REPORT

ON THE

AGRICULTURAL AND MINERAL RESOURCES

OF

VIRGINIA AND WEST VIRGINIA,

AND MORE PARTICULARLY ON THE

Extent, Quality, and Value of the Coal and Iron Deposits situated along the line of the Chesapeake and Ohio Railroad, showing the advantage of that region for successful

MINING AND MANUFACTURING INDUSTRY.

BY

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WITH AN APPENDIX OF VALUABLE INFORMATION ON THE SUBJECT FROM OTHER SOURCES

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DEPOSITS OF IRON AND COAL

ALONG THE ROUTE OF THE

CHESAPEAKE AND OHIO RAILROAD.

THE *Chesapeake and Ohio Railroad* in its course west crosses three distinct belts of iron ore before reaching the coal formation.

The first, that of the primitive rocks, east of the Blue Ridge, containing the magnetic ores. There are many reported beds said to be of great value, but no special development authorizes this assertion. The difficulty of working this kind of ore in the charcoal furnace, and the want of a harder fuel, have prevented attempts at smelting and hindered that keen search which demand always leads to, and which will probably develop workable beds. At present this belt is simply of prospective and uncertain value.

The second belt is in the palæozoic strata, on the western slopes and foot-hills of the Blue Ridge, crossed by the railroad just after passing through the long Blue Ridge tunnel. The ores are what are known as hydrated peroxydes, or brown hematites, and give a brown border to the eastern side of the Great Limestone valley for its entire length.

The most persistent bed of ore is where the limestone, slates and shales meet the sandstone. The well-known "Cornwall Bank" of Pennsylvania is in this range. In Pennsylvania this belt has been the chief dependence of the anthracite furnaces; and two-thirds of the anthracite iron of the State is made from its ores. In Virginia it has supplied a range of charcoal furnaces, extending its length

through the State, making an iron which is mostly used for the manufacture of boiler-plate and for other purposes requiring excellent qualities.

It has been asserted that, notwithstanding the vast deposits of magnetic ore found at lakes Champlain and Superior, in Missouri, and at other points in the United States, more available ore exists in this belt than in those deposits; "that the brown oxides of the limestone are more than equal in quantity and quality to the magnetic and specular ores." While this assertion seems extravagant, certain it is that, wherever fuel is available for the manufacture of iron on this belt, it has never failed to furnish any quantity of ore demanded, and its development in Virginia shows it to be quite equal in quantity in that State to any other place where worked. It is quietly awaiting coal from the Kanawha to give growth to a large trade.

Fifteen miles west of Staunton the railroad passes out of the Limestone valley and approaches the Great North Mountain, composed of the Medina sandstone (the No. 4 of Pennsylvania geologists), and gets into the series of rocks lying between the limestone and the coal formations. The rocks of this series are broken into numerous mountains and valleys, which run into each other in curious zigzags, "doubling like hares."

The mountains are formed by the reappearances and disappearances of the Medina sandstone as it rises and sinks in waves. The valleys and subordinate hills are a world of thin limestones, cement layers, black slates, coarse, ragged flint-stones, many-colored shales and argillaceous sandstones, thousands of feet thick, out of which, at favorable points in the slates, gush hundreds of mineral springs.

At the Little North Mountain the railroad meets in that mountain the first deposit of the third belt, everywhere in Virginia noted for its iron ores, which have been worked from before the Revolution. Zanes, Van Buren, Columbia, Newmans, Elizabeth, Estaline, Bath, California, Australia,

Lucy Salina, Catawba, Rebecca, Jane, and other furnaces in Virginia, are on the line of this deposit, and draw their supplies from it. Most of them are located on, or within a few miles of, the line of the *Chesapeake and Ohio Railroad.*

Prof. W. B. Rogers, in his report to the Legislature of Virginia, made during the survey of that State in 1837, speaking of this formation, says: "In an economical point "of view this rock is chiefly interesting from being the "repository of beds of iron ore of great extent and value, "and of large deposits of the oxide of manganese. In "regard to the former, incalculably the more important of "the two, the extraordinary productiveness of this rock "has already been illustrated in sketching some of the "results of our explorations in the Big and Little Fort "valleys of the Massanutten. But I may be allowed again "to call attention to the rich abundance and excellent "quality of the iron ores appertaining to this member of "our series, as forming a part of the structure of those "mountains, as well as to ample deposits exhibited in "numerous other localities in connection with the same "rock."

The railroad from Buffalo Gap to Clifton Forge, a distance of forty miles, is almost within sight of these strata, and within easy reach of the furnaces located upon them. The Estaline, Australia, and Lucy Salina have been sold to Northern men. The two last to Pennsylvanians, now operating on the Lehigh, who are actively at work to put them in blast, and who look to large operations so soon as they can get coal.

At the Clifton Forge we strike, in the Rich Patch Mountain, a stratum of iron ore of many miles in extent, which in appearance seems to correspond to the celebrated fossil ore of Danville, Pa. This stratum is said to be traceable for a distance of ten miles, most of the time in sight of the railroad. At this point (Clifton Forge) the road meets Jackson's river, or the Upper James, down which a branch road of twenty miles would pass near sixteen different banks or deposits of iron ore, counting only those near the river, while short laterals would open as many more.

Just north-east of the town of Covington, about two miles from the road, a vein of ore of wonderful development occurs at the Dolly Ann furnace. This furnace has also been purchased by the same party of Pennsylvanians who bought the Lucy Salina, and who regard this bank as of great value. This vein, which is apparently distinct from either of the others named in this belt, crops out at many other points.

Again, three miles west of Covington, near the temporary track to avoid the Mud tunnel, is an old furnace stack said to have been built as long ago as 1800, now abandoned by reason of its distance from market, and which was worked with ores taken from a vein in the neighborhood. This vein is said to crop out very largely on Dunlap's creek, but its value has never been investigated.

Still further west, beginning at a point six miles north-east of the White Sulphur Springs, and easily traceable for over twenty miles, there are surface indications of ore. Should further development bear out present appearances, this vein, from its proximity to coal, will rank among the most valuable in the country.

While the value of the first iron belt, or primitive range, in that part of Virginia crossed by the *Chesapeake and Ohio Railroad Company*, is not yet known, and while the second or Blue Ridge belt of brown hematites (the Allentown, Reading, Lebanon, and South Mountain range of Pennsylvania) is known in Virginia to be fully equal in quality and quantity to its condition at any other points, the third belt or range of iron ores—that lying between the valley limestone and the coal formations, and therefore the nearest of the three to coal, and through and along which the railroad runs sixty miles—in its present imperfectly developed condition, is known to be of far greater magnitude than the same strata in Pennsylvania or elsewhere.

