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## Glossary

This glossary provides brief explanations of the technical terms used in the Introductions to the chapters and in the 'conclusions' sections of the site reports. These explanations are not rigorous scientific definitions but are intended to help the general reader. Detailed stratigraphical terms are omitted as they are given context within the tables and figures.

**Abrasion:** the process of wearing away parts of fossils or rocks by sediment-laden water or air. The process produces an increasingly smoothed and rounded outline shape.

**Aerobic:** an environment in which air (oxygen) is present, or a depositional environment with more than 1 ml of dissolved oxygen per litre of water. See *also* anaerobic and dysaerobic.

**Age:** a time unit (cf. chronostratigraphy), usually taken to be the smallest standard division of geological time.

**Agglomerate:** a pyroclastic rock with predominantly rounded clasts greater than 64 mm in diameter.

**Algae (sing. alga):** a large and diverse division of the plant kingdom, consisting of mainly aquatic organisms. Simple plants that have no true stems, roots or leaves, they contain chlorophyll and therefore can photosynthesize. They range from microscopic single cells to very large multi-cellular structures.

**Algal-reef:** an organic reef formed largely from algal remains, and in which algae are or were the main lime-secreting organisms.

**Allochthonous:** descriptive of a fossils or rocks that were transported from elsewhere to their current position.

**Alluvial:** a term applied to the environments, action and products of rivers or streams. Alluvial deposits are composed of clastic material deposited on the river floodplain.

**Alluvial fan:** a cone-shaped deposit made up of waterlaid deposits, and also some material transported by mudflows.

**Ammonite:** any ammonoid of the order Ammonitida (subclass Ammonoidea, class Cephalopoda (see cephalopod), phylum Mollusca (see mollusc)). Typically characterized by a coiled, chambered shell, with \_ complex lines between the chamber walls and the outer wall of the shell (sutures), they are an extinct relative of the modern-day squid and cuttlefish.

**Ammonoid:** any extinct cephalopod belonging to the subclass Ammonoidea; they are important zone fossils for the Palaeozoic and Mesozoic eras.

**Anaerobic:** an environment in which air (oxygen) is absent, or a depositional environment with 0–0.1 ml of dissolved oxygen per litre of *water*. See *also* aerobic and dysaerobic.

**Annelid:** any member of the phylum Annelida, a major invertebrate group comprising segmented worms such as modern earthworms and leeches. In the fossil record they are usually preserved as trace fossils because they have almost no hard parts.

**Anoxic:** literally 'without oxygen'; often used to describe an anaerobic environment.

**Anticline:** an arch-shaped upfold of rocks produced by tectonic activity with younger strata on the outermost part of the arch and older rock in the core (cf. syncline).

**Anticlinorium:** a large arch of regional extent, resembling an anticline in form, each limb of which is composed of a number of small folds.

**Apron reef:** a discontinuous reef that covers only a small area and represents the initial stages of a fringing reef.

**Arenite (adj. arenaceous):** a general term for a detrital, clastic sedimentary rock made of sand-sized particles.

**Arnsbergian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Arnsbergian Age. The second stage of the Namurian Series, it is dated to approximately 325–323 Ma, and is preceded by the Pendleian Stage and followed by the Chokierian Stage.

**Arthropod:** any member of the phylum Arthropoda; the largest and most diverse phylum of the animal kingdom. These invertebrate animals are characterized by a segmented body and paired antennae, wings or legs. Examples include insects, crustaceans and arachnids.

**Arundian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Arundian Age. The third stage of the Dinantian Subsystem, it is dated to approximately 340–337 Ma, and is preceded by the Chadian Stage and followed by the Holkerian Stage.

**Asbian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Asbian Age. The fifth stage of the Dinantian Subsystem, it is dated to approximately 333–330 Ma, and is preceded by the Holkerian Stage and followed by the Brigantian Stage.

**Autochthonous:** descriptive of fossils or rocks that lived or formed in their current positions.

**Avonian:** see Dinantian.

**Back-reef:** the area between a reef and the land.

**Bafflestone:** a term used in a refinement of the 'Dunham' system of limestone classification to denote a rock in which a sparse population of sessile benthic organisms caused grains to be deposited by functioning as baffles and thereby reducing current velocity.

**Basalt:** a fine-grained, usually dark-coloured, basic, volcanic (extrusive) igneous rock. It usually occurs as a lava or dyke.

**Basement:** the oldest rocks recognized in a given area; a complex of metamorphic and/ or igneous rocks that underlies all the sedimentary formations.

**Basin:** an area of subsidence, or depression, usually of considerable size, in which sediments accumulate and/or volcanic strata may be laid down.

**Bed:** in lithostratigraphy, a subdivision of either a member or a formation; the smallest unit within the scheme of formal lithostratigraphical classification. Also used informally to indicate a stratum within a sedimentary rock succession.

**Bedding plane:** a planar feature in sedimentary rocks representing an original surface of deposition. Conspicuous bedding planes may indicate a short interruption in, or change in character of sediment deposition.

**Benthos (adj. benthic):** aquatic organisms living on or in the sea floor.

**Bioclast (adj. bioclastic):** a sediment grain consisting of comminuted fossil remains.

**Bioerosion:** the erosion of consolidated material or a lithic substrate by the action of living organisms.

**Biofacies:** a facies defined by its characteristic fossil assemblage, and reflecting a specific set of environmental conditions.

**Biogenic:** produced by living organisms or biological processes.

**Bioherm:** a reef-type mound-shaped body of sediment made up from the skeletons and shells of living and dead organisms.

**Biomicrite:** a limestone containing bioclasts in a carbonate mud matrix.

**Biomicrosparite:** a microsparite containing fossil fragments.

**Biosparite:** a limestone containing bioclasts in a cementing matrix of crystalline calcite.

**Biostratigraphy:** the stratigraphical subdivision, classification and correlation of sedimentary rocks based on their fossil content.

