Willis S. Blatchley and Raymond S. Blatchley on Petroleum in Indiana and Illinois: A Note

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The history of oil and gas production in America begins in Pennsylvania. Later, oil fields were found in the cis-Mississippi West, and Ohio and Indiana became leaders in the industry. In 1884 the Lima-Indiana Field was discovered in northwestern Ohio, then extended westward into east-central Indiana in 1886. Production there exceeded the yield in any other area of the United States in the 1890s. In the twentieth century petroleum production reached boom proportions in Illinois along the Wabash River, particularly in Clark, Crawford, and Lawrence counties. Known as the Southeastern Illinois or Old Illinois, the field opened in 1904 with a boom period from 1905 to 1912.¹

Petroleum geology, with its origins in the 1860s, advanced along with the oil fields. In the forefront among petroleum geologists were Willis S. Blatchley and his son, Raymond S. Blatchley. Willis Blatchley wrote about petroleum in Indiana and Illinois and served as Indiana state geologist from 1894 to 1911. Raymond Blatchley became the leading authority on the early petroleum fields of Illinois. Both men achieved first rank in their profession although their works were not as well known as those of many of their colleagues.²

All petroleum geologists in the nineteenth and early-twentieth centuries labored under a disadvantage. The practical oilmen, espe-

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² For the publications of Willis S. Blatchley see Blatchleyana: A List of the Published Writings of W. S. Blatchley ... (Indianapolis, 1930); and Blatchleyana II: A List of the Published Writings of W. S. Blatchley ... (Indianapolis, 1939). Included among Raymond S. Blatchley’s writings are Oil and Gas in Bond, Macoupin and Montgomery Counties, Illinois (Illinois State Geological Survey, Bulletin 28; Urbana, Ill., 1914); and “The Indiana Oolitic Limestone Industry in 1907,” in Thirty-Second Annual Report of the Indiana Department of Geology and Natural Resources (Indianapolis, 1908), 299-459.
WILLIS S. BLATCHLEY

cially in the nineteenth century, preferred the old unscientific means of petroleum prospecting and scorned the findings of the professionals. Not until 1917 when the *Bulletin of the American Association of Petroleum Geologists* began publication did petroleum geology come of age.3

The Blatchleys helped to lay the foundation for the study of petroleum reservoirs in the United States. The early oil and gas reservoirs, especially in Pennsylvania, consisted of sandstones. In fact, oilmen and geologists alike believed that only sandstones would produce petroleum. A surprise ensued with the discovery and development of the Lima-Indiana Field because its petroleum reservoir came from the Trenton limestone that had been transformed ages before into dolomite, a porous rock ideal for holding oil and gas.

Early petroleum geologists, led by Edward Orton, discovered a distinctive structure for the Lima-Indiana Field, which was on the Cincinnati Arch, a huge regional anticline (an upfold or arch in the rock strata). Only that part of the arch made up of dolomite produced petroleum. The arch bifurcated in eastern Indiana, the eastern arm underlying northwestern Ohio referred to as the Findlay Arch and the western arm trending northwestward in Indiana called the Kankakee Arch.

Illinois also had a distinctive structure for the storage of oil and gas. Known as the Illinois Basin, it extended as a spoon-shaped depression under most of Illinois, southwestern Indiana, and western Kentucky. That portion of the Illinois Basin producing petroleum in the prairie state's first oil boom derived from the LaSalle Anticline, which trended in a northwest-southeast direction.

The first oil from the Illinois Basin was produced in 1865. At Terre Haute, Indiana, Chauncey Rose drilled a hole near his hotel, the Terre Haute House. Seeking water, he found oil instead in limestone at 1,629 feet. The output was about two barrels a day.4 That discovery of oil occurred only six years after Edwin L. Drake ushered in the modern petroleum industry with a well near Titusville, Pennsylvania.

Petroleum production in Indiana and Illinois did not amount to much for several years. Major output in Indiana came with the opening of the Lima-Indiana Field extension in 1886. Illinois then entered the picture with its first oil boom in 1905, the same year as the foundation of the Illinois State Geological Survey. That organization, soon after its establishment, commissioned Willis Blatchley to study the Old Illinois Field. The result was *The Petroleum Indus-

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3 The *Bulletin of the American Association of Petroleum Geologists* continues today as the major journal in the field of petroleum geology.

try of Southeastern Illinois, published in 1906. By the time of that report Blatchley had authored numerous accounts of various aspects of the oil industry, including many for the Indiana Department of Geology and Natural Resources. Those comprehensive reports became the major source, with the addition of Orton's work, for the information on the Lima-Indiana Field.

