

eastern side, or in the ridges and troughs nearest the Atlantic, south eastern dips predominate, in consequence of the beds having been folded back upon themselves, as in *i*, those on the northwestern side of each arch having been inverted. The next set of arches (such as *k*) are more open, each having its western side steepest; the next (*l*) open out still more widely, the next (*m*) still more, and this continues until we arrive at the low and level part of the Appalachian coal-field (D E).

In nature or in a true section, the number of bendings or parallel folds is so much greater that they could not be expressed in a diagram without confusion. It is also clear that large quantities of rock have been removed by aqueous action or denudation, as will appear if we attempt to complete all the curves in the manner indicated by the dotted lines at *i* and *k*.

The movements which imparted so uniform an order of arrangement to this vast system of rocks must have been, if not contemporaneous, at least parts of one and the same series, depending on some common cause. Their geological date is well defined, at least within certain limits, for they must have taken place after the deposition of the carboniferous strata (No. 5), and before the formation of the red sandstone (No. 4). The greatest disturbing and denuding forces have evidently been exerted on the southeastern side of the chain; and it is here that igneous or plutonic rocks are observed to have invaded the strata, forming dykes, some of which run for miles in lines parallel to the main direction of the Appalachians, or N. N. E. and S. S. W.

The thickness of the carboniferous rocks in the region *o* is very great, and diminishes rapidly as we proceed to the westward. The surveys of Pennsylvania and Virginia show that the southeast was the quarter whence the coarser materials of these strata were derived, so that the ancient land lay in that direction. The conglomerate which forms the general base of the coal-measures is 1500 feet thick in the Sharp Mountain, where I saw it (at *c*) near Pottsville; whereas it has only a thickness of 500 feet about thirty miles to the northwest, and dwindles gradually away when followed still farther in the same direction, until its thickness is reduced to 30 feet.\* The limestones, on the other hand, of the coal-measures, augment as we trace them westward. Similar observations have been made in regard to the Silurian and Devonian formations in New York; the sandstones and all the mechanically-formed rocks thinning out as they go westward, and the limestones thickening, as it were, at their expense. It is, therefore, clear that the ancient land was to the east, where the Atlantic now is; the deep sea, with its banks of coral and shells to the west, or where the hydrographical basin of the Mississippi is now situated.

In that region, near Pottsville, where the thickness of the coal-measures is greatest, there are thirteen seams of anthracitic coal, several of them more than 2 yards thick. Some of the lowest of these alternate

\* H. D. Rogers, Trans. Assoc. Amer. Geol. 1840-42, p. 440.