After leaving the White Sulphur Springs the railroad, in seven miles, gets out of this series of strata into the valley of the Greenbrier river, down which it runs thirty-seven

miles, most of the distance in the carboniferous limestone, which from a seam of six inches, on the borders of the anthracite coal-fields, has here thickened into several hundred feet, and forms a valley of twelve miles in width and one hundred in length—with a natural blue grass soil of great fertility, as rich and beautiful a piece of country as any of its size in the United States. Lying two thousand feet above the sea, hilly, and thoroughly drained, it is unusually healthy. (For an extended statement of the climate, etc., of this section of country, see the "United States Patent Office Report for 1863," title "West Virginia.") The entire want of cheap communication with the outside world has alone prevented it from teeming with population. It is hemmed in by mountains north, south, east, and west, and will be entirely tributary to the *Chesapeake and Ohio Railroad*, which commands all its trade and travel.

The carboniferous limestone of England contains some of the most valuable British iron ores, but no valuable deposit has as yet been seen in it here. The proper search (which has certainly not been made) may bring to light workable lodes.

The Greenbrier river empties into the New, or Upper Kanawha, river, where that river is running through the red and olive shales and sandstones which underlie the coal-bearing strata, and which from this point to the Ohio are nearly horizontal, having but a total average western dip of thirty feet to the mile.

From this point to Charleston the New river, for sixty-two miles, to its junction with the Gauley, and then (as the Kanawha) for forty miles more, is a deep chasm or cañon bounded by mountain slopes and cliffs from one thousand to twelve hundred feet in height, more rugged and precipitous as the harder rocks of the coal-bearing strata gradually lower toward the river. In all this distance there is but little more room between the mountain base and the river than suffices for the railroad, if we except occasional pieces of rich bottom a few acres in extent.

Seeing this vast chasm and judging the adjacent country

only as developed along the level of the river, one would naturally infer that a railroad through it could only serve as a short-cut between distant points—most emphatically a "through line"—that could expect no local freight or travel other than an occasional backwoodsman and his family, and the few pounds of dry goods and groceries they now carry in on horse-back.

But, like all judgments formed from "narrow views," this would be erroneous, and when all the surroundings are seen and understood it will be recognized as a fact, that this most unlikely portion of the road to give freight and travel, will eventually furnish far more tonnage, and quite as much travel as any portion of the broad and fertile plains of the West of equal distance; and that neither the Baltimore and Ohio nor Pennsylvania Central, in the portions of their lines lying between the navigable waters of the Ohio and the eastern slopes of the Alleghanies, are situated so as to command and control so large a tonnage from the country bordering on the sections of their lines of road as is the Chesapeake and Ohio Railroad on the section between Covington and Charleston. This arises from two causes: the one, position in reference to the surrounding country; and the other, climate and soil, and consequent productiveness.

The very cause which has rendered the New river so forbidding in its appearance, and made it look so little like a source of tonnage and profit to a railroad, has given it points of advantage over those well-known and profitable roads. One of these is that of grade for its through trade.

The Pennsylvania Central has undertaken to remedy its position in this respect by the construction of numerous expensive laterals. The Baltimore and Ohio spreads out its two tracks (one to Wheeling, the other to Parkersburg), and receives tribute from the south side of its road by the Monongahela and Cheat rivers; but the *Chesapeake and Ohio Railroad*, in the gut of New river, five hundred feet below the natural level of the country, with all the streams on either side for fifty miles running into it and cutting down

natural routes of travel, will as imperatively receive the tonnage of this large section of country as does the river its waters.

While the difference in climate between the country traversed by the *Chesapeake and Ohio Railroad* and the Baltimore and Ohio Railroad is not so marked as that between the Pennsylvania Central and *Chesapeake and Ohio Railroad*, it is still something in favor of the latter road; but, in soil and productions, this difference is quite decidedly in favor of the country adjacent to the New and Kanawha rivers.

On climbing up these mountains it is found that all the slopes and hill-sides made by the numerous streams, and the table-lands on top, are covered with a rich mellow soil that raises with ease, and yields finely, wheat and corn, and particularly oats, potatoes, and all root crops in great abundance. This is the unanimous testimony of all persons acquainted with the country. On the south of New river, tobacco, said to be the finest sent to the Cincinnati market, is raised as easily and abundantly as in any part of old Virginia.

Cattle and sheep fatten and flourish on the herbage and undergrowth without other food, and with literally no care. The size of the sheep thus raised is stated by an intelligent gentleman, who has frequently passed through this country, and had his attention called to it, to be much greater than common, and their hardihood unusual.

With this fertile soil, with a good climate, with the excellent water that always belongs to coal strata, and with unsurpassed healthfulness, this country, mountainous and hilly as it is, would have been filled with a hardy, industrious, and thrifty population, instead of the few settlements that are now met with, were it not for two causes, the principal one of which has been want of communication and market, and the other the magnificent growth of timber with which the land is covered.

This consists of large white, black, red, and chestnut oaks; black and white hickory, black walnut, ash, poplar, wild cherry, and chestnut, with occasional groves of the

maple, and valleys of some size of the white pine and hemlock. There are other varieties, such as the dogwood, gum, etc., etc., which are not so numerous. When for some time among these forests, one does not so feel their size, but upon leaving the coal strata and coming to the Alleghanies, the trees there look dwarfish and the woods like a collection of brush.

To the European immigrant, unaccustomed to the use of the axe, this fine growth of timber is an insurmountable objection, and he wends his way to the prairies of the West—with their chills and fevers, which most surely destroy the general health of his family—rather than undergo the unaccustomed task of clearing, in the mountain forests, the acres he needs. Even to our American woodsman this has been a serious task, arising from the necessity that heretofore existed of destroying the timber to get rid of it, in addition to the ordinary labor of clearing. Land, when rid of this valuable timber, is worth five times as much as when covered with its natural growth.

But, with the railroad opened, giving easy access to Eastern and Western markets, all this will soon be changed. There will be demand for products and a road to market. The car builders, the cabinet-makers, and the numerous industries, dependent upon cheap lumber, will necessarily come along the line of road. The unlimited supply of good bark will bring tanneries and their associate industries; and when to these demands is added the timber that will be marketed in bulk, and the large consumption for mining purposes, it will be seen how acre after acre will soon be opened to the husbandman, not only without cost, but with a fair profit for the labor of clearing.

These values are, however, but surface values; accessories to the real riches of this region. The peculiar position of the cañon or chasm of the river renders its most essential service in its relations to coal. About two-thirds of the way up the Big Sewell there is a marked change in the soil and rocks. On top of the red and olive shales the true coal-bearing strata come in, and maintain their position

from this point to the Ohio at their proper level, gradually lowering toward the river, getting at Cannelton nearly to its level.