**Biostrome:** a sheet-like mass of organic material that forms rock, for example stromatolites.

**Biota:** the flora and fauna of an area; or the faunal and floral assemblage of a bed or other stratigraphical unit.

**Bioturbation:** the physical disturbance of unconsolidated sediment, such as by burrowing and feeding, caused by the organisms living on or in it. These disturbances are often preserved as trace fossils in ancient sediments.

**Biozone:** in biostratigraphy, a restricted unit of sedimentary rock defined by its fossil content, most usefully by species of narrowly defined temporal, but wide spatial, range, and named after one or more abundant or characteristic species.

**Bivalve:** any member of the class Bivalvia (phylum Mollusca (see mollusc)). These marine invertebrates are characterized by bodies enclosed in two, hinged, often mirror-image, shells (valves). Modern examples include cockles and mussels (cf. brachiopod).

**Bouma sequence:** a fixed characteristic succession, of five intervals, that makes up a complete sequence of a turbidite.

**Boundstone:** a term used in the 'Dunham' system of limestone classification to denote a rock in which the primary grains or constituents were bound together during formation or deposition (e.g. as in an organic reef).

**Brachiopod:** any member of the phylum Brachiopoda. These marine invertebrates are superficially similar to bivalves but with a different anatomy and two hinged shells that are typically dissimilar.

**Brackish:** descriptive of water with a salinity intermediate between fresh and marine.

**Breccia:** a rock composed of angular broken fragments greater than 2 mm in diameter; can be pyroclastic, sedimentary or fault-related.

**Brigantian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Brigantian Age. The last stage of the Dinantian Subsystem, it is dated to approximately 330–327 Ma, and is preceded by the Asbian Stage and followed by the Pendleian Stage.

**Bryozoan:** any member of the phylum Bryozoa. These very small, moss-like aquatic organisms often form permanent colonies, linked by their box-like skeletons of calcium carbonate.

**Calcarenite:** a limestone composed mainly of sand-sized calcium carbonate grains.

**Calcareous:** containing large quantities, or composed, of calcium carbonate.

**Calci-:** prefix indicating containing/composed of calcium carbonate.

**Calcilutite:** a limestone composed mainly of mud-sized calcium carbonate grains.

**Calcirudite:** a limestone composed mainly of gravel-sized calcium carbonate grains.

**Calcsiltite:** a limestone composed mainly of silt-sized calcium carbonate grains.

**Calcsphere:** a hollow, typically spherical, calcareous nannofossil.

**Calcite:** the most common, rock-forming crystalline form of calcium carbonate; the main constituent of limestone and the shells of many brachiopods, echinoderms and other invertebrates.

**Calcium carbonate (CaCO<sub>3</sub>):** a colourless or white crystal compound, which occurs naturally as limestone, marble and chalk. See *a/so* calcite

**Calcrete:** a 'fossil soil' (palaeosol) rich in calcium carbonate, indicative of arid or semi-arid environments.

**Caliche:** a hard soil horizon rich in carbonate that forms in seasonally arid environments.

**Carbonaceous:** containing carbon.

**Carbonate:** a mineral salt of carbonic acid, usually referring to the common sedimentary form of calcium carbonate in limestones and invertebrate shells, but also encompassing other minerals, notably dolomite.

**Carbonate platform:** an area of the Earth's crust flooded by shallow shelf seas, in which limestones are formed.

**Carboniferous Period:** a geological time division (c.f. chronostratigraphy); ranging from 354 to 290 million years ago, it precedes the Permian Period.

**Carboniferous System:** a chronostratigraphical unit comprising the rocks deposited during the Carboniferous Period.

**Cement:** the mineral 'glue' that holds particles together in sedimentary rocks.

**Cementstone:** argillaceous limestone and dolostone.

**Cephalopod:** any member of the class Cephalo-poda, the most advanced class of the phylum Mollusca (see mollusc). These marine organisms include the modern-day squid, octopus, and cuttlefish, and the extinct ammonites.

**Chadian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Chadian Age. The second stage of the Dinantian Subsystem, this stage spans the end of the Tournaisian Series and the beginning of the Viséan Series and is dated to approximately 344–340 Ma. It is preceded by the Courceyan Stage and followed by the Arundian Stage.

**Chert:** microcrystalline silica (quartz and chalcedony), which may be of organic or inorganic origin. It occurs as layers or nodules in sedimentary rocks (mainly chalk and limestone). An example is flint.

**Chokierian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Chokierian Age. The third stage of the Namurian Series, it is dated to approximately 323–322 Ma, and is preceded by the Arnsbergian Stage.

**Chronostratigraphy:** the subdivision and correlation of rock units on the basis of relative age. The hierarchy of principal chronostratigraphical units to which layers of sedimentary rocks are allocated through the study and interpretation of their stratigraphy is erathem, system, series and stage, which are related, respectively, to the geological time units of era, period, epoch and age. Rocks of the Carboniferous System (a chrono-stratigraphical unit) were laid down in the Carboniferous Period (a geological time unit).

**Class:** a category used in the taxonomic classification of organisms, which consists of one or several related orders. Similar classes are grouped into a phylum.

**Clast (adj. clastic):** a sedimentary particle — a fragment of a pre-existing rock or fossil. See *a/so* biocList.

**Clay:** an extremely fine-grained sediment (grain size less than 0.004 mm) composed of so-called 'clay minerals'.

**Colluvium:** loose deposits at the foot of a slope or cliff, transported mainly by gravity.

**Comminuted:** finely divided.

**Concretion:** a rounded or irregular mass of mineral matter concentrated around a nucleus and formed during diagenesis in a sedimentary rock.

**Conglomerate:** a sedimentary rock consisting of rounded pebbles (cf. breccia).

**Conodont (Conodonta):** an extinct group of small eel-like marine animals, characterized by assemblages of paired tooth-like structures made of bone-like material. These 'teeth' have considerable use in biostratigraphy.

**Contemporaneous:** formed or occurring at the same time.

**Coral:** any member of the class Anthozoa (phylum Coelenterata). These aquatic animals typically have a calcium carbonate external skeleton. They may live as individuals or in large colonies.

