**A Guide to Geological Terminology**

Produced by the North Pennines AONB Partnership for *Know Your Geopark* tourism workshops.

****

****

**Glossary**

**Adit** – A horizontal or nearly horizontal tunnel or mine entrance.

**Alluvial deposits** –Accumulations of gravel, sand and mud deposited by rivers.

**Aureole** – Zone of altered rock surrounding an intrusion of igneous rock, such as the Whin Sill.

**Avalonia** – The continent upon which England and Wales sat around 485 million years ago. It later collided with the continent of Laurentia (which contained Scotland) to form the UK.

**Basement** – The oldest rocks at the very bottom of the succession, which all the younger rocks have been deposited on top of. In the North Pennines these are the Skiddaw Slates and Borrowdale Volcanics, which date to between 485 and 420 million years ago.

**Bed** – A term for a single layer of sedimentary rock.

**Bedding surface** – The surface on top of a bed, which separates it from the one above.

**Bedrock** – The solid rock beneath loose cover deposits.

**Bivalve** – A mollusc with two shells that is common today but rare during the Carboniferous. Modern examples include mussels, clams and scallops.

**Brachiopod** – A shellfish-like creature that is rare today but was common in the Carboniferous period. Their fossils are frequently found in the limestones of the North Pennines.

**Caledonian Orogeny** – A period of mountain formation that took place around 490 to 390 million years ago, when the continent of Avalonia (containing England and Wales) collided with the continent of Laurentia (containing Scotland). The Skiddaw Slates of the North Pennines were formed from the alteration of marine mudstones caught up in this collision.

**Carboniferous** – The period in geological time that dates from around 360 to 300 million years ago. Most of the limestones, sandstones and shales of the North Pennines were formed during this period.

**Cenozoic** – The span of geological time from 66 million years ago to the present. It is divided into the Palaeogene, Neogene and Quaternary, and is informally known as ‘the age of mammals’.

**Clubmoss** – Small, spore-producing plants with needle-like leaves. Their extinct Carboniferous relatives were the size of trees.

**Conformable** – Beds are conformable when they were deposited in sequence with no gaps in time between them.

**Conglomerate** – A type of sedimentary rock made up of pebble to boulder sized rocks suspended in a finer-grained matrix of mud or sand. The oldest Carboniferous rocks in the North Pennines are conglomerates. They can be seen on some parts of the Pennine Escarpment, and at a Falcon Clints to the east of Cauldron Snout.

**Contact metamorphism** – The process by which rocks are altered by being close to a source of intense heat. An example is the sugar limestone, which has been transformed into a type of marble through contact with the magma of the Whin Sill. It can be seen on and around Cronkley Fell.

**Crinoid** – A filter-feeding animal related to starfish with a long stem ending in a head with tendrils. Their fossilised remains are common in the Carboniferous limestones of the North Pennines. They usually look like tiny, white polo mints, but occasionally whole segments of the stem are preserved together.

**Cross-bedding** – Ripples or dunes usually preserved in sandstone. They appear in cross-section as more steeply inclined lines compared to the typically horizontal bedding surfaces.

**Cyclothem** – A repeated sequence of limestone, sandstone and shale (and sometimes coal), which records rising and falling sea levels in the Carboniferous.

**Devonian** – The period in geological time that dates from around 420 to 360 million years ago. The Weardale Granite was formed during this period, at the time when our distant, amphibian-like ancestors were taking their first steps onto the land.

**Dolerite** – A dark, hard igneous rock which comprises the Whin Sill, formed from cooled magma.

**Drift/Superficial deposits** – The cover of soft sediments, such as gravel, sand, soil and peat which blanket the underlying bedrock in many places. Often these were either deposited by glaciers, or have steadily accumulated in the last 12,000 years since the end of the last Ice Age.

**Drumlin** – An elongated mound of sediment deposited beneath a glacier, which can be used to determine the direction of ice flow. Exceptional examples can be seen at Holwick in Teesdale.

**Dyke** – A vertical injection of magma along a fissure into the surrounding rock. Dykes feed larger magmatic systems, such as the Whin Sill.

**Emplacement** – A term for the rising of molten magma into the surrounding rock.

**Erratics** – Large blocks of stone that have been transported long distances by glaciers.

**Escarpment** – An abrupt edge that separates areas of differing elevation. The North Pennine Escarpment separates the upland areas of the North Pennines from the lower lying land of the Eden Valley.

**Esker** – A raised mound of sediment that snakes across the landscape. They were deposited by high-pressure flows of water beneath glaciers.

**Evaporite** – Mineral deposits formed by the evaporation of standing water. Salt flats are modern examples of their formation.

**Fault** – A fracture between two rocks resulting in an offset. Movement along large faults can result in earthquakes, although most faults in the North Pennines haven’t moved for thousands of years. The largest fault in the region runs along the Pennine Escarpment, and has an offset of well over 1,000 metres!

