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The Geological Society of America

In December 1888, thirteen geologists gathered at Cornell University in Ithaca, New York, to found a new geological organization, the American Geological Society, later the Geological Society of America, today one of the preeminent societies of geology. Present at the founding were two former members of the Second Geological Survey of Pennsylvania, John J. Stevenson and Israel C. White. The former had been professor and the latter his student, and then both were Assistant Geologists of the Pennsylvania Survey during the period from 1875 to 1883. Of the 112 Original Fellows of the new Society, these two, plus eight others, had been or were members of the Second Pennsylvania Survey, which was in 1888 in the last phases of its remarkable accomplishment of mapping and describing the geology of each of the 67 counties of the Commonwealth.

The seeds of the Geological Society of America were planted in 1834 when Henry Darwin Rogers, later to be the organizer of the First Pennsylvania Geological Survey in 1836, returned from England proposing to his geological colleagues that the United States should have an association similar to the British Association for the Advancement of Science. Rogers, with four other Pennsylvania Survey staff, and geologists from the State Surveys of Delaware, Massachusetts, Michigan, and New York, met in Philadelphia in 1840 to form the Association of American Geologists. Originally only to be an association of geologists, later meetings included other scientists, and in 1843 the group changed its name to the Association of American Geologists and Naturalists. In 1847 it became the American Association for the Advancement of Science, fulfilling Henry Rogers' original intent.

As was the founding of the Association of American Geologists supported by geologists of state geological surveys, so too the founding of the Geological Society of America included support of State Geologists and the geologists of their surveys. Prominent among the Original Fellows of the American Geological Society were the State Geologists of Arkansas (Branner), Georgia (Spencer), Indiana (Collett), Kentucky (Proctor), Michigan (Wadsworth), Minnesota (Winchell), Missouri (Winslow), New Jersey (Cook), New York (Hall), Ohio (Orton), Pennsylvania (Lesley), Tennessee (Safford), and Texas (Dumble). It was through association with the many state surveys, and the newly formed United States Geological Survey, that geologists of the new Society received much of their geological training and practical experience in preparing geological maps and reports.

We celebrate the birth of the Geological Society of America through descriptions of the geological accomplishments of the two Founders and eight other Original Fellows who had been members of the Second Geological Survey of Pennsylvania during the decade of the Society's founding.

Donald M. Hoskins

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State Geologist

The Second Geological Survey of Pennsylvania—An Original Supporter of the Geological Society of America

by
Clifford H. Dodge

lthough the birth of the Geological Society of America (GSA) in 1888 nearly coincided with the demise of the Second Geological Survey of Pennsylvania (1874–1889), both great organizations shared much in common, not only through their pursuit of excellence in the geological sciences but also because their reputations and achievements resulted from work by many of the same individuals. The Second Geological Survey boasted ten Original Fellows of GSA as having been associated with the Survey in some capacity during its existence. These Original Fellows were C. A. Ashburner, J. C. Branner, E. W. Claypole, Persifor Frazer, Jr., J. P. Lesley, Franklin Platt, J. J. Stevenson, I. C. White, Arthur Winslow, and G. F. Wright. When GSA was founded, these ten ranged in age from 28 to 69. Some were young men just beginning their careers; others were seasoned professionals with national and international reputations; but all shared a common bond of pride and accomplishment in their chosen field. Several of these men held important leadership roles in the young Society, and three, Stevenson (for 1898), Branner (for 1904), and White (for 1920), were elected President of GSA. The early history of GSA has been discussed in detail by Fairchild (1932) and has been reviewed briefly by Eckel (1982). In commemoration of the centennial anniversary of the Geological Society of America, the Pennsylvania Geological Survey is pleased to devote this issue of *Pennsylvania Geology* to articles on each of the ten Original Fellows who contributed to the success of both organizations.

Survey involvement with GSA continued to grow, and during the two years that followed the formation of the Society, six more geologists once affiliated with the Second Survey joined. These six were elected Fellows and included C. E. Beecher, H. M. Chance, E. V. d'Invilliers, W. M. Fontaine, F. A. Hill, and T. S. Hunt. Many other Survey assistants were equally well qualified to join but did not seek admittance owing to advanced age or inclination. Needless to say, the geology of Pennsylvania, its economic importance, and the achievements of the Second Survey were subjects of numerous discussions among early GSA Fellows.