The coal area naturally depending upon the New river and Kanawha valleys for its outlet (in fact by its contour inaccessible by other passable outlets) embraces a territory of over six thousand square miles, the extent of which is more readily comprehended when the fact is stated that it is quite equal in superficial extent to the whole productive coal area of Great Britain, from which is now mined over one hundred million tons per annum.

The great variety and fine quality of the coal of the middle section of this field are well known, and frequently tested.

The fine fatty Bituminous, the Splint, and the Cannel are the principal varieties. The work "Coal, Iron, and Oil," by Daddow & Bannan, edition of 1866, page 340, speaking of this location and its coal, says: "Coal river, "Elk river, and Gauley, diverge from the Great Kanawha "and spread their branches over one of the *richest and most* "*magnificent coal regions* in the world, and bring down their "wealth to one common center on the Great Kanawha. "The coals of this region generally are *better*, *purer*, and "*more available* for all the requirements of trade and manu- "facture than the coal from any other portion of the Alle- "ghany coal-field. The seams of coal are more numerous "and their thickness greater than in any other portion of "this coal-field; it can be *mined cheaper* and with more "economy generally, under the same rates of labor, *than* "*in any other region in this country, without exception.*"

The peculiar splint coal of this section is a superior fuel in its raw state for the manufacture of pig-iron. In its proper place, the experience and opinion of an intelligent iron manufacturer, who has worked it, will be given.

The coal of the eastern edge of this basin is also of remarkable purity. In Taylor's "Statistics of Coal" (edition of 1855), in which the analysis of over four hundred specimens of American coal is given, there is on page 604

an analysis of the "Deem bed," opened on the south-east flank of Big Sewell mountain, in which the impurities, or earthy matter and ashes, are put at 1.14 per cent., or less than that of any other American coal of which an analysis is given, not excepting the best Lehigh anthracite, the finest of which from the Summit mines of the Lehigh he gives at 1.28 per cent., and another specimen from Beaver Meadow 1.28 per cent. The other two veins on the Big Sewell mountain that were analyzed, the "Rogers' seam" and "Tyner's bed," show almost equal purity.

The number of workable beds is variously stated from seven to fourteen. The last is the number given in "Coal, Iron, and Oil."

There are four items that affect the value of a coal-field.

First—Quality of the coal.

Second—Quantity.

Third—Accessibility of the coal itself.

Fourth—Market.

The last, one of the most essential, will be given to this region by the Railroad.

The facts already stated have demonstrated its value in the first and second of the above conditions.

In respect to the third item, the most essential to cheap and profitable working, this region stands unrivaled.

It has been stated before that the chasm of the river renders it most peculiar service in its relation to the coal. Cutting all the coal strata for nearly its whole length entirely through, and getting down among the shales under the coal, the river has caused the numerous streams which pierce this whole coal region to cut down through most of the coal-bearing strata on their courses, leaving the coal entirely above water level, accessible at hundreds of points by simply scraping off the surface-soil; so that, so far as the mere getting of the coal is concerned, two thousand dollars will open a mine ready to ship one thousand tons per week. There is no region in the world where less physical labor will prepare a mine for delivery of coal at the drift's mouth.

This will be made clearer by a comparison of the position of coal here and in Great Britain in this respect.

In Great Britain, and in fact in most all of the European coal-fields, the coal is deep below the water-level. To reach the seams requires the expenditure of years of labor and vast sums of money in sinking shafts or pits, and in erecting pumping and hoisting machinery, to be maintained and renewed at heavy annual expense. It is authoritatively stated that the cost of sinking shafts in the Newcastle region of England to the depth of one thousand feet has been, in many instances, one thousand dollars per yard. In the great northern coal-field of Great Britain, producing twenty million tons per annum, there are two hundred pits or shafts, costing, in first outlay, for sinking and machinery fifty millions of dollars, to which must be added the necessary expense of constructing and maintaining proper air-courses and their accessories requisite to the safety of the employés.

There is now invested, simply in pits, and machinery for pumping and hoisting the one hundred million tons produced in Great Britain, two hundred million dollars; and this vast sum is destined to utter destruction in serving the purpose for which it was used.

These pits and machinery being constructed, they involve a certain amount of labor for every ton of coal got, in addition to their cost and renewal.

Now, in this great coal-field crossed by the *Chesapeake and Ohio Railroad* Nature has already sunk all the necessary pits and shafts, which need neither repair, renewal, or labor to work them. The laws of gravity have provided the most perfect, permanent, and costless pumping machinery; and the most perfect ventilation of the mines and safety of the employés, instead of requiring scientific knowledge and anxious thought, is simply a matter of the most ordinary care, the almost perfect freedom from noxious gases being the natural result of the position of the coal strata.

In Pennsylvania there has occasionally been found, between the carboniferous limestone and the coal conglomerate, a vein of iron ore of workable thickness and quality.

On the New river, just before reaching the coal, evidences of the presence of this vein exist, and the amount of ore which it sometimes leaves on the surface is considerable; but

there has been no opening which demonstrates its permanent value.

The buhrstone ore lying above the first workable coal vein—the Johnstown ore of Cambria county, Pennsylvania—is known to exist in its proper geological level, and is said to be opened in many places in its best condition.

Higher up in the series a second seam of ore is found, which can occasionally be profitably worked, furnishing a fine argillaceous ore, but it is much more uncertain in its yield and thickness than the other. While furnaces should not be erected to depend entirely upon these ores, they are a most valuable and desirable addition to the richer and differently constituted ores from the East.

With the facts now at hand, a fair consideration of the prospects of the line of the *Chesapeake and Ohio Railroad* as an iron manufacturing center can be had. In this connection the following letter, which has been made public, is most pertinent as to the value of the Kanawha as an iron coal, and as giving the views of the leading Western iron men on this subject.

OFFICE OF C. & C. MENDENHALL & Co.,
No. 27 Vine Street,
CINCINNATI, October 10, 1867.

J. G. PAXTON, Esq., Lexington, Va.:

DEAR SIR—Your note making inquiry respecting the character of the Kanawha coal as a blast-furnace fuel is received.

In reply may briefly say that we have thoroughly tested its quality for this purpose in our own furnace, near Wheeling, with the most satisfactory results, regarding it as better adapted to smelting iron than any known coal of the Alleghany field. We used the Campbell's creek and Coalburg coals with about equal results. The estimate in which our furnace manager holds those coals is evidenced by the fact that I am authorized to contract for a supply to be carried up the river to Wheeling, for use in our furnace there.

