In the beginning

Long before humans appeared on earth, the foundations were being laid for Rossendale's quarrying industry. Stone was already playing its part in shaping the landscape in which we now live. In this section we look at how Rossendale's rocks were formed, the part they played in shaping our hills and valleys and how these events millions of years ago led to Rossendale's quarrying heritage.

How Rossendale's rocks were formed

The rocks that lie underneath the valleys and hills of Rossendale were formed millions of years ago when the whole of what is now the North of England was a huge river delta. Sand and mud settled to the bottom of the slow moving water and built up until it was hundreds of metres thick. In this section we examine how this became the "sedimentary" rocks we know today.

Rock strata and Haslingden Flag

Not all of the rock is the same. Over the years conditions changed leaving different layers in the sediment. Each layer turned into a different type of rock. One of these rocks, found only in Rossendale, is known as Haslingden Flag. In this section we look at what was so different about this stone and why demand for this stone led to many of Rossendale's hills being torn apart by large scale quarrying.

How rocks shaped Rossendale's hills

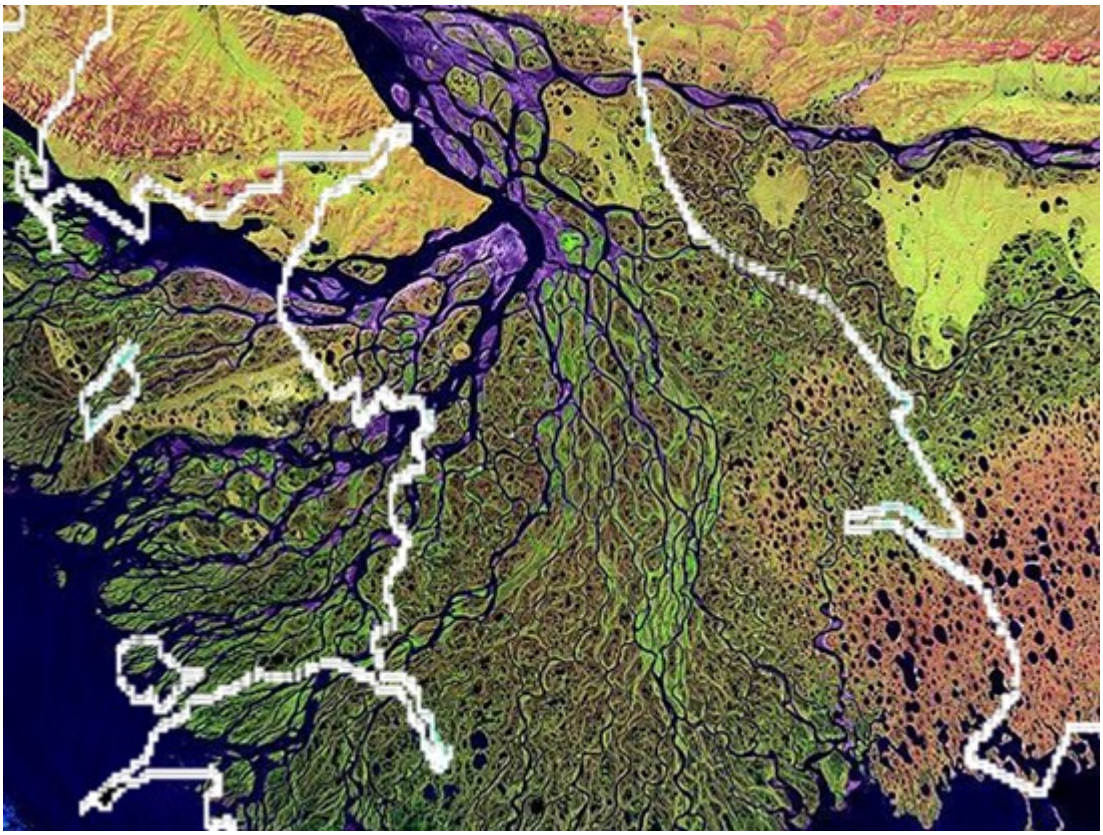
As millions of years passed, the rock layers gradually rose out of the water and were eroded by wind, rain and ice. Millions of years of weathering and the affects of the ice age created the hills and valleys we know today. In this section we see how the shapes in the Rossendale landscape stem from the rocks which lie beneath them and why this determined where quarries were located.

How Rossendale's rocks were formed

The rocks that lie underneath the valleys and hills of Rossendale were formed millions of years ago at a time when the whole of what is now the North of England was covered by huge river deltas and lagoons.

We believe that sediments, mainly sands, silts and muds, were eroded from hills in an area that now includes Scandinavia and Greenland and were swept into vast river deltas and lagoons in a central basin in a position now occupied by the Pennines. The sediment settled to the bottom as the water slowed down in the deltas and lagoons. The nearest equivalent sediments of today are forming in huge river deltas such as the Mississippi delta.

Diagram of delta



This sediment built up until it was hundreds of metres thick and was gradually compacted and cemented into the "sedimentary" rocks we know today. To geologists they form part of the

Millstone Grit series. The overall thickness of sediments indicate infilling of a tremendous basin, yet features in the rocks, such as ripples like those on a beach, show shallow water conditions, so sediment infill must have kept pace with large-scale subsidence.