**Fault zone** – An area with a particularly high number of connected faults.

**Fluorspar (fluorite)** – A common mineral in the North Pennines often found associated with galena. For much of the region’s mining history it was discarded as a waste product, but was later mined for use as a flux in steel making. It is also much prized by gem collectors, and examples from the North Pennines can be found in museum collections around the world. It is often pink, purple or yellow with a glassy appearance

**Fluvial processes** – Processes of sediment deposition associated with rivers.

**Formation** – A group of members (see below). An example is the Alston Formation, which includes the Single Post Limestone and Tynebottom Limestone Members.

**Fossil** – Any evidence of ancient life, most often preserved in stone. This can be the body of the animal or plant itself, an impression, or a trace it left in the sediment such as a burrow or trackway. For remains to count as fossils they must be at least 10,000 years old, although the examples found in the North Pennines are much, much older.

**Galena** – A dark grey mineral with a metallic sheen, which contains large quantities of lead and small amounts of silver. It has been mined in the North Pennines for centuries.

**Gangue** – Commercially useless minerals that are found in association with more valuable minerals.

**Glacial maximum** – The point in time around 20,000 years ago when the ice sheets covering northern Europe were at their greatest extent.

**Granite** – A specific type of igneous rock with large crystals, which formed by the crystallisation of very slowly cooling magma deep underground. It is usually white or pink in colour.

**Graptolite** – A group of extinct marine organisms, whose fossils can occasionally be found in the Ordovician slates of Teesdale and the Pennine Escarpment. They look like tiny, white sawblades.

**Group** – A collection of Formations (see below). An example is the Yoredale Group, which includes the Alston Formation. Collections of groups are known as ‘supergroups’ and often represent vast amounts of geological time.

**Hornfels** – A dark, brittle rock formed by the alteration of mudstones when exposed to intense heat. Examples are found in the River Tees near Newbiggin, close to intrusions of the Whin Sill.

**Iapetus Ocean** – The ocean that divided the continents of Avalonia and Laurentia around 485 million years ago.

**Igneous rocks** – Rocks formed as a result of volcanic or magmatic processes, such as lava erupted from volcanoes, magma injected upwards from deep within the Earth, or accumulations of volcanic ash. The dolerite that makes up the Whin Sill is an example, as are rocks such as basalt and granite.

**Inlier** – An exposure of much older rock surrounded by younger rock. Examples in the North Pennines include the Teesdale Inlier and the Cross Fell Inlier, which are regions of Ordovician/Silurian slates surrounded by younger sedimentary rocks.

**Intrusion** – An injection of molten magma into the surrounding rock that has cooled and solidified into solid rock. Examples in the North Pennines include the Whin Sill and the Weardale Granite.

**Joint** – Vertical cracks in rock with no displacement (as in a fault), commonly found in limestone as a result of dissolving in rainwater.

**Kame** – A mound of unsorted sediment left behind by a retreating glacier. They form when sediment which accumulated in a hollow on top of the glacier is deposited as the ice melts. Particularly impressive rows of kames can be observed along the base of the Pennine Escarpment on the western edge of the North Pennines.

**Karst** – The unique landscape formed by the presence and dissolution of limestone, which often includes caves, sinkholes and limestone pavements.

**Laminations** – Very finely spaced layers of sediment, often found within fine-grained sedimentary rocks such as shales.

**Lapilli-tuff** – A type of rock made from volcanic ash and fragments of lava.

**Laurentia** – The continent upon which Scotland sat around 485 million years ago. It later collided with the continent of Avalonia (containing England and Wales) to form the UK.

***Lepidodendron*** – An extinct variety of giant clubmoss closely related to modern horsetails. Parts of them can occasionally be found as fossils in the Carboniferous sandstones of the North Pennines.

**Limestone** – A sedimentary rock formed from the bodies of microscopic organisms and tiny fragments of shell. It often contains the fossilised remains of larger sea creatures such as corals.

**Lithology** – Another way of saying ‘type of rock’.

**Ma** – Commonly used shorthand for ‘million years ago’.

**Magma** – Molten rock underground (as opposed to lava, which is magma erupted at the surface).

**Marble** – A type of metamorphic rock that forms from the alteration of limestone in contact with intense heat. An example is the ‘sugar limestone’ seen on and around Cronkley Fell. (The famous ‘Frosterley Marble’ is actually a type of limestone).

**Matrix** – A constituent part of some rocks, the matrix is finer material in which coarser grains or crystals sit.

**Member** – A particular bed or group of beds that can be traced over large areas. Examples include the Five Yard Limestone Member and the Single Post Limestone Member.

**Metamorphic rocks** – Rocks formed by the alteration of other rock types, either through intense heat and pressure deep underground, or by being close to a body of magma nearer to the surface. While rare in the North Pennines, local examples include the ‘Sugar Limestone’ and the Skiddaw Slates.

**Mesozoic** – The span of geological time from around 252 to 66 million years ago. It is divided into the Triassic, Jurassic and Cretaceous periods. It is informally known as ‘the age of the dinosaurs’.

**Mineral** – A naturally occurring material with a regular, crystalline structure. Quartz is a common example.

**Mineralisation** – The process by which minerals are formed, usually through the circulation of mineral-rich fluids driven by heat within the Earth.