An extensive acquaintance with nearly all parts of our Alleghany coal-fields justifies me in saying that I know of no coal equal to it, in every respect, and there is no portion of the field so richly developed as on the waters of the Great Kanawha, or where it can be brought into use at so cheap a rate.

The coal in the Mahoning valley, which is now used by

the works of Governor Todd and others there, has hitherto been regarded as of the finest quality known by the works which use it; but our founder, who has managed furnaces for many years in that valley, places the Kanawha coal unquestionably before it; and the extent to which the seams of that coal are developed bear no comparison with the seams on the Kanawha, while the cost of mining the former must always be two to three times the cost of mining the latter.

Since the trial of Kanawha coal by us, in April last, two furnaces of large size have been, or are about to be, commenced at Ironton, Ohio, designing to use it as a fuel, and one near this city is also provided for, intending to use the Kanawha coal, Missouri Iron Mountain ore, and the limestones of this vicinity. A careful comparison of the cost of making pig metal with these materials in this place proves it to have a very decided advantage over any other iron district in the Ohio valley—an advantage which cannot be superseded until you can, by a railroad to connect with the Virginia Central Railroad (now Chesapeake and Ohio), or an improvement of the navigation of the New river, bring together the rich, brown hematite ores existing along that railroad and river, and the coals of the Kanawha, and also the limestone of the Greenbrier. I am informed that the brown hematite ores, to which I refer, can be mined and placed on the Virginia Central Railroad at a cost of about one dollar per ton; if so, by a reciprocity of freights between this district and the Kanawha coal region, this ore can be laid down at the Kanawha Salines for $3 per ton, or for a ton of iron $6; three-quarters of a ton of limestone from Greenbrier, $1.50, and two and a half tons of coal (seventy bushels), at not over four cents a bushel, $2.80; making the total outside cost of materials per ton of iron, $10.30.

These appear to me to be the highest cost for materials at the present high prices of labor, and at less than half the cost of similar materials in the most favorable of the districts where iron is now made in the Ohio and Mississippi valley.

Intelligent iron men have seen clearly, since the trial of the character of your coals, that if the materials I have referred to are thus brought together, the Kanawha valley and the ore region will be at an early day teeming hives of industry and wealth; and one of the most important centers of the iron manufacture of the United States must be in this portion of the interior of the State of Virginia.

Yours truly,

CYRUS MENDENHALL.

The best method of arriving at a proper conclusion, as to the feasibility of manufacturing iron along the line of road, will be a comparison of the cost of manufacture at other points, and delivery to principal markets, with such cost and delivery to this Road.

As representative points of Eastern Pennsylvania, Allentown on the Lehigh, and Phœnixville on the Schuylkill river, are fair places for comparison, with New York as their market.

Pittsburg is probably the cheapest point in the West for the manufacture of finished iron, and while Cincinnati will be a somewhat cheaper point of delivery from the Chesapeake and Ohio Railroad than from Pittsburg (to Chicago it would be somewhat dearer), it will be fair to treat delivery from these points to the general Western market as equal.

It will not be necessary, in making the comparisons, to go into the minutiæ of manufacture, as labor, contingent expenses, interest, &c., vary but little at all points, final results as to cost being a question of the cost of ore and coal.

The point on the line of the Chesapeake and Ohio Railroad assumed will be that where the first available coal is found.

It is necessary to first consider the quantity of the different kinds of coal used at the different points. On this subject there is the statement of the Committee on Statistics of the American Iron and Steel Association made to that association November 16, 1864. The figures referred to occur in what is styled the Supplementary Report of that Committee. The report says that "at works using Alleghany or bituminous coal " it requires four tons of raw coal (to be first coked) to make " one ton of pig-iron; also, 1.43 tons of pig-iron to make one " ton of rails, and two tons of coal to convert the pig-iron " into rails. Hence the total quantity of coal per ton of rails " is 7.72 tons.

" At works using anthracite coal for making the pig-iron, and bituminous coal for converting the same into rails, two and a quarter tons are required per ton of pig-iron, and two tons in the conversion. Hence the total quantity of coal (the pig-iron used being 1.43 tons as in the former case) per ton of rails is 5.25 tons."

In regard to the quantity of raw bituminous coal taken to make a ton of pig-iron, there is the testimony of Mr. Mendenhall, who uses two and a half tons of Kanawha coal.

There is a published letter of Brown, Bonnell & Co., of Youngstown, Ohio, saying that in July, 1868, they were using from two and a quarter to two and a half tons of coal to one ton of pig-iron.

The Nimrod Furnace Company, of the same place, under date of December, 1869, say they use three and a quarter tons of coal. This latter must have been inferior. If the extremes are taken—two and a quarter and three and a quarter—and an average struck, the result is two and three-quarter tons of this kind of coal, which will be assumed as the amount of Kanawha coal that will be required to make one ton of pig-iron; and, on the same basis as given in the extract from the report referred to, it will take 5.92 tons of this coal for one ton of rails, in round numbers six tons, which gives 2.8 tons of coal per ton of pig-iron.

At Allentown they use only the anthracite coal, it being cheaper at that point than the bituminous. This coal will cost there $4 per ton, and 5¼ tons at $4 gives $21 as the item of coal, to which add freight to New York, $2; we then have, for the total of these items for iron made at Allentown and delivered at New York, $23.

At Phœnixville they use anthracite to make pig-iron and Broad-Top bituminous for converting the pig into rails. The anthracite costs $4.25, and takes three and a quarter tons for one ton of rails, giving $13.81 for this item. Two tons Broad-Top at $4 per ton, $8, in all $21.81 for fuel; freight to New York $2.25. Total, for iron made at Phœnixville and delivered in New York, for coal and freight, $24.06.

For iron put in the Western market the cost of delivery to Pittsburg from either of these places is not less than $6 per ton, and would give $27 per ton, at least, as the representative for coal and freight at this point, delivered into Pittsburg, or at any point, from which delivery to the general Western market will cost the same as from the point named on the line of the Chesapeake and Ohio Railroad.

According to the letter of Mr. Mendenhall, who was a

purchaser and user of Kanawha coal, the cost of that coal at the high prices of 1864 was four cents per bushel, or $1.12 per ton. In the estimate of the cost of coal at Allentown and Phœnixville the price of 1864 has been reduced twenty-five per cent.; but, assuming the price as stated to be $1.12 per ton, the following is the result:

Six tons of coal, at $1.12	$6 72
Freight to New York	7 00
Cost of one ton of rail	$13 72

manufactured on the Chesapeake and Ohio Railroad for the items of coal and freight delivered in New York.

For the West, assuming, as we have, that it will take the sum of six dollars per ton to equalize Allentown and Phœnixville with these works, we have the item of coal only, or $6.72.

