

**Arthur J. Phinney, M.D.,
Indiana's First Subsurface Geologist**

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In the words of John B. Patton, State Geologist of Indiana, Arthur J. Phinney's paper entitled "The Natural Gas Field of Indiana" was "one of the earliest and best in the annals of petroleum geology" (1). Though Phinney lived to be 92 years old, only 15 years were spent doing geologic research, and during these years he maintained his medical practice in Muncie, Indiana. Edgar Wesley Owen observed: "Many highly trained geologists were less productive than the amateur Phinney." (2)

Arthur John Phinney was born in Russell Township of Geauga County, Ohio in late August of 1850. He was raised on a farm 20 miles east of Cleveland (3). He received his early education in high school and the Geauga Seminary, an academy of that area. After attending the academy, he entered Oberlin College. After completing two terms (one year) at Oberlin College he went on to Allegheny College in Meadville, Pennsylvania for two more years, where he reached the junior year. During these college studies he taught in the common schools at Geauga County and surrounding area for six years. He concentrated on the sciences and mathematics during these early years of education (4).

In 1875 at the age of 25 he began his medical studies. He attended Wooster University (4) and Western Reserve Medical School (3). From one of these institutions he left to enter Pulte Medical School in Cincinnati, Ohio. He graduated from Pulte Medical School in 1877 (3, 4).

Phinney began a short medical practice in Galion, Ohio and then, in October 1878, he went to Muncie, Indiana where he began a long medical practice (4). In Muncie he joined the local Literary and Scientific Association of Muncie. Between 1878 and 1882 he gave two talks to that society, one entitled "Evolution from a Geologic Standpoint" and another entitled the "Earth and Its Motions (5)." These talks indicate that Dr. Phinney had developed a certain amount of expertise in geology prior to beginning his geologic studies in east-central Indiana.

There is no indication when Dr. Phinney first became interested in geology; however, a short biography states that he had been a student of geology for many years. His first recognition as a geologist was in 1881 when he was employed to make a geological survey of Delaware County (4). At this time John Collett was state geologist. Apparently the geologic studies were begun in association with Phinney's botanical studies of the area. For his study of Delaware County Phinney received \$30.00 (6).

Dr. Phinney continued his medical practice while doing geology. He completed five separate articles for the Indiana Geological Survey. The first article appeared in the *11th Annual Report* in 1881 and was entitled the "Geology of Delaware County" (7). In the following year a report on the "Geology of Randolph County" (8) and a "Catalogue of the Flora of East Central Indiana" (9) appeared in the *12th Annual Report*. Apparently Phinney was paid \$100.00 for the report on Randolph County. For the *13th Annual Report* Phinney completed a general report on Henry and portions of Randolph, Wayne and Delaware Counties (11).

In these regional reports Dr. Phinney correctly identified the age of the bedrock as Silurian. He recognized the glacial origin of the drift and identified the Muncie esker, for which he used the Scandinavian spelling, assar. He recognized that many river valleys were underfit and additionally that many of the original prairies in this region represented the position of ancient lakes now filled with peat. To help prevent summer peat fires, he suggested improved methods of peat extraction. In the initial phases of subsurface work related to the gas field, he recognized bedrock valleys buried beneath the glacial till.

Concurrently with his regional work the Gas Boom began. Gas was discovered in Ohio in November 1884. A bore, originally drilled for coal at Eaton in Delaware County was deepened, and as a result gas was discovered in Indiana in September 1886.

In Maurice Thompson's 1886 report on Natural Gas in Indiana he quoted Dr. A. J. Phinney of Muncie who in his words had ". . . proved himself a very able and painstaking assistant, . . ." The following words show Dr. Phinney's attention to detail when describing the early Eaton Well:

"The gas has some odor, though not very unpleasant, it burns without smoke, and is thought to be free of sulfur. The roar produced by the escaping gas can, under favorable conditions, be heard at a distance of two miles. A two-inch pipe was extended from an elbow at the top of the casing to a point 18 feet above the derrick, or 90 feet from the ground. Another two-inch pipe was extended horizontally from the elbow about 60 feet from the well. Both pipes were furnished with a T, giving four places for escape of the gas. When lighted the flame from each was about 10 feet long. The light could easily be seen from Muncie, twelve miles south, and I was told that it had been seen twenty miles" (12).

At this time Dr. Phinney was 36 and must have been the acknowledged expert on the geology of the region. In the words of W. J. McGee:

"When the drill began its operations in Indiana it fell to Dr. Phinney, an amateur geologist of Muncie, to observe and study the boring records; and to him belongs the credit for commencing and carrying well forward, at his own cost a comprehensive investigation of the data brought to light by the test borings in that State (13)."

After the first seven paying wells had been drilled in Indiana, Phinney published a short article entitled "Facts About Gas" in the January 28, 1887 *Indianapolis News*. Phinney obtained records for seventeen wells. He determined the elevation of the "mouth of each bore" and from the well record found the elevation of the Trenton. From this data he determined that a structural arch existed in the area of the gas field and that the arch had an axis which ran southeast-to-northwest. He also surmised that outcrops of Niagaran limestone might be used as a clue to the location of the arch. By analogy to other gas fields which were controlled by "anticlinals or archs", he implied that the arch controlled the occurrence of gas in the Trenton (14).

