

land or in Wales exceed from six to nine feet in thickness; but a difference in the quality may generally be observed in the upper, lower, and middle parts of the same bed.

A curious fact is stated by Mr. Keir respecting the main coal of Staffordshire. In one situation the upper part of the bed separates from the lower, and rises to the surface, or crops out. It is at first divided by indurated clay called bind or clunch; but as the distance becomes wider, the intervening stone grows harder, and will strike fire with flint. Similar separations sometimes take place in the beds of coal in the mines of Northumberland and Durham. The largest known bed of coal in the west riding of Yorkshire is near Barnsley: it is ten feet thick, and is supposed to be formed by the meeting of two or more seams, which soon separate again. The miners have not been able to trace the same bed in situations where it might have been found, had it preserved the same thickness, in other parts of its course.

Coal strata, beside the more common dislocations by faults, present remarkable contortions, which it would be difficult to explain, except by admitting a lateral force, which has compressed them into a zigzag form. To the same cause, or perhaps to a partial sinking of the earth, we may attribute the origin of what is called *faulty ground*, which frequently occurs in coal-fields. In this, no actual dyke appears to have been formed; but the beds of coal, with all the accompanying strata, are so broken and shattered, that no workings can be carried on, till the miner has got through them into regular strata. These broken parts of the strata, called *troubles* and *faulty ground*, occasion much more difficulty to the miner than common faults or dykes, and are sometimes of great extent.

In some coal fields one part of a stratum is inclined, and the other part vertical. A curious fact of this kind may be seen in a small coal field near the town of Manchester.*

The position of coal strata in many coal fields may be represented by a series of fresh water muscle shells, decreasing in size, laid within each other but separated by a thin paste of clay. If one side of the shell be raised, it will represent the general rise of the strata in that direction; and if the whole series be dislocated by partial cracks rising one part a little and depressing the other, to represent faults in the coal, it will give a better idea of the coal field than any description can convey. We are here to suppose that each shell represents a stratum of coal, and the partitions of clay the earthy strata by which they are separated. The outer shell represents the lowest bed of coal, which may be many miles in extent. Now, if a much larger shell be filled with sand, and the lowest shell be pressed into it we may consider the large shell to represent limestone, and the sand

* I have given a short account of this coal field in the second volume of the Transactions of the Geological Society.