GEOLOGY OF TODMORDEN MOOR 2

BACKGROUND

1) THE CARBONIFEROUS SERIES OF ROCKS

- The rocks of the Todmorden district are of the Carboniferous Series and were first laid down in an ancient sea, which covered most of England. The shells of marine animals in this sea accumulated on the sea floor to form thick beds of chalk-like ooze, which formed Carboniferous Limestone.
- An upward movement of the land made the sea shallower bringing the limestone beds closer to a new shoreline. As a result, sand and mud brought down by the continental rivers became sandstones and shales. They tend to be laid in alternating layers, usually with the shales thicker than the sandstones.
- Shales are very weak rocks, and grade into mudstones, which are even weaker. Sandstones are much stronger, but again vary considerably in character, some being easily crumbled, some massive but varying in hardness, while others are compressed into layers of hard flag. Sometimes sand and silt have been mixed and form intermediate shaley mudstones.
- Some sandstones are so coarse that they are called Millstone Grit. Some of the grits are called Kinderscout grit, because a fine example occurs at Kinderscout in Derbyshire, while other beds of sandstone have names such as Todmorden Grit, Middle Grits, Gorpley Grit, Hazel Greave Grit, *&c*. according to location or position. There are also many other layers of shale and sandstone that have no special characteristics that enable them to be named specifically. The last of the layers of the Millstone Grit series is a bed of particularly coarse sandstone known as Rough Rock. The rocks deposited above the Rough Rock layer during this last stage of the Carboniferous Period are called the Coal Measures, since they contain trapped vegetation that has been transformed into coal.
- After the Millstone grits had been formed, the land began to sink, so that the whole of England and large parts of Europe were changed into immense swamps scarcely lifted above sea level. The climate was warm and moist, and enormous forests grew on the swampy ground, consisting of gigantic ferns, clubmosses and horsetails and trees similar to fir trees. A series of changes took place in the level of land and sea. When the land sank the forests were submerged and buried under deposits of sand and mud. When the land rose again, forests flourished once again

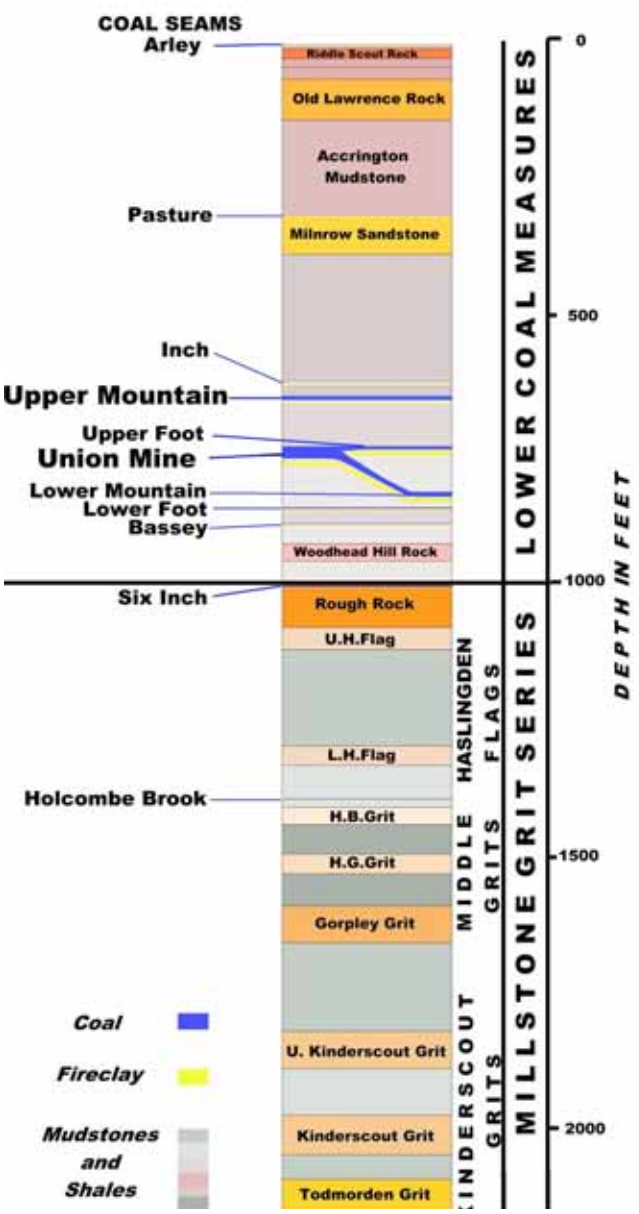


Diagram of the sequence of rocks in the Todmorden Region

on the swampy soil, until they in turn were buried beneath the sea and, trapped between beds of shale and sandstone. They were then changed into seams of coal. Below the coal seams there are beds of fireclay formed from the soil in which the forests grew and this has been used to make special bricks and pipes.