By July 1887, Dr. Phinney had constructed a preliminary map of the Indiana Gas Field. This map was published in a weekly periodical entitled the *American Manufacturer and Iron World* on September 2, 1887. This remarkable map must qualify as the first structural contour map of the Trenton Oil Field in Indiana (15). This map precedes Orton's 1888 Ohio Geological Survey publication "Oil and Gas in

Ohio" (16) and Orton's 1889 publication "The Trenton Limestone as a Source of Petroleum and Inflammable Gas in Ohio and Indiana" which was published in the *9th Annual Report of the United States Geological Survey* (17).

The map is a representation of the elevation of the top of the Trenton. That portion of the Trenton which lies above sea level is shown in ruled lines, the portion from sea level to 100 feet below sea level is shown in dashed lines, and that portion which is lower than 100 feet below sea level is left white, without pattern.

He termed the 100-foot below sea level line the "dead line", and suggested strongly that efforts to find gas outside the "dead-line" would be less fortunate.

In October, 1887 Dr. Phinney published a more comprehensive article entitled "The Gas Territory of Indiana" in the periodical, *Petroleum Age*. In this article he reviewed the literature on the Cincinnati Arch or Anticlinal and began to refine further his concept of the trap, reservoir, and pressure aspects of the gas field (18).

These articles caught the attention of Major John Wesley Powell, then director of the United States Geological Survey. Powell sent W. J. McGee to visit Phinney in Muncie during the height of drilling activity in 1887. As a result of this visit, Phinney was appointed United States Geological Surveyor for the Indiana Gas Field. Arrangements were made to complete the work for publication. A portion of this work was published in the *United States Geological Survey Mineral Resources* for 1887 in 1888 (19). In Phinney's words: "the study took place over a period of three years" (4). It was complete in March of 1890 and the work resulted in a major contribution to the *11th Annual Report of the United States Geological Survey* published in 1891 (20).

The American Association of Petroleum Geologists Memoir 5 (*The Sourcebook of Petroleum Geology*) refers to this work nine times (21). The sourcebook attributes to Orton and Phinney the first use of the word "trap" in petroleum geology. Phinney may well have been the first to use it in the form of a noun. Dr. Phinney was one of the first geologists to state clearly that hydrostatic pressure played a role in gas migration. He also recognized that the gas in the Trenton Field accumulated from broader areas adjacent to the Cincinnati Arch. Thus Phinney recognized the concept which would later be called "gathering area" and that gas could migrate considerable distances.

One of the most striking contributions of Dr. Phinney was his list of requisites for a gas field. A modern list of this kind has been published by Momper for oil and gas (22).

1. Effective Source
2. Carrier System
3. Reservoir
4. Effective Seal
5. Trap
6. Timing
7. Preservation

Phinney's list includes the following:

1. A carbonaceous stratum within which the hydrocarbons are generated
2. A porous rock overlying it or adjacent to it
3. An impervious cover to prevent its escape
4. The presence of the necessary structural relief to enable a separation of the gas, oil, and salt water to take place

5. The absence of extensive deformation and fracture of the strata that would afford avenues of escape
6. Absence of outcrop whereby the products might escape

Compared to Momper's 1978 list, the only thing missing from Phinney's 1891 list is the carrier system.

Also included in this volume (20) were nicely printed color maps of the geology of the state, with the Trenton Gas Field superposed over the geology; and a structural contour map of the entire state, called a hypsographic map. This map may represent the first structural contour map of an entire state.

At the age of 41, Dr. Phinney rightfully could consider himself a physician, an accomplished geologist, and a botanist. He considered music his only pastime (4). Perhaps it was in order to simplify his life that he determined to devote himself entirely to his medical career. It seems this was his decision since in the fall of 1892 he sold his collection of fossils, minerals, and land shells which numbered greater than 17,000 species, "all classified and labeled (4)."

He continued to practice medicine and probably moved to Indianapolis in 1907 or 1908 where he practiced medicine for a few years before retiring. Phinney outlived his wife, Mary, who died in 1923 and is buried in Beech Grove Cemetery of Muncie.

He was a charter member of the Indiana Academy of Science and spoke at the 50th anniversary meeting of the Academy in 1934 (3). He retained an interest in non-medical science, in the evolution of religious beliefs, in the origin of the American Indian, whom he believed to be a cross between the black and brown man, and in the problems of irrigation in the western deserts. Phinney was reported to have written 1,200 pages of manuscript which he hoped to have published (3). The last few years of his life were spent in the Masonic Home in Franklin, Indiana (4). During this time his only daughter Louise passed on in 1940. Dr. Phinney died on May 26, 1942. He was buried in Muncie's Beech Grove Cemetery on May 28, 1942 along side his wife and daughter in the Little Family plot. At the present, neither his daughter's nor his grave has markers.

It is unfortunate that McGee employed the term amateur to describe Dr. Phinney. This adjective has too many shades of meaning. Not only was Dr. Phinney an expert in the geology of east-central Indiana, but his understanding of the entrapment of hydrocarbons was probably further advanced than that of most geologists of his time. His description of the Trenton Gas Field possibly represents the earliest description of a carbonate stratigraphic trap (20). One can only imagine what contribution Dr. Phinney might have made to geology had he devoted a larger part of his life to this science.

Though his geologic career was short Dr. Arthur J. Phinney became Indiana's first subsurface geologist.

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