Glossary

Acadian orogeny: 375-325Ma. Mountain building in the Devonian period due to the closing of the Rheic Ocean and bits of Avalonia crashing into Laurasia. Created mountains along the eastern border of North America but also the anticlines and synclines of Plynlimon

Accretionary complex: the rocks that fall into a subduction_trench, from the land and the ocean floor. A mix of turbidites, ocean floor basalts and marine sediments (pelagic and hemipelagic)

Adit: horizontal entrance to a mine. Cf. mineshaft

Agglomerates: ill-sorted mix of volcanic fragments. vs. conglommerate, breccia

Albite: white sodium feldspar

Alkaline: containing sodium/potassium

Amphibole: common mafic double-chained silicate minerals in igneous and metamorphic rocks forming prisms or needle-like crystals

Angular unconformity: underlying rock was tilted and/or eroded prior to horizontal deposition of next strata

Anoxic: environment with little or no oxygen

Anticline: upward fold which when eroded has the oldest rocks in the centre. Cf. syncline

Antidune: underwater dunes where sediment is deposited on the upstream side and eroded downstream

Arenig: epoch 493-476Ma in the Ordovician period (510-439Ma)

Arenig series: named after Arenig Fawr, a sedimentary series reaching 1,500m thickness on Anglesey laid down in the subsiding and expanding Welsh_basin

Argillic alteration: hydrothermal alteration of feldspars and micas to clay_minerals

Arvon Basin: terrane of upper Precambrian to Cambrian rocks in the north of Snowdonia. Volcanic ashes (tuff) and sandstones under a large thickness of high quality slate which has been extensively quarried in Nantlle, Llanberis and Bethesda.

Asbestos: 6 different fibrous silicate_minerals, the commonest is chrysotile – white asbestos

Ash: (volcanic): fine (<4mm) material from an explosive volcanic eruption. Multiple eruptions can produce bedded ash. Cf. lava

Ashgill: epoch 443-439Ma in the Ordovician period (510-439Ma)

Ashgill regression: ice_age resulting in falling sea levels

Attrition: a type of erosion. Rocks breaking into smaller pieces from crashing into each other. Abrasion refers to superficial wear, such as pebbles becoming smoother. Cf. weathering

Autobrecciation: incorporation of already solidified blocks of lava or magma into subsequent lava flows or intrusions. Cf. breccia

Avalonia: a microcontinent that broke away from Gondwana in the Paleozoic era, with the spreading Rheic_Ocean behind it, and the shrinking Iapetus_Ocean in front. Colliding with Baltica, then Laurentia, and finally Gondwana again, it ended up inside Pangea. Subsequently split by the Atlantic Ocean into West and East, it underlies parts of the east coast of North America, and southern Britain, Ireland and nearby mainland Europe.

Axial plane: the plane that bisects the hinge of a fold

Axis of a fold: direction of the hinge, at right-angles to the forces that created it

Back-arc basin: at a subduction zone, volcanic activity within the uplifted region creates a new spreading sea floor behind an island arc. e.g.Sea of Japan. Cf. back-arc_basin

Backwash: the water flowing back down the slope of a beach. Cf. swash

Bala-Mawddach Fracture: The Bala Fault is a SW-NE fault in Wales that extends through Bala Lake, along the Tal y Llyn valley to the south of Cader Idris, and offshore into Cardigan Bay. A deep crustal fracture

which produced other sub-parallel faults through the Cader Idris area in the Lower_Palaeozoic, including the Ceunant fault to the north of the Cader Idris escarpment.

Baltica: a continent 1,900-410Ma before colliding with Laurentia. Now Scandinavia and much of western Europe as far as the Urals

Banded hornfels: silt bands have recrystallised to quartz, whilst mud layers have been converted to chlorite and sericite sheet silicate_minerals

Bar: unit of pressure ≈ atmospheric pressure

Basalt: an extrusive mafic volcanic rock that contains olivine and pyroxene minerals that make the rock dark-coloured. It is fine-grained because of the rapid cooling of lava under the sea and the evaporation of water on the Earth's surface. Flood basalts are commonplace, formed by lava pouring out and solidifying. Unweathered basalt is black or grey.

Basement: the surface below which no sedimentary rock is found

Basin: area of former sea where sediments collected and later became rock. A syncline enclosed by normal_faults, a slump

Batholith: a solidified low level magma chamber >100km^2. Also called plutons. Usually granite. Cf. laccolith

Bedded/bedding: sedimentary rock with visible layers

Bench: long narrow strip of relatively level ground

Biotite: a dark mafic type of mica (sheet forming silicate_minerals). Cf. muscovite

Bioturbation: features originally made by living creatures, especially worms etc. burrowing into the see floor

Bivalve: mollusc with two identical (left and right) shells. Cf. brachiopod

Blanket bog: creates peat

Block faulting: area with all strata within it at a different height due to the enclosing faults

Blueschist: metamorphic basalt due to high pressure (up to 5000bars) but low temperature (200^{o}C-500^{o}C). Often from ocean_crust in a subduction zone. Blue due to the amphibole glaucophane

Boss: an outcrop of igneous or metamorphic rock

Boudinage: rock strata (between more plastic rock) that have been stretc.hed creating boudins (sausage shaped)

Boulder bed: coarse conglomerate from a pebble beach deposit

Bouma sequence: effect of slowing down of an underwater landslide producing a series of layers creating turbidites. Graded from A more proximally and underneath (very coarse sandstone often with pebbles) to E more distally and on top very fine (mudstone), each with corresponding features. See Bouma_ABCDE

Bouma ABCDE: A – coarse sandstone and pebbles. B – planar-laminated medium sandstone. C – ripple-laminated fine sandstone. D – parallel-laminated siltstone. E – mudstone. See Bouma_sequence

Brachiopods: animals with two non-identical shells – smaller brachial and larger pedicle valves. Cf. bivalve

Breccia: rock containing angular fragments within a finer matrix/groundmass. Cf. conglomerate

Calc-alkaline: containing Calcium, Sodium and/or Potassium

Calcareous: mostly calcium carbonate. E.g.limestone

Calcite: calcium carbonate

Caldera: the result of the roof of a large magma chamber collapsing in on itself e.g. after a massive eruption. Over 1km diameter

Caledonian orogeny: 490-390Ma. Mountain building in the Ordovician and Silurian periods caused by the closure of the Iapetus_Ocean and Laurentia, Baltica and Avalonia colliding. Produced mountains in Northern Ireland, Britain and Scandinavia

Cambrian: 542-488Ma. First Period in the Paleozoic era. Preceded by the Proterozoic (2,500-542Ma) eon. Followed by the Ordovician (488-444Ma) period. Epochs: Caerfai, St David's, Merioneth

Caradoc: epoch 464-443Ma in the Ordovician period (510-439Ma). First epoch of the late Ordovician (Bala) sub-period followed by the Ashgill epoch (443-439Ma)

Carbonaceous: containing carbon

Carbonaceous organic matter: vegetation (which typically has 45-50% carbon when oven-dried). Carbon content due to photosynthesis of atmospheric CO_2

Cassiterite: tin oxide SnO_2

Cenozoic: 65Ma-today. Most recent era of the phanerozoic eon.