The Illinois Basin yields oil and gas from rocks of Paleozoic age. So, too, does the Cincinnati Arch province. Without the chemical reaction known as dolomitization, however, that province would not have produced petroleum. Willis Blatchley wrote about that transformation. According to the molecular replacement theory, calcium carbonate was replaced by dolomite in a chemical reaction. Blatchley gave the formula—\(2 \text{CaCO}_3 + \text{MgCl}_2 = \text{CaMg(CO}_3)_2 + \text{Ca Cl}_2\) (two molecules of calcium carbonate plus one molecule of chloride of magnesium equal two molecules of dolomite plus one molecule of calcium chloride)—and went on to state:

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Wherever the above change took place, which was only in the shallow, briny areas noted, the resulting dolomite was porous. This porous condition was due to the fact that the new crystals of dolomite were smaller than, and never entirely filled the spaces occupied by, the older crystals of lime carbonate. In other words each crystal of dolomite occupies less space than it did as a crystal of lime. Therefore, between each is a void or small pore which gives space for gas, oil or water, and allows the rapid passage of these substances through the changed limestone.
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Oil and gas entrapped with dolomitized Trenton limestone is normally found in the upper thirty feet of the formation. In some cases, however, the dolomite occurred “at 50 feet and more rarely as much as 100-200 feet below the top of the Trenton.” Whatever the horizon, there was much oil and gas to be found.

In the early days gas production was more important than the oil output in Indiana. In 1886 a well at Kokomo in Howard County produced the first commercial quantity of gas. Production peaked around 1900, when $7,255,000 worth of natural gas was marketed. The first commercial yield of oil, on the other hand, was in 1889 in east-central Indiana. In that year 25,000 barrels went to market. According to

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Willis Blatchley, the commercial output there commenced with a well drilled "by the Northern Indiana Oil Company, on the D. A. Bryson farm near Keystone, Chester Township, Wells County." The oil production from the Trenton limestone reached 2,335,293 barrels in 1893 and peaked in 1904 with 11,281,030 barrels.9

In the annual report of the Indiana Department of Geology and Natural Resources for 1897, Willis Blatchley, then state geologist, discussed the organic and inorganic theories of the origin of oil and gas. Blatchley supported T. Sterry Hunt's organic theory, which had first been proposed in the early 1860s. Known as the primary decomposition theory, it stated that petroleum had "been formed from the remains of animals or plants in the rock strata now yielding the oil . . . ." The oil and gas did not migrate from their origin in the shales; instead, the animal or plant remains "passed directly into petroleum which has since remained in the rocks where it was formed." According to Blatchley, "the facts gathered and observations made in the Trenton-limestone fields of these States [Ohio and Indiana] have furnished much evidence in support of his [Hunt's] theory." Scientists, said Blatchley, accepted the notion that limestone and oil resulted from "the direct decomposition of organisms originally inhabiting the water in which the rock was deposited."10

Most petroleum geologists from the late-nineteenth century to the present have agreed with Willis Blatchley that organic theories for the origin of oil and gas comport better with the known facts on the formation of petroleum than do the inorganic theories. Blatchley also observed that inorganic theories, such as those of M. Berthelot and Dimitriy Ivanovich Mendeljeff, were
to say the least, not only crude and unscientific, but . . . productive of much harm, in that they tend to cause the masses to believe that natural gas and petroleum are being formed as fast as they are used. Such a belief is responsible for much of the reckless waste which has taken place in the gas fields of Indiana in the past; a waste which has already brought the stored supply down close to the limit at which the natural rock pressure of the gas is overcome by salt water."11

In his report for 1897 Willis Blatchley also gave the approximate cost for the first well in the Lima-Indiana Field. The amount was based upon a well drilled to a depth of one thousand feet. The rig cost $275, with the additional expense of $500 for drilling. The total outlay reached $2,180.12

In a report in 1903 Willis Blatchley treated petroleum prospecting in Indiana in some detail. He observed that there were no sur-
face indications of oil and gas in the state. Petroleum existed "only at depths ranging from 500 to 1,600 feet below the surface." Then, too, there were no trends of a northwest-southeast or northeast-southwest direction to follow in the search for oil and gas pools. For that reason, as Blatchley noted, oil and gas "operations in Indiana have always an element of chance connected with them." The state geologist also discounted the use of "hazel rods or what not." He stated: "There is one instrument, and but one, that can be used in locating oil, and that is the drill. All others are and ever will be humbugs..."13