At the time GSA was established, most of what was known about Pennsylvania geology was the result of recent investigations by the Second Geological Survey. The contributions and character of this

organization have been discussed recently by Jordan and Pierce (1981) and by Dodge (1987).

The success of the Second Survey depended upon the capabilities of its staff and its mode of operation. In this regard, it is fortunate that J. Peter Lesley was appointed State Geologist. Lesley's outstanding credentials and widespread respect among his peers are evident in an unsolicited letter written in June 1874 from James Hall, later to become the first President of GSA, to W. A. Ingham, a member of the Board of Commissioners responsible for selecting the State Geologist:

> And without disparagement to anyone else, whether an applicant for the place or otherwise, I would beg leave to say that Prof. Lesley's abilities and qualifications for the position are so far superior to those of anyone whom I know that I could not for a moment entertain a doubt of his selection for the place were the matter referred to a number of scientific men.
>
> (Merrill, 1924, p. 694)

In a letter to Governor Hartranft a year earlier, Lesley (1873) responded to the Governor's request for information concerning the proper organization of a state geological survey and stressed the need for hiring well-qualified assistants at a good salary:

> It is no economy to employ inferior talent. Mistakes committed by inexperienced and incompetent persons produce not only waste, but permanent mischief. Men of the best standing in the science would be eager and proud to take part in so great a work.
>
> (p. 9)

> The State should pay well for the best talent, where so much mischief might be done by incompetent persons.
>
> (p. 10)

The many notable (or subsequently well-known) late nineteenth century geologists associated with the Second Survey attest to Lesley's success at attracting highly motivated, capable staff.

Lesley's organization and management of the Second Geological Survey were impeccable. He demanded the highest standards of accuracy and completeness in its geologic and topographic investigations, and emphasized rapid, timely publication of its results. He maintained an excellent rapport with his staff and made certain that they received all due credit for their work. He was forthright and thorough in his dealings with the Pennsylvania Legislature and the Survey's oversight committee, the Board of Commissioners. (See Jordan and Pierce, 1981.)

The work of the Second Survey was empirical and practical, and not theoretical; it dealt primarily with economic geology. Lesley pointed out that

> practically viewed, the geology of Pennsylvania is wholly Paleozoic, on the most magnificent scale, with an unexampled wealth of anthracite and bituminous coal, brown hematite iron ore, limestone, rock oil, and rock gas; and to the study and description of these its geological survey has from first to last been devoted.
>
> (Merrill, 1924, p. 497)

Many of these investigations were particularly accurate and successful. Moreover, the Second Survey systematically examined the rock stratigraphy of the state and established much of the stratigraphic nomenclature still used today. Detailed regional stratigraphic correlations were made in the oil and gas and bituminous coal fields of western Pennsylvania, and truly quantitative geologic mapping commenced during the 1880's in the Anthracite region, which helped unravel the structural complexities of the coal basins. (See Dodge, 1987.) Among its other achievements, the Survey delimited for the first time the terminal moraine of the glaciated areas in the northern part of the state. Even though paleontological investigations were not emphasized, much valuable work was accomplished by several of the assistants. Leo Lesquereux's paleobotanical studies of the coal measures are especially noteworthy and received considerable praise. On the other hand, the major deficiency of the Second Survey was the lack of adequate topographic base maps, a condition caused by legislative failure to appropriate the necessary funding for this kind of mapping (Dodge, 1987).

The Second Geological Survey of Pennsylvania published nearly 120 atlases and volumes, including geologic maps for all 67 counties and one for the entire state. The Survey was innovative in its use of color printing and, beginning in 1883, published some of the first photographs using the newly perfected halftone process. The wealth of maps, drawings, and descriptive information that it produced helped "to uncover with precision the economic mineral resources of Pennsylvania in an age of great industrial expansion" (Jordan and Pierce, 1981, p. 75) and to provide a firm foundation for more detailed studies by industry, government, and academia in the ensuing years.

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Charles Albert Ashburner

by
Clifford H. Dodge

The member of a prominent Pennsylvania family, Charles Albert Ashburner (1854–1889) was born and raised in Philadelphia. He entered the University of Pennsylvania in 1870 at the age of 16 and enrolled in the Towne Scientific School, where he majored in civil engineering. As an upperclassman, he received instruction in geology from J. Peter Lesley, who was then the Professor of Geology and Mining at the University and shortly thereafter State Geologist of the Second Geological Survey of Pennsylvania (1874–1889). Lesley had a profound influence on Ashburner's career, and their years together at the University marked the beginning of a close, lifelong personal and professional relationship.