Chalcopyrite: yellow copper and iron sulphide $CuFeS_2$

Chemistry of rocks: mineral content. Earth's crust: oxygen 47%, silicon 28%, aluminium 8%, iron 5%, calcium 4%, potassium 2%, sodium 2% and magnesium 1%

Chert: cryptocrystalline varieties of quartz – silica (SiO_2). Flint is a nodular variety of chert. Other varieties include jasper and agate

Chlorite: low grade metamorphic sheet silicate minerals, derived from mafic clay minerals such as biotite and related to mica. Found in slate

Cirque: (corrie, cwm) hollow created by a glacier

Clastic sedimentary rocks: products of erosion. Specific grain size (sandstone and various mudstones). Graduating grain size (turbidites). Containing larger clasts (breccia, conglomerate, volcanic agglomerates)

Clasts: broken rock fragments

Clay minerals: ultrafine grained hydrous sheet silicate_minerals from the weathering and low-temperature hydrothermal alteration of feldspars and micas..

Claystone: very fine grained mudrock 0-4 µm grain size

Cleavage plains: parallel planes into which a rock naturally splits created by (and perpendicular to) massive compressive forces. Distinct from the original bedding plains. Trace fossils can only be found in bedding plains.

Co-magmatic: from the same magma chamber

Columnar jointing: originally vertical joints due to very slow cooling from above of lava (typically basalt and dolerite) in sills

Compositional banding: layers or bands of different composition in metamorphic rock, typical of gneiss

Concordant: in the same plane as the country rock. E.g. sills

Concretions: local nodules within a rock. Chemical precipitates which grew in the soft mud of the sea floor, perhaps around a nucleus such as a fragment of organic matter. Calcium, magnesium and iron carbonates

Conduit system: the ducts which carried magma towards the surface from a magma chamber

Cone sheets: an igneous intrusion, just a few metres thick, into conical fractures created by and extending from a high level magma chamber. Cf. dyke, sill, ring_dyke

Conformable junction: rock or sediment strata that were deposited either adjacent to or on top of each other without interruption by processes such as erosion or folding. Cf. unconformity

Conglomerate: rock containing rounded pebbles within a finer matrix/groundmass. Cf. breccia (angular fragments)

Contact metamorphism: due to being next to a magma chamber, extreme heat (200-1000^{o}C) creating hornfells in mudstone, quartzite in sandstone and marble in limestone

Continental crust: up to 1500 million years old. Felsic. Less dense (2.7g/cm3) and thicker (mostly 35-40km) than oceanic_crust. Including continental shelves, 40% of the earth's surface. Although moved about by tectonic_processes, their bases are permanent. Cf. oceanic_crust

Convolute bedding: distortion of very fine stratification in a sedimentary rock with complex folding or crumpling.

Copper minerals: Malachite: a green copper mineral. $Cu_2CO_3(OH)_2$. Chalcopyrite: yellow copper and iron sulphide $CuFeS_2$

Corris-Rhobell Fracture: A deep crustal N-S fault zone with other sub-parallel faults. Cf. Bala-Mawddach_fracture

Country rock: any background sedimentary rock in which you get (non-country) igneous intrusions.

Cross bedding /cross-stratification/cross-laminated: criss-crossing of bedding planes due to non-horizontal deposition and erosion. Created by flowing water over ripples or wind over sand-dunes where overall deposition exceeds erosion. Cf. parallel_lamination

Crustal basement: where the continental_crust meets the outer mantle

Crustal fractures: going right through continental crust

Cryptocrystalline: crystals only visible microscopically

Crystal cumulate: caused by gravitational separation of particular crystals in semi-molten magma. See fractional crystallization

Cubic jointing: horizontal and vertical jointing, the precursor to creating boulders

Current bedding: undulating patterns created by water or air currents producing cross-bedding. Larger scale than ripple_bedding

Cwm: (corrie, cirque) hollow created by a glacier

Detrital zircon analysis: a method of calculating radiometric age – the last time the mineral was molten. ^{238}U to ^{206}Pb half-life 4470 million years. ^{235}U to ^{207}Pb half-life 710 million years

Devonian: period 409-350Ma between the Silurian (439-409Ma) and Carboniferous (350-290Ma) periods in the Paleozoic era (542-251Ma)

Diapirs: upward intrusion of a different rock due to its lower density allowing for it to rise when plastic

Diorite: intermediate (between felsic and mafic) coarse-grained intrusive igneous rock

Dip: maximum slope of a plane. For a horizontal plane 0^o. Cf. strike. Apparent dip: apparent slope of a cut-through plane, e.g. at a cliff face

Dip slope: following the bedding plane (concordant). Cf. escarpment

Distal turbidite: distal region of turbidite missing Bouma A and B sequences

Dolerite: dark medium grained mafic intrusive igneous rock. Contains plagioclase, pyroxine and olivine. Common in intrusions (dykes and sills)

Dolomite: limestone containing often >90% of the mineral dolomite – $CaMg(CO_3)_2$

Dome: an anticline with older rock exposed in the centre

Drape structures: apparent folds due to the shape of the underlying structure

Dyke: minor igneous intrusion crossing the bedding planes of the country rock at a steep angle

En-echelon: multiple tiny approximately parallel very short S-shaped faults (kinks) due to shear forces oblique to the main trend, typically filled with quartz or calcite

Energy (kinetic): low=slow moving, high=fast moving

Eons: the beginning 4,567Ma Hadean 3,800Ma Archean 2,500Ma Proterozoic 542Ma Phanerozoic (palaeozoic, mesozoic, cenozoic) the present

Epidote: a green calcium feldspar

Epithermal mineralisation: produced by relatively low temperature (50-200^oC) hydrothermal fluids

Epoch: subdivision of a period, early/lower middle late/upper or specifically named. In the Cambrian period – Caefai; St David's; Merioneth. In the Ordovician period – Tremadoc, Arenig; Llanvirn, Llandeilo; Caradoc, Ashgill. In the Silurian period – Llandovery, Wenlock, Ludlow, Pridoli

Erosion: the wearing away of pieces of rock or other solid materials by weathering and attrition

Escarpment: steep slope or cliff cutting through the bedding planes (transgressive). Cf. dip slope

Eutaxitic texture: banded or streaky areas between undeformed areas in ignimbrite

Extensional basin: a basin enclosed by multiple normal_faults which are moving apart, and hence is becoming progressively larger and deeper

Extrusive volcanic rock: from lava – mafic basalt, intermediate andesite, felsic rhyolite. From volcanic eruptions – tuff and ignimbrites

Facies: sedimentary features that reflect the specific environmental conditions in which a rock was formed.

