PETROLEUM, ITS HISTORY AND USES

One of the Greatest of Our Industries Entertainigly Described.

ITS ORIGIN BAFFLES THE SAVANTS

Many Theories Advanced but None Fits All the Facts--Text of an Interesting and Instructive Paper Recently Read by Dr. W. F. Connors Before the Lackawanna Institute of History and Science.

It has been said a country is rich in proportion to its mineral wealth; in that respect, the United States surpasses all others, and Pennsylvania any state in the union. The discovery of petroleum for illuminating purposes has been of incalculable benefit to the human race, for during the past thirty years and more it has added at least one-eighth to each and every day of the civilized inhabitants of the world.

The earliest history speaks of petroleum and its various uses, but it was left for Samuel W. Kier, of Pittsburg, in 1849-50 to discover its value as an illuminant; and from a small refinery of forty gallons a day it has grown to be one of the most gigantic industries the world has ever known, extending even across the great Sahara desert in Africa to the remotest corners of the earth. It has made many multi-millionaires; but be it said to the credit of the Standard Oil company that it has never taken undue advantage of its ability to increase the cost to the consumer; that it pays its labor the highest wages, and that there has never been a strike, to my knowledge, among its employes.

OIL IN CRUDE FORM.

As taken from the earth petroleum is of a dark brown color, which, by reflected light, appears greenish. It is about as thick as thin molasses, getting thicker in cold weather, but never freezing. It is a hydro-carbon of a peculiar penetrating odor which differs largely in the different fields. Generally its odor is of naptha, which it contains, but that which comes from the vicinity of Lima, O., smells like a mixture of burning sulphur or rotten eggs, and is even found after a brief period in the refined product. For a long time the oil from that region was successfully used as fuel; it contains a smaller proportion of lamp oil, but the demands for the latter are in excess of the amount produced and its use for fuel has been discontinued.

THE FIRST WELL.

The first well was drilled near Titusville, Pa., in August, 1850, by Colonel Drake, and oil and gas were found at sixty-nine feet from the surface, and yielded what at that time was a phenomenal quantity, 400 gallons per day, though by deeper drilling since, a single well has thrown out over 4,000 barrels a day, equal to 160,000 gallons.

Pithole, Venango county, was the center of early active operations, and the experience of people during these days of excitement would rival the tale of Monte Cristo or the Arabian Nights. In May, 1865, Pithole was laid out and six months later it had 500 houses, 50 of which were hotels, three of which cost in constructing over $80,000 apiece, and its postoffice was the second in the state. In one instance $24,000 was given for the privilege of drilling a well on a single one-half acre of land; speculation was rife, men carried as high as $50,000 in their pockets and slept on the floors of hotels, and many people formed companies and sold lands they never possessed to gullible buyers; and the capital stock of companies in that year reached $600,000,000. Reaction followed in 1867-68, and machinery that cost $2,500 to $3,000 sold for $25 to $50; but good business men made money and saved it. One well alone earned for its owners over $3,000,000. But, alas, poor Pithole! Now you would need a trusty guide to locate it.

THE PIPE LINES.

During recent years the surplus oil has been stored in large tanks holding 25,000 to 35,000 barrels, torn down and built up as the fields changed and ten years ago there was nearly 30,000,000 barrels stored on the surface in these large reservoirs. The oil is pumped from the small tanks at the wells to the stations and from them not only into the big tanks, but by a series of stations, situated about thirty to forty miles apart, to the seaboard, thus saving vast sums of money in barreling and transportation.

For a number of years oil was barrelled and sent to Pittsburg on flat boats from Oil Creek, a distance of 132 miles. Later, refineries were built along the creek and large iron tank cars constructed, holding about sixty barrels, on which the refined product was conveyed to all parts of the United States and to the seaports for export to Europe. Now large iron tank steamers carry the export oil across the ocean.

GEOLOGICALLY CONSIDERED.