Ashburner received his baccalaureate in 1874 and graduated valedictorian of his class. He received his Master of Science degree in geology from the same institution three years later, and in 1889, his alma mater awarded him an honorary Doctor of Science degree for his outstanding contributions to Pennsylvania geology.

Ashburner was a superb field geologist and administrator. An applied rather than theoretical geologist, he was a meticulous, systematic, and hard-working individual who, though well aware of his talents and abilities, was not arrogant as some people thought. Ashburner's life and career have been discussed in detail by Dodge (1981).

Shortly after the Second Geological Survey of Pennsylvania was organized in 1874, Ashburner was hired and thus abandoned his career in civil engineering for one in geology. There were few trained geologists in the United States at that time, but Ashburner's superior scientific abilities and experience gained in the field soon eliminated any deficiencies. No doubt because of their growing friendship, the choice of assignments for Ashburner reflected Lesley's particular interests—both geologically and geographically.

Initially, Ashburner and a former classmate, Charles E. Billin, were geologic aides of John H. Dewees, Assistant Geologist in charge of the study of the fossil iron ore (hematite) beds in the Juniata River district of central Pennsylvania. Assignments for the two aides included topographic mapping and investigation of the Silurian and Devonian regional stratigraphy. Within a year, they were promoted to Assistant Geologists and assigned separate dis-

tricts to examine. In 1875, Ashburner independently studied the geology of Sideling Hill and the East Broad Top coal basin in western Huntingdon County, and published the results of this work three years later (Dewees and Ashburner, 1878).

In 1876, Lesley commissioned Ashburner to survey the important and poorly understood district in northwestern Pennsylvania comprising McKean, Elk, Forest, and Cameron Counties. The famous Bradford oil field of McKean County was then undergoing rapid development and soon was to surpass all other fields in the world in productivity. Although he was to concentrate on the geology of the coal measures and leave the study of oil geology to the Survey's petroleum specialist, John F. Carll, Ashburner's four-year investigation of this district proved to be as important to the understanding of oil as to coal. Moreover, this assignment marked the beginning of his lifelong interest in oil and gas geology.

Charles A. Ashburner, circa 1880.

The results of Ashburner's work in McKean (Ashburner, 1880a, b) and in the other three counties (Ashburner and Sheafer, 1884, 1885) were published in two reports and two accompanying atlases, and still constitute the only comprehensive study of the region. Ashburner used both field observations and subsurface information to establish the stratigraphic relationships of the Upper Devonian and Carboniferous rocks. He successfully correlated the coal seams by recognizing, in part, that the Olean Conglomerate (basal Pottsville Formation) and Vanport Limestone are important key beds in the Pennsylvanian coal measures. The Olean Conglomerate was also used by drillers to estimate the depth to the oil-bearing sandstones, but there was much confusion in distinguishing the Olean from subjacent conglomerates until Ashburner (1880a, p. 57) recognized that "the pebbles in the upper [Olean] conglomerate are invariably round or prolate spheroids (egg shaped); consequently this rock cannot be mistaken for the lower or Sub-Olean conglomerate in which the pebbles are flat or oblate spheroids having the shape of a flattened orange." Among his other contributions was recognition of the rapid southward thickening of the Upper Devo-

nian and Mississippian rocks between the Catskill (Upper Devonian) and Pottsville (Pennsylvanian) Formations, which helped explain why many drill holes failed to penetrate the deeper Bradford oil sand in the southern part of the district. There is no known evidence, however, that he attributed this thickening (or thinning) to a pre-Pottsville regional unconformity, which is now widely recognized.

Appointed in 1881 at the age of 27 as Geologist in Charge of the long-delayed survey of the anthracite coal fields in eastern Pennsylvania, Ashburner undertook his greatest challenge. At that time, anthracite coal was the single most important mining industry in any one state and the third most important one throughout the United States. Ashburner conducted the Anthracite Survey in an efficient, systematic manner; his skill at planning, organizing, and implementing this Survey was his greatest achievement and led to international acclaim for the Second Geological Survey. The Anthracite Survey was a thoroughly modern enterprise: qualified staff were hired; field offices were set up in the main coal fields; numerous contacts were made with representatives of the railroads and coal companies; and an organized system of mapping, colleague review, and publication was established.

