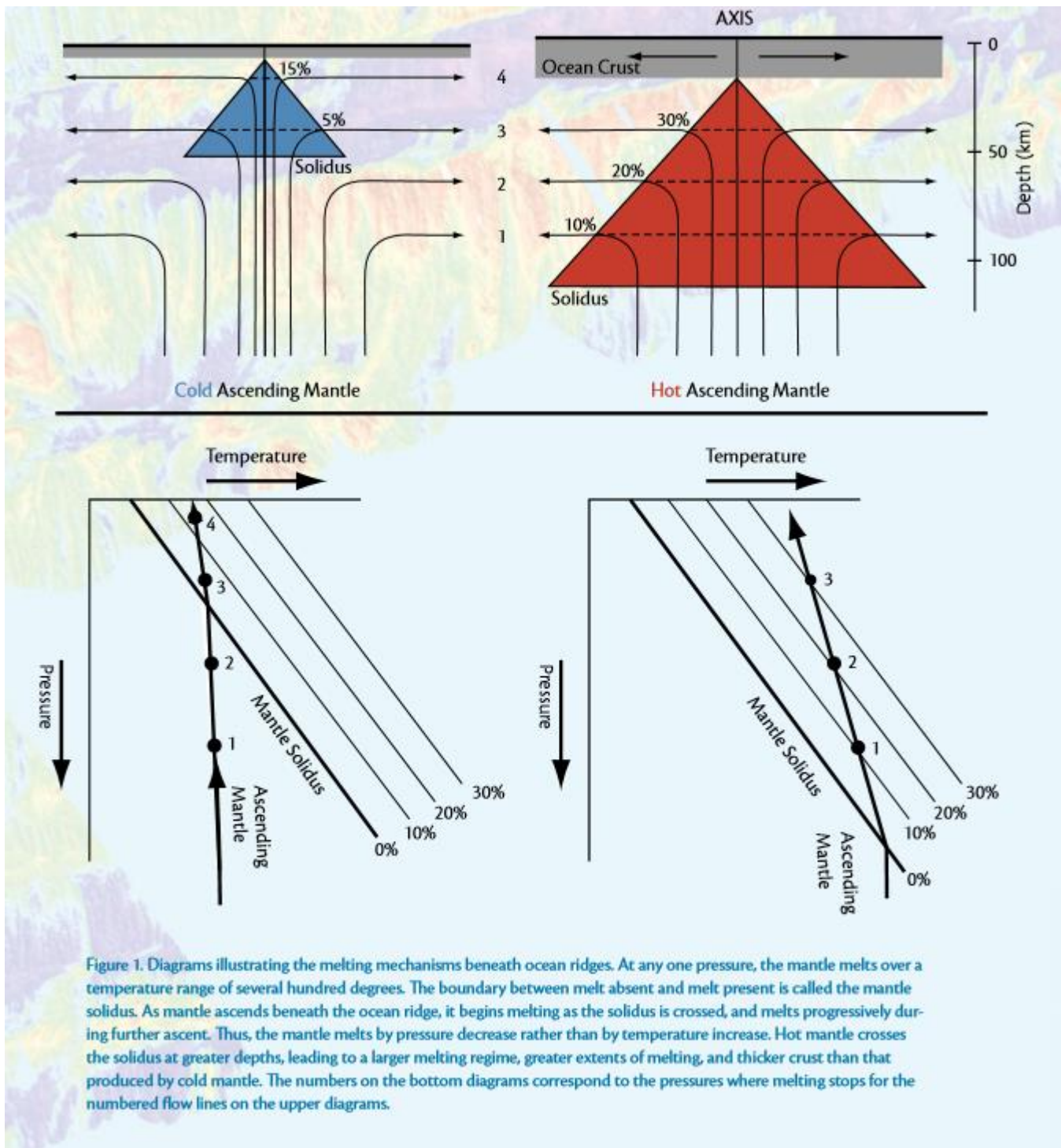
Transform boundary



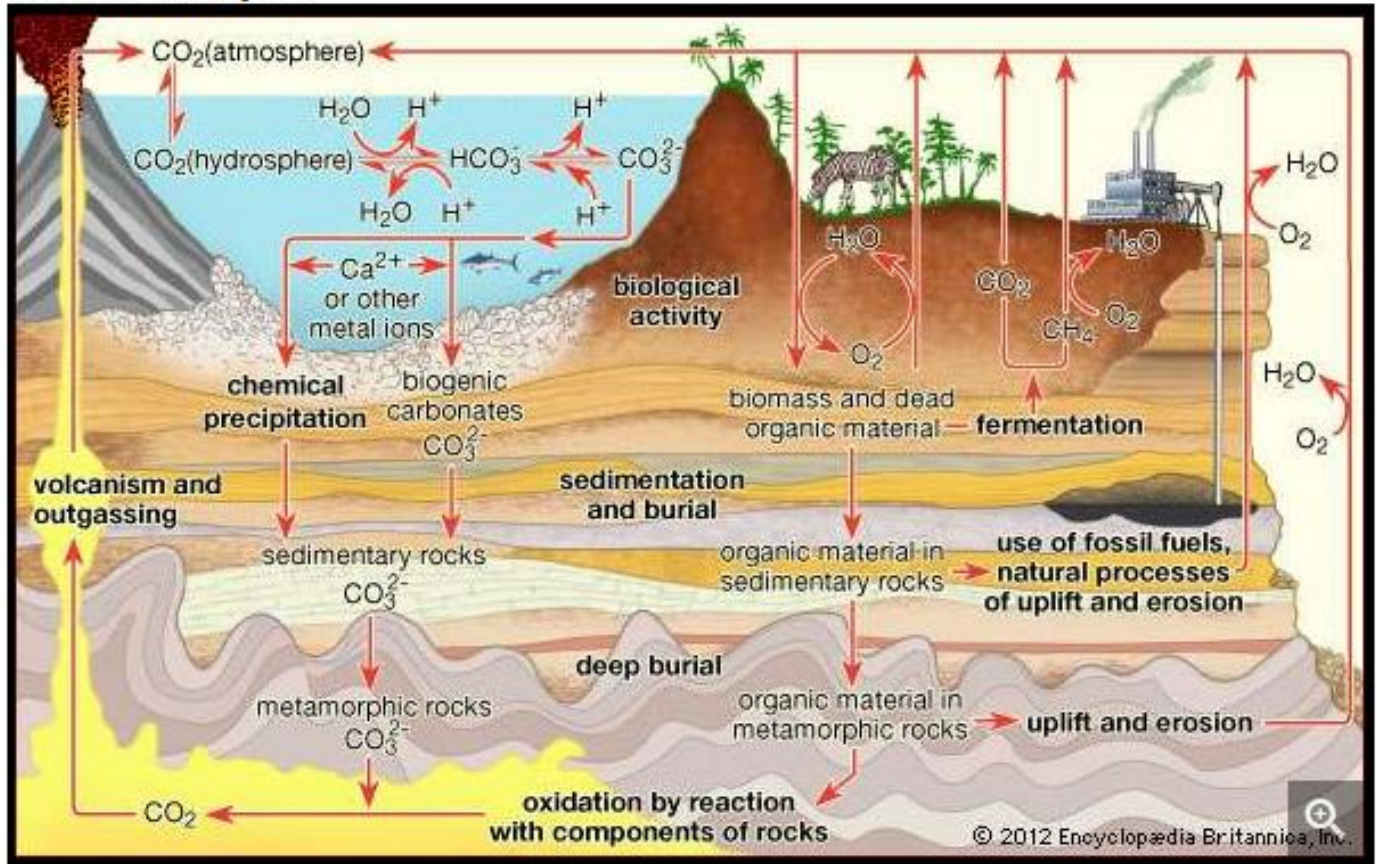
Divergent boundary



Convergent boundary



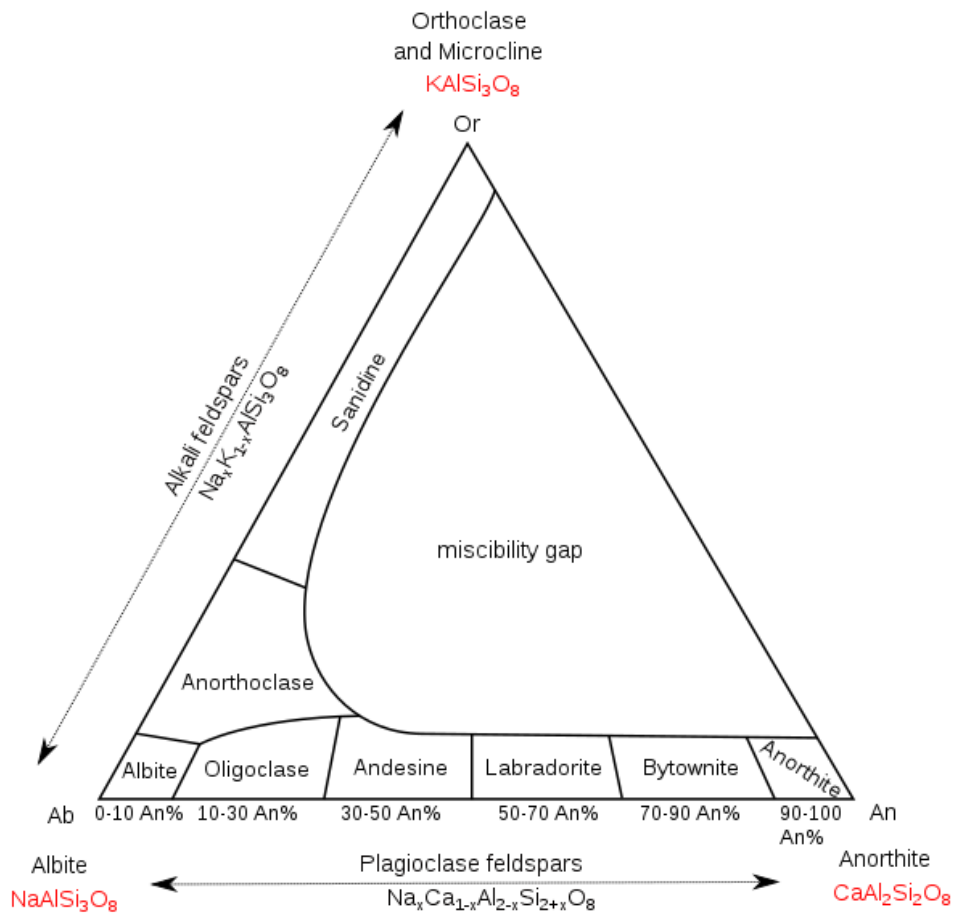
The carbon cycle



Carbon is transported in various forms through the atmosphere, the hydrosphere, and geologic formations. One of the primary pathways for the exchange of carbon dioxide (CO_2) takes place between the atmosphere and the oceans; there a fraction of the CO_2 combines with water, forming carbonic acid (H_2CO_3) that subsequently loses hydrogen ions (H^+) to form bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) ions. Mollusk shells or mineral precipitates that form by the reaction of calcium or other metal ions with carbonate may become buried in geologic strata and eventually release CO_2 through volcanic out-gassing. Carbon dioxide also exchanges through photosynthesis in plants and through