Fan: deposits spreading out in a cone or fan shaped manner. Alluvial fans. Turbidite fans have distinct upper (proximal) mid and lower (distal) fan sequences

Fan delta: underwater deposition of very course sediment from a single water source, unlike a braided delta derived from multiple streams

Fault: major fracture causing downward displacement (normal fault), upward displacement (reverse fault) or transverse sideways slippage

Fault breccia: rock created by the grinding action between the two sides of a fault

Feeder vent: part of the plumbing within a volcano

Feldspar: extremely common aluminium silicate_minerals with 3-dimensional framework. Orthoclase – with potassium &/ sodium (Alkali-feldspar). Albite – with sodium. Plagioclase – with sodium &/ calcium. Anorthite – with calcium

Felsic: high silica content over 70%, average 72%. Also rich in aluminium sodium and potassium, but low in magnesium (1%). Mainly biotite, alkali feldspar and quartz. Cf. quartz 99%, intermediate 60% and mafic 50% silica

Felsic igneous rocks: granite (intrusive), rhyolite (extrusive). Light coloured, mostly feldspar (especially K-feldspar), at least 10% quartz, and muscovite mica. Less than 15% mafic_silicate_minerals. Cf. mafic

Felsic magma: has high viscosity and high gas content, so volcanic eruptions are less common but explosive and pyroclastic, resulting in destruction and rhyolitic ignimbrite, tuff and pumice. Intrusive felsic magma produces granite and microgranite. Cf. mafic_magma

Felsic silicate minerals: (with 3 dimensional framework) quartz and orthoclase Na/K-feldspars; (with sheet framework) white muscovite mica

Felsite: very fine grained light-coloured felsic igneous rock

Ferroan: containing a small amount of ferrous iron (Fe^{2+}) replacing other cations

Fiamme structures: flattened elongated glassy pumice clasts in welded ignimbrites

Flags: sedimentary rock that can be cleaved along bedding planes. Cf. slate, which is usually split along cleavage planes

Flame structure: soft_sediment_deformation with the underlying bed pushing up through the overlying bed because less dense, generally when both strata are saturated with water

Flaser bedding: alternate layers of mud and sand created in high-energy environments, typically tidal, but can occur in turbidite sediments (Bouma C). Majority sand, with mud forming lenses. Cf. lenticular_bedding

Flow banded /Flow foliation: patterns (banding) developed in igneous or metamorphic rock when very viscous (by varying concentrations or preferred orientation of components) as it flows

Flower structures: structures resembling petals due to local changes in pressure and vertical movement across a transverse_fault

Flute casts: broad sole_markings produced by scour of the underlying bed by a fast moving flow

Fold: in sedimentary rocks, originally flat layers becoming curved in one or two dimensions. Down (syncline and basin). Up (anticline and pericline/dome)

Foliated: parallel thin layers in metamorphic rocks due to the realignment of crystals. Foliated metamorphic rocks include slate, phyllite, schist and gneiss. Non-foliated metamorphic rocks (such as hornfels, marble and quatzite) lack a layered or banded appearance

Fore-arc basin: at a subduction zone, between the accretionary wedge/prism and the volcanic island arc. Cf. back-arc basin behind the volcanic island arc

Foreset beds: on the front sloping edge of a delta or dune

Formation: a named (with starting capital letters) mappable grouping of rock beds originally laid down within a specific timespan.

Fossiliferous: containing fossils or organic remains.

Fossils: preserved remains, impression or trace of a once-living thing in rock. Trace_fossils are mainly of tracks and burrows

Fractional crystallization: processes in the magma chamber separating heavier mafic minerals with higher melting points from lighter felsic minerals with lower melting points

Fracture zone; multiple deep faults

Fractures: faults – longitudinal (along), transverse (across), orthogonal (perpendicular) to the direction of the main feature.

Froth flotation: process which separates hydrophobic ingredients (which go into the froth) from hydrophilic elements (which remain in the liquid). Used to concentrate mineral ores, e.g. copper

Fumarole: volcanic vent emitting steam, other gases and volatiles at 100°C to 1000°C

Gabbro: black or dark green coarse grained intrusive mafic igneous rock. Mainly plagioclase feldspar and pyroxine. Forms much of the oceanic crust, below the finer grained basalt of similar composition

Galena: silvery-grey lead sulphide, PbS

Ganderia: eastern coast of Avalonia or a neighbouring separate terrane. In the British Isles now underlying SE Ireland, Ynys Mon, Isle of Man and the Lake District.

Glacial till: sediments created by glaciers and giving rise to boulder clay

Glass: see volcanic_glass

Gneiss: high-grade regional metamorphic rock with gneissosity. Mineral grains recrystallized under intense pressure and up to 700°C. Cf. slate and schist

Gneissosity: mineral banding – (bands or lenses of) pale felsic minerals (quartz and feldspar) alternating with dark mafic minerals (mica or amphibole). Layers (gneissic banding) are much thicker than in schist and do not easily split. Cf. schistosity

Gondwana: supercontinent 550-320Ma. Included Africa, South America, Australia, Indian subcontinent and Arabia. Became part of Pangea with the closue of the Rheic and Tethys oceons. Cf. Laurentia, Baltica, Avalonia

Graben: area between deep normal faults that is sinking due to the sides moving apart – extension feature. Cf. horst

Graded bedding: with coarsest layers underneath and progressively finer layers above, usually due to under-water precipitation

Grain sizes: clay, silt (fine/medium/coarse/very coarse), sand (fine/medium/coarse/very coarse), granules (=very fine gravel), small/medium/large/very large pebbles (=very coarse gravel), cobbles, boulders. Each grade is twice the diameter of the previous grade with clay particles <0.004mm, very coarse sand 1-2mm, boulders >256mm diameter. Clay and silt are mud

Granite: coarse grained felsic. See igneous_rock_classification

Granodiorite: coarse grained between granite and diorite. See igneous_rock_classification

Granules: a grain_size 2-4mm diameter. Between coarse sand and small pebbles

Graptolites: extinct, often stick-like, marine organisms creating fossils 510-320Ma. Free drifting and used for dating deep water sediments thanks to their rapid evolution and the diverse morphology of their tubular body (theca) and branches (stipes). Cf. trilobite

Greenschists: regional metamorphic rock produced at 300-450°C and 2-10kbars and containing green minerals such as chlorite and platy minerals such as muscovite mica and showing some schistosity or other foliation or layering

Greenstone: term used in North Wales for mafic igneous rock subjected to regional metamorphism. Olivine and pyroxine converted by hydrothermal_fluids to chlorite or serecite, often resulting in a greenish colour

Greywacke: hard coarse sandstone (quartz, feldspar and small rock fragments) with >15% clay minerals. Dark grey colour

Grit: a hard coarse grained sandstone

Groove casts: narrow roughly parallel sets of sole_markings produced by scour of the underlying bed by fast moving flow infilled by the overlying strata

Groundmass: finer-grained material in a porphyritic rock – the matrix

Gwna group: part of the Monian_supergroup. Exposed on Anglesey, the northern coast of Llŷn and Bardsey Island. A mélange (the result of a giant underwater gravity slide). Includes clasts of all sizes, a millimetre up to a kilometre, of diverse sedimentary and igneous rock, subjected to low grade metamorphism

