The Rocks of Our Region.

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Rocks are divided into 3 types, based on how they form.

1. **Igneous** – rocks that solidify from a molten mass (magma).
2. **Sedimentary** – rocks formed on land or in water, from sediment produced by the breakdown of earlier rocks.
3. **Metamorphic** – rocks which have been altered by heat and pressure.

In Great Britain the rocks are broadly younger in the South East and older in the West and North.

In our region, as in many other areas, there are surface deposits of glacial materials, alluvium etc ("Superficial Deposits") of the past few hundred thousand years.

The youngest solid rocks near Preston are rocks of **Triassic** age – 200 million year gap to the Present!

WHY are there no sediments from these times? Because the much of the time most of Northern England was LAND. Erosion has removed a lot of rock, including some sediments that almost certainly were deposited at times in the gap.

Over the bedrock are the “Superficial Deposits”.

These include **Alluvium** – clay, silt, sand and gravel deposited in river channels, flood plains and levees of rivers & estuaries. There are also river terrace deposits – alluvial deposits left at higher levels when river channels incise.

**Peat** deposits are found at many places in the region.

**Blown Sand** is found near the coast. We also have large areas of blown sand from beaches when sea levels rose after the glaciations and moved much sand shorewards – often mapped as “Sherdley Hill Sand” e.g. as used for St Helens glass making.
Superficial deposits of Glacial origin are widespread.

**Glacial till** – material deposited directly from the glacial ice. This is commonly clay rich but contains larger material, including often boulders (the older name was “boulder clay”). This is dated at “up to 2 million years old” by the British Geological Survey, as it is possible some (very little) is from the very early Quaternary (or Ice Age) Period. However most of it will be from the Devensian (the last Ice Age) and be less than 100,000 years old. (Diamicton = unsorted).

**Glaciofluvial Sands and Gravels** are common in the region – sand and gravel deposited in meltwater rivers which transported the abundant sediment.

There are also **Head** deposits. This is material that has moved on slopes - often with frost action aiding - solifluction. Head deposits are very common in Southern England, but less extensive in our region, though they can be locally quite extensive.

Often they are glacial till deposited on slopes and then moved by slope processes. Or other processes may have produced surface deposits on a slope, which are then mobilised by slope processes.

Please note – I am starting with the youngest rocks and working backwards. Many geology reports etc start with the oldest rocks and work forwards.

The Triassic Rocks in Britain are divided into 3 groups:

Uppermost Triassic - **Penarth Group** – not found in our region.

The Mid-Later Triassic – **Mercia Mudstone Group**

The Early-Mid Triassic - **Sherwood Sandstone Group**

Few visible exposures of Mercia Mudstone in our region (compared to e.g. sandstones around Liverpool) because mudstone is quite weak material and does not stand up as ridges.

Within the Mercia Mudstone in Cheshire and Shropshire are HUGE quantities of SALT.

2 main groups of salt bearing beds within the Mercia Mudstone - combined = 2,000 feet (610 m) thick.

80% salt - therefore 1,600 feet (nearly 500m) of salt!

Estimated at least 69 cubic miles of salt (283 cubic km).

Where did the salt come from: most likely the sea. Regular flooding and drying up in the desert environment. Layers of salt were buried in mud which prevented the salt being dissolved when flooded again.

![Tunisia – ephemeral lake with salt deposits on the surface.](image)
Sherwood Sandstone: usually reddish sandstone, but can be pebble beds or mudstone beds.

Large scale cross bedding in wind deposited sandstone. Navajo Sandstone, Utah. Image by Roger Sutren

Similar bedding is seen around Merseyside e.g. at Lime Street

Modern salt mining at Winsford, Cheshire.

Note: most of the salt produced commercially is extracted by pumping water into bore holes, not mining.

Sherwood Sandstone. Hilbre Island

Sand dunes, Douz, Tunisia

Formation of Cross Beds:
1. Rough surface on the sea floor which forms an uneven layer.
2. The rock layer sometimes form a small dome or hill called a syncline.
3. Cross beds are formed when the layer of sand is moved by wind.
4. The cross beds are then covered by another layer of sand.

