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PECULIARITIES OF COAL SEAMS.

BY ANDREW ROY.

The following facts which have come under the personal observation of the writer may be of some interest to the Institute:

The great vein of the Cumberland or Frostburg coal region, of Maryland, extends from Mt. Savage in Maryland to Elk Gorden in West Virginia, a distance of twenty miles. The line of strike of the vein is Southeast and from Mt. Savage to Westernport there is not a single break in the coal by erosive or from any other cause at Mt. Savage. The seam is about three feet in thickness while at Elk Gorden it is 22 feet thick. It gradually increases in height from Mt. Savage all the way along its line of strike. There is no coalescing of seams to account for the extraordinary thickness of 22 feet at Elk Gorden. The vein is divided into the bench coal and top coal. The bench coal, which is three to four feet in thickness, has two thin seams of shale running through it. As the coal thickens up along its line of strike the additional height is due to the enlarging of the top coal, the bench coal being nearly if not fully as thick at the small end as at the large end of the basin. This seam of coal is regarded as being the equivalent of the Pittsburg seam.

In the Hocking Valley of Ohio coal No. 6, or the the great vein in-

creases in thickness from three to fourteen feet in a distance of eight to ten miles. At New Lexington, McCuneville, McLuny's and other points in Perry county the seam is only three feet high, while at Shawnee, New Straitsville and on the Lower Sunday creek it ranges from ten to twelve, and at one or two points fourteen feet. The great vein of the Hocking Valley, like the great vein of the Frostburg region, is divided into bench and top coal and in the Hocking Valley field as in the Frostburg field the bench coal remains about the same thickness. There is some additional thickness given to the bench coal in the Sunday Creek Valley, but it bears no corresponding relation to the thickness of the top coal. In the Hocking Valley the thick coal is due to the coalescing of two seams. At Nelsonville the main coal is about six feet thick, but in the roof shales, two or three feet above, there is seen another vein about eighteen inches in height. As we descend the Valley this rider comes down on the main coal, forming a union so perfect that not even the judging eye of a mineral expert can point out the line of coalescence. The rider increases in height in descending the Valley, and at the Doanville mines is nearly three feet. In the Floodwood

mines of Messrs. Seffield, the two are together in one part of the mine and in another part they are one to two feet apart. At Shawnee the rider leaves the top coal again, and after running a few yards by itself then out altogether and not a trace of it is ever seen in the mines at New Lexington, McLuny's and other points along the branch road running from Shawnee to Newark, opened on the same vein. At Zaleski, Vinton county, coal No. 4 known in Southern Ohio as the Limestone coal, is divided into three benches by two bands of shale. The upper bench is about a foot thick and is separated from the middle bench by two or three inches of fireclay. In one mine the upper bench of coal gradually separates itself from the benches below, until an interval of fourteen feet is reached the space between being filled with a kind of fire-clay shale. Three or four hundred yards from the point of divergence the upper coal comes gradually back to its old place directly over the middle bench. A similar freak of nature is met in the Steubenville region. In the market street shaft a rider overlies the main coal, which sometimes comes down on the main bed forming one seam; again it loses it, and in the shaft is seen twelve feet above the main coal, the intervening space being filled with shale.

At Salineville the big vein ranges from four to seven feet in thickness. This deposit is a narrow trough, the coal rising and thinning out on the edges of the basin. The strip vein which lies about 60 feet above the big vein is never found in good mineable quantity and quality directly above the lower seam. In

other words wherever the strip vein is good the big vein is bad and vice versa. This is a coincidence that has been noted by all the coal men of that region. The upper coal does not thin out on a hillside like the lower one, but it is so troubled with "horsebacks" as to unfit it for commercial purposes.

One of the mines of the late Glasgow Port, Washington county, situated near New Comerstown, shows a coal seam ranging from four to nine feet thick and resting on an undulating floor. Like the Salineville big vein the thick coal is invariably met in the swamps or low places of the mine. Both the Salineville and Port Washington coals were undisputably deposited in troughs or basins which have been scooped out of the originally level plain by erosive agencies before the coal vegetation was deposited. Whenever the floor of the mine is blasted up the rocks below the coal are seen to extend in a level plain with the normal dip to the Southeast while the coal itself often rises at a pitch of fifteen or twenty degrees. The strata directly beneath the coal for a foot or two conform to the pitch of the coal.

The Massillon and Mahoning coals are everywhere disposed on an uneven floor, the coal in some cases rising as high as sixty feet from the swamp or low place of the mine. This peculiarity of these coals has been long understood, it having been described years ago by Dr. Newberry in the Geological Reports of the state. The basins in which the coal reposes were also formed by erosive agencies, for the bottom rocks lie in level sheets, while the coal sometimes rises on hills as steep as the roof of a house.