The geological strata in which oil is found consists of conglomerate slates and shales. Conglomerate rock is made up of pebbles mixed with more or less sand and all cemented into a close, hard rock. These pebbles vary in size and quality in various localities, being usually of quartz, though some times sandstone, and they are found from the size of a pea to that of a goose egg, and occasionally larger. They have evidently been thrown together in their present shape by the action of water tumbling pushing and rolling them together. The conglomerates of the location mentioned belong to the vespertine formation of the Pennsylvania survey. It is found in situ in its native bed only upon the tops of the highest hills; but pieces of it which have been broken off by their own weight, after the softer rock beneath had been decomposed and washed away, are found scattered over the hillsides, sometimes in immense blocks, which are so enduring as to defy the action of the elements and bear record in their ruins of the former conditions and changes, which their more yielding neighbors, the sandstones and slates, could not withstand.

As found here it is not coarse, the pebbles being rarely larger than hickory nuts, and they become smaller as we trace this formation westward, while the opposite will hold good as we go eastward. The accompanying vespertine sandstone and slates also becomes finer in their textures, and the whole formation becomes thinner as it spreads westward from 2,600 feet on the Susquehanna river to not more than 100 to 150 feet on Oil Creek. From this thinning down of the mass toward the westward and a corresponding change in the texture from coarse to fine we are led to believe the material from which these rocks are composed was derived from a continent lying on the east or northwest of the Appalachian ranges, previous to their upheaval, and that these materials after being brought down to the sea through the channels of rivers flowing west and southwest were distributed to their present location by the powerful ocean currents that were undoubtedly subject to laws similar to those which govern our present great rivers to the sea.

AN ILLUSTRATION.

For a familiar illustration take a long mill pond or lake with a creek flowing into it at one extremity and out at the opposite, the creek will bring down, especially at the time of a flood, large quantities of loose stone, pebbles, sand, black mud, vegetable mould, and blue mud or clay; and it will dispose them over the bottom of the pond or lake in the order in which we have named them, that is, at the upper end of the lake. At the mouth of the creek will be found the large stones, then the smaller ones or pebbles; then, as the current becomes less, the black mud was deposited, and finally the blue clay, which the water held longest and carried farthest; and the beds will be found to become thinner as they become finer in texture, thus corresponding to the conglomerates, sandstones, slates and shales of the New York state and Pennsylvania formations of the second series.

It will be readily inferred from the above that a sandstone is only a very fine conglomerate; also that black carbonaceous slates may be attributed to vegetable origin; and, that argillaceous shales, or the soapstones of the oil regions, are derived from clayey formations. The vergent series of rocks so called by Professor Rogers is immediately below the vespertine and it corresponds to the Chemung and Portage groups of the New York state geologists. This formation consists of sandstones, slates and shales interspersed with the sandstones, in their layers, varying from five to fifty feet in thickness, while the slates and shales are found in immense deposits, sometimes 800 or 1,000 feet in thickness. To this series doubtless belong the sandstones, slates and shales which appear in the bluffs along the valley of Oil Creek through its entire length; also the first, second and third sand rocks of the wells with the intervening slates and shales, and how much deeper it extends is unknown. The fourth sand rock of Pithole corresponds with the third of Oil Creek, because the second is split into a stray sand. The rocks above described are stated to belong to the Paleozoic rocks, because containing the most ancient remains of ancient animal and vegetable life yet discovered, stretching all the way between the gneissic formations beneath and the lowest of the coal deposits above. Sometimes they are denominated "fossiliferous," "sedimentary" or "secondary" rocks.

KEYSTONE FORMATIONS.

In Pennsylvania, says Professor Rogers, who is considered the highest authority, and to whom I am indebted for the foregoing description, this class has been deposited during the four earliest periods of the great European divisions, namely the Cambrian, Silurian, Devonion and Curboniferous. No traces of the fifth or Permian group, has been found in North America. The prolonged succession of sedimentary action closed with the close of the Cambrian system, being terminated by the upheaval of the ocean, in whose broad bed, and around whose margin these deposits had collected. The same eminent authority states that the vergent series abounds in the remains of Marine vegetation, and also that the aggregate thickness of all the rocks belonging to the class above described measured at their greatest depths not more than thirty-five thousand feet. The sand rocks of McKean county belong to an entirely different strata. West of the Alleghenies there is a dip of the coal strata which crops out in McKean county on the top of the highest hills of eleven feet to the mile, irregular 20 to 21 in oil field on a line 32 degrees west of south, and toward the Gulf of Mexico. This strata overlies the conglomerate or third sand by 60 feet, but here the McKean county third sand underlies that of the lower oil country by 2,200 feet, and if an entirely different composition, being reddish in color, resembling chocolate grounds and abounding in fine shells, which are not found in the other regions.