- There is a rhythmic character to the sedimentary layers of the Millstone Grits and Lower Coal Measures. Throughout this geological period a cycle is found in varying degrees of completeness, namely;

- **Coal**
- **Grit and sandstone**
- **Flags and sandy shale**
- **Mudstone and shale**
- **Marine shale.**

- Although it is helpful to divide the Coal Measures from the Millstone Grit Series, the division is not absolute and traces of coal can be found in the Grit Series, particularly at the top of the Middle Grits.

2) FORMATION OF THE PENNINE CHAIN

- After the Coal Measures were laid down, earth movements altered the arrangements of land and water. Over many millions of years the North Atlantic continent sank beneath the sea to form the bottom of the Atlantic Ocean, while on either side rocks were piled up into huge mountain ranges. During the process rocks were smashed and split. Previously level beds were tilted in all directions and great thicknesses of rock were often wrenched from their places and pushed into new positions. The Pennine Chain gradually rose into a wide arch of rock.

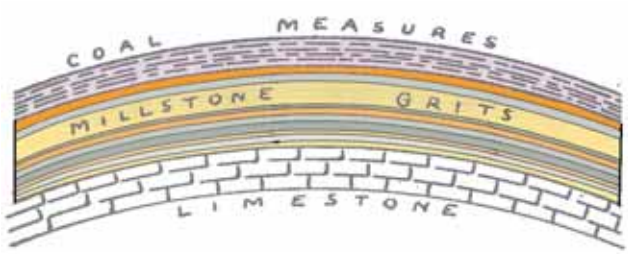


Diagram of carboniferous rocks bent upwards into an arch

- The Todmorden region lies along the central axis of this great arch of rock. On the Yorkshire side the layers of rock slope gently eastward, while on the Lancashire side the rocks dip westwards. However, the present Pennines are the remnants from the erosion of a much larger mountain range. During the upward movement, the surface of the land was being eroded by the action of weather, rivers and ice. The Coal Measures were the first to be eroded, then the grits and shales, and last of all the Carboniferous limestone was exposed. In Todmorden, however, the process was incomplete. A thickness of several thousand feet of rock has been removed, reaching to the Kinderscout grit on the Yorkshire Moors and exposing the shales and sandstones along the Todmorden Valley, but leaving the Carboniferous limestone still well beneath the surface.

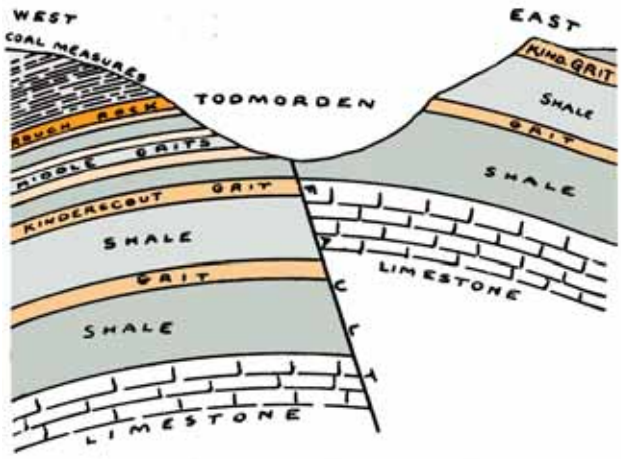


Diagram of rocks in the Todmorden Valley

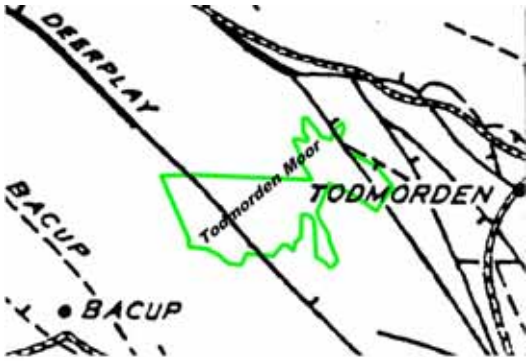
- However, the rocks on each side of the Todmorden valley are different, being split by a great fault running from north to south. So, on the Lancashire side the beds were thrown down hundreds of feet below the corresponding beds on the

Yorkshire side. To the west of Todmorden there are only Middle Grits, with Rough Rock and the lower Coal Measures above, while eastwards the Coal Measures do not appear until Halifax and Elland.

