

first thrust its alluvial deposits as far as the southern shore, then it rejoined the eastern delta and one of the deltas of the west. Lastly, by the continuation of the same process, the lake was completely filled up. It must be remarked that M. Fayol based this appreciation of the progress of sedimentation on the lithological relations of the rocks comprised in the different parts of the Commentry coalfield, and the diversified rocks of the formations which now surround it, as well as on the very diversified aspect of the coal-seams of Commentry, which frequently present in horizontal cutting the form of a C, or of a horse-shoe, opening towards the south, and not that of a basin. Before explaining more fully the theory of M. Fayol, it will be well to briefly mention a few of the peculiarities of the lie of the beds which suggested this theory to him.

At Commentry the coal strata have by no means the parallelism which characterizes the rocks of the Franco-Belgian basin—a parallelism which, though far from being complete, is yet sufficient to allow of the supposition that they were formed almost horizontally. In addition, M. Fayol states that the great Commentry seam, which is in one towards the east and centre of the basin, divides towards the west into six distinct seams, which as they ascend become more and more remote from one another, until, when they reach the surface, the two extremes are distant from each other 1,968ft. The splitting of coal-seams in consequence of the increase in thickness of intercalated schist is certainly not uncommon with us; but this phenomenon, as well as the local variations in the parallelism of the layers, is not of such great importance as that, taken as a whole, they could not be considered as in harmonious stratification. On the other hand, in Belgium, the coal-seams are in general separated cleanly from their wall and from their roof, but in Commentry it happens that the boundaries of the seam are altogether confused; as, for instance, when the roof is constituted of schistous layers and small oblique veins of coal, oblique with respect to the seam, and converging towards it. Let us also remark that if in the Franco-Belgian basin mention is made of the lateral modifications in the mineralogical constitution of the rocky beds which separate the seams of coal, if it is possible to pass from sandstone to psammite, from psammite to schist, these passages are made by very gentle transitions, whilst at Commentry the modifications in kind are much more rapid; for example, in this basin a coarse pudding-stone passes abruptly to a fine sandstone, and this again to a schist.

M. Fayol mentions the upright trunks; but, in his opinion, there is no more reason to suppose that they are now found in the place where they flourished, than other much more numerous specimens found by M. Fayol, either laid down or inclined at every possible angle. He carefully estimated the number of trunks laid down, inclined, and upright, which he met with in the various kinds of coal-rocks of the basin, and arrived at the following results: The upright trunks are almost equal in number to those inclined, and, with respect to the trunks found lying down, they become more numerous in proportion to the coarseness of the constituent elements of the rocks, so that it is the sandstone and conglomerates which enclose the greatest number of them; but, taking the formations as a whole, the total number of upright and inclined trunks is only one-tenth of that of the trunks laid down; in other words, the upright trunks—that is to say, those almost perpendicular to stratification—are only one-twentieth part of the trunks in the horizontal position. But if we suppose for Commentry that all these trunks were carried by water there is nothing impossible in the supposition that by reason of entanglement, in consequence of the presence of coarse sediment, the bearing along of which would require a great velocity, a small proportion of these trunks became perpendicular, or inclined to the bottom, on which they buried themselves, or even were fixed upright, and, according to an instance cited by M. Fayol, with the roots upwards.

This skilful engineer has supposed that into the deep and quiet water of the lake at Commentry, whose original dimensions, according to M. Fayol, we have indicated, there came torrents charged with pebbles, gravel, sand, argillaceous mud, and vegetable *débris*, destined to become pudding-stone, sandstone, schist, and coal.

Possessed on their arrival at the lake of a certain speed of movement which tends to displace them horizontally, they are further urged by their weight, which tends to make them fall vertically at various ratios of speed, dependent on volume, form, and the specific gravity of these materials, and which aid their separation; the pebbles and the gravel fall first, describing parabolas with short focus, and form a deposit with very steep gradient, attaining 45 degrees near the mouth. The sand, then the mud, superpose themselves with an inclination less and less great, extending themselves farther than the foot of the first cone of dejection. Lastly, the vegetable *débris*, with the exception of a small part which remains mixed with the foregoing sediments, in their turn spread themselves on the bottom, advancing much further, and with a still slighter inclination, in order to form a first seam of coal. A fresh supply of mingled sediment being produced, the same classification is effected; strata of a different nature are superposed upon those going before, their inclination decreases with the volume and the specific gravity of the elements, and the second seam of coal converges in depth towards the first. It may even be superposed directly, for the vegetable sediments, being lighter, extend themselves beyond the muddy sediments. The same phenomena being produced, the alluvial deposits advance into the lake, while at the same time at the mouth they rise towards the surface of the water. Soon they reach the surface, and compel the water-course to bifurcate for the first time. The well-known process of the formation of deltas goes on, and these extend laterally, whilst at the same time progressing forward. Lastly, the various deltas in process of formation become joined laterally, which indicates the mingling of the various elements brought by the different watercourses, and the lake finishes by being entirely filled.

In order to verify the deductions drawn from the observation of the lie of the strata at Commentry, M. Fayol organized numerous experiments, notably those of rapid sedimentation, in a basin 393ft. in length, 11½ft. in breadth, and about 4ft. in depth. This basin usually served for the reception, by decantation, of the particles of coal brought by the water used in the washing of the coal.