Haematite: red ferric iron oxide Fe_2O_3. Cf. rust, ferrous oxide FeO and black ferrous/ferric magnetite Fe_3O_4

Half-graben: area on the downside of a normal_fault that has no corresponding parallel fault. See graben

Harlech dome: a horst and a geological dome approximately 4.5km thick in southern Snowdonia, extending from Blaenau Ffestiniog to Tywyn, and including the Rhinog and Cadair Idris mountains. Comprises Cambrian sedimentary rocks and Cambrian and Ordovician volcanic and intrusive rocks. Bounded by the N-S Mocchras fault, the SW-NE Bala-Mawddach Fracture, the N-S Corris-Rhobell Fracture and the N-S Trawsfynydd fault zone

Heavy metals: High density metals such as copper, gold, iron, lead, manganese and silver

Hemipelagic sediment: occurs on continental shelves, mainly clay and silt-sized grains from erosion of adjacent land rocks but also containing detectable marine origin biogenic matter including plankton. Cf. pelagic sediment

Horizons: a layer of a particular age

Hornblende: a calcium-rich amphibole – double-chained silicate_mineral

Hornfels: Contact metamorphism of (usually) mudstones, with heat (300°-800°C but <2kbar pressure) from the intrusion causing thermal and hydrothermal alteration, making the rock much harder. Higher grades can become spotted or banded

Hornfelsed: changed to hornfels by contact metamorphism

Horst: area between deep reverse faults that is rising due to the sides moving closer together – compression feature. Cf. graben

Hydrothermal alteration: minerals converted by super-heated water (hydrothermal fluids)

Hydrothermal fluids: hot (usually >200°C) water-based solutions of compounds and gases still liquid at high temperatures due to simultaneous very high pressure.

Hydrothermal quartz veins: crystallized minerals from hydrothermal_fluids containing dissolved silica

Iapetus ocean: 600-400Ma. Southern hemisphere ocean between Laurentia, Baltica and Avalonia. Closed with the Caledonian (490-390Ma), Taconic (470-444Ma) and Acadian (375-325Ma) orogenies and the creation of Euramerica and subsequently Pangea. Previously called the Proto-Atlantic. See Rheic ocean

Ice ages: major periods of ice ages 2900-2780Ma, 2400-2100Ma, 720-635Ma (snowball earth), 580Ma, 547Ma, 450-420Ma (includes the Late_Ordovician_ice_age), 360-260Ma (the late paleozoic icehouse), 34Ma-present (the Late Cenozoic ice age / Antarctic glaciation). We are currently in an interglacial of the Quaternary/Pleistocene glaciation which started 2.6Ma. Ice ages can result in sea level falls of possibly over 400m. Currently sea level is 130m higher than it was 20,000 years ago and would rise a further 70m if all the ice caps and glaciers melted.

Igneous intrusions: dykes, sills, cone sheets and laccoliths

Igneous rock classification: [course-medium-fine grained] mafic (gabbro dolerite basalt) intermediate (diorite microdiorite andesite) felsic (granite microgranite rhyolite). Mafic rocks have a higher melting point and more iron magnesium and calcium – darker, heavier. Felsic rocks have more silica, sodium and potassium – paler

Igneous rock: products of volcanic activity, extrusive and intrusive

Igneous rock grain size: in the presence of water larger crystals are formed when rock solidifies. Water vaporises and is lost from hot melts at low pressures, but remains liquid at high pressures. Hence extrusive igneous rocks tend to be fine grained, and intrusive rocks coarser grained. If crystals are microscopic, it is called cryptocrystalline. If isolated crystals (phenocrysts) are exceptionally large, it is porphorytic. Very rapid cooling can produce uncrystallised volcanic glass.

Ignimbrites: result of explosive volcanic eruptions, poorly sorted and partly welded on landing due to pressure and >500^{o}C. Felsic

Incline: in quarries, a steep artificial slope for a tramway

Inlier: area of older rock surrounded by younger rock as occurs with horizontal erosion of an anticline or dome. Cf. outlier

Interbedded sediments: alternating beds of different sedimentary rocks

Intermediate igneous rocks: diorite (intrusive), andesite (extrusive). Roughly even mixtures of feldspar (mainly plagioclase) and mafic minerals (mainly amphibole, pyroxene, and biotite mica). Relatively little quartz. Silica 60%, magnesium 2.5%. Cf. felsic >70%, and mafic 50% silica

Intrusion: igneous rock that has solidified at depth within sedimentary rock. See dyke, sill and cone sheet

Intrusive rock: igneous_rock that solidified underground. See dykes sills laccolith batholith

Iron minerals: Magnetite, black, Fe_3O_4. Iron pyrites, FeS_2, 'Fool's gold'. Haematite red Fe_2O_3

Iron oxides: low oxygen – black/green, ferrous, FeO. High oxygen – red/purple, ferric, Fe_2O_3

Iron pyrites: ferrous sulphide FeS_2. 'Fool's gold'

Jasper: variety of quartz, coloured red by haematite (Fe_2O_3)

Joints: microscopic fractures in igneous rocks occurring on cooling. The reason such rocks break into blocky boulders with non-parallel flat surfaces

Kaolinite: a common clay mineral formed by the breakdown of feldspars

Keratophyre: intermediate_igneous_rock with particularly high sodium feldspar content

Laccolith: a solidified high level magma chamber. A circular domed sill fed from a central vent. Several at different levels called a cedar tree laccolith. Cf. batholith

Lamina: sedimentary layers <1cm thick. Cf. beds are >1cm thick

Laminated: having very thin bedding planes <1cm thick

Lapilli: pyroclastic fragments 2-64mm. If smaller – ash, if larger – blocks and (semi-molten) bombs

Late = younger, upper

Late Ordovician ice age: ice_age around 450Ma when temperatures plunged 10^{o}C with an icecap centred on the Sahara area and sea-level falling 50m. Duration uncertain (1 to 35 million years). Probably the leading cause of the Ordovician-Silurian extinction event.

Latite: intermediate feldspar-rich (half plagioclase) igneous rock with < 5% quartz. Cf. quartz latite

Laurasia: supercontinent 200-55Ma. Origin: separation of Gondwana from Pangea. Split by the Atlantic ocean into North America and Eurasia (minus Indian subcontinent)

Laurentia: supercontinent 750-320Ma. North America, Greenland and northwestern Scotland (the Hebridean Terrane). Origin: the break up of Rodinia. Joined with Baltica, Avalonia and finally Gondwana to form Pangea

Lava: molten rock that has escaped from a magma chamber and subsequently solidifies. Cf. pyroclastic eruptions

Lava types: The surface of *aa* (pronounced "ah-ah") consists of free chunks of very angular pieces of lava. The less common *pahoehoe* (pronounced 'paw-hoey-hoey") has a comparatively smooth or "ropy" surface. Eruptions under the sea produces pillow lavas due to rapid cooling. All produce basalt

Leached: soluble chemicals or minerals removed by circulating liquids

Lead minerals: silvery-grey galena – lead sulphide PbS

Lens: a small region within other rocks which is thick in the middle, thin at the edges. See lenticular_bedding (sandstone lenses) and flaser_bedding (mudstone lenses)

Lenticular_bedding: alternate layers of mud and sand created in (low energy) slack water. Majority mud, with sand forming lenses. Cf. flaser_bedding

Limestone: rock >50% calcium carbonate, partly or wholly produced by organisms

Lithic fragments: sand-sized pieces of other rocks

Lithification: sediments changing into rock. Cf. petrification

Lithology: the macroscopic features of a rock

Lithosphere: oceanic and continental crust.