**Cornstone:** a concretionary limestone deposit typically developed in sandstones, characteristic of arid terrestrial environments (synonymous with calcrete).

**Correlation:** the tracing and identification of a stratigraphical unit away from its type area by comparing lithologies and/or fauna.

**Courseyan Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Courseyan Age. The first stage of the Dinantian Subsystem, it is dated to approximately 354–344 Ma, and is followed by the Chadian Stage.

**Crinoid:** any member of the class Crinoidea (phylum Echinodermata (see echinoderm)). These marine invertebrates have a flowering plant-like structure and are often called 'sea lilies' or 'feather stars'. They may be sessile (with a stem) or free-floating.

**Cross-stratification:** subsidiary bedding surfaces oblique to the upper and lower bounding surfaces of a particular stratum and representing ripples or dunes formed in the sediment by water currents (or wind). Large-scale features are named 'cross-bedding', small-scale features are known as 'cross-lamination'.

**Crustacean:** any member of the class Crustacea (phylum Arthropoda (see arthropod)). These animals typically have two pairs of antennae, a pair of mandibles and often many other appendages, and are mainly aquatic. Examples include lobsters, shrimps, barnacles and wood lice.

**Cryptic:** descriptive of reef organisms, mainly invertebrates, that live under corals, shells and rocks.

**Cyclothem:** a succession of sedimentary layers, representing a sequence of depositional events that tend to be repeated; the result of cyclical sedimentation.

**Delta (adj. deltaic):** a tract of sediment, typically fan-shaped, deposited where a river enters a lake or the sea.

**Demosponge:** a class of the phylum Porifera, including sponges with a skeleton of one- to four-rayed siliceous spicules.

**Dendroid:** a multibranched graptolite belonging to the order Dendroidea, typically with branches (stipes) connected by strengthening rods (dissepiments) and with differentiated thecae (cups). Mostly benthic.

**Diachronous:** descriptive of a lithological unit, or contiguous rock body, that was deposited at different times in different locations and therefore differs in age from place to place.

**Diagenesis: (adj. diagenetic):** the post-depositional changes in mineralogy and texture of sediments and organisms that combine to produce rocks and fossils. The term excludes metamorphic alteration.

**Dinantian Subsystem:** a chronostratigraphical division comprising much of the Lower Carboniferous Subsystem in Europe, dated to about 354–327 Ma. It precedes the Silesian Subsystem, and comprises the Tournaisian and Viséan series, which include the Courceyan, Chadian, Arundian, Holkerian, Asbian and Brigantian stages.

**Dip:** the angle between a bedding surface and the horizontal.

**Disconformity (adj. disconformable):** a break in continuity of deposition, (unconformity), where the beds above and below are parallel and therefore show no angular discordance.

**Dissolution:** the natural process of dissolving a solid; specifically in karst processes, the dissolving of carbonate rock to create a liquid solution of calcium and bicarbonate ions in water; also known as solution.

**Distal:** far from the source.

**Dolerite:** a medium-grained igneous rock that generally occurs in dykes and sills.

**Dolomicrite:** a sedimentary rock consisting of clay-sized dolomite crystals.

**Dolomite (CaMg(CO<sub>3</sub>)<sub>2</sub>):** a white or colourless mineral with a structure similar to calcite but with some calcium replaced by magnesium.

**Dolostone:** a limestone whose carbonate fraction contains more than 50% dolomite.

**Downthrow:** the amount of downward displacement of rock along a fault.

**Dyke:** a band of igneous rock that has 'intruded' or 'cut through' pre-existing rocks. See also neptunian dyke.

**Dysaerobic:** a depositional environment with 0.1–1.0 ml of dissolved oxygen per litre of water. See also aerobic and anaerobic.

**Dysoxic:** descriptive of an environment with dysaerobic conditions.

**Echinoderm:** any member of the phylum Echinodermata. These marine invertebrates are characterized by a five-fold symmetry, an internal skeleton of calcite plates and a complex water-vascular system. Examples include echinoids (sea-urchins), crinoids, and starfish.

**Echinoid:** a member of the class Echinoidea (phylum Echinodermata (see echinoderm)). More commonly known as the 'sea-urchin', these organisms are characterized by a rigid, globular or disc-shaped shell.

**Epifauna:** a collective term for the benthic organisms that live or lived on the substrate of the sea floor, or attached to some solid object.

**Epoch:** a geological time unit (cf. chrono-stratigraphy), of shorter duration than a period and itself divisible into ages (e.g. the Late Triassic Epoch).

**Era:** a major geological time unit (cf. chrono-stratigraphy), which is divided into periods (e.g. the Palaeozoic Era).

**Erosion:** the wearing away of the land's surface by mechanical processes such as the flow of water, ice or wind.

**Erosion surface:** a land or rock surface shaped by the processes of erosion.

**Eustatic:** concerning world-wide (as distinct from local) changes in sea level that are caused by a major geological event such as tectonic activity or an ice-age.

**Euxinic:** descriptive of an environment of restricted circulation and stagnant or anaerobic conditions.

**Evaporite:** a sediment or mineral grown from a saline solution by evaporation of water, which may be marine or continental in origin.

**Extrusive:** descriptive of igneous rocks that have been extruded onto the Earth's surface, rather than being intruded beneath the surface (intrusive).

**Facies:** the sum total of a rock's lithological and gross faunal/floral characteristics that together reflect the particular environment in which it formed.

**Family:** a category used in the taxonomic classification of organisms, which consists of one or several related genera. Similar families are grouped into an order.

**Fan:** a cone-shaped sedimentary deposit.

**Fanglomerate:** a sedimentary rock containing angular rock fragments cemented in a finer-grained groundmass; often formed from the coarse material in an alluvial fan.

**Fault:** an approximately planar fracture surface in rock along which there has been some movement of one side relative to the other.