Photos of ripples on flags and fossils evidencing shallow water conditions

The age of these rocks has been determined by fossil comparison and radioactive dating at 320 to 315 million years. Geologists refer to this period of the Millstone Grit series as the Upper Carboniferous, about the middle period of obvious life on earth.

All Rossendale's rocks are layered or "stratified". This is because over the years conditions changed leaving different layers in the sediment. Sometimes the sediment would be mud, whilst at other times it would be sand. There were even times when pebbles were washed down to form a layer of pebbles mixed with sand. The different layers eventually turned into rocks with different properties. Coarse grained sedimentary rocks, perhaps containing pebbles, are known as gritstones, but in the past have been called 'grits' leading to the name Millstone Grit; medium grains equal 'sandstone'; finer grains give rise to 'siltstones'. The finest grained sedimentary rocks were once mud and are often dark coloured. Formerly known as 'shale' they are now referred to as 'clayrock'. Typically the rock sequence is alternating layers of strong brown sandstones, softer dark shales (clayrock) and occasional gritstones.

Photos showing alternating strata of silt and sands at Thurns Head

At times, tops of deltas were colonised by vegetation and extensive peat swamps formed (perhaps like the Everglades of Florida today) which were later compressed to form the coal seams of the area.

Whilst the general process that gave rise to sedimentary rocks was the same over the whole of the Pennines, conditions would vary from place to place giving rise to local variations in the type and sequence of rocks. Peculiar conditions in what was to become Rossendale gave rise to deep beds of hard sandstones, known geologically as Haslingden Flag. This stone has a hardness and silica content equivalent to granite and was the principal reason for the growth of quarrying in Rossendale.

Haslingden Flag is of particular interest to geologists. Detailed geological mapping shows the shapes of the Millstone Grit deltas. The two most common types are found throughout the Pennines, but a third type is recognised only in the Haslingden Flags in Rossendale. This is an elongate delta: the nearest modern equivalent is the Mississippi / Everglades 'Birds Foot' type delta. Because it shows evidence of this rare type of delta, Lee Quarry is designated as a Site of Special Scientific Interest (SSSI).

Rock strata, Haslingden Flag and fossils

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Two units of Haslingden Flags are recognised - Lower and Upper – of interbedded sandstones and siltstones. These delta type sandstones show elongate west to east orientation as 'bar finger delta form' instead of the northerly orientation of the other delta types. The lower Haslingden Flags are important in the west and north-west Rossendale from Haslingden to Crawshawbooth. The Upper Haslingden Flags dominate the southern moorlands of Rossendale from Edenfield round to Whitworth.

Above the Haslingden Flags is usually a weak layer of mudstone; then a quite dramatic geological change to the Rough Rock – a very coarse gritstone. In places the bottom beds of the Rough Rock are rich in broken fragments of plant fossils, with branches stems and roots, sometimes nicknamed 'Log Jam Rock'. Powerful currents must have swept in these sediments and trees, possibly representing climate change. One possible theory is rapid glacial melting in the mountains near the source of the large river that created the 'Haslingden Delta'

The Rough Rock is the most common gritstone of the Millstone Grit group, occurring right across the Pennines, with its origins as the most common 'sheet delta sediment'. Although quarried elsewhere, it is ignored and rejected in Rossendale as inferior economically to Haslingden Flags.

Fossils in Rossendale Quarries

Over the centuries the word 'fossil' meant different things, now the term is restricted to 'recognisable traces of ancient animals and plants preserved naturally in the earth's crust'. Fossils are important because they tell us what life was like millions of years ago.

Fossilisation is a chancy process. The conditions of formation of the sediments of most of Rossendale's quarries were not really suitable, with shallow water conditions and turbulent current action breaking up shells and plants.

The tops of the deltas of the later Carboniferous sandstones were forested by large horsetails, seed ferns and now extinct club mosses. Trees and branches, perhaps swept down in flash floods,

were stranded on sand banks and are often in the Rough Rock at the tops of the quarries. Sometimes the vegetation remains are only indicated by a black carbon film.

Much more common in the Rossendale quarries, rather than the fossils themselves, are the traces of fossils including tracks, trails or burrows of invertebrate animals living on the deltas. Feeding tracks show as furrows in the sandstone, and irregular worm burrows or casts are often found. Very common are oval 'bump marks' indicating positions of the escape burrows of shellfish (cockle shells) (see picture). Although millions of years old these marks are mere points in time – hours or days!

How rocks shaped Rossendale's hills

Rossendale's distinctive scenery is one of flat topped hills with steep sides and a characteristic terraced or stepped skyline. This is a direct result of the geology beneath. Throughout the area the underlying rocks are almost horizontal layers of alternating hard sandstones and much softer shales (clayrock). Tough sandstones create the obvious steep steps or ledges, and the softer shales are more easily worn away into shallow slopes. Sometimes known as 'edge and ledge' scenery, the steps rise tier on tier above the narrow river valleys of Rossendale. Overall, the impression is a broken up (dissected) upland plateau with a characteristic terraced or stepped skyline.

Double edges on Holcombe Hill

Often, hard sandstone outcrops protrude at the tops of the plateau edges. These were where many of Rossendale's quarries were started and in places man-made features have replaced the natural shape of the landscape. Many outcrops have been quarried away and replaced by quarry remains.

Musbury Tor – an almost horizontal plateau cut by valleys on both sides. A rock outcrop protrudes at the top of the right-hand side.