Owing to public demand, the Anthracite Survey produced many more atlases than it did "Reports of Progress," which contain detailed descriptive information. The atlases consist of up to five series of sheets including mine maps, cross sections, columnar sections, topographic maps, and miscellaneous maps and charts. The mine sheets were considered by many to be the most important part of the atlases, and they contain a wealth of surface and subsurface information. Especially noteworthy is Ashburner's unprecedented extensive use of structure contours to portray the fold geometry of the coal measures. Use of structure contours not only assisted in planning future mining but also in accurately calculating coal resources. (See Ashburner, 1881; 1883a, b.) Even today, the results of the Anthracite Survey constitute a significant source of detailed geologic information for the region.

In 1885, Ashburner acquired additional responsibilities with his appointment as First Assistant Geologist in charge of general supervision of all Second Geological Survey activities. This was done to allow Lesley time to begin writing a comprehensive "Final Summary Report" on Pennsylvania geology.

However, a year later, Ashburner reluctantly resigned from the Second Survey (though he still worked for it part time) to accept a more lucrative position with George Westinghouse, Jr., in Pittsburgh, and thereafter he became a consulting geologist. Ashburner

traveled extensively throughout the United States and Canada, and devoted the rest of his brief career to examining and reporting on new oil and gas fields and, to a lesser extent, on the mining of precious metals and copper. Tragically, two months before his 36th birthday, he fell ill in Arizona and returned home to Pittsburgh, where he died unexpectedly from a kidney infection on Christmas Eve in 1889.

As one of the most distinguished and productive geologists of the Second Geological Survey, Ashburner contributed greatly to our understanding of the Upper Devonian and Carboniferous stratigraphy of Pennsylvania, and much of his work is still valuable today. Despite his heavy work load, he found time to participate actively in many professional organizations. In addition to his status as an Original Fellow of the Geological Society of America (and, sadly, one of the first to die), Ashburner was a member of the American Philosophical Society, American Institute of Mining Engineers, American Association for the Advancement of Science, and many others.

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John Casper Branner

by
Dawna Yannacci

John Casper Branner (1850–1922) was a man of wide-ranging interests and accomplishments. His writings cover topics ranging from geology to biology, and from the Portuguese language to education. Branner was a geologist, biologist, botanist, engineer, interpreter, college professor, State Geologist, and college president. Although his interests and talents were many, he was first a geologist. He was an Original Fellow of the Geological Society of America as well as its president in 1904.

Branner was born on July 4, 1850, and entered Cornell University in 1870, where he met Dr. Charles F. Hartt. Dr. Hartt invited Branner to accompany him on a geologic expedition to Brazil. This trip was the start of a lifelong interest in Brazil and all of South America for Branner; he made numerous trips there throughout his life. His activities in Brazil included geologic mapping, gold mining, and the study of coral reef environments. He also studied insects injurious to cotton crops in Brazil for the U.S. Department of Agriculture, conducted a scientific investigation of the geology and biology near the mouth of the Amazon River, and, in 1880, visited Brazil at the request of Thomas Edison to search for plant fibers that would add strength to incandescent lights. He also studied the Portuguese language.

John C. Branner, 1892.
(Photograph courtesy of the Library of Congress.)

Beginning in 1883, Branner worked as an Assistant Geologist with the Second Geological Survey of Pennsylvania. He worked for two years in the Lackawanna Valley area. This work included topo-

graphic and geologic mapping as well as observations concerning glaciation in the region. J. Peter Lesley was State Geologist during the time of Branner's work in Pennsylvania. That Branner fondly remembered the time spent working in Pennsylvania is indicated in a letter to the Academy of Natural Sciences when he received the Hayden Medal. He wrote that Lesley "pointed out the road that every worthy geologist should travel" (Branner, 1911).

Following his work with the Pennsylvania Geological Survey, Branner was appointed professor of geology at Indiana University. He taught there for two years until he was appointed State Geologist of Arkansas in 1887. A primary reason for organizing the geological survey in Arkansas was the excitement caused by the rumored presence of gold and silver in the Ouachita Mountains. Numerous financial deals had been struck prior to an official survey of the area, and excitement was running high among the citizenry. Unfortunately, after a thorough study it was concluded that only insignificant amounts of gold and silver were present in the area. When made aware of this fact, indignant citizens blamed the messenger for the bad news and burned the State Geologist in effigy and demanded his removal from office. Branner stood by his conclusions and weathered the storm created by his first investigation in Arkansas. He continued the survey of the state for about five years and published an amazing 14 volumes before leaving Arkansas for Stanford University in 1891.