respiration in animals. Dead and decaying organic matter may ferment and release CO_2 or methane (CH_4) or may be incorporated into sedimentary rock, where it is converted to fossil fuels. Burning of hydrocarbon fuels returns CO_2 and water (H_2O) to the atmosphere. The biological and anthropogenic pathways are much faster than the geochemical pathways and, consequently, have a greater impact on the composition and temperature of the atmosphere.

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FELSPAR GROUPS



The following table includes all currently recognized periods. The table omits the time before 2500 million years ago, which is not divided into periods.

<u>Eon</u>	<u>Era</u>	<u>Period</u>	<u>Extent, Million Years Ago</u>	<u>Duration, Millions of Years</u>
<u>Phanerozoic</u>	<u>Cenozoic</u>	<u>Quaternary (Pleistocene/Holocene)</u>	2.588–0	2.588+
		<u>Neogene (Miocene/Pliocene)</u>	23.03–2.588	20.4
		<u>Paleogene (Paleocene/Eocene/Oligocene)</u>	66.0–23.03	42.9
	<u>Mesozoic</u>	<u>Cretaceous</u>	145.5–66.0	79.5
		<u>Jurassic</u>	201.3–145.0	56.3
		<u>Triassic</u>	252.17–201.3	50.9
	<u>Paleozoic</u>	<u>Permian</u>	298.9–252.17	46.7
		<u>Carboniferous (Mississippian/Pennsylvanian)</u>	358.9–298.9	60
		<u>Devonian</u>	419.2–358.9	60.3
		<u>Silurian</u>	443.4–419.2	24.2
		<u>Ordovician</u>	485.4–443.4	42
<u>Proterozoic</u>	<u>Neoproterozoic</u>	<u>Cambrian</u>	541.0–485.4	55.6
		<u>Ediacaran</u>	635.0–541.0	94
		<u>Cryogenian</u>	850–635	215
	<u>Mesoproterozoic</u>	<u>Tonian</u>	1000–850	150
		<u>Stenian</u>	1200–1000	200
		<u>Ectasian</u>	1400–1200	200
		<u>Calymmian</u>	1600–1400	200
	<u>Paleoproterozoic</u>	<u>Statherian</u>	1800–1600	200
		<u>Orosirian</u>	2050–1800	250
		<u>Rhyacian</u>	2300–2050	250
		<u>Siderian</u>	2500–2300	200

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