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A WALK AROUND PENISTONE HILL, HAWORTH, TO LOOK AT THE ROCKS, QUARRYING AND LANDSCAPES
Grid Reference SE 025 369

Coal seam in mudstones in Dimples Quarry

The mudstones are finely laminated, with a very small coal seam with a fireclay layer below it.

The rocks of the Penistone area are **Upper Carboniferous** (Kinderscoutian and Marsdenian) in age, so they are about 320 million years old.

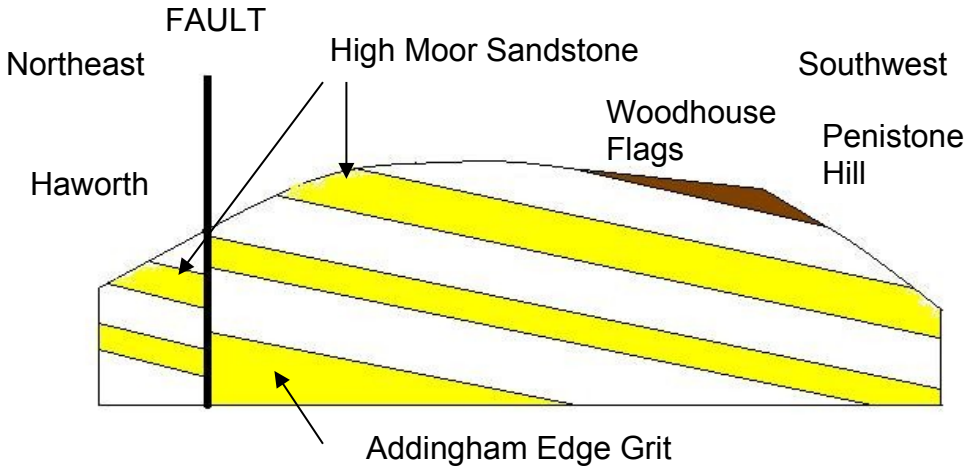
These rocks were laid down in **deltas** on the edge of a large continent, with mountains to the north and south. Sands and muds were deposited by rivers in shallow water. Because the continent was close to the equator, the climate was warm and wet so that tropical rain forest flourished. Dead plant material became trapped in stagnant swamps between river channels. Over geological time it was buried by muds and sands as the rivers in the delta changed position and built up more deposits. The water, oxygen and hydrogen were driven out of the plant remains, leaving only the carbon in coal seams.

After the sediments were formed close to sea-level, they were buried by hundreds of metres of sediment and **compressed**. As the sea water was squeezed out, it carried minerals which **cemented** the sand and mud grains together to make rocks called **sandstones** and **mudstones** (shales).

The rocks were tilted into a large fold, called the **Pennine anticline**, shortly after they were formed. The rocks of the Haworth area are close to the top of the anticline so they are nearly horizontal, which gives the flat plateaux surfaces you can see on the horizon. However, at Penistone Hill, the rocks dip at a few degrees to the south, so different sandstones outcrop near the top of the Hill, as shown on the cross-section. The mudstones are less resistant and can be weathered easily unless they are protected by a layer of sandstone lying above, so they form the steep slopes between each bench of sandstone.

The sandstones in this area have different names. The **Woodhouse Flags** form the south side of Penistone Hill and have been quarried widely. The **High Moor Sandstone** (also called the Doubler Stones Sandstone) is older and is found on the north and west sides of the hill and has been quarried at Dimples Quarry. Both sandstone beds are not continuous and probably represented flood deposits in the delta area. The **Keighley Bluestone** is an unusual dark grey, fine-grained sandstone which was deposited in shallow lakes on the delta top. It is only a few metres thick but was quarried widely for roadstone. This area also has a thin coal seam, only a few centimetres thick, found in Dimples Quarry. Another coal, the **Stanbury Coal**, usually about 30cm thick, is slightly younger and lies under the Woodhouse Flags.

During the Carboniferous period the sea-level changed regularly, because of glaciations in the southern hemisphere. Therefore the delta was sometimes drowned by sea-water which meant that dark mudstones with marine animals were deposited above the delta sediments. These marine bands contain marine **goniatite and bivalve fossils** which can be found in some local mudstones.



Cross section to show the geology of Penistone Hill, Haworth
Sandstones are shown in yellow
Mudstones are found between the layers of sandstone