- This general picture is further complicated both by a larger number of smaller faults and by extensive landslips. The Todmorden Valley is geological comparatively young at about 10,000 years and is still subject to movement. In particular, shales are often formed in thin layers that may slip over one another when wet. On the north side of the valley between Lydgate and Todmorden, extensive landslips covering the lower slopes mostly conceal the Todmorden grit. The town itself stands on shale and there are many examples in recent history of buildings demolished or shifted by land movements.
- Although the greater part of the area is free from glacial drift, there are a number of places where drift deposits of clay or sand cover the underlying grits, shales or coal measures. This is material brought to the area by glacier action during the last Ice Age. Other overlying materials are alluvium from rivers and peat on the higher moorland areas..

THE GEOLOGY OF TODMORDEN MOOR ITSELF

- To the west of Todmorden, another powerful fault, the Deerplay Fault, runs from north west to south east, and this cuts right across Todmorden Moor. To the west, the strata have dropped by as much as 650 feet, and in the region of Bacup and Rossendale they become more or less horizontal. At the margin of the fault the layers have a curvature where the rocks have been dragged

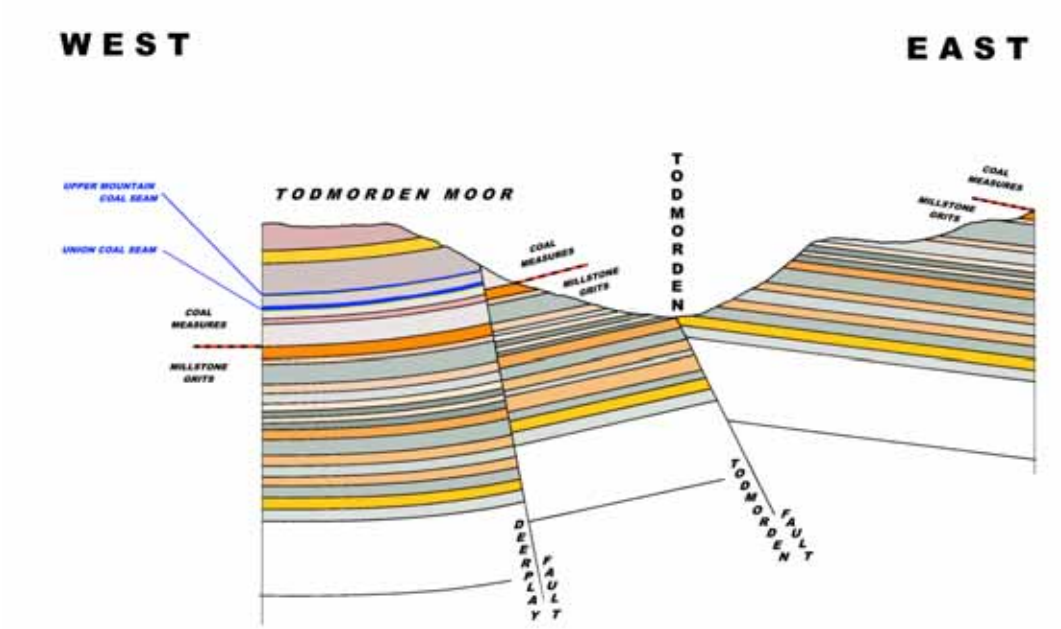


Major geological faults in the region of Todmorden Moor

- Major faults, such as the Deerplay Fault, are not simple fractures, but narrow complicated fault belts. A big fault is frequently accompanied by a series of smaller faults that throw in the opposite direction. Also faults with a throw of

several hundred feet may fork and die out in a few hundred yards. This is why most of Todmorden Moor's coal mines were small-scale affairs, because the coal seams have been fragmented and displaced in ways that are not easily predicted and so may disappear abruptly in a particular working. It also accounts for why the main workable coal seams, the Upper Mountain Mine and the Union Mine, are not necessarily found at the level expected from simple stratigraphy.

- The geology of the moor is further complicated by its proximity to the graphically named "Todmorden Smash Zone" of faulting. Although the major NW-SE faults are well known and mapped, they have also created an irregular system of minor faults running mostly east to west that are largely unrecorded.



A simplified diagram of the displacement of strata by faulting in the Todmorden

- Quite apart from variations produced by faulting, it is clear that sand and mud have been deposited in widely varying depths. This is particularly apparent on a line drawn through Todmorden Moor from the Cornholme region to the north west and the Dulesgate valley and Gorpley Clough to the south east. This shows that there is considerable local variation in the basic pattern, particularly in the Middle Grits, both in the thickness and nature of the strata.