Lithostatic equilibrium: when a relatively low density plastic rock at depth responds to excess pressure by rising through the strata (instead of metamorphic change)

Littoral zone: from the highest tide line to the lowest tide line, with a sublittoral zone variously defined as where there is sufficient light (the photic zone) to still get seaweed, or the edge of the continental shelf (c.200m depth).

Llandovery transgression: rising sea levels flooding coastal regions following the previous ice age and Ashgill_regression

Llandovery: epoch 439-430Ma in the Silurian period (439-409Ma)

Lode: a commercially useful mineral vein

Lower Palaeozoic: Cambrian, Ordovician and Silurian periods

Lower: earlier, so producing lower strata. Lower Cambrian 542-513Ma. Lower Ordovician 488-472Ma

Mafic: rocks rich in magnesium (15%) and iron but with lower silica content (50%). Cf. felsic >70% silica

Mafic magmas: have low viscosity and low gas content, so volcanic eruptions are more common and produce lava flows and basalt. Intrusive mafic magma produces course-grained gabbro and finer dolerite. Cf. felsic_magma

Mafic rocks: dark-coloured igneous rocks containing iron-magnesium silicate_minerals. Dominated by mafic_silicate_minerals. Little or no quartz. Gabbro (coarse – intrusive), microgabbro and basalt (fine – extrusive)

Mafic silicate minerals: (isolated) olivine, (single chain) pyroxene, (double chain) amphibole, (sheet) biotite mica, (3 dimensional) plagioclase Ca-feldspar

Magma: molten rock (>600^{o}C, >2kbar) containing dissolved gases (volatiles) and crystals. Felsic magma is less dense, mafic magma heavier

Magmatically related: from the same magma source

Magnetite: a black iron ore. Fe_3O_4

Malachite: a green copper mineral. $Cu_2CO_3(OH)_2$

Manganese ores: black pyrolusite MnO_2, red rhodochrosite $MnCO_3$. Used for very hard manganese steel

Mantle wedge: a triangular shaped piece of mantle that lies above a subducting tectonic plate and below the overriding plate

Mantle: region below earth's crust. 2,900km thick. The rigid uppermost mantle (100km under oceanic_crust, 150-200km under continental_crust) is dominantly ultramafic peridotite. Below is the more viscous asthenosphere

Marble: metamorphosed limestone

Marine basin: the bottom of an inland sea

Massive: without internal structure or layers and homogeneous in composition.

Matrix: the groundmass of a rock, the finer-grained material in which are larger grains, crystals or clasts

Megumia: marine basin bordered to the east by the Midland platform within the land mass of eastern Avalonia but including the Meguma Terrane area in Nova Scotia

Mélange: a mappable but chaotic mixture of rock types due to a catastrophic (often underwater) landslide

Menai Straits Fault Zone: a SW-NE fault system through the west side of Llŷn and spreading out through and on either side of the Menai Strats

Mesozoic: 245-65M. Middle era of the phanerozoic eon.

Meta-rocks: sedimentary rocks that have had a degree of metamorphic change

Metamorphic aureole: around a magma chamber, country_rocks converted and recrystallized by heat and steam. Width dependent on the size and temperature of igneous_intrusion, and greater if heat transferred by hydrothermal_fluids rather than just conduction

Metamorphic rocks: created by extreme pressure and heat. In regional_metamorphism, pressure(>2kbars)>heat. In contact_metamorphism, heat(200-1000^{o}C)>pressure(<2kbar). Foliated – slate, phyllite, schist and gneiss. Non-foliated – hornfels, marble and quartzite

Mica: sheet silicate_minerals. Muscovite – white. Biotite – brown/green

Micro-rocks: finer grained. E.g. microgranite

Mid-ocean spreading centre: at mid-ocean ridges, where new oceanic_crust is formed through volcanic activity and then gradually moves away from the ridge

Midland platform: area of eastern Avalonia southeast of the Welsh Basin. Now east and south Wales and most of England

Migmatite: extra high grade metamorphism producing a mixture of metamorphic gneiss and igneous granite (recrystallized gneiss). Frequently has irregular small stripes or patches of different colours

Mocchras fault, a N-S crustal fault along the coast from Harlech to Barmouth, and the western fault boundary of the Harlech Dome. The Mochras borehole on Shell Island found relatively young tertiary and Mesozoic rocks suggesting a drop of at least 4,500m across the fault line.

Monian Supergroup: the rocks of Ynys Mon (Anglesey). Includes the South Stack Group (meta-sedimentary with stunning folds), the New Harbour Group (aluminium rich metamorphic rock) and the overlying Gwna Melange. Radiometric_age 500-475Ma

Monocline: asymmetric fold with one limb dipping more than the other

Mudrock: 50% of sedimentary rocks, less coarse than sandstone, includes: claystone, mudstone and shale, siltstone and slate

Mudstone: fine grained mudrock 0-64 μm that breaks into blocky bits – Cf. shale

Muscovite: white felsic mica Sheet forming silicate_mineral. Cf. biotite

Mylonites: 'milled rock' produced in fault and shear zones by crushing and grinding previously coarser rock

Normal Fault: where the two sides are being pulled apart (tensional) with one side slipping down. A system of normal faults can create a downfaulted graben

Obsidian: volcanic glass, >70% silica (SiO_2), <1% water (H_2O)

Oceanic crust: basalt (and underneath gabbro) repeatedly created from lava erupted at the mid-ocean ridge. Mafic. Denser (3g/cm3) and thinner (7-10km) than continental_crust. About 60% of earth's surface (Cf. 71% covered by water). Tectonic_processes cause oceanic plates to get consumed back into the mantle after 2 to 4 hundred million years

Olivine: Isolated silicate_minerals, M_2SiO_4 where M=magnesium, iron, manganese or calcium

Ordovician: 488-444Ma. Period in the Paleozoic era between Cambrian (542-488Ma) and Silurian (444-416Ma) periods. Epochs: Tremadoc, Arenig, Llanvin, Llandeilo, Caradoc and Ashgill

Orogeny: mountain building due to colliding tectonic plates

Orthoclase: potassium &/ sodium feldspar silicate_mineral. Cf. plagioclase (calcium and sodium feldspar)

Outcrops: exposed rock formations

Outlier: area of younger rock surrounded by older rock as occurs with horizontal erosion of a syncline. Cf. inlier