**Fauna:** animals — often referring to the characteristic animal assemblage of a region or time period.

**Ferruginous:** containing iron or iron-rich minerals.

**Fireclay:** a poorly bedded mudstone high in alumina.

**Fissile:** descriptive of a sedimentary rock that contains very thin bedding or cleavage laminae along which the rock splits into thin sheets.

**Fissure:** a fracture surface or crack within a rock along which a clear separation can be seen. Often filled with material, frequently mineral-bearing.

**Flaggy:** descriptive of a sedimentary rock that contains bedding between 0.01 m and 0.1 m thick, along which the rock can be split into thick sheets ('flagstones').

**Flaser structure:** a sedimentary structure consisting of fine sand or silt lenses that are aligned or cross-bedded.

**Floatstone:** a carbonate rock containing a few bioclasts or fragments greater than 2 mm in diameter, embedded in a sand- or mud-sized carbonate sediment.

**Flora:** plants — often referring to the characteristic plant assemblage of a region or time period.

**Flowstone:** a deposit of calcium carbonate formed by flowing water on the wall or floor of a cave.

**Flute:** a sedimentary structure formed by the scouring of a turbulent sediment-laden water current.

**Flute cast:** a raised, sub-triangular welt on the bottom surface of a siltstone or sandstone bed formed by the filling of a flute.

**Fluvial:** relating to a river or river system.

**Flysch:** deposits of dark, fine-grained, thin bedded sandstone, shales, and clay, typically syn-orogenic and thought to be deposited by turbidity currents.

**Fold:** a bend in rock strata produced by earth movements.

**Foraminifera:** a mainly marine order of the subclass Sarcodina in the phylum Protozoa, consisting of single-celled aquatic animals that have a calcareous protective external shell, often with an elaborate form. Usually microscopic in size, but some are larger.

**Fore-reef:** the seaward side of a reef.

**Foreset:** the steeply dipping surface of cross-bedded strata.

**Formation:** a succession of contiguous rock strata that is distinctive enough in its lithology from the surrounding rocks to be mapped as a unit; the fundamental unit of lithostratigraphy.

**Fossil:** the preserved remains of an animal or plant. *See also* trace fossil.

**Framestone:** a term used in the 'Dunham' system of limestone classification to denote an autochthonous organically bound limestone where the organisms (e.g. corals) form a rigid framework during deposition.

**Friable:** descriptive of a rock that is crumbly or easily broken.

**Ganister:** a fine-grained, hard, quartzose sandstone.

**Gastropod:** any member of the class Gastro-poda (phylum Mollusca (*see* mollusc)). These ancient invertebrates are characterized by a well-developed head, a flattened foot, and spirally shaped shells of aragonitic calcium carbonate. Examples include snails, slugs, limpets and conches.

**GCR:** Geological Conservation Review, in which nationally important geological and geomorphological sites were assessed and selected with a view to their long-term conservation as SSSIs.

**Genotype:** the type species of a genus.

**Genus (pl: genera):** a category used in the taxonomic classification of organisms, which consists of one or several related species. Similar genera are grouped together into a family.

**Geochronology:** the measurement of absolute geological time and its division into episodes, in years, or millions of years (Ma), before the present time.

**Geopetal:** a sedimentary fabric that records the way up at the time of deposition. Commonly found in cavity fills within limestones.

**Goniatite:** an extinct group of upper Palaeozoic ammonoid cephalopods with coiled shells.

**Graben:** a linear block of crust downthrown between two parallel faults to form a rift or trough-shaped valley.

**Graded bedding:** a stratification in which each stratum displays a gradation in the size of grains from coarse to fine.

**Grainstone:** a term used in the 'Dunham' system of limestone classification to denote a mud-free, grain-supported, carbonate sedimentary rock.

**Granite:** a pale-coloured, coarse-grained, typically plutonic (intrusive) igneous rock, with a high SiO<sub>2</sub> content. Commonly found in batholiths and veins.

**Granodiorite:** a coarse grained igneous rock similar to granite in texture but containing slightly less silica.

**Granophyre:** a fine-scale intergrowth of quartz and either alkali feldspar or plagioclase commonly patchily developed and found as an interstitial, late-stage crystallization product in certain granites or quartz diorites.



**Grapestone:** a cluster of sand-sized grains held together by incipient cementation shortly after deposition. The outer surface is lumpy and resembles a bunch of grapes.

**Graptolite:** an extinct marine colonial organism belonging to the class Graptolithina (phylum Hemichordata) and characterized by a cup- or tube-shaped, highly resistant exoskeleton made of collagen.

**Graptoloid:** any graptolite belonging to the order Graptoloidea. The graptoloid exoskeleton is characterized by relatively few branches (stipes), lacks strengthening rods (dissepiments) and is without thecal (cup) differentiation. Typically planktonic.

**Group:** in lithostratigraphy, a grouping of two or more formations with significant unifying lithological and/or genetic features.

**GSSP (Global boundary Stratotype Section and Point):** an internationally recognized chronostratigraphical boundary established following strict procedures of the International Union of Geological Sciences Subcommittee on Stratigraphy.

**Half-graben:** an elongate trough bounded by a normal fault on one side only. See also graben.

**Hemipelagic:** descriptive of a deep-sea muddy deposit in which more than one quarter of the coarser fraction is of terrigenous, volcano-genic, or neritic origin.

**Heterolithic:** of varied lithologies.

**Highstand:** a phase of high sea level.

**Holkerian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Holkerian Age. The fourth stage of the Dinantian Subsystem, it is dated to approximately 337–333 Ma, and is preceded by the Arundian Stage and followed by the Asbian Stage.

**Holothurian:** a member of the class Holo-thuroidea, of the phylum Echinodermata (see echinoderm). Commonly known as 'sea cucumbers', these organisms typically have a non-rigid calcitic skeleton, composed of small sclerites or spicules.