The results, then, are that for the Eastern or New York trade there will be an advantage of the difference between $23 and $13.72, say $9 per ton, and for the Western trade $20 per ton.

The ores used at Allentown and Phœnixville are much nearer the furnaces and mills than the ores on the Chesapeake and Ohio Railroad to the coal where it is proposed to locate the mills, and this will, of course, neutralize some of this difference. Again, too, in the beginning of trade, there will be a great want of those facilities which proximity to large communities, with their numerous manufactories and dense populations, always gives.

At Pittsburg the question of ores enters more materially into the difference of ores. The cost now at Pittsburg for ores necessary to make one ton of pig-iron is not less than $15, and at the estimate before assumed of 1.43 tons pig-iron to one ton of rail, this would give $21.45 as the cost of ore per ton of finished rail. On the Chesapeake and Ohio Railroad $12 per ton of pig-iron for the ore will be admitted to be a high figure. This would give $17.16 per ton of rail—over $4 per ton advantage. The Pittsburg coal has, how-

ever, to be coked, and to this item is, therefore, to be added one and a half tons of coal and the cost of coking, so that there is, under the most favorable statement, to Pittsburg a difference of $6 per ton in favor of the Virginia location.

As articles of iron require more work, such as locomotives, steam mills, finished iron work of all descriptions, the manufacture of steel, etc., so do they represent more coal per ton of finished work, and can be manufactured proportionably cheaper, as fuel is cheaper.

In Pennsylvania the manufacture of charcoal iron is gradually dying out, owing to the want of proximity of the wood and ore. This proximity still exists over a large field of country in Virginia, and is transferring the manufacture of charcoal iron to that State. This article is essential to the production of good car wheels and the manufacture of Bessemer steel, and is now transported to Pennsylvania, to be there used for these purposes, and worked up by a dear fuel. The laws of trade will only permit this so long as this iron cannot meet its natural ally, the coal of Virginia. When this occurs, and rolling-mills have been erected to make the necessary axles and bar iron, and all brought into connection with the cheap and superior lumber of the coal region, the industry of freight and heavy car construction will be driven to seek the line of this road, and it will not be five years from its completion before four-fifths of this class of cars used in the United States can be here manufactured.

Allusion should also be made to one peculiar facility incident to this river, resulting from the deep chasm cut by the waters, and which certainly can be found at but few other points. It is the use that can be so easily made of cheap hydraulic means for the lifting and handling of heavy weights.

To illustrate: At almost any point along the river the mountain streams can be turned into pipes with heads of (say) 300 feet, giving a pressure at the railroad level of (say) 125 pounds to the square inch. If you wish at any point to lift and handle weights of ten tons, you simply turn this water into a cylinder with a piston of 18 inches, which will allow over thirty per cent. for friction, and it will lift the ten tons and can be operated by any one who can turn a hydrant-cock.

This plan can be adopted in hundreds of ways inexpensively, and with a saving of labor that in some instances amounts to a fair profit in itself.

Again, it may be suggested, and with plausibility, that while our statesmen and merchants are bemoaning the inability of our mechanics to build iron vessels in competition with the English, the solution of the difficulty may be found in some position on this road where, with a fuel that will cost in actual physical labor to get it scarcely more than half of the cost of British coal, and a concentration at one point of the furnace, the rolling-mill, the foundry, the machine-shop, and the finishing-shop, a ship may be built to be delivered in ten, twenty, or even thirty-ton sections to the seaboard, to be there simply tacked together and put afloat.

Mr. Hewitt, our Commissioner to the Paris Exposition, says "we are already making railroad iron in this country cheaper than anywhere in the world, estimated in days' labor." It is certain that a vessel built as proposed would be far cheaper, estimated in this way, than any now built on the Clyde, and by this arrangement there would at least be avoided that false system that now so largely exists in this country of manufacturing our bulky articles in piece-meal at many different points, and paying accessories, such as superintendence, book-keeping, handling freights, commissions, and an exaggerated profit (necessary from the limited business done at any one place) twenty times over; and it would be a curious and instructive inquiry that would ascertain precisely how much the cost of an American-built iron steamship, as now constructed, is made up of these items.

All these facts and suggestions in regard to the working of iron on this road will undoubtedly arrest the attention of investors in the industries belonging to it, and will most certainly draw capital, both from this country and Europe, in large sums for the erection of vast works along the line of this road.

Some ten miles below the mouth of the Greenbrier, on New river, salt has been found and manufactured, but as the only means of transportation was the pack-horse, the manufacture was abandoned. It is probable that salt can be found,

at the proper depth, from this point to the Kanawha Salines ; and on the completion of the road its manufacture will at once revive.

At several points on New river there are natural falls, where water-power to the extent of from 5,000 to 10,000 horse-power can be had, and this power can be secured by artificial dams at almost any desired point.

The great value of these powers can only be fairly understood when the fact is known that water-power is rated and paid for in the Middle and Eastern States at a rent of from twenty to fifty dollars per horse-power per annum, according to location.

Even in works where not ordinarily considered desirable, water-power has been found profitable. In the manufacture of pig-iron the waste gases have been thought to be all that could be wished as a means of power; but on the Lehigh, above Easton, there are five furnaces, standing almost side by side, working precisely thes ame kind of stock; four worked by steam, raised by the waste gases, and one worked by water taken from the Lehigh canal, for which the owners pay a water-rent to the Canal Company, for the mere use of the water as a power, of $3,000 per annum, rather than use the waste gases for the purpose, and an experience of many years has shown that it is more profitable so to do.

With this fine water power, with the great breadth of excellent wool-growing country all along it, and with a short outlet East and West, so soon as population grows to give the necessary hands, the woolen industry will spring up and thrive; and while this location is some hundreds of miles nearer to the cotton-fields of Georgia and Alabama than the seat of many present manufactories of this article, it is to be expected that in course of time a fair proportion of this industry will also be established ; and it will not be many years before trains will be seen on the *Chesapeake and Ohio Railroad* wending their ways to the East and the West, all of which—the locomotive, the cars, the freight, and the rails on which they run—have been constructed, manufactured and made on the line of road.

HOWELL FISHER.

[From the Report to the Chamber of Commerce* of Richmond on the Trade, Commerce, Mining Manufactures, &c., of Virginia, for 1871.]

CHESAPEAKE AND OHIO RAILROAD.