In his report of 1907 Blatchley commented on the decrease in petroleum production in Indiana for 1905. One reason for the decline involved a decrease in the price for oil and gas. In addition, the beginning of the boom in southeastern Illinois in 1905 and the development of fields in mid-continental United States attracted oil operators away from Indiana. In that regard Blatchley complained: "The average oil operator is much like the gold prospector. He is usually eager to let the bird in hand escape when he sees or hears of a new one in the bush."14

Willis Blatchley’s knowledge about petroleum in Indiana, especially in the Lima-Indiana Field, came in large part from the findings of the drill. Information gained from the boring of thousands of holes indicated that four conditions must be met "before an accumulation and preservation of oil in commercial quantities can take place": a porous stratum of the Trenton rock to form a reservoir, an impervious cover above the reservoir, an arched or anticlinal structure of the rock in which the reservoir is located, and a pressure behind the oil to force it into the reservoir. The impervious cover for the Trenton limestone was about two hundred feet of Utica shale.15

In Willis Blatchley’s day the pressure behind the oil and gas was known as rock pressure. “Sometimes,” Blatchley wrote, “this pressure is so great that when the oil stratum is reached the boring tools are expelled from the drill hole, and the oil escapes in a fountain, rising high above the derrick, much of it being lost before the flow can be controlled.”16 That rock pressure resulted from the presence of large quantities of water impinging on the petroleum from the side and came to be called water-drive.

Like his father, Raymond S. Blatchley published extensively on oil fields and oil production. Although he specialized in Illinois petroleum, he first wrote an interesting article for the Indiana Depart-

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15 Ibid., 441-43, quotation on 441.
16 Ibid., 445.
ment of Geology and Natural Resources on the Princeton oil and gas field. Located in Gibson County along the Wabash River in southwestern Indiana, that field dated from 1891 when William R. Wright of Princeton drilled the Evans well on the eastern edge of town. Wright obtained enough gas "to pipe it to the courthouse yard and burn it, so attracting public interest to his well." Four additional wells were soon bored nearby, but none of the five holes produced gas in commercial quantities.\textsuperscript{17}

The commercial production of petroleum in the Princeton area came with the twentieth century. On January 16, 1902, Seth Ward, Sr., S. T. Heston, Eugene Criswell, G. E. Bryant, Harry Kurtz, and J. W. Archer, businessmen from the town, organized the Interstate Oil and Gas Company. They leased three thousand acres in the neighborhood of Princeton and shortly thereafter drilled a hole on the Charles Brownlee farm, one-half mile north of the town limits. Drillers hit a six-foot-thick deposit of asphaltum at 450 feet before abandoning the well at a depth of 1,453 feet. At 869 feet a small amount of oil appeared in the hole with an additional showing at 1,026 feet. Although that failure discouraged the operators for a time, commercial quantities of oil were found in the Princeton field by May, 1903.\textsuperscript{18}

In Illinois, Raymond Blatchley worked under Frank W. DeWolf, director of the Illinois State Geological Survey. As the geologist in charge of oil studies, Blatchley prepared a classic report on a part of the Illinois oil fields. He began the study in 1908 with "a final review in 1911." The final report, as printed in 1913, represented "the most comprehensive subsurface work since [Edward] Orton's classic study of the Trenton limestone of Ohio-Indiana."\textsuperscript{19}

A series of maps, "about 15 in number," accompanied Bulletin 22. As Raymond Blatchley stated, "The method of study was to map by means of contour lines, or lines through points of equal altitude, the geologic structure of the producing sands. . . . These maps show the oil sand as if everything above it had been removed."\textsuperscript{20}

The Blatchleys, father and son, contributed significantly to the literature of oil and gas. Their studies remain some of the most author-

\textsuperscript{17} Raymond S. Blatchley, "The Princeton Petroleum Field of Indiana," in Thirty-First Annual Report of the Indiana Department of Geology and Natural Resources, 563-64, quotation on 563.

\textsuperscript{18} Ibid., 562, 564.


\textsuperscript{20} Blatchley, The Oil Fields of Crawford and Lawrence Counties, 11. Before the publication of this report Raymond Blatchley wrote "The Structural Relations of the Oil Fields of Crawford and Lawrence Counties, Illinois," Economic Geology, VII (September, 1912), 574-82.
itative accounts of petroleum in Indiana and Illinois and deserve to be better known. The petroleum geologists and oil operators who came after them, not only those in Indiana and Illinois but also those in the United States at large, owe much to their research and writing.