Overthrust: a reverse fault with one side of an inclined compression fault overriding the other creating vertical repetition of strata

Palaeo-: ancient. Former in geological time

Palaeo-geography: the mapping of former continents and oceans in past geologic ages

Palaeomagnetism: the magnetism in rocks that was induced by the earth's magnetic field at the time of their formation. Iron containing minerals in rocks loose their magnetism above specific (Curie) temperatures, and remagnetized on cooling. A major contribution to tectonic theory, and the palaeo-mapping of tectonic_plate movement. Intermittently the earths polarity reverses (e.g.12 times in the past 5 million years), a record preserved in oceanic_crust

Palaeozoic: first era of the phanerozoic eon 542Ma-251Ma. Periods: 542Ma Cambrian 488Ma Ordovician 444Ma Silurian 416Ma Devonian 359Ma Carboniferous 299Ma and Permian 251Ma

Pangea: supercontinent 335Ma to 175Ma. Created from Laurentia, Baltica, Avalonia and Gondwana. Rifted by the Atlantic Ocean

Parallel lamination: sequence of fine layers (<1cm) in sedimentary rocks. Less coarse than bedding plains. Cf. cross_bedding

Parallel-laminated siltstone: Bouma D

Pebble: rounded rock fragment, larger than granules. 4mm small 8mm medium 16mm large 32mm very large 64mm. Cobble 60-200mm. Boulder >200mm. Cf. angular rock clasts

Pelagic sediment: fine-grained sediment that accumulates as the result of the settling of particles to the floor of the open ocean, far from land. Cf. hemipelagic sediment

Pericline: a fold in two directions creating a dome. When eroded the rocks get progressively younger from all directions towards the centre. see anticline

Peridotite: coarse grained ultramafic igneous rock. 40-90% olivine and pyroxene. The dominant rock of the upper part of earth's mantle

Petrification: organisms turning into fossils. Cf. lithification

Phanerozoic: eon 542-0Ma. Eras: 542Ma Paleozoic 251Ma Mesozoic 65.5Ma, Cenozoic to the present. Preceded by the proterozoic eon 2,500-542Ma

Phenocrysts: larger distinctive crystals in a finer rock matrix (the groundmass). Rocks with them are porphyritic

Phyllite: fine grained, metamorphic low-grade schist

Phyllosilicate: platy 2-dimensional silicate mineral such as micas, clay minerals and chlorite

Picrite: porphyritic basalt with olivine phenocrysts

Pillow lava: basalt lava extruded onto the sea floor and rapidly cooled creating pillow-shaped boulders.

Pipe: originally a conduit created by the violent eruption of a deep origin volcano

Plagioclase: calcium &/ sodium feldspar silicate_minerals

Planar-laminated medium sandstone: Bouma B

Plastic: capable of being deformed without fracturing

Plate tectonics: the movements of continental crust, and the creation and destruction of oceanic crust

Platy: sheet silicate_minerals in parallel planes causing rock to split into thin plates. Chlorite, muscovite and biotite mica

Pleistocene: epoch 1.81-0.11Ma followed by the current Holocene

Porphyritic: igneous rock containing larger crystals (phenocrysts) within the groundmass

Porphyry copper mine: a large magma chamber several kilometres below the mine released (mineral-rich, mineral-dissolving and mineral-converting) hydrothermal_fluids which disseminated up, often through a very extensive stockwork of hairline fractures and veins. Further mineral conversion (alteration) can occur from rain and other water. Because of their large volume (1-2km width and depth, 10-1000 million tonnes) open-mined porphyry orebodies can be economic from copper concentrations as low as 0.15% copper and minute but economic amounts of molybdenum, silver and gold

Porphyry: medium/coarse grained felsic intrusive igneous rock with >25% phenocrysts

Precambrian: >542Ma. Proterozoic eon, Edicarion period

Pretannia: landmass to the south of the Welsh_Basin now the Bristol Channel, Devon and Cornwall

Propylitic alteration: metamorphic conversion of biotite and plagioclase feldspar to chlorite (sheet silicate), epidote (Ca Feldspar) and albite (Na Feldspar) by hydrothermal_fluids

Proximal turbidite: region of turbidite containing Bouma A and B sequences

Pumice: very light vesicular pyroclastic volcanic rock created from froth due to the release of dissolved gases under reduced pressure. Usually felsic

Pygidium: hind segment of some invertebrates, including trilobites

Pyrite: yellow iron sulphide FeS_2. 'Fool's gold'. Pyritic – containing pyrite

Pyroclastic: resulting from an explosive volcanic eruptions of usually felsic_magma.

Pyroclastic rocks: ash, tuff, ignimbrite, pumice

Pyroxene: single-chained silicate_minerals. Common in mafic metamorphic and igneous rocks

Quartz: Silicon dioxide SiO_2 with a 3 dimensional framework. Colourless/white. Very common silicate mineral but absent from mafic rocks

Quartz latite: fine grained intrusive intermediate igneous rock with phenocrysts and 5-20% quartz. Cf. latite (<5% quartz), rhyolite (contains >20% quartz)

Quartz vein: magma can release high temperature hydrothermal_ fluids – water (still liquid because of tremendous pressure) with dissolved quartz and other minerals. It flows into cracks in surrounding rock where it cools. Most of the quartz rapidly solidifies and the water becomes supersaturated as it cools further. The dissolved minerals can then produce larger crystals from the remaining quartz and sometimes also garnets, calcite, sphalerite, galena, pyrite, and even silver and gold

Quartzite: hard pale regional-metamorphic rock from sandstone. 90-99% quartz SiO_2

Quartzose: rich in quartz

Radiometric age: age determined by the relative amount of daughter isotopes trapped in an igneous or metamorphic rock after crystallizing. See detrital zircon analysis

Recrystallization: in metamorphic processes, solid-state transformation. E.g. limestone to marble and clay minerals to mica minerals (biotite, chlorite, muscovite)

Reduction spots: often originally spherical, sharply demarcated areas in a sedimentary rock possibly caused by microbial activity reducing oxygen levels and e.g. changing red ferrous to green ferric iron compounds

Regional folding: folds on a regional scale

Regional metamorphism: massive pressure (>2kbar) and heat (200°-600°C) due to tectonic_processes resulting in (low grade) slate, phyllite, schist and gneiss (high grade) mineral recrystallization

Reverse fault: where the two sides are being pushed together (compression) with one side riding up. A system of reverse faults can create an upfaulted horst

Rheic ocean: ocean 470-280Ma between Laurentia-Baltica-Avalonia and Gondwana, disappearing with the creation of Pangea. Cf. Iapetus ocean

Rhyolite: fine pale grained felsic extrusive/intrusive igneous rock. Cf. granite (coarse), basalt (mafic)

Rhyolitic ash: felsic volcanic ash

Rhyolitic ignimbrites: felsic ignimbrites. Mafic ignimbrites are rare

Rhyolitic lavas: felsic lavas. Mafic lavas are commoner

Ring dyke: collapse downwards of the country_rock above a high-level magma chamber resulting in a dyke intrusion with a ring shape on the surface which can become bigger or smaller with depth, with near vertical axis. Usually much thicker than cone_sheets

Ripple-laminated fine sandstone: Bouma C

Rippled bedding: flow structure similar to ripple marks in sand on the seashore. Asymmetric, showing the direction of flow. Smaller scale (at most a few centimetres) than current_bedding.