Movie sequence from: "Earth" by Marshak
Desert Flood El Hamma, Tunisia. Occasional intense rainstorms produce flash floods. Lack of vegetation means a lot of sediment is moved.

Wadi well over 600m wide in Tunisia. Flows in some years.

Wadi, Tunisia. Note the thicknesses of the depositional layers.

Mud Balls left by a flash flood. In a dry environment flash floods can occur so fast that clay lumps don’t have time to become saturated and disintegrate.

Mud pebbles deposited with ordinary pebbles by a desert flood.

Group of Mud pebbles in sandstone. Red Rocks, Wirral.
Photo Hazel Clark.

Cracked layer of clay - deposited in quiet water at the end of a flood. A new flood will rip up these fragments & deposit them with the material carried in the main flood. "Rip up fragments".

"Rip up fragments" in bedrock. Right side of Anglican Cathedral.

Cross bedding, rip up fragments and small pebbles in sandstone.
Liverpool Anglican Cathedral wall, right side, near rock outcrop.

When looking at local Geology maps note:
for the Triassic the rock formation names have changed, but most maps in libraries etc are older and use the old names:

The Mercia Mudstone is equivalent to the old Keuper Marl.

The Sherwood Sandstone is equivalent to the old Bunter and the lower part of the Keuper.

Further North the Triassic Rocks are generally similar. They underlie the whole of the Fylde.

However there is no bedrock above sea level in the Fylde – there are only “Superficial Deposits” west of the M6. Glacial Till, Glaciofluvial sands and gravels, Blown Sand (Recent and just after deglaciation), Alluvium and Peat.

Further North again St Bees Sandstone is named at the base of the Sherwood Sandstone Group – named after the St Bees headland West of the Lake District. (see Wikipedia - Sherwood Sandstone Group).
Storeton Quarry, High Bebington, Wirral. 1914

This quarry was a major source of building stone for Merseyside – used both sides of the Mersey. This is also the quarry where dinosaur footprints were found in the 1830s. The quarry workers described them as “blocks of stone with the impressions of men’s hands”. The footprints were in clay layers separating the sandstone layers.

Photo from British Geological Survey collection.

Before the Triassic there was the **Permian Period**, with again many red beds. Often in Britain the two are described together as “The Permo-Triassic rocks”.

In our region West of the Pennines the Permian Rocks are mainly limited to near Kirby Stephen and Brough in the North, and between St Helens & Stockport in the South. East of the Pennines there is a continuous belt of Permian rocks about 5 miles wide from Darlington to Nottingham. There is a range of sandstone and marl beds, and Upper and Lower Magnesian Limestone beds. The Lower Magnesian Limestone is magnesium rich calcium magnesium carbonate (dolomite). The Upper Magnesian limestone is not very magnesium rich. The Lower Permian often has a range of marine fossils including brachiopods, bivalves and a range of other marine fossils. The Upper Permian has few fossils.

The **Carboniferous** in England and Wales has 3 distinct sediment groups:

- **Coal Measures**: Sandstones, mudstones and frequent coal seams.
- **Millstone Grit**: Sandstones and mudstones. Coal very limited.
- **Carboniferous Limestone**: Limestones and shales (in Lancashire & Yorkshire part of this group has sandstone, shale, limestone repeated cycles, the other part all limestone).

Geology of the Pennines and adjacent area.
Under special conditions (often wet) peat can accumulate from plant remains. If buried in other sediment this can become brown coal (lignite) and eventually high grade coal.

Suitable swamps are likely to be found in deltas, which also give conditions where the peat is likely to be buried in sediments and therefore has a good chance of being preserved.

Coal is usually found in relatively thin seams (up to 1 or 2 metres thick), together with much greater thicknesses of mudstone or sandstone.
Typical Millstone Grit is sandstones, mudstones and siltstones. Coarser sandstones suitable for making millstones give the formation its name.

In our region Millstone Grit is widespread in the Peak District and also further north in the Pennines, (including around Longridge) and it caps Ingleborough & adjacent hills. (See geological map.)

Limestones are formed from calcium carbonate deposition, as a chemical precipitate, or organic deposition of shells etc, often both together.