Branner taught at Stanford University for seven years before becoming Vice-President of the university in 1899. He was elected President of the Geological Society of America in 1904 and became President of Stanford University in 1913. He remained head of the Department of Geology throughout this time. He was regarded as an excellent teacher and was well respected in the community. John Casper Branner died on March 1, 1922.

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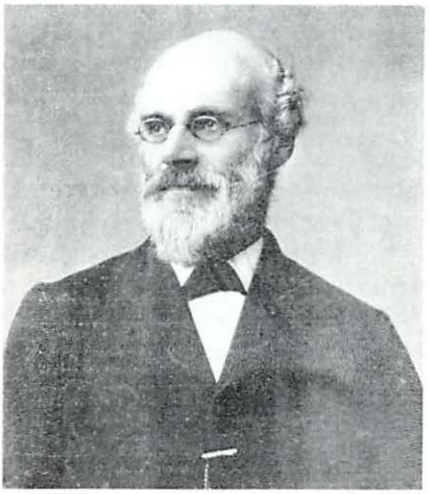
Edward Waller Claypole

by
W. D. Sevon

Edward Waller Claypole (1835–1901), a teacher by profession and an Original Fellow of the Geological Society of America, was employed by the Second Pennsylvania Geological Survey during the years of 1882 and 1883. Commissioned to study the fossils of Perry County, Claypole did much more and made significant contributions to unraveling the geology of central Pennsylvania by more precisely delineating the boundaries of certain units and by recognizing the absence of units previously thought to be present (Claypole, 1885a, p. xi). His report on Perry County followed the general format of other Second Survey reports and included chapters on physical geography, structure, stratigraphy, economic geology, and a separate geological description of each township. In addition, Claypole included items generally not found in Second Survey reports: a geologic history (p. 35–42) and a catalog of the names of plants found in the county during the course of fieldwork (p. 113–145).



E. W. Claypole, circa 1895.
(Photograph reproduced from American Geologist, 1902, v. 29, no. 7, Plate 1.)

Claypole achieved some widespread acclaim as a result of his discovery and reporting of a Pteraspidian fish from the Upper Silurian rocks of Perry County. At the time it was the oldest known fish. He received little recognition for some of his other achievements. Claypole is apparently the first person to calculate the amount of foreshortening (40 percent by his calculation) caused by folding of the rocks in Pennsylvania (Claypole, 1885a, p. 40–41; 1885b). Perhaps even more obscure is the fact that Claypole was one of the first, if not the first, to calculate an erosion rate for the Appalachians (Claypole, 1885a, p. 39–40). His starting value of 8 grains of sediment per gallon of water (160 mg/L) in the Juniata River during or-

dinary weather and his subsequent calculations leading to an estimated surface lowering of 1 foot in 1,500 years are probably excessive, but the methodology and insight into such processes were at the forefront of thinking at the time.

In addition to the Second Survey county report, the work that Claypole did in Perry County and elsewhere in Pennsylvania resulted in 36 articles and abstracts published in scientific journals. Nor did he restrict his communications to the scientific audience. During his two years in Pennsylvania he contributed to the Perry County Freeman newspaper 30 articles written in popular language. He presumably gave numerous lectures and carried on extensive correspondence during this period because such were always a part of his life. During Claypole's employment by the Pennsylvania Geological Survey, he was a valuable resource for other Survey personnel and is often mentioned in other reports. This period of work in Pennsylvania ended in 1883 because the Pennsylvania Legislature failed to provide money for continuation of the project. Claypole's final paper on a Pennsylvania related topic was published in 1891.

A member of many societies, Claypole was most active in the American Association for the Advancement of Science (AAAS) (Chairman of Section E, 1897; Secretary of Section E, 1886), and both he and his wife were faithful attendees of annual meetings. An editor for *American Geologist* from its inception, his articles appeared most often either in that journal or in the AAAS proceedings. His association with the Geological Society of America, particularly with the Cordilleran Section, was growing at the time of his death.