**Holotype:** the single specimen (the so-called 'type specimen') selected to epitomize a particular named species.

**Homeomorph:** an organism that exhibits a resemblance to another organism although they have different ancestors.

**Horizon:** an informal term denoting a thin bed or plane within a succession of strata.

**Horst:** an upfaulted block of crustal rocks, often on either side of a graben.

**Hypersaline:** descriptive of water with a particularly high salt content.

**Ichnofacies:** a sedimentary facies characterized by particular trace fossils.

**Igneous rock:** a rock that has formed from the cooling of molten magma, either following volcanic (extrusive) activity or intrusive processes. It consists of interlocking crystals, the size of which depends on the rate of cooling of the magma.

**Imbrication:** a sedimentary fabric typically displaying elongate fragments that are aligned in a preferred angle to the line of bedding.

**Index fossil (index species):** a particular fossil (or species) that gives its name to a biozone.

**Induration:** the process of compaction and cementation during which a soft sediment becomes a rock.

**Infauna:** a collective term for the organisms that live or lived below the sea floor, especially in burrows in soft sediments but also including some rock-boring organisms.

**Inlier:** an outcrop of older rocks surrounded, on a geological map, by younger rocks commonly exposed by erosion (cf. outlier).

**Intercalation:** layering within a sedimentary sequence within one body of rock which is interbedded with another, different body of rock.

**Intertidal:** littoral; the zone between high- and low-water marks on a shoreline.

**Intraclast:** a fragment of rock derived from coeval parent material rather than an 'older' (extraformational) source.

**Intrusion (adj. intrusive):** an igneous rock that has formed as a body intruded into other rocks below the Earth's surface.

**Ironstone:** an iron-rich sedimentary rock.

**Isochronous:** occurring at the same time.

**Joint:** a fracture in a rock that exhibits no displacement across it (unlike a fault). May be caused by shrinkage of igneous rocks as they cool in the solid state (columnar jointing), or, in sedimentary rocks, by regional extension and compression caused by earth movements.

**Karst:** descriptive of a distinctive terrain developed upon a soluble rock, typically limestone; characterized by caves, sinkholes and dry valleys.

**Klippe:** a tectonic outlier produced by the erosion or gravity sliding of one or more nappes and typically separated from underlying rocks by a low-angled reverse or thrust fault.

**Knoll reef:** a bioherm or fossil coral reef represented by a small, prominent round hill, up to 100 m high, consisting of resistant reef material, being either a local exhumation of an original feature or a feature produced by later erosion.

**Lacustrine:** relating to, formed within, or produced by, lakes.

**Lagoon:** an area of shallow, generally salt, water more-or-less cut off from the sea by a narrow bar of sediment.

**Lahaar:** a mudflow or landslide of pyroclastic material, occurring on the flank of a volcano, and the deposit formed by such a process.

**Lamina (pl. laminae, laminations):** the finest layer within a sedimentary rock, typically less than 10 mm thick.

**Laminated:** descriptive of a bed with a fabric composed of laminae.

**Limestone:** sedimentary rock composed of calcium carbonate, often partly derived from the shells of organisms.

**Lineation:** any linear feature that appears on the bedding or other surface of a rock. May be formed during deformation.

**Litharenite:** a sandstone that contains more than 25% detrital rock fragments, and more rock fragments than feldspar grains.

**Lithic:** descriptive of a rock clast found within a sedimentary rock.

**Lithification:** the conversion of sediment into rock.

**Lithoclast:** a mechanically deposited rock fragment, normally greater than 2 mm in diameter, derived from any older, (pre-existing) lithified rock.

**Lithofacies:** a facies defined by sedimentary rock type (using, for example, colour, texture and mineral composition).

**Lithology:** descriptive of the constitution of a sediment or other rock, including composition, texture, colour and hardness.

**Lithostratigraphy:** the organization and division of strata into mainly mappable rock units and their correlation, based entirely upon their lithological characteristics. Units are named according to their perceived rank in a formal hierarchy, namely supergroup, group, formation, member and bed.

**Littoral:** descriptive of the zone between high-and low-water marks on a shoreline.

**Lower Carboniferous Subsystem:** a chrono-stratigraphical division of the Carboniferous System comprising the rocks deposited during the Lower Carboniferous Subperiod. It is dated to approximately 354–323 Ma.

**Lowstand:** a phase of low sea level.

**Macrofossil:** a fossil that is easily seen by the naked eye.

**Marble:** a metamorphic rock consisting of calcite or dolomite; typically a metamorphosed limestone.

**Marker band/bed/horizon:** a bed or layer within a rock succession with distinctive, easily recognizable characteristics that allow it to be traced for long distances or to serve as a reference or datum, and thereby enabling correlation.

**Marl:** a fine-grained calcium carbonate-rich mud or clay.

**Massif:** a very large topographical or structural feature.

**Massive:** descriptive of a bed or layer of sedimentary rock with an apparently uniform structure and lacking bedding fabric or lamination.

**Matrix:** the fine-grained sediment or crystalline cement that infills the spaces between larger grains.

**Megaspore:** a fossil plant spore greater than 0.22 mm in diameter, for which the parent plant is often unknown.

**Member:** in lithostratigraphy a subdivision of a formation.

**Mesothem:** a stratigraphical unit forming major cycles of deposition, normally bounded above and below by unconformities on shelf areas.

**Metamorphic rock:** a rock that has been altered by the action of heat and/or pressure, without melting.

**Metamorphism (adj. metamorphic):** the process of radical alteration of the mineralogical and/or physical nature of rocks as a result of pressure and/or temperature.

**Metasediment:** a sedimentary rock that has undergone metamorphism.

**Micrite:** a microcrystalline calcite; typically a lime mud.

**Microfauna:** a microscopic animal.

**Microfossil:** a microscopic fossil.

**Microspar:** a recrystallized component of limestone rocks comprising mosaics of irregular-sized crystals (4–50 microns) of calcium carbonate.

**Microsparite:** a limestone rock dominated by microspar.

**Miospore:** a fossil plant spore less than 0.22 mm in diameter, for which the parent plant is often unknown.

**Mollusc:** any member of the phylum Mollusca, consisting of about 5000 species. These invertebrates are characterized by a fleshy soft body, and usually, a hard shell. They may be marine, freshwater or terrestrial, and examples include gastropods (snails, limpets), bivalves (oysters, mussels) and cephalopods.