This railroad is the result of a consolidation of the Virginia Central Railroad with the Covington and Ohio Railroad, authorized by the Legislatures of Virginia and West Virginia in 1866. Its route is from Richmond via Gordonsville, Charlottesville, Staunton, the White Sulphur Springs, and by the valleys of the Greenbrier, New and Kanawha rivers to a point sixteen miles west of Charleston, and thence by a direct line to the mouth of the Guyandotte, in the Ohio valley, which it follows for twelve miles to the mouth of Big Sandy river, its chartered western terminus. This distance is about four hundred and twenty-seven miles.

The company also have the right to construct a branch road from near Clifton Forge, on Jackson's river, the main fork of the James, to Richmond, by the valley of the James, or any other route which may be preferred. Also the right to construct a branch from a point not east of Charlottesville, nor west of Staunton, to Washington City. Also a branch from Richmond down the Peninsula.

Of the main line two hundred and twenty-seven miles, or from Richmond to the White Sulphur Springs, is in operation, and the track is now being laid on about ninety miles between the mouth of Gauley river and the new city of Huntington on the Ohio river. The remaining one hundred and ten miles will be completed in 1872, the contracts for graduation being limited to May 1st.

Arrangements have already been made for completing a road from the western terminus to Lexington, Kentucky, where there is a direct rail connection with Louisville. Dis-

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* Report on the Trade and Commerce of Richmond, Va., for 1871, and several years preceding, compiled for the Richmond Chamber of Commerce, p. 205, by P. G. Coghlan, Secretary, Richmond. Ferguson & Rady, 1871.

tance by this line from Richmond to Louisville not over six hundred and forty-six miles, and this will probably be reduced by surveys to be made. Arrangements are also being made for a continuation of the line north of the Ohio river to Cincinnati and Chicago. The distance to the former point will not be over five hundred and sixty miles, and to the latter eight hundred and twenty-two miles.

When the branch by the valley of the James is constructed, and this line from the Ohio to Cincinnati, there will be no grade facing westward on the entire route exceeding thirty feet per mile, and but one, facing eastward (ascending the Alleghany Mountain) as much as sixty feet per mile. There will be *practically* but one summit between tide-water and navigable waters on the Kanawha—that at the crest of the Alleghany.

In distance, in grades, in total rise and fall, and in climate, this road will have important advantages over any other route crossing from the Atlantic to the Mississippi valley. Its western terminus touches the Ohio river, where it takes its western direction, and at the head of reliable navigation, where steamers of the largest class which leave Cincinnati, going East, can almost always find ample depth of water and a channel unobstructed by ice. This terminus is three hundred and fifteen miles nearer Cincinnati than Pittsburg, two hundred and twenty-four miles nearer than Wheeling, and one hundred and thirty-one miles nearer than Parkersburg. While, if it is found cheaper to employ more steamboat navigation and less rail—the road also touches the Kanawha, always a more reliable stream than the Ohio above the mouth of the Kanawha, where for most of the year (from nine to ten months) there is good navigation to a point only three hundred and thirty-eight miles from Richmond, *the shortest portage* between tide-water on the Atlantic coast and navigable water in the West.

The road runs through a fine agricultural region. The productions are from the tobacco and wheat of Virginia and Kentucky to the grass lands of the mountain region. It passes the more celebrated of the mineral springs, and directly by the world-renowned Greenbrier White Sulphur.

But the line is peculiarly endowed with mineral resources. It is stated on authority, considered reliable, that there is more iron and coal which will be tributary to this road than exists in the whole of Great Britain, and the amount of coal (about 6,000 square miles) exceeds that of any other portion of the United States. Nor is this all. The splint coal exists in large quantities along the line of the road—a coal which is said to be superior to any other mineral coal for smelting iron, and which does not require coking, while it is free from sulphur and phosphorus. The cannel coal also exists in exhaustless quantities and of superior quality. Cannel coal is now imported from Great Britain, and sells in New York at from eighteen to twenty dollars per ton. Many tons of this coal, now mined in Kanawha, are carried in barges down the Kanawha, and up the Ohio, one hundred and twenty miles, to Parkersburg, and thence by the Baltimore and Ohio Railroad to Baltimore, and thence by water to New York. The Chesapeake and Ohio Railroad will save the whole of the river navigation, and offer a grade of thirty feet per mile as against one hundred and sixteen feet, and also a shorter portage by rail. It is expected that this coal can be laid down in New York at less than ten dollars per ton.

Iron ores of excellent quality exist in exhaustless quantities east of the Alleghanies, and some beds have been found west of them. It has been stated by practical iron manufacturers, from Pennsylvania, who have examined the ore beds along the line of this road, that iron can be manufactured there and delivered in New York ten dollars a ton cheaper than the same can be done from prominent iron centers in Pennsylvania.

The advantages of this road to Richmond must be very great. The road runs through the tobacco belt, and as Richmond has held the front rank as a tobacco mart, she must draw the larger part of the product of West Virginia, Kentucky and Ohio, and thus largely increase her trade in this staple.

The flouring mills of Richmond have, it is said, a capacity of four thousand barrels per day, and at present can run only a part of the time for want of wheat. This road will supply

the deficiency with Western wheat at low rates. This will enable the millers to grind with more economy, and indirectly enable them to control the Virginia wheat; the flour from which, sold in Southern marts, will bring a return in coffee and other articles, which by this road can find the cheapest freights to Western cities.

MINERAL DEPOSITS OF WEST VIRGINIA.

COAL, IRON, SALT, LIME, OIL, &c.

[From an elaborate Treatise entitled "Coal, Iron and Oil," by Messrs. Daddow & Bannan—the former a practical Mining Engineer, and the latter the Editor and Proprietor of the Pottsville *Mining Journal*,—a work regarded as standard and reliable on those subjects, and altogether the most recent, exhaustive and valuable treatise on the Coal and Iron deposits of the United States extant, Chapter xviii.]

West Virginia contains a larger portion of the Alleghany coal-field than any of the States enumerated through which it extends. Over 16,000 square miles of this great coal-field lie in Western and Eastern Virginia; of this area, however, only a few miles exist in Old Virginia, on the eastern edge of the field, in the south-west,—perhaps less than 150 square miles of available coal. But the best and most available portion of the Alleghany coal-field lies in West Virginia, and the greater portion of the vast area is naturally opened to development by the numereus streams which traverse its face from east to west.

The Great Kanawha river, running off at right angles from the Ohio, traverses the richest portions of the Great Alleghany coal-fields, cutting the coal measures of the region—2000 feet thick—to their base, and developing their exhaustless mineral treasures in the most available manner for practical production. But, after performing this most acceptable service to the future prosperity of the West, it renders the benefits conferred still more valuable, by dividing the otherwise impassable Apalachian chain at right angles, and taking the *nearest course* to the waters of the East, thus opening the most available route from the great rivers of the West to the seaports of the East, and connecting the minerals of the older geological formations—the iron, lead, copper, &c.—with the coal of the Alleghany.

