RIVER COURSES—CANALS—OIL VEINS.

[For the Scientific American]

In a previous article on the oil regions of Pennsylvania, the position was taken that the rivers and creeks had dug their own channels to the depths at which they are now found below the general table lands above, instead of the latter having been individually upheaved, as most persons appear to believe. After having formed this theory by a personal examination of the country, it was some satisfaction to the writer to find this view sustained by such an authority as Professor W. D. Rogers, in his geological report on that State. "The Alleghany River," he observes, "flows through a deep and narrow trench, excavated in the north-western plateau and western coal basin of the State, entering the north-west margin of the coal basin at Warren." Again: "It is evident that while the main discharge of the eroding wave was south-westward, one large influx of eroding waters swept north-westward of the Appalachian Mountains, and another south-eastward from the regions of the lakes." It is to these several agencies that he attributes the remarkable course of that river—now northward into New York, next south-west, then south-east, and finally south-west to Pittsburgh, beyond which the Ohio proceeds north-west, and then westward, before passing out of Pennsylvania. Yet on all this distance the river has never been once deflected from its course by what can be styled a chain of mountains; and the hills are nothing but bluffs through which it has excavated its own channel.

That the entire oil regions, in common with the great Mississippi basin, were upheaved from the ocean bed is a point which admits of no reasonable doubt. As the several layers of sedimentary rocks composing it (nearly all which are absent in New England and Eastern New York and New Jersey) were formed, the sea would appear to have gradually kept sinking to enable the masses of sand to become sand-stone rocks, clays to become shales, peat bogs and forests to become coal beds, gravel beds to become conglomerates, etc. This done, each layer having received its own collections of plants and marine or fresh-water shell-fishes, as the case might be, the whole country was gradually and gently upheaved to its present elevation, the operation being so easy as scarcely to disturb the beds of rocks composing the different strata of the Great West. Traveling along the lines of the Erie and the Pennsylvania Central Railroads, one may observe, on approaching the Alleghanies, synclinal and anti-clinal beds of perhaps ten miles in width, and in places twenty degrees from the horizontal; but along the Alleghany and the Ohio the dip is scarcely perceptible—seldom as much as three or four degrees. The lines of sand-stone and shale are arranged as regularly as the leaves of a book. In the course of more than two hundred miles' travel on foot through the oil region of Pennsylvania, the writer has not been able to observe one violent dislocation in the rocks beyond that produced by huge masses sliding from the summits. He was told, indeed, that such irregularities existed, but failed to find an example. Perhaps to the exception stated should be added the contortions made in the soft shale by huge trees, now petrified, around whose stems of thirty or forty inches diameter the clay had been bent and twisted, so that the horizontal lines were broken.

Before discussing the practical bearings of this subject, it may be proper to explain another feature in the physical formation of the valleys of the Alleghany, Oil Creek, French Creek, etc. In traversing their tortuous courses, which are often loops rather than mere bends, the visitor will observe that the bluffs opposite each convexity are high and precipitous, while the headlands embraced within the curve or concave side of the river slope gradually and gently down to its margin. Illustrations of this may be found every mile or two, and the rule may be set down as general, if not universal. The explanation of that phenomenon is manifestly this: Like every other substance, water has a tendency to move in straight lines. The slight undulations originally existing on the surface of the plateau, together with the agencies alluded to by Professor Rogers, caused the currents to bend this way and that, instead of pursuing a direct course. As the waters were deflected by one elevation, they turned off at an angle, and struck against the next opposing hight, undermining it more or less, and causing its upper series of rocks or clays to fall down to the river bed, in which they were gradualiy dissolved or ground together and carried away. Thus it came to pass that a double action was carried on during the thousands of years or of centuries in which these water-courses were forming. The first was downward, its action gradually decreasing as the channel approached the sea level; the second was outward at the several curves in its course, by striking against the elevated lands, which gradually became bluffs and precipices, in many cases too steep for human foot to climb without the assistance of the hands.

This centrifugal action of the waters, as it may be termed, has kept on for ages, actually increasing the length of the rivers and creeks, whose deep channels invariably lie as close on the outsides of the several curves as the masses of falling debris will permit. Boatmen and raftsmen understand this "law" thoroughly, though failing to comprehend its *rationale*. For in seeking the deepest channel downward or a shallower channel with little current upward, they steer for the concave or convex shore, as the case may be. Travelers on the Potomac, the James, or other rivers in alluvial countries. will have observed that the boat makes no short cuts at bends, having to stand out well from the shallows lying opposite to the various headlands. On the Alleghany these headlands are usually cultivated—in fact, they are the only cultivated soils on the slopes. In some cases, as at Tidioute, villages have been built upon these gentle inclinations.

