the Subcarboniferous and the epoch of the Millstone grit; and they were continued even after the Carboniferous, during the Permian.

These submergences, although quietly carried forward, played havoc with the leaves, trunks, and stumps, floating them away for burial by the in-washed sediments. Some of the transported stumps may occasionally have had aboard large stones which they finally dropped, thus putting an occasional "bowlder" into the forming beds. The encroaching waters at times flowed with great force and plunging waves, as is shown not only by the formation of coarse gravel beds (now conglomerates), but also by the erosion of the rock deposits, and in some cases of the beds of vegetable debris. In Vermilion County, Ill., as observed by F. H. Bradley, a portion of the Upper Coal-measures, including shales, argillaceous limestones, and two coal-beds, were carried away to a depth of 60 feet; and, in the depression thus made, a sandstone, which belongs at the top of the series, was laid down so as to fill and overlie it. Also, on the same authority, in Vermilion County, Ind. (adjoining the county just mentioned), the Millstone grit (here a pebbly sandstone), under the Coal-measures, is cut off short and followed horizontally by shale and limestone; as if the grit stood as a bluff in the waters, in which the latter rocks were deposited. Other evidences of erosion have been described from these states, and also from Ohio, Kentucky, and Missouri. The change of level over Iowa, Illinois, and Missouri, which permitted the Coal-measures to spread northward beyond the limits of the Chester limestone, the last of the Subcarboniferous beds, and even beyond the Kinderhook beds, was of the same nature with the oscillations above referred to. No unconformity with the Subcarboniferous was produced except that of overlap. The little value, as regards time divisions in geological history, of unconformity by overlap or erosion is well illustrated by the facts here stated.

The coal-beds are thin compared with the associated rocks. But the time of their accumulation, or the length of all the periods of verdure together, may have far exceeded the time occupied in the accumulation of sands and limestones. If there were but 100 feet of coal in all, it would correspond to more than 500 feet in depth of vegetable debris. The sands and clays which came in after each time of verdure put under heavy cover the thick bed of vegetable debris which had accumulated, and thus the decomposition of the plants and the change to coal took place, under the best of conditions for coal-making. In some regions the coal-plants may have been drifted to their places of deposit; but this was not the usual way in North America.

The great marsh from which proceeded the Pittsburg coal-bed of the Upper Productive Measures, according to J. J. Stevenson, was the "parent marsh" also of the coal-beds above it in the series, times of temporary burial being indicated by the intervening beds of shale and sandstone during the progress of a very slow and intermittent subsidence.

A coal-bed itself bears evidence of alternations of condition in its own lamination, and even in the alternations in its shades of color. A layer one