By actual measurement one well on Oil Creek was drilled through 32 feet of earth, 168 feet of slate rock to first sand, which was 20 feet deep, then through another strata of slate 115 feet to second sand, 25 feet thick, then 110 feet of slate rock to third sand of 20 feet, making in all 470 feet to the top of third sand, which was 25 feet thick.

SHOOTING A WELL.

Some wells flow at irregular intervals, while the quantity of gas in others is sufficient to blow the oil out. Others have to be piped to the bottom and the oil pumped or lifted out, often from a depth of 2,000 feet several times a day as it accumulates. After a well has been drilled to the proper depth and sand in order to loosen the rock and make a pocket for the oil to gather in a torpedo, which consists of a tube of tin 2x4 inches in diameter is anchored near its mouth and from 10 to 40 quarts of nitroglycerine poured into it, and on top is placed a percussion cap and all lowered, and when in readiness a weight is dropped down which strikes the cap, exploding the nitroglycerine, and then follows a magnificient sight. At first there is heard a rustling sand followed by a noise like distant thunder, which increases in volume, and shortly a black column of oil which retains the form of the tubing, is carried more than 100 feet up through the derrick, where it spreads out in the form of a spray, and like a sudden shower on a sunny day is sprinkled over the vicinity of the well, covering the new timber with mud and oil; this is followed by a perfect fusilade of stones of all sizes up to a goose egg; then all is quite for a little while, when the well flows again if it is a large one, or it may continue to flow constantly or at intervals for hours or days, throwing out thousands of barrels like a huge hole spouting, or it may cease after being shot and compel its owner to pump the oil out. When a big well is expected arrangements are made by the erection of large tanks to store the oil and when it first ows it is connected by a series of pipes to them, but when an unusual well is found and its thousands of barrels are poured into the nearest stream it becomes a source of danger to everyone living along its torturous way.

Geologists have stated that there was no oil east of the Alleghenies and it was left for the wild-cat driller to demonstrate that large quantities of oil existed in western New York and gas has been found in many places in that state and in paying quantities, in Oswego county, and it would not be surprising to find oil even farther east.

Many theories have been advanced as to the origin or causes which lead to the production of oil some of them very ingenious; but most of them wanting in some essential feature. If oil was always found in the same strata, if it was always of the same uniform character many of these theories would be more valuable; but why should the oil found on Oil Creek be of a specific gravity of 57 baum and that from Franklin, less than ten miles away, be of a 20 baum and of an entirely different character, the former worth $1.00 per barrel for light while the latter is worth six to eight dollars as a lubricant? Again that found in Canada is impregnated with aeroleine, a pungent substance very irritating to the lungs and throat and found in fish oil by the distillation, while nothing of the kind exists in Pennsylvania petroleum.

Another writer says "the transformation of wood fibre into oil is a chemical change, taking place always out of contact with atmospheric air, and usually under water, but by no means connected with any geological period. As for instance, the coal period with which many intelligent people associate it.

Dr. Gresner says: "During the passage of vegetable substances into coal ther is an escape of vast quantities of carbon confined with hydrogen; it is only necessary that he gases of these elements should be condensed to produce hydrocarbon oils; the operation is a decomposing and combining one and the new combinations formed during the transmutation of wood into coal have a close anology to those produced during the distillation of wood without the admission of air; the gases generated in strata of coal and coal strata are always under great pressure which tends to their condensation and the consequent formation of oil."

OF VEGETABLE ORIGIN?