**Monocline:** a stratigraphical unit that dips from the horizontal in one direction only, not as part of an anticline or syncline.

**Mud:** a mixture of clay and silt.

**Mudrock (mudstone):** a fine-grained sedimentary rock; lithified mud.

**Namurian Series:** a chronostratigraphical division of the carboniferous System, comprising the rocks deposited during the Namurian Epoch. The lowermost series of the Silesian Subsystem in Europe, it is dated to about 327–316 Ma and is preceded by the Viséan Series and followed by the Westphalian Series. It includes the Pendleian, Arnsbergian, Chokierian, Alportian, Kinderscoutian, Marsdenian and Yeadonain stages.

**Nappe:** a coherent body of rock that has been moved a considerable distance away from its original location on a near-horizontal surface by thrusting or recumbent folding.

**Nautiloid:** a member of the subclass Nautiloidea (class Cephalopoda (see cephalopod)). These marine invertebrates possess a multichambered external shell of calcium carbonate which may be straight or coiled. Only one genus, the *Nautilus*, survives today.

**Neptunian dyke:** a sheet-like body of sand that cuts through bedded sediment in a manner analogous to an igneous dyke. Formed by the upward injection of liquefied sand through a fissure, often as a result of earthquake activity.

**Neritic:** relating to the sub-littoral zone, between the continental shelf and low-water mark.

**Nodule:** a small concretion, generally roughly spherical or ellipsoidal.

**Non-sequence:** a relatively minor break in the accumulation of sediment and therefore a gap in the sedimentary rock record.

**Olistolith:** a large coherent mass of rock that has been transported down a submarine slope by gravity sliding, and which forms part of a body of rock (olistostrome) composed of similar masses in a varied fragmental matrix.

**Omission surface:** a discontinuity of a minor nature, which marks a temporary halt in deposition but little or no erosion.

**Oncoid (oncolith):** a sub-spherical biogenic sedimentary structure built by cyanobacteria and composed of layers of calcium carbonate concentrically arranged around a nucleus of some other sedimentary particle; commonly regarded as the subtidal equivalent of a stromatolite.

**Onlap:** associated with unconformities, beds that successively overlap each other.

**Ooid (oolith):** a spherical or sub-spherical carbonate-coated sedimentary particle, less than 2 mm in diameter.

**Oolite:** a rock, usually limestone, made up largely of ooids produced by accretion of carbonate around a nucleus.

**Order:** a category used in the taxonomic classification of organisms, which consists of one or several related families. Similar orders are grouped together in a class.

**Orogeny:** a process of mountain building during which the rocks and sediments of a particular area of a continent are deformed and uplifted to form mountain belts.

**Ostracode:** any member of the subclass Ostracoda (class Crustacea (see crustacean), phylum Arthropoda (see arthropod)). These small invertebrates are mostly less than 1 mm in size and consist of two calcareous valves ('shells'). They can be found in a wide range of aquatic environments, both in fresh- and salt-water.

**Overstep:** a relationship in which a younger series of sedimentary strata rests upon a progressively older series of strata, the older and younger series of strata being separated by a plane of unconformity.

**Outlier:** an outcrop of younger rocks surrounded, on a geological map, by older rocks (cf. inner).

**Packstone:** a term used in the 'Dunham' system of limestone classification to denote a sedimentary carbonate rock in which constituent grains are in contact; a carbonate mud fills the interstices.

**Palaeo-:** 'ancient'.

**Palaeokarst:** ancient (occurring or formed in geological time) karst landform. The term is commonly applied to irregular, smooth and occasionally potholed, bedding plane surfaces located beneath palaeosols within limestone sequences.

**Palaeontology:** the study of fossil fauna and flora, including their evolution and the reconstruction of pre-existing environments.

**Palaeosol:** an ancient or 'fossilized' soil.

**Palaeozoic Era:** a geological time division; the first major division of geological time characterized by abundant life. It precedes the Mesozoic Era.

**Palyno-:**prefix indicating 'pollen' or 'spores'.

**Palynology:** the study of pollen, spores and certain other, generally plant, microfossils.

**Paralic:** the coastal zone.

**Parasequence:** in sequence stratigraphy a relatively conformable succession of related units bounded by flooding surfaces or their correlative surfaces.

**Paratype:** a specimen, other than the holotype, on which the original description of a species or subspecies is based.

**Patch reef:** a small isolated reef development, commonly located on a carbonate platform but away from the platform edge.

**Pedogenic:** processes relating to the development of soil profiles.

**Pedogenesis:** the origin and formation of soils.

**Pelagic:** of, or relating to the open sea; particularly the organisms that swim or float within the water column.

**Peloid:** a sand-sized to granule-sized grain of finely crystalline calcium carbonate of many possible origins, including pellets.

**Pendleian Stage:** a chronostratigraphical subdivision of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Pendleian Age. The first stage of the Namurian Series, it is dated to approximately 327–325 Ma, and is preceded by the Brigantian Stage and followed by the Arnsbergian Stage.

**Penecontemporaneous:** formed or existing at almost the same time.

**Pericline:** a dome-shaped anticline.

**Period:** a geological time unit (cf. chrono-stratigraphy); of shorter duration than an era and itself divisible into epochs.

**Peritidal:** the zone from somewhere above highest storm or spring tides to somewhere below lowest tide, referring to a broader region than intertidal.

**Petrology:** the study of the composition, occurrence and origin of rocks.

**Phanerozoic Eon:** period of time comprising the Palaeozoic, Mesozoic and Cenozoic eras, commencing around 540 million years before present.

**Photic zone:** the part of a water body in which there is enough sunlight for photosynthesis to occur.

**Phreatic:** of or relating to ground water below the water table.

**Phylum (pl. phyla):** a category used in the taxonomic classification of organisms, which consists of one or several related classes. The phyla are grouped together into two kingdoms, the Plantae (plants) and the Animalia (animals).