Rôche moutonnée: rock formation created by a glacier. Upstream a smoothed surface with glacial striations, downstream a ragged small cliff

Rubbly texture: looking as if created from rubble. Breccia and agglomerate

Sand: sediment with grain_size between silt and granules. Mainly silicate_minerals, especially quartz

Sandstone: sedimentary rocks with sand grain sizes – (coarse silt) 1/16mm very fine 1/8mm fine 1/4mm medium 1/2mm coarse 1mm very coarse 2mm (granules)

Sandstone cementing agents: silica (quartz cement) is strongest; calcite cement is soluble in acidic water and produces very porous sandstone; iron oxides also colour the sandstone

Sandstone minerals: most sandstones are mainly composed of quartz (up to 90%) and feldspar.

Scarp: escarpment. A steep slope or cliff cutting through bedding planes (transgressive). Cf. dip slope

Schist: medium-grade metamorphic rock with schistosity. >50% orientated platy and elongated minerals between even thinner layers of quartz and feldspar. Cf. slate and gneiss

Schistosity: very narrow parallel layers of platy minerals (chlorite, muscovite and biotite mica) and amphiboles between thinner paler layers of coarse grained quartz, feldspar and other minerals. Breaks into thin slabs. Cf. gneissosity

Scree: a slope of loose fallen rock usually due to frost and other weathering. Blocky rocks create a slope of 35%, slate-like rocks 27%

Sea floor vents: a hydrothermal vent usually at a mid-ocean ridge

Sedimentary rocks: are derived from erosion (see clastic sedimentary rocks), biochemical (limestone, coal, chert), chemical (inorganic precipitates – rock salt, gypsum) and non-welded products of volcanic eruptions (volcanic ash and tuff)

Sericite: a fine-grained white mica produce by hydrothermal alteration of feldspar. Found in slate and schist

Series: strata formed during one epoch

Shale: fine grained sedimentary mudrock 0-64 µm that breaks into slivers corresponding to the bedding plane. Cf. slate

Shearing: stress within brittle rocks, causes fractures and faults; within ductile rocks creates long-wavelength folds; within more ductile rocks short-wavelength folds with/without metamorphosis

Shear zones: long narrow highly stressed regions where rocks have undergone intense deformation. Brittle at higher crustal levels, ductile at deeper crustal levels where rocks are more plastic

Sheet intrusion: dykes, sills and cone sheets

Shelf: continental shelf or insular shelf round an island

Shelf sea: submerged continental crust – e.g. North Sea. Cf. ocean on oceanic crust

Silica: silicon dioxide SiO_2. See chemistry of earth's crust

Silica content of rocks: >65% felsic, 55-65% intermediate, 45-55% mafic, <45% ultramafic

Silicate minerals: based on silicate tetrahedra $(SiO_4)^{4-}$ which are isolated (olivine), in single chains (pyroxenes), double chains (amphiboles), sheets (micas, clay minerals, chlorite), or 3-dimensional (feldspars, quartz – SiO^2). Within the structure oxygen atoms can be shared and the overall charge balanced by Sodium Na^+, Potassium K^+, Calcium Ca^{2+}, Magnesium Mg^{2+}, Iron Fe^{2+} Fe^{3+}, Aluminium Al^{3+}

Sill: mafic or felsic volcanic intrusion between the bedding planes of the country rock

Silt: granular sediment with grain_size between clay and sand. Typically quartz and feldspar

Siltstone: less fine grained mudrock 4-64 µm. Cf. sandstone

Silurian: 444-416Ma. Period in the Paleozoic era between the Ordovician (488-444Ma) and Devonian (416-359Ma) periods. Epochs: Llandovery, Wenlock, Ludlow, Pridoli

Silver minerals: argentite (Ag_2S), chlorargyrite (AgCl), and associated with galena (PbS), a lead ore often containing significant amounts of silver

Slate: low-grade regional metamorphic mudrock with well-developed cleavage. Contains mica-like metamorphic silicates – sericite and chlorite. Cf. shale, schist

Slaty cleavage: cleavage not in the original bedding plane but perpendicular to subsequent massive compressional forces

Slickenside: smooth, often polished surfaces with parallel scratches or grooves. They form at fault planes when rocks on either side scrape past each other. They also form when glaciers grind over rocks

Slide plane: downslope mass movement of a body of rock

Slope failure: an avalanche of mud and rock

Slump deposit: loosely consolidated saturated deposit, in a fluid state, that has slid a short distance down a slope. Cf. turbidite

Slump fold: a fold created during slumping when the material is still not fully consolidated

Slump structures: mass sliding of semi-consolidated sediment downslope creating overturned folds

Soft sediment deformation: deformation of consolidated but not fully lithified material producing structures such as convolute_bedding, flame_structures, slump_structures, dish structures and sole_markings

Sole markings: Larger flute_casts and smaller groove_casts produced by scour of the underlying mud by a fast moving turbidite flow, e.g. Bouma C units.

Solid geology: the bedrock. Cf. superficial deposits (drift geology)

Sphalerite: grey zinc sulphide ZnS

Spoil tips: accumulated waste rock when mining

Stipe: a stalk or stem. The branches of graptolites

Stockwork: a complex system of (mineral ore) veins

Stope: the space left after a desired mineral ore has been removed. Often narrow, steep and possibly at risk of collapsing in

Stoping: the mining process that creates a stope. By analogy, the process by which lower density hot magma can move upwards through the earth's crust by melting or assimilating rock from the overlying strata

Stratigraphic succession: stratification due to sorting by particle size in a submarine debris flow. See turbidite, Bouma series

Stratigraphy: the study of rock strata, their age and relationship

Strike-slip fault: see transverse_fault

Strike: for a strata, horizontal straight line at right-angles to a line showing its true dip. Also the direction of a fault. Given as a compass direction

Subaerially: from the sky onto land, not onto water. Cf. submarine deposits

Subduction: where a (usually oceanic) plate gets thrust under a continental plate and down into the mantle

Subduction trench: at a subduction zone, starting from the sea, a very deep ocean trench, an accretionary wedge/prism of scraped off material, a fore-arc basin, a volcanic island arc, and a back-arc basin if there has been oceanic trench rollback

Submarine eruptions: volcanic eruptions under water

Superheated steam: dry steam well above the (pressure dependent) boiling point of water

Swash: the water flowing towards a beach when a wave breaks, often at an angle to the slope. Cf. backwash

Syncline: downward fold which, when eroded, has the youngest rocks in the centre. Cf. anticline

Tactonic orogeny: 550-444Ma. Mountain building in the middle and late Ordovician period caused by the closure of the Iapetus Ocean and Laurentia, Baltica and Avalonia colliding. Created a great mountain chain from Eastern Canada and down the eastern coast of the United States

Tectonic activity: movement of tectonic plates causing earthquakes etc.