Crinoids are star fish on a stalk made of many pieces called ossicles. Crinoid stems make up almost all of some limestones.
Shelled fossils are common in the Carboniferous limestone, e.g. the brachiopods shown here.

Corals in Carboniferous Limestone.

A common sequence from the beach out to sea is: coarse sand, then medium sand, fine sand, then mud.

Limestones usually form in the zones where very little land derived sediment reaches (away from land).

In North Lancashire and nearby Yorkshire there are sequences of deposition from limestone to mudstone to sandstone (and very rarely to coal). These sequences are repeated several times (in beds called The Yoredale Series) e.g. around Ingleborough.

They represent deposition under shallowing water conditions and also getting nearer to land/the sediment source.

Carboniferous Limestone with shales, sandstones and limestones overlying = Yoredale Series

Stream sinking into Carboniferous Limestone. Ingleborough.
Cave in Carboniferous Limestone (as are most British caves, except coastal caves, which are usually short).

British Geological Survey : Geology of Britain Viewer
Go to “BGS” in Google.
Select “Geology of Britain Viewer” : Click on map:
To begin with – easiest to click on “Go to location” – enter Name or Post Code – viewer goes to that place. Click on the map & it gives the bedrock geology. You can also select superficial geology etc.

Further Bedrock Geology of Longridge:
Strong Brown SE of L: Warley Wise Grit, Sandstone
Yellow – Pendle Grit Member - Sandstone
Dark Blue = Pendle Grit Member, Mudstone
Green NW of Longridge = Bowland Shale Formation, Mudstone and Siltstone.
Orange Brown, NW of Longridge : Pendleside Sandstone Member, Sandstone.
Greenish Strong Blue NW of Longridge : Pendleside Limestone
Pale Blue NW of Longridge: Hodder Mudstone Formation, Mudstone.
ALL of these rocks are Carboniferous – from 347 million years ago to 326 mya – fairly Early to Middle Carboniferous. Oldest in SE, youngest NW.

The variations from limestone to mudstone to sandstone around Longridge are variations of sedimentation comparable to the Yoredale Series changes seen around Ingleborough.

Variations of water depth and proximity to sediment source/proximity to land when the sediments were deposited, have caused these variations in the lithology.
Lower Palaeozoic Rocks. Cambrian-Ordovician-Silurian Lower Palaeozoic Rocks are found near Ingleborough and in the Howgill Fells. The Cambrian is absent, but Ordovician rocks are found in the eastern part of the Howgill Fells and North of the Craven fault near Ingleton. Only Upper Ordovician sediments are found, with impure limestones and mudstones. There are igneous rocks in the uppermost parts, with dolerites, rhyolites and tuffs (see Howgills cross section).

Note in our region the Howgill Fells is the only large area of Pre Carboniferous rocks, unless you go to the Lake District or North Wales.

Silurian rocks are found in both the Howgill Fells and at Horton in Ribblesdale, Ingleborough. The rocks are coarser grained and sandier than the Ordovician. Graptolites have been found in these rocks.

Note the major unconformity between the Carboniferous Limestone (7 in the cross sections) and the Lower Palaeozoic. There has clearly been both folding of the rocks and much erosion before the Carboniferous Limestone was deposited.

Pre-Cambrian
There are limited Pre-Cambrian rocks at Chapel le Dale (near Ingleton) and at Horton in Ribblesdale. These rocks are slates with grit bands, impure sandstones (arkoses) and conglomerates. There has been moderate metamorphism of these rocks.

The metamorphism has toughened the rocks enough so that they are sold as “Ingleton Granite”, even though they are clearly not granites. This is legal as these rocks have sufficient toughness to be comparable to granite.

Further North and West we have the Lake District, which is quite a complex area that has been studied in great detail.

The oldest rock is the Skiddaw Group, Cambrian mudstones and sandstones with much slate. These rocks form rounded mountains.

The highest peaks are formed of Borrowdale Volcanics – tough ashes and lavas formed 450 m.y.a.

The Windermere Group is mudstones, siltstones and sandstone with some limestone, deposited in Late Silurian, and generally forming lower ground.

Huge masses of granite were intruded around 420 m.y.a.

Later, in the south of the Lake District extensive Carboniferous Limestone was deposited.

That’s all folks!