**Pisoid (pisolith):** a large ooid with a diameter of more than 2 mm.

**Pisolite:** a sedimentary rock consisting mainly of pisoids.

**Plankton (adj. planktonic):** minute aquatic organisms that drift with water movement.

**Pluton (adj. plutonic):** an intrusion of igneous rock emplaced at depth in the Earth's crust.

**Prod mark:** a short current mark, produced by the continuous contact or intermittent impact of current-borne objects, oriented parallel to the current and gradually deepening down-current.

**Province:** the geographical region occupied by a particular assemblage of organisms in response to certain environmental factors such as climate and water temperature.

**Proximal:** near to the source.

**Pseudomorph:** a replacement product, composed either of a single mineral or an assemblage of minerals, that retains the distinctive overall shape of the parent crystal.

**Pyroclastic:** descriptive of unconsolidated deposits (tephra) and rocks that form directly by explosive ejection from a volcano.

**Quaquaversal:** descriptive of strata and geological structures dipping outward in all directions away from a central point.

**Quartz:** a rock-forming mineral composed entirely of silica ( $\text{SiO}_2$ ); one of the most common minerals of the Earth's crust.

**Radiolarian (pl. radiolaria):** a group of marine, single-celled, planktonic micro-organisms that secrete siliceous skeletons that are often preserved as fossils in deep-sea sediments.

**Radiometric dating:** methods of dating certain rocks or minerals using the relative abundances of radioactive and stable isotopes of certain elements, together with known rates of decay of radioactive elements. Radiocarbon dating can extend back to only 50 000 years, but other elements (potassium, lead, uranium) can be used to obtain dates of the order of tens to thousands of millions of years.

**Ravinement:** an irregular junction that marks a break in sedimentation.

**Reef:** a rigid and wave-resistant carbonate buildup produced by the lime secreting activities of marine invertebrates such as corals, bryozoans and algae that lived in shallow, warm shelf seas.

**Regression:** the withdrawal of the sea from the land due to a fall in relative sea level.

**Reworking:** the natural excavation and transportation of sediment or fossil material that is then re-deposited elsewhere.

**Rhizcretion:** a hollow, concretion-like mass that has formed around the root of a living plant.

**Rift:** a depressed area of continental crust produced by tensile stretching of the crust and down-faulting along parallel faults.

**Rottenstone:** a soft, highly decomposed, but still coherent rock.

**Rudstone:** a carbonate rock composed of bioclasts or fragments over 2 mm in diameter, closely packed and in physical contact.

**Sand:** sediment particles typically between 0.0625 mm and 2 mm in diameter

**Sandstone:** a sedimentary rock composed of lithified sand grains between 0.625 mm and 2 mm in diameter.

**Sand volcano:** an accumulation of sand resembling a miniature volcano formed by the expulsion liquefied sand to the sediment surface.

**Scaphopod:** any member of the class Scaphopoda (phylum Mollusca (see mollusc)). These marine invertebrates burrow into sediment and secrete and occupy hollow calcareous tubes open at both ends.

**Scarp:** a steep or cliff-like slope, rising above the surrounding land. Typically produced by the outcrop of a relatively hard unit of rock.

**Scolecodont:** a fossilized jaw from an annelid.

**Seatearth:** a bed of rock that underlies a coal seam and represents an old soil.

**Sediment:** granular material such as sand or mud derived from the weathering and erosion of pre-existing rocks, biological activity (e.g. shells and organic matter), or chemical precipitation (e.g. evaporites).

**Sedimentary rock:** a rock composed of sediments, deposited by water, wind or ice.

**Sedimentology:** the study of sediments and sedimentary rocks, including their deposition, structure and composition.

**Seismic stratigraphy:** the study of stratigraphy and depositional facies through seismic data.

**Sequence stratigraphy:** the study of stratigraphy through the use of repetitive, related units bounded by surfaces of erosion or non-deposition.

**Series:** a chronostratigraphical division comprising all the rocks formed during an epoch; it can be divided into stages.

**Serpulid:** a member of the family Serpulidae (phylum Annelida (see annelid)). These small marine worms build tubes that become mineralized with calcium carbonate.

**Shale:** a mudrock that splits easily into thin layers.

**Silesian Subsystem:** a chronostratigraphical division covering the end of the Carboniferous System. It is dated to approximately 327–290 Ma. It is preceded by the Dinantian Subsystem, and followed by the Permian System and comprises the Namurian, Westphalian and Stephanian series.

**Siliciclastic:** a sediment or sedimentary rock comprising a high proportion of silica-rich grains or clasts.

**Sill:** a tabular body of igneous rock that is more-or-less concordant with the bedding or foliation of the host rocks.

**Silt:** a fine-grained sediment intermediate in grain size between clay and sand.

**Siltstone:** a rock made of silt.

**Sole mark:** an irregularity or mark on the undersurface of a sedimentary stratum.

**Sorting:** the ordered distribution of grain sizes. A well-sorted rock has a narrow range of grain sizes. A poorly sorted rock has a wide range of grain sizes.

**Species:** a category used in the taxonomic classification of organisms. Similar species are grouped together in a genus.

**Speleothem:** a cave formation.

**Sponge:** any member of the phylum Porifera; primitive multi-cellular aquatic animals which secrete a skeleton of either silica, calcium carbonate or an organic material.

**SSSI:** Site of Special Scientific Interest; the designation of an area of land for statutory protection under the *Wildlife and Countryside Act 1981*.

**Stage:** a chronostratigraphical division comprising all the rocks formed during an age. Usually taken to be the smallest standard unit.

**Stephanian Series:** a chronostratigraphical division, the upper series of the Silesian Subsystem in Europe, dated to about 306290 Ma. It follows the Westphalian Series and precedes the Permian System

**Stratiform:** consisting of parallel bands, layers or sheets.

**Stratigraphy:** the study of the temporal and spatial relationships within a rock succession.

**Stratotype:** a sequence of sedimentary rocks at a particular locality chosen as the standard against which other sequences can be compared. Stratotypes are established for lithostratigraphical, chronostratigraphical and biostratigraphical units, both regionally and internationally.