Tectonic plates: seven extremely large and many smaller distinct sections of both thicker permanent continental crust and thinner transient oceanic crust (lithosphere), which can move relatively to each other

Tectonic processes: large-scale movements of sections (tectonic plates) the earth's crust causing mountain building and ocean creation and destruction etc.

Tensional fracture: one producing a normal fault. Cf. compression creating a reverse fault

Tephra: unconsolidated material from explosive volcanic eruptions. Cf. tuff

Terrane: a fault-bounded region

Tertiary age: 65Ma to 1.8Ma followed by Quaternary

Texture: grain size and variation

Theca: a cuplike or tubular structure. See graptolites

Thinly bedded: narrow sedimentary bands

Tholeiite: a fine-grained mafic igneous rock relatively rich in silica and poor in sodium, typical of ocean floor basalts

Thrust fault: due to compression, a reverse fault with a dip of 15°-45° creating uplift and horsts

Tin minerals: cassiterite tin oxide SnO_2

Tonalite: igneous rock with 20-30% quartz, but feldspar mainly (>90%) calcium (plagioclase) found in solidified magma chambers

Trace fossils: indirect evidence of past life, such as fossils of footprints, tracks, burrows, borings and faeces

Trachydacite: fine-grained felsic igneous rock with >20% quartz but less than rhyolite (>69%)

Transect: a cross-section. A theoretical survey line showing underlying structure

Transform faulting: movement predominately horizontal. Most common in the deep ocean

Transgression (marine): flooding of land areas. Opposite of marine regression, when sea floor becomes exposed

Transgressive zone: a short dyke-like segment where a large sill hops between different bedding planes

Transitional junction: a diffuse/non-sharp junction

Transverse fault: fault where the main movement between the adjacent blocks is sideways slippage. Also known as a strike-slip fault because the slippage is in the direction of the strike of the fault

Trench: sea floor trench at subduction zone. See subduction trench

Trilobites: 20,000 species of extinct (521-262Ma) three part (cephalon, thorax and pygidium) marine arthropods (invertebrates with renewable exoskeletons, which can fossilise, and paired jointed limbs). Size – smallest 1.5mm, average 3cm to10cm, largest 72cm. Their rapid evolution and diverse morphology used for dating shallow water sediments. Crab/spider-like but with no modern equivalent. Cf. graptolite

trough: a linear structural depression that extends laterally over a distance, a narrow basin

Tuff: a sedimentary igneous rock. Volcanic ash (from explosive eruptions) compacted over time into relatively soft rock. Cf. tephra

Tuff classification: felsic (rhyolitic) mafic (basaltic) or intermediate. By predominate grain size: normal tuff or ash tuff (<2mm), lapilli tuff (2mm to 64mm), tuff breccia (angular blocks >64mm), agglomerate (blocks and smooth bombs >64mm)

Tuffite: tuff containing mainly pyroclastic material but also detrital material (clasts produced by weathering or erosion of pre-existing rocks)

Turbidite: sedimentary rock with an (often repetitive) sequence of contemporaneous layers, the product of turbidity currents. See Bouma sequence

Turbidity currents: the result of massive underwater high-energy landslides (triggered by e.g. earthquakes) down into the deep ocean. In 1929 one was recorded travelling at 60mph and going 400 miles

Ultramafic: containing >90% mafic minerals with magnesium 48%. Silica content <45%, average 40% (Cf. mafic 50%, intermediate 60%, felsic >70%, quartz 99%). The earth's mantle is composed of ultramafic rocks, dominantly peridotite

Unconformity: adjacent strata where there has been erosion of intermediate strata and/or extensive periods of time without sediment deposit. Angular unconformity occurs when lower strata get tilted during the time gap

Unlithified: inorganic material not yet become rock. Cf. petrified

Unwelded: pyroclastic material that landed with insufficient temperature (<580^{o}C) to weld

Upfaulted: compression causing strata to rise between reverse_faults

Upper: more recent, so producing higher up strata. Upper Cambrian 501-488Ma. Upper Ordovician 461-444Ma

Veins: sheets of crystallized minerals within a rock, precipitated from hydrothermal fluids. See quartz_veins

Vent pipes: fractures allowing magma to escape from a pressurized magma chamber. Commonest are central vents which connect to a crater. Slits, which can be kilometres long, are called eruption fissures. Fumeroles emit gases and water. Deep ocean hydrothermal vents cause black smokers and white smokers

Vergence: the direction of overturning of an asymmetrical fold in which one limb is shorter and steeper than the other. The direction of the force that created the fold. At right-angles to its axis and axial plane

Vesicular texture: volcanic rock pitted with small cavities produced by dissolved gases vaporising under reduced pressure but trapped. Pumice

Viscous: sticky. Highly viscous lava is felsic, lower temperature and produces granite, rhyolite and, associated with explosive volcanic eruptions, pyroclastic material. Low viscosity lava flows readily, is mafic, higher temperature, and produces basalt.

Volcanic glass: amorphous (uncrystallized) lava or magma that has cooled very quickly. Obsidian comes from felsic lava. Pumice is highly vesicular, and usually felsic

Volcaniclastic: clastic sedimentary rock containing volcanic material

Volcanics: extrusive igneous rock

Wave base: depth below which waves do not disturb the sediment

Wave-cut platform: A flat area in front of a cliff, just below the low tide mark. These are formed when the waves eroded the cliff, but left a flat platform behind.

Weathering: a type of erosion. The breaking down of rocks in situ by the action of weather, plants, animals and chemical processes. Cf. attrition

Wedge out: when a rock strata protrudes into another in a wedge shape, tapering out (“pinching out”)

Welded: pyroclastic rock that was sufficiently hot at time of deposition to immediately weld together. Welded tuff/ash-tuff from sub-aerial fallout. Ignimbrite from pyroclastic density currents (landslides). During welding volcanic glass shards and pumice adhere together, compact and deform creating fiamme structures and a eutaxitic texture

Welding foliation: a glass shard groundmass, cementing volcanic ash and larger elements, creating a eutaxitic_texture. See ignimbrites,

Well-bedded: clearly defined beds

Welsh basin: a back-arc subsiding basin during Cambrian to Silurian periods between the Midland Platform (part of Avalonia) and a volcanic island arc (now Ireland and the Lake District) at the edge of the Iapetus Ocean. Huge quantities of sediment accumulated in it which became uplifted by the collision of Avalonia with Laurentia, and the Caledonian Orogeny. Possibly part of a larger deep-water basin that included the Meguma terrane in Nova Scotia, together comprising Megumia

Xenoliths: inclusions of a visually distinctly different and clearly demarcated rock within an igneous rock, either torn from the magma chamber wall or from rock picked up by a flowing body of lava