

or bituminous shales or pyroschists, as they are called. Black slate, cannel, fat coal, like lignite, peat and living wood, will yield the oils and gases by distillation, but the geological distinction must be carefully preserved between the free Petroleum of the rocks and wells and the distilled Petroleum of the old oil works.

The connection of the oil regions with the coal basins of western Pennsylvania and Virginia, and eastern Ohio and Kentucky, is, in good measure, a geographical deception. (In the report of a geological reconnaissance of Indiana, 1859, 1860, under D. D. Owen, State geologist, and published in 1862, Profeso<sup>r</sup> Lesquereux expressed the opinion that the mineral oil of the borders of the coal field comes from the lowest great bed of the coal measures, I. B., page 285. The opinion of such an authority is to be carefully considered.) The Oil creek rocks, dipping southward, pass 500 or 600 feet below the coal measures. The nearest coal bed to the more northern springs occurs on the highest hill tops, many miles away. The hills in the vicinity of some of the wells are capped by the conglomerate base of the coal measures at least a hundred feet thick. The shales and sandstones of the valley belong to formations X, IX, and VIII descending, called by the New York geologist the Catskill, Chemung, and Portage groups, extending over all the southern counties of western New York. The southern dip carries down these oil bearing rocks, and the wells must deepen in the same direction. Mr. Ridgeway reports (July 10, 1862) the lowest oil-bearing sand rock, capping the hills near Waterford, on Le Boeuff creek, and the same sandstones appear on Big French creek, full of plant remains.

The following wells show the dip in a well-marked manner: The Philipps well on Oil creek, is 460 feet deep; the Brawley well, at the mouth of Cherry run, 503 feet; the Cornwall well, 530 feet; the Avery well, over 700 feet; and at Titusville he estimates the proper depth at 1000 or 1,200 feet.

In the Mahoning coal oil region in western Pennsylvania and eastern Ohio, near the line, the three oil-bearing sand rock strata are beneath the lowest coal bed. The "Continental" boring at Edenburg, in Lawrence county, penetrated, in descending order, the following formations before it struck the oil: First, the superficial drift, 80 feet thick. Second, sandstones and shales, 200 feet thick, the bottom layers of which consisted of fetid black shales, from which coal gas blew off with violence. Third, the first white sandstone, 50 feet thick, arranged in three strata, a softer middle between harder upper and lower formations; the whole mass said to be thin, going east, and holding abundance of gas in its crevices. Fourth, shales and slates, 45 feet thick, charged with oil and gas. Fifth, the second white sandstone, 75 feet thick—softer, coarser, and tougher, or more difficult to bore through than the first, and full of gas; after passing through which they struck the great oil stratum, 448 feet from the surface. Crawford's boring, not far off, went down 580 feet, through another shaley formation, and struck oil, supposed to come up through a crevice from the third white sand rock.

That there is an intimate connection between the

character of these sand formations and the character of the oil which issues from them is indubitable. The rule among the miners is, as stated by Mr. Clark in the "Proceedings of American Philosophical Society," (June, 1862, p. 57,) that the harder the rock may be to drill, the lighter in color, purer in quality, and smaller in quantity, will be the oil obtained therefrom; and the softer the rock, the darker and more abundant the oil.

The chemist of the Canada survey, Mr. Hunt, insists strenuously "upon the distinction between lignitic and bituminous rocks, inasmuch as some have been disposed," he says, "to regard the former as the source of the bitumen found in nature, which they conceive to have originated from a slow distillation. The result of a careful examination of a question has, however, led us to the conclusion that the formation of the one excludes more or less completely that of the other, and that bitumen has been generated under conditions different from those which have transformed organic matters into coal and lignite; and probably, in deep water deposits, from which atmospheric oxygen was excluded."

Mr. Hunt instances in support of this view, the fact that the highly inflammable pyroschists or black slates of the Utica and Hamilton groups contain no soluble bitumen, and that the Trenton and Corniferous limestones at the base of the Silurian system are impregnated with Petroleum, and give rise to Petroleum springs, although no fossil land plant has been found in them. The fact that a considerable portion of the tissues of the lower marine animals is destitute of nitrogen, and very similar in chemical composition to the woody fibre of plants, forms another link in the chain of reasoning on this distinction between bituminous and lignitic rocks. The black slates, and even the coal beds are, in fact, layers of mud, charged slightly or to excess with lignitic matter, peat, or humus, part of which has assumed the form of glance coal and part the form of mineral charcoal, but almost none of which is soluble in benzole or sulphuret of carbon; whereas these liquids easily dissolve out the ready-formed bitumen from the rocks which may contain them. But whenever a coal bed became a repository of dead fish, like the eight-foot coal at the mouth of Yellow creek, at the bend of the Ohio, or as in the case of the two foot stratum of phosphatic iron-ore deposited between the two branches of the Deep river coal bed, at Egypt, in North Carolina—how different an aspect the mineral then wears, glossy with soluble bitumen!

Mr. Hunt argues with much force that the mere fact that intermediate strata, porous enough to absorb all the floating bitumen in their vicinity, are nevertheless destitute of any, is enough to prove that the accumulations of oil now furnishing the world with light, never came from the sub-volcanic distillations of the beds of coal in their neighborhood, but that the mineral has been generated by the transformation of organic matter in the strata where it is. Mr. Wall has shown that the asphalt of Trinidad and Venezuela (belonging, however, to a much later—upper miocene or lower pliocene—tertiary age) occurs in limestones, sandstones, and shales, associated with beds of lignite or fossil wood, and is confined to