In the mines where there are marked undulations in the coal floor, the bed is nearly always thickest in the swamps or hollows. As the coal rises on hill-sides it becomes gradually thinner and the loss of height is mainly from the bottom of the seam. In a mine near Coshocton there is a hill twenty-five feet high, with a rather gradual ascent. In the swamp the coal is nearly five feet in height and there is a band of shale twenty inches above the floor of the seam. As the coal rises on this hill, the bottom bench becomes less and less until it finally disappears leaving the seam a homogenous mass on top of the hill but reduced in thickness nearly two feet.

In the Wellston district of Jackson county the floor of the coal frequently becomes very wavy. In the Emma mine at Glen Roy the coal on the south side of the shaft occupies an elevation twenty-two feet higher than it does at the bottom of the pit. Undulations are met in every mine of this field, but the swamps unlike those of the Mahoning Valley mines are not continuous. You can in every mine in the Mahoning Valley get round a hill by keeping your entry in the swamp, but in Jackson county the hills frequently rise at all points of the compass.

There are face and end joints which cross each other like latitude and longitude lines in all coal beds. In the Wellston field the bearing of these slips is North 5 to 11 degrees west; in the Hocking Valley they bear N. 7 to 11 degrees west; in the Mahoning Valley the bearing is about N. 37 degrees east. The roof of coal seams is generally shale or sandstone, but sometimes lime-

rock, fire-clay or iron ore form the immediate cover. Under shale the coal is purer and better than under sandstone. A rock roof means as a general rule a curly coal and the presence of iron pyrites in the vein; the rock top is also liable to cut down into the coal and reduce its height. The horsebacks met by the miner are generally masses of sandstone coming down from the rock roof above, and usurping the place of the coal.

The mines opened about Dell Roy, in Carrol county, are drift openings. This district has been more troubled with horsebacks than any other region in the State and a curious fact in this connection is that the center or body of the hill is where the horsebacks are nearly always met. The coal is all round the line of outcrop and for several hundred yards forward, but when the heavy cover of the hill is encountered the horseback presents its ugly flank.

Where a coal seam lies under cover and has to be reached by shaft mining, it is invariably thicker under a flat piece of land, or a wide valley, than under a hill. The miners who are keen observers of such facts predicted before the mines were opened about Glen Roy that the thickest coal in the Coalton district would be met in the valley at Glen Roy. The Emma mine opened in this flat has coal four feet thick. The Standard opened a quarter of a mile east in the same valley has coal four feet four inches thick, while the Acorn and Glen Roy shafts in the immediate neighborhood but on hill sides have never met coal of such height. Even the workings of the Emma and Standard mines when

pushed under the hills discover a reduced vein. bottom. Bone coal is rejected in mining; it is sometimes present in one part of the mine and absent in another part.

The bottom part is generally the purest part of a coal vein, though some seams have bone coal in the

DISCUSSION.

MR. HOWELLS: I can bear witness to the irregularity of the Massillon vein of coal. It happens I have got some figures here showing the great unevenness of that vein of coal. It is not very often that there is a difference of 60 feet. It is in some few cases, however, and one of these I have right here. The level of the coal in one vein 130 ft.; in another 70 ft. The difference is great in all of them; one 132, the other 116, the other 120, 105, 83, 108, 96, 116, 125, which makes the maximum between the two points that we know of 62 feet between the 70 and 132. Now, 30 to 40 ft. is very common in the Mahoning or Massillon district; however there is one thing where Massillon differs from Mahoning, and while it is admitted that it rules that the coal is going up the hill thins down and generally runs out, still there are exceptions to that, if not many there are a few. In the mine we lately worked out we found invariably that the coal run out in the deepest places we had in the mine, until finally it run out entirely.

of these peculiarities are concerned I don't think I [can] say anything about it. I had charge of the Dell Roy mine and came to the conclusion it was going to be the finest coal field in Central Ohio. The coal was 6 feet thick. I drove the entry in far enough to get started from the works on the double entry system. I drove in 150 ft. of fine coal; then I lost all the shale that was over the coal, and then about 3 ft. of sandstone cut out every bit of my coal. I drove into that about 50 ft. and the rock was just as good in the far end as when I started. I came 20 ft. from where I lost the coal and drove in that 50 ft., and the rock was right before me.

Twelve thousand dollars in cash was paid for it, and all of the coal there was, was just a little around the crop. In another mine lately opened near there they paid \$11,000 for the tract of coal land independent of their surveys. They have opened two entries, and three weeks ago those two entries had just struck rock on both sides. On both sides of the main it was going to come before them again.

MR. MORRIS: As far as the causes