* * * * * * In no other portion of our country, North or South, are there more inviting prospects to labor, enterprise, and capital, than is now

presented in the Great Kanawha valley. Not only its unlimited mineral resources invite attention, but the best portion of the trade of the Great Mississippi valley may be diverted into the channel of the Kanawha by ordinary means. To those who have observed the prodigious growth of that trade, and the still superior proportions it must assume in the future, the questions we are discussing of this new route to the East will not be a matter of speculation, but of necessity. The routes now provided will not accommodate it, while the superior advantages offered by this route, in the hands of a free and enterprising people, cannot fail to attract attention. The *distance*, the *elevation*, the freedom from *ice*, and the constant supply of *water* from the mouth of the Kanawha, all present important and available advantages which cannot be overlooked.

THE COALS OF THE GREAT KANAWHA REGION,

As we shall specially describe, are of various constituencies, and are adaptable to all the requirements of the trades and manufactures. The *hard* and *caking*, with the fat and gaseous bituminous, the variable splint, and the rich and oily cannel, are all found in the same mountains, and are all accessible to the miner and to navigation, through the agencies of the eroding waters, which have exposed coal in a thousand places.

The avenues to markets afford the cheapest and most available transportation on navigable rivers; while the markets themselves are unlimited in extent, and rapidly increasing their consumption.

The whole valley of the Mississippi is open beyond controlling competition to the trade and the production of this region, while the present avenues to the East and the commerce of the world are but little less available than from the older and more developed centers, with *this* advantage ever open to the Kanawha region.

Coal river, Elk river, and Gauley diverge from the Great Kanawha and spread their branches over one of the richest and most magnificent coal regions in the world, and bring

down their wealth to one common centre on the Great Kanawha; or such might and may be the result under future dedelopments.

The coals of this region, generally, are better, purer, and more available for all the requirements of trade and manufacture than the coals of any other portion of the Alleghany coal-field. The seams of coal are more numerous and their thickness greater than in any other portion of this coal-field; it can be mined cheaper and with more economy generally, under the same rates of labor, than in any other region in this country, without exception. The markets of the West, or the great Ohio and Mississippi valleys, are open beyond any controlling competition to the trade of the Kanawha in *coal*, *oil*, *salt*, *iron* and *lumber*. * * * The principal volume of the great and rapidly increasing trade of the West may be diverted to the seaports of the East, *via* the Kanawha Valley, with much economy in time and transporting power.

The geological reports on the coals of West Virginia make the number of workable seams to be 13; but 14 have been developed on the dividing ridge between the waters of the Great Kanawha and Coal rivers, on a line with Lenn's creek, and in all probability these are all below the Pittsburg seam. But here every seam appears to have reached a maximum size for the bituminous formations. While B and E are not as large as found in a few other localities, the intervening seams, which in other portions of the field are of no commercial or workable value, are here found in workable size, or from 2 to 3 feet in diameter. The number of workable seams are greater than those found within the same measures in Pennsylvania, any place, not excepting the anthracite fields, though the total amount of coal is less than that which is found at many points in the anthracite regions. But were we to count all the seams, both small and large, in the western part of the anthracite measures, they would correspond nearly with the coal-seams found on the Great Kanawha. We have stated our belief, however, that the cannel coal-seams have no counterpart in the anthracite regions—that they appear within the rich bituminous shale, which does not exist in the Eastern maesures; and, consequently, three of

the numerous seams in the Kanawha section are thus accounted for.

We may also here notice a fact which may be interesting, and which may have some connection with the divisions of the seams in this locality, and *vice versa.*

It will be found farther on that the coal measures in Western Kentucky, and in the same general geological range or position in the great basin with the Kanawha, are in like manner divided and represented by numerous small seams instead of a few large ones, as in some portions of the anthracite regions, where the coal measures reach the same elevation.

The seams which we give in the following table exist, we have reason to believe, under the Pittsburg seam, and do not, therefore, represent all the productive coal measures of West Virginia. There are still several seams found in the higher grounds back from the river, or on the head-waters of Elk, Coal, Gauley, and other large streams emptying into the Great Kanawha ; also on the Little Kanawha, Guyandotte, Big Sandy, &c. Yet we have not found the same productive condition in any other part of the Great Alleghany coal-field as compared with the measures between Coal and Kanawha rivers. The thickness of the strata is estimated in this table, but the seams have been practically developed.

A short distance above the conglomerate a small seam exists, not considered workable. But about fifty feet from the conglomerate a variable seam is found, ranging from five to ten feet in thickness ; this coal in all probability lies below the level of Lenn's creek, at the forks, and is not found above *water-level.* Above this exists the large seam of iron ore to be noticed farther on. The third seam of coal appears to be small, but varies from two to four feet. The fourth is a cannel coal of about four feet, but varies from three to six feet. The fifth seam is a hard bituminous, ranging from two to four feet in thickness. The sixth is likewise bituminous, but not generally over three or four feet thick, and is sometimes smaller. The seventh seam, sometimes cannel coal, ranges from three to five feet thick. The eighth and ninth are hard, bituminous seams, from thirty inches to four feet thick. The

tenth seam is generally large, ranging from seven to ten feet, but is divided by fire-clay, which sometimes, in practical effect, makes two workable seams of the one. The eleventh is a fine cannel seam, known as the "Peytona" (?) cannel, five to six feet thick. The twelfth, thirteenth and fourteenth are not opened or developed, but, from appearances, are known to be seams of good workable dimensions, and one of them is supposed to be cannel. The average dimensions of the seams and the thickness of the intervening strata are about as given in the accompanying table:

DIMENSIONS OF SEAMS AND THICKNESS OF STRATA ON THE LAND BETWEEN KANAWHA AND COAL RIVERS.*

			Feet.	Feet.	
A	No.	1, coal on the conglomerate	30	2	A
B	"	2, coal and intervening measures	50	6	B
	"	3, coal and " "	100	3	
	"	4, coal cannel " "	90	5	
C	"	5, coal " "	95	3	C
	"	6, coal	80	2½	
	"	7, coal, sometimes cannel "	100	3	
D	"	8, coal " " "	85	2	D
E	"	9, coal " " "	90	2½	E
	"	10, coal " " "	50	10	
	"	11, coal cannel " "	100	6	
F	"	12, coal " "	100	4	F
?	"	13, coal cannel ? " "	195	5 ?	
	"	14, coal " "	80	3 ?	
		Coal measures	1250 coal	50	

THE GREAT KANAWHA AS A MINING AND MANUFACTURING REGION.