**Moraine** – A mount of earth left behind by a retreating glacier.

**Ordovician** – The period of geological time that dates from around 485 to 445 million years ago. England and Wales were divided from Scotland by the Iapetus Ocean, and trilobites were common on the sea floor.

**Ore** – A mineral rich enough in a particular metal to be extracted on a large scale economically. An example is galena which was extensively mined for its lead content.

**Outcrop** – A visible surface exposure of bedrock found *in situ*. Loose boulders don’t count, as they have been moved from the location where they originally formed.

**Palaeogene** – The period of geological time that dates from around 66 to 23 million years ago. The only rocks dating to this period in the North Pennines are the dolerites which form the Armathwaite Dyke (also referred to as the Cleveland Dyke in some sources).

**Palaeozoic** – The span of geological time from around 540 to 252 million years ago. It is divided into the Cambrian, Ordovician, Silurian, Devonian, Carboniferous and Permian.

**Pegmatite** – Coarse igneous rocks containing large crystals. Parts of the Whin Sill are classified as pegmatite.

**Permian** – The period of geological time that dates from around 300 to 250 million years ago. Many of the red sandstones and shales beneath the Eden Valley date to this period.

**Pluton/Batholith** – A large, globular intrusion of magma that cooled and solidified deep beneath the surface. The Weardale Granite that underlies much of the North Pennines is an example.

**Quaternary** – The period of geological time that dates from around 2.5 million years ago and continues to the present day. Most of the deposits dating to this period are associated with the last Ice Age, and are so young (geologically speaking) they have yet to harden into stone.

**Rock** – Solid material, made from grains or crystals, which form the solid surface layer of the Earth.

**Rugose coral** – A now extinct type of horn-shaped coral found within the Carboniferous limestone of the North Pennines.

**Sandstone** – A common sedimentary rock formed from compacted sand grains.

**Section** – An exposure of rock where a sequence of sedimentary layers can be observed.

**Sediment** – Loose deposits of mud, silt, sand, gravel, pebbles and boulders.

**Sedimentary rocks** – Rocks formed by the accumulation and compaction of ancient sediments such as sand, gravel and mud. Examples include limestone, sandstone and shale.

**Shale** – A dark sedimentary rock made from very thin layers of mud.

***Sigillaria*** – An extinct species of giant, tree-like clubmoss that is occasionally found as fossils within the Carboniferous sandstones of the North Pennines. Usually only segments of bark or roots are found, although occasionally a larger section is discovered like the fossil tree in Stanhope.

**Sill** – A horizontal injection of magma into the surrounding rock, which follows a weakness between two sedimentary layers. The Whin Sill sits between layers of Carboniferous limestone.

**Silurian** – The period of geological time that dates from around 445 to 420 million years ago.

**Sinkhole/Shake hole** – A circular depression in the ground caused by the dissolution of the underlying limestone.

**Slate** – A dark, brittle rock type that splits to form clean layers. It forms from the alteration of mudstones under intense heat and pressure.

**Spar** – Minerals that form sharp, glassy crystals with flat faces. The most common spar mineral found in the North Pennines is fluorspar.

**Sphalerite** – A mineral found in the North Pennines that is rich in zinc.

***Stigmaria*** – The fossilised roots of ancient trees such as *Sigillaria* and *Lepidodendron*. They are distinguishable by small, circular pits across their surface, which would have held tiny rootlets in life.

**Stratigraphy** – The study and description of layered rocks to determine their relative ages.

**Succession** – A sequence of sedimentary rocks, with the oldest at the bottom and the youngest at the top.

**Throw** – The amount of displacement measured along a fault.

**Till/Boulder clay** – Glacial deposits made up of larger blocks of stone within a matrix of muddy material, which was left behind by a retreating glacier.

**Topography** – The overall shape of the landscape (hills, valleys, etc.).

**Triassic** – The period of geological time that dates from around 250 to 200 million years ago. Some of the red sandstones and shales found in the Eden Valley date to this period. It is also the time when the first dinosaurs appeared on Earth.

**Trilobite** – Extinct marine arthropods related to horseshoe crabs. They were common throughout much of the Palaeozoic, although their remains are rare in the rocks of the North Pennines.

**Unconformity** – A gap in the geological record where no rocks were deposited. They are seen in the field when younger rocks are immediately next to much older ones. A notable example in the North Pennines can be seen along the Pennine Escarpment, where the Ordovician slates are overlain by much younger Carboniferous rocks.

**U-shaped valley** – A large, often straight, valley with steep sides and a flat bottom, carved out by the movement of a glacier. High Cup Nick in the west of the North Pennines is a classic example.

**Vein** – An accumulation of a particular mineral deposited by the flow of hot fluids within a crack in the surrounding rock.

**V-shaped valley** – A valley with inclined sides which usually meet at a stream in their base. They are carved out over thousands of years by the downward-cutting of the water, and are often meandering.

While this guide contains definitions of most of the terms you are likely to encounter in the North Pennines, it is by no means an exhaustive list of geological terminology. For additional information we recommend the book *“A Dictionary of Geology and Earth Sciences, 4th Edition, Oxford University Press”*, along with exploration of the wealth of online resources that are also available.