Edward Waller Claypole, the eldest of six children, was born in the village of Ross, Herefordshire, England, on June 1, 1835. He received a sound education under the tutelage of his father and mother. The firm foundation of classical drill served him well throughout his life in the form of his masterful command of the English language. He received a baccalaureate degree in arts and science from the University of London in 1859 and a doctor of science degree in 1888. A brief teaching career at Stokescroft College was ended when he declined to renounce the hypothesis of evolution. After several years of problems, including the death of his wife, he emigrated to the United States in 1872 and took the chair of natural science at Antioch College in Yellow Springs, Ohio, in 1873. During his Antioch period he remarried and published an unpopular paper on the preglacial origin of the basins of Lakes Erie and Ontario. Following his Pennsylvania Geological Survey experience, he accepted the chair of natural science at Buchtel College, Akron, Ohio, where he remained until 1898. He reinvolved himself in glacial phenomena, continued his prolific work in paleontology, and contributed many articles to the *Daily Beacon* of Akron. In

1898 he took his invalid wife to Pasadena, California, where he accepted a professorship in geology and biology at Throop Polytechnic Institute. He remained there until his death on August 17, 1901.

Further information about Edward Waller Claypole is available in the excellent memorials written by Comstock (1902, 1903), Richardson (1902), and Bridge (1902).

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Persifor Frazer, Jr.

by
Christopher D. Laughrey

In his *Memoir of Persifor Frazer*, R. A. F. Penrose, Jr., well-known benefactor of the Geological Society of America, described Frazer as "a strong man, strong in his intellectuality, strong in his convictions, strong in his capacity to fight, seeking for truth as he saw it" (Penrose, 1910, p. 9). Persifor Frazer (1844–1909) was a Life Fellow in the American Association for the Advancement of Science (AAAS) and the Geological Society of America, and he was one of the Original Fellows of the latter. He was a committee member for the 1884 meeting of the AAAS in Philadelphia, and he subsequently served the AAAS as its representative at the inauguration of the Royal Society of Canada.

Frazer distinguished himself as a geologist and chemist. He was educated at the University of Pennsylvania (A.B. in 1862 and A.M. in 1865), and he studied at the Royal Saxon School of Mines in Freiburg, Germany, from 1866 to 1869. There he passed the State examination in mineralogy in the German language, "with as high a standing as was ever granted a foreigner by that institution" (Harrison and others, 1909, p. 76). Frazer returned to the United

States in 1869 and joined Hayden's national survey party in Colorado and New Mexico as a mineralogist and metallurgist. He remained with the Hayden Survey until 1870, when he began teaching natural history and chemistry at the University of Pennsylvania in Philadelphia, where his father, the eminent chemist John Frazer, was professor of chemistry and vice-provost. At Penn, the younger Frazer advanced to professor of chemistry, and later replaced his father as chairman. He was one of the key figures in the efforts to convince the Legislature to support a second geological survey of the Commonwealth. When these efforts succeeded, Frazer resigned his professorship at Penn and joined the Second Survey.

Persifor Frazer, Jr., circa 1880.

Frazer began his assignment with the Second Survey by initiating reconnaissance mapping in York and Adams Counties, along with adjacent portions of Cumberland and Franklin Counties. During the first two years of his work with the Second Survey, from 1874 to 1876, he presented and published numerous papers dealing with igneous and metamorphic petrology, geochemistry, geomorphology, structural geology, and economic geology. Some of Frazer's work in these areas was particularly significant. For example, Lower Mesozoic diabase rocks in the eastern United States were then considered essentially uniform in mineralogical composition (Dana, 1873). Frazer (1875) compared diabase rocks from the Gettysburg basin and the Hartford basin and, while acknowledging their macroscopic similitude, he documented mineralogical differences between the diabases from the two basins using thin-section petrography. Frazer made considerable use of petrographic procedures in his investigations, and he pioneered several photomicroscopy techniques during the course of his work with the Second Survey (for example, see Frazer, 1876, p. 127–129).

Frazer continued mapping the geology of southeastern Pennsylvania over the next five years. In addition to four Second Survey reports, he published 14 papers concerning Pennsylvania geology in various scientific and technical journals. Most of these papers dealt with the geology of Mesozoic diabase and the economic geology of copper and iron ores in southeastern Pennsylvania. One of Frazer's contributions to the literature during this time was particu-

larly important. In his monograph, *Classification of Coals* (1877), he formally presented and carefully demonstrated the utility of classifying coals on the basis of fuel ratios. Frazer's classification, demonstrated in his paper by numerous examples of Pennsylvania coals, was