Now for some of the practical lessons deducible from this explanation of the river-courses of the West. Major-General Butler undertook to force the James into a new channel at Dutch Gap, as Major-General Grant had undertaken with the Mississippi at Vicksburg. Both failed. The current refused to forsake its round-about course and seek the bed of the cut-off, or adopt any other "modern improvement." The trouble lay here: In both cases the river coming down by a pretty straight line struck a bluff a short distance above the upper end of the proposed canal. There the stream was deflected from its course, and struck off at nearly a right angle—one in the direction of another bluff (undermined) known as the Howlett House, the other against that on which Vicksburg stands (also undermined). Had the artificial channels been constructed further inland, or been so bent that their upper termini would have set up against the current of the river, as it struck off toward the opposite shore, there can be no doubt that both projects would have proved successful. In the case of the Dutch Gap work, if it had been located only two hundred yards nearer Bermuda, or if, instead of a straight course, it had adopted the serpentine, its northern entrance opening to receive the waters as they struck the bluff, the James would have rushed through it, and in the course of a few hours removed all obstructions. Yet the possibility of failure, from the cause stated, would seem never to have entered the head of military officer or civil engineer. Neither had studied the philosophy of water-courses.

Once more: There is an impression among men engaged in the oil regions, though not so strong as formerly, that river beds, headlands, bluffs, and table-lands, as such, have something to do with the discovery of oil; that, aside from the veins known to exist beneath the surface, one is more likely to succeed on the east than on the west side; close to the bluffs rather than by the streams; on the bottoms rather than on the plateaus. This is all moonshine. The first discoveries were made in bottom-lands, simply because the oil of the first sand-rocks could more easily force itself to the surface in the valleys than on the hights. As to any other distribution, it is absurd to expect it. At so much greater outlay for drilling, in the first place, and working the machinery afterward, together with the greater risk to seed-bags, tubes, pump fixtures, etc., oil can be obtained as readily on the hights as in the hollows, provided the oil veins are struck. That these are distributed pretty equally throughout what is known as the oil basin, without any reference whatever to upland or lowland, is manifest to all who have studied the physical formation of the country. In the writer's judgment, they have no connection or relation whatever to the coal-beds, which are many hundreds of feet higher geologically; while the structure of the rocks is such that it were impossible for oil, salt water and gas to have percolated downward through one thousand feet of solid rock—a depth to which fresh water is never found to penetrate without artificial channels. If we could even suppose that the oil had first worked its way downward, the gas being formed subsequently, an answer can readily be found in the fact that in the process of distillation the salt water would have become decomposed, and carbonic acid gas, instead of carbureted hydrogen, been evolved from the combination. If there is one truth more than another evident from the oil discoveries, it is that petroleum is as much an older formation than coal as coal is older than wood or peat. To comprehend it aright, we must study it from this point of view.

Correspondence

The Harrison Steam Boiler.

MESSRS. EDITORS:—Referring to your remarks on the Harrison steam boiler, published in your number of April 29th, I wish to say a word in regard to the *strength* of this boiler. In making many experiments to test the bursting strength of the spheres under hydraulic pressure, no sound casting ever gave way under *fifteen hundred pounds* to the square inch; it was not unusual for them to resist *two thousand pounds*, and this, too, when made of iron of no greater strength than the best brands of Scotch pig metal In a practical experience of several years with boilers varying from 5 to 200 horse power, explosions have never happened under any circumstances. Extreme pressure will open its joints before any thing gives way, thus making each joint a safety valve. A cracked sphere may produce a leak, but a boiler under pressure has never been suddenly emptied from such a cause. Instances have once or twice occurred where a cracked sphere has been continued for some time after the fracture was discovered, with no troublesome consequences from the leakage, and no necessity for instant repairs.

There have been but four fractures of spheres in all the boilers mentioned in the advertisement now in your journal, and in every case these could be fairly traced to special causes not connected with pressure. In my experience with this boiler, several have been *burnt*, or, in other words, rendered unfit for service for the moment by overheating after the water had fallen too low. The result in such case is obvious; spheres with no water inside and intense heat outside, are soon heated to redness and warped so much that the integrity of the joints is destroyed, causing the boiler at the injured parts to leak badly, but nothing like an explosion occurs. With great facility and little cost of time or money, the injured parts, in such a case, can be taken out and replaced by new ones, without even the use of highly-skilled workmen, after which the boiler is as good as before the accident. Some of these boilers are working daily at 180 pounds pressure to the square inch; and a good evidence of their value is shown in the fact that several parties, who have used the boiler longest in this country, have already in use, or have sent me orders for, a second one.

With this boiler on our Western steamboats, to which it can be easily adapted, such wholesale destruction of human life as took place on the *Sultana* a few days ago, *cannot possibly occur*.

JOSEPH HARRISON, JR., patentee.

Philadelphia, Pa., May 2, 1865.

Saleratus and the Teeth.

MESSRS. EDITORS:—The ground taken by a recent writer in your journal is not well founded. He asserts that saleratus or soda will dissolve the teeth or render them carious. His experiments do not prove it, though his deductions are true to a certain extent. It is true that a strong alkali will dissolve, or has affinity for, the lower part or root of the tooth, for this part of the tooth, together with lime, is composed of gelatine and albumen, which an alkali will dissolve. But the enamel is composed almost entirely of