

Upper Productive, 200'; Upper Barren, 500', but much reduced from the original thickness by denudation; the total number of coal-beds is 13; the mean thickness of the lower 7 is  $4\frac{1}{2}'$ ; of the upper 6, 4'. Bed No. 1, called the Brier Hill, Massillon, or Jackson coal, is 3' to 6' thick, and is supposed to be No. A of the Pittsburg section; No. 6, the Upper Freeport, 3' to 12' thick; No. 8, 4' to 8' thick, the Pittsburg coal-bed, at the top of the Lower Barren Measures; and No. 11,  $1\frac{1}{2}'$  to 4' thick, the Waynesburg coal-bed (Newberry).

In Indiana, the Coal-measures cover an area of about 7000 square miles over the western part of the state, are 800' to 1000' thick, and include 10 coal-beds varying from 1' to 11' in thickness (Collett).

In Illinois, the total thickness is 600' to 1000', and the number of workable coal-beds 6, and of other thin seams, 6. The thickness of the former is nearly 20' (Worthen). Near Morris, and elsewhere, in northeastern Illinois, there is a single bed of coal with clay above and below. Four miles to the southeast of Morris, sandy shales of the Coal-measures contain concretions which have made the place famous because of the many kinds of Ferns, Insects, Spiders, Myriapods, rare Crustaceans, and even Amphibians, which have been found in the concretions—the specimens having been in many cases the nuclei. No marine fauna has been found in them.

In southwestern Kentucky, the Coal-measures north of Pine Mountain are 1650' thick, and contain 9 workable beds of coal; and farther east they are still thicker.

The Coal-measures spread northwestward over southwestern Iowa, where they have a maximum thickness of 600', and a thickness of coal-beds of about 8', as in Illinois. The Coal-measures extend northward beyond the limits of the upper beds of the Subcarboniferous limestone. At Davenport, on the Mississippi, a boring found a thickness of 30', and the beds resting on the Devonian Corniferous limestone.

In Arkansas, the area of the Coal-measures is about 1000 square miles, and the mean thickness of the coal-beds is estimated at 3'.

The isolated coal area of Michigan covers about 6700 square miles, and the beds have a thickness of 300' or less. At East Saginaw, this 300' includes the underlying Parma white sandstone 105', and the overlying Woodville brown sandstone 79 feet; and in the intermediate shales and sandstone there is one bed of coal 3' to 4' thick (Winchell).

In Alabama, the Coal-measures cover 5500 square miles. There are 3 areas,—the Warrior, the Cahaba, and the Coosa. The first contains nine tenths of the whole area. The thickness near Tuscaloosa, where the beds disappear beneath more recent formations, is about 3000'. The number of coal seams is about 35, of which 15 are over  $2\frac{1}{2}'$  thick, and 6, of 4' and over. The beds become thinner to the northwest. The lowest of the coal-beds are those in the Pottsville conglomerate.

The Rhode Island Carboniferous covers the most of the southern part of the state, and extends northward, through Providence, to the northern border; there it passes into Norfolk County, Mass., and thence eastward, through Bristol County, to Plymouth County. The exact limits, east, west, and north, have not been made out, the stratification of the rocks being much obscured by displacements or flexures and metamorphism. There are conglomerates and slates which are supposed by Hitchcock and Jackson to be a part of the formation. The quartzose conglomerate outcrops at Newport and elsewhere, and forms a bold feature in the landscape at "Purgatory,"  $2\frac{1}{2}$  miles east of Newport, and at the "Hanging Rocks." The stones vary in size from an inch to a foot or more. Associated with the slate there are beds of limestone.

The principal points where coal outcrops are near Providence, Cranston, Bristol, Portsmouth, Valley Falls, Cumberland, and Newport (a thin bed outcropping on the coast), in Rhode Island; and in Raynham, Wrentham, Foxboro, and Mansfield, in Massachusetts. The beds are much broken and very irregular in thickness, owing to the upturning and flexures the formation has experienced, and the coal is an exceedingly hard anthracite, because of the metamorphism, and to some extent is graphitic. Still, the slates often contain fossil plants, part of which are identical in species with those of Pennsylvania.