"That coal has been derived from vegetables is undoubted; peat and wood are found to pass by insensible shades into lignite, lignite into compact, bituminous coal and the end of the transformation appears in anthracite from which nearly all the hydrogen has been expelled and carbon remains. From the expulsion of oxygen, carbon and hydrogen from wood and the variety it presents until it forms true coal heat has not been necessary, although it has doubtless exercised a powerful influence in connection with those chemical changes ever going forward in the earth.

"The condensation of hydrogen and carbon producing oil and the fact of strata of coal and shale before they reach the maximum of carbonization, giving out these elements in great quantities under pressure and the tendency of these gases and oils to diffuse reasons for finding oil in formations having no traces of vegetation."

Another writer supposes "that the petroleum of Pennsylvania arises from the distillation by subterranean heat of the hydro carbon agents resident in the carbonaceous strata underlying the oil regions."

Still another says: "That the great beds of anthracite coal of Pennsylvania on the southern slope of the Alleghenies are merely the residuary coke, as it were, of a distillation process which has converted their bituminous matter into oil, and distributed it by some convulsion of the earth through the formations beyond the mountain range."

The theory of scientific men of the present day in explanation of the source of salt in the sea is this: "The carbonic acid of the air is constantly acting upon the rocks on the surface of the earth, thus turning them to clay and forming carbonates with soda potash lime and magnesin set free. These are carried down as carbonates to the sea, where the carbonate decomposes the chloride of calcium of its waters and forms common salt and carbonate of lime. This series of action is the source of the salt of the sea of clays and limestone. Organic living beings do not generate the carbonate of lime, but appropriate it when formed for them by chemical reactions; and thus great portions of our limestone rocks are made up of fossil remains. In a volume of limestone there is separated and condensed from the air a large amount of carbonic acid gas. The early atmosphere was therefore very dense and unfit for the sustenance of the higher forms of life, until by far the greater portion of this gas had been removed by thef ormation of the carbonate of lime, and vegetable matter now constituting petroleum."

PRACTICAL LESSONS.

In the brief time allotted to this paper I have only been able to touch lightly on this formation feature of petroleum, but the drill has proven that many of the above theories do not hold true and that geologists of great reputations have been put right by its practical tests.

It is assumed that for every sixty feet we enter the earth towards its center there is an increase of one degree of heat, but instances have occurred in which pellets of ice have been blown from the bottom of a well 600 feet deep, and by the thermometer the temperature has been found in oil coming to the surface at or below the freezing point, and I have often found by dipping the fingers into such oil that it was exceedingly cold.

A very important question here arises, Does the chemical laboratory of nature reproduce the oil as it is removed, or do we exhaust the supply? There are wells still pumping that have continuously supplied oil for upward of twenty-five years, while others are worthless after flowing or pumping for a brief period. A careful estimate of its various wells in different locations a few years ago by the Forest Oil company puts the cost of production at an average of 75 cents per barrel. There is considerable expense connected with keeping a well in working order, as parafine wax collects around the interior of its tubing, frequently requiring that it be pulled out and cleaned. If allowed to stop for a few weeks the production decreases or ceases altogether, as if the oil found other means of exit.

CHEMICAL QUALITIES.

It is a general rule with few exceptions that the harder the rock the greyer the color of the sand, the lighter colored the oil, the smaller the well and the better its staying qualities. When first distilled refined oil has an acid reaction, is water white to a bluish shade; the lowest grade is 100 degrees flash test. That which we generally get is 120 to 150 degrees while headlight runs to 300 degrees. Clean copper remains untouched by refined oil as it contains no oxygen. Clean pottasium remains bright in it, strong sulphur acid decomposes and destroys it, nitric acid changes it as it does other oils to a yellow oily flued; hydrochloric and acetic acid do not affect it at all, neither does litharge or other metalic oxides nor by hydrates of potassa, soda or lime, nor bi-chloride of culcium or many other salts. It is nearly insoluble in pure alcohol only 4 to 5 per cent. being dissolved, but either has the power of completely dissolving it, and if the ether is evaporated it at once assumes its former appearance.

Besides the above grades of oil there are produced from crude petroleum naphtha, rhigoline, an anarsthelic, parafine wax, cosmoline or vasaline, tar and analine dyes besides a neutral oil that resembles sweet oil and is called alboline.