**Stratum (pl. strata):** a bed or single layer in a succession of rock.

**Strike:** the trend of a geological surface (e.g. a bedding plane) measured at right angles to the direction of maximum slope or dip.

**Strike-slip:** a tectonic break in strata in which the predominant displacement is lateral rather than vertical.

**Stromatactis:** a sedimentary structure, characterized by a horizontal or nearly flat bottom, up to 10 cm in diameter, and an irregular upper surface, consisting of sparry calcite and usually found in the central part of a reef.

**Stromatolite:** a laminated, mounded structure composed of limestone built by cyano-bacteria. They are known in rocks throughout the geological record; today, they develop in warm, shallow tropical seas, commonly in a peritidal setting.

**Stylolite:** an irregular surface, generally parallel to a bedding plane, in which small toothlike projections on one side of the surface fit into cavities of complementary shape on the other surface. A diagenetic feature caused by pressure solution.

**Subduction:** the process of one crustal plate descending into the mantle beneath another during plate convergence and collision, with the release of energy in the form of earthquakes and often accompanied by volcanicity.

**Subsidence:** the sinking of a local or regional portion of the Earth's surface with respect to its surroundings.

**Subsystem:** a chronostratigraphical division comprising all the rocks formed during a sub-period. A formally recognized, occasionally used, subdivision of a system, it is divided into series.

**Supratidal:** the shore area immediately marginal to and above the high-tide level.

**Syncline:** a downfold of rock produced by tectonic deformation; the youngest rocks occur in its core (cf. anticline).



**System:** a chronostratigraphical division comprising all the rocks formed during a period; can be divided into series.

**Taphonomy:** in palaeontology, the study of the change, including transportation, that affect organisms after death, including the physical and chemical interactions that take place between burial of the organism and its subsequent discovery as a fossil.

**Taxon (p1. taxa):** any group of organisms that has been scientifically designated as belonging to a specific taxonomic group.

**Taxonomy:** the study of the rules of classification of living and extinct organisms.

**Tectonism (adj. tectonic):** deformation of the Earth's crust and the consequent structural effects (e.g. faults and folds).

**Terrigenous:** deposited or formed on land, or derived from the land.

**Throw:** the amount of vertical displacement between the rocks on either side of a fault.

**Thrust fault:** a fault characterized by movement of rocks under lateral compression along a low-angle fault plane.

**Tournaisian Series:** a chronostratigraphical division of the Lower Carboniferous Subsystem, comprising the rocks of the Tournaisian Epoch. The first series of the Dinantian Subsystem, it is preceded by the Devonian System and followed by the Viséan Series.

**Trace fossil (ichnofossil):** a biogenic sedimentary structure produced by activity of an organism within a substrate; examples include burrows and footprints.

**Transgression:** the encroachment of the sea on the land due to a rise in relative sea level.

**Trilobite:** any member of the class Trilobita, an extinct Palaeozoic marine class of the phylum Arthropoda (see arthropod). Characterized by a three-lobed head, body and tail, comprising an articulated and mineralized dorsal carapace.

**Trough cross-bedding:** cross-bedding in which the lower bounding surfaces are curved surfaces of erosion, due to local scour and subsequent deposition.

**Truncation:** the cutting or breaking off of the top of a geological structure or landform.

**Tuff:** cemented and lithified volcanic ash, comprising rock and crystal fragments from an explosive eruption.

**Turbidite:** any sediment or rock transported and deposited by a turbidity current, generally characterized by graded bedding, large amounts of matrix and commonly exhibiting a Bouma sequence.

**Turbidity current:** a highly turbid, dense current carrying large quantities of clay, silt and sand in suspension which flows down a submarine slope through less dense sea water.

**Type locality/area:** the place where the type section (or stratotype) for a stratigraphical unit is located, or from where the type specimen of a fossil came.

**Type section:** see stratotype.

**Type specimen:** a single specimen designated as typifying a named species or subspecies. *See also* holotype and paratype.

**Unconformity:** the surface that separates two sedimentary sequences of different ages; it represents a gap in the geological record when there was erosion, and/or tectonism and/or non-deposition. There is often an angular discordance between the two sequences.

**Upper Carboniferous Subsystem:** a chrono-stratigraphical division of the Carboniferous System comprising the rocks deposited during the Upper Carboniferous Subperiod.

**Upthrow:** the amount of upward displacement of rock along a fault.

**Vadose:** relating to or derived from water occurring above the water table.

**Varve:** a sedimentary bed, layer, or sequence of layers deposited in a body of still water within a year, and usually during a season.

**Viséan Series:** a chronostratigraphical division of the Lower Carboniferous Subsystem, comprising the rocks deposited during the Viséan Epoch. The second and last series of the Dinantian Subsystem, it is preceded by the Tournaisian Series and followed by the Namurian Series.

**Volcanic rock:** an extrusive igneous rock formed by a volcanic eruption.

**Wackestone:** a term used in the 'Dunham' system of limestone classification to denote a carbonate rock with up to 50% of larger grains dispersed in a carbonate mud matrix.

**Waulsortian mud-mound:** a particular type of mud-mound, based on those in the Lower Carboniferous succession of Waulsort in Belgium. The mounds are grey with stromatolite structures, fibrous calcite, marine cement and few fossils.

**Weathering:** the chemical alteration and physical breaking down of rocks through the effects of exposure to the weather.

**Westphalian Series:** a chronostratigraphical division, the middle series of the Silesian Subsystem in Europe, dated to about 316–306 Ma. It follows the Namurian Series and precedes the Stephanian Series.

**Winnowing:** the selective sorting or removal of fine-grained particles by the action of water currents or wind, leaving coarser-grained material behind.

**Zone:** a stratigraphical unit in many categories of stratigraphical classification. In chronostratigraphy, a division smaller than a stage, defined by its base in a type section.

## [References](#)