The salines of the Great Kanawha have been celebrated and productive for a period of fifty years; and, though the brine is not so dense or saturated with salt as the production of many of our best salines, the availability and cheapness of the material and means of evaporation render the economy of manufacturing more favorable than that of most salines and, we should infer, equal to the best.

Take one instance—which will cover all; for the same

* The thickness of the measures is perhaps exaggerated, as they are only estimates. The coal-seams, however, are actual developments as far as No. 11.

means are available to all. A salt-well is bored to the salt strata and through the upper or heavy oils, and carefully tubed to the brine. The well is then bored from 500 to 1000 feet deeper, until the gas of the second or light oils is struck, as shown by figure 000 under the head of Petroleum. Sometimes this gas exists in such a state of tension that, on being tapped, it bursts forth with the violence of gunpowder, but this violence is soon blown off, and the gas continues to flow with considerable force, or with force enough to blow the brine up the tube and into the salt-works, and then, passing on to the fire, under the evaporating furnaces, is there used as fuel instead of coal. The gas thus pumps the brine into the tanks and evaporotes it in the kettles. With proper fixtures and mechanical arrangements, the cost of producing salt under such circumstances would be merely nominal. We cannot see how any other mode could be more economical ; even if solar evaporation be used, the cost of pumping is saved.

Our remarks on the oil or petroleum of this region will be reserved for a more appropriate place in another chapter. We may state, however, that the region of gas above mentioned lies immediately over the great reservoirs of oil which have been so productive in Pennsylvania and on the Little Kanawha in this State.

IRON ORES.

Two prominent seams of iron ore exist,—one as shown by figure 124, on its proper geological level over B, as found and worked at Johnstown, Cambria county, Pennsylvania, and which exist in variable quality and quantity wherever this seam of coal exists. In some places it is rich and productive, while in others it is lean and worthless. Here, however, it appears at the surface as a brown oxide of great richness, yielding 60 per cent. of metal in the furnace; but the bed is naturally a calcareous ore, where not oxidized, yielding here from 40 to 45 per cent. of metallic iron. Its size is from 3 to 4 feet when in its best condition, accompanied, however, by leaner shales or argillaceous ores.

COAL OIL.

The manufacture of coal oil from the rich cannel coal of the Kanawha was extensively carried on in that region before the war, and practical men who know the cost and have calculated the profits by experience state that, as a general rule, more money may be made in manufacturing this oil from the coal than by boring for it and obtaining it in a natural state. The one is certain and continuous, while the other is uncertain and precarious. The first depends on skill and capital; the second, on a fortunate "strike"—which, unfortunately, is not the rule, but the exception: far more blanks than prizes are drawn from oil wells.

But when the manufacturing of oil from coal is conducted with the proper skill and judgment, the results are certain; and in no place can this be done with more success that in the Great Kanawha valley, because in no other locality are there richer coals or a more abundant supply, while timber for barrels and other accessory means are abundant and available.

The best cannel coal, when properly treated on the large scale, will yield 60 gallons of crude oil to the ton; and the cost of the mining and manipulation ought not to exceed $2.50 per ton—which, at even 10 cents per gallon in the tanks, would leave a large profit on the oil produced.

It will thus appear that the Great Kanawha valley is not only a great natural mining and manufacturing region, but one that may enjoy the greatest trade that ever flowed from the mountains or the inland plains and valleys to the sea. The coal, iron, oil, and salt of this region are inexhaustible, and may be produced with the minimum of labor and expense, and, consequently, the maximum of profits.

We have long beheld the vast mineral resources of this part of the Great Alleghany coal-field with professional admiration, and have frequently called attention to their valae. If we now *seem* partial to West Virginia, we can prove that our affections have always turned towards her unlimited

stores of coal and iron with an ardent desire to be able to pronounce the "open sesame" which should expose her treasures to the world.

THE ALLEGHANY COAL-FIELD IN KENTUCKY.

We shall briefly present a few of the leading features of this portion of the great coal-field, since it is but little developed, and presents but few points of special interest, where the coal is intersected by navigable rivers, since it lies near the head of the streams. Its margin, of course, on the north lies along the Ohio; but we think the Big Sandy and the Cumberland are the only navigable waters which intersect it. The Big Sandy runs its full length over or among coal-beds, but only the upper waters of the Cumberland, which are seldom navigable, reach this coal-field. None of the Kentucky railroads penetrate its almost unbroken area,* except a short branch at Ironton on the Ohio. The coal-area occupies all or part of twenty counties in Eastern Kentucky, and embraces an extent of 10,000 square miles. The western margin of the field enters Kentucky near Portsmouth on the Ohio, and leaves it near Monticello, a short distance below and east of which it crosses into Tennessee, the general course being south-west.

THE NEW RIVER ORE-BANKS.

Not only on both banks of the New river are the brown oxides of the limestones found, but the red and brown oxides of the copper region are also penetrated by this stream. It runs for fifty miles through the rich limestone valley, abounding in iron and lead, and then enters the Azoic formations to the east, formerly described in this connection, where immense masses of red and brown ores exist. Below the valley,

[* The *Elizabethtown, Lexington and Big Sandy R. R. Co.* are now (1872) actively constructing their line which skirts the coal fields of Kentucky for half its length. It connects with the *Chesapeake and Ohio R. R.* at its eastern terminus, and with the *Louisville, Cincinnati and Lexington R. R.* at is western terminus.—Ed.]

or west of the valley limestones, the river enters the mountain ranges of the formations overlying the Matinal. These mountain-ranges are made up of heavy sandstones, slates, and limestones, and contain numerous masses of brown ores, as developed in Giles, Craig, Monroe, Alleghany, Mercer, and Tazewell counties.

These ores may not be of any great value for the production of iron locally, because the timber to produce charcoal will not be adequate or in proportion, though the mountain or azoic region in Floyd, Carroll, and Grayson counties is almost an unbroken primeval forest, and the counties before named, to the west of the valley, also possess an abundance of timber; but these resources are insignificant, when compared with the resources of this region in iron ores.

But the Alleghany coal field is in available proximity, and the coals of the Great Kanawha and the ores of the New river, in Virginia and North Carolina, are both on a scale of equal magnitude. We will not exaggerate if we compare the resources of the Kanawha in this respect to the most favored localities in Pennsylvania, not even excepting the Lehigh region, with its coal and iron. The only requirements are enterprise and capital to develop these resources and to combine the coal and the ores by rail.*

[* The completion of the Chesapeake and Ohio Railroad across this belt of mineral territory, supplies the medium desired for the most extensive interchange of ores and fuel; and at the same time opens these wonderful deposits, and their manufactured products, to the markets both East and West.—Ed.]

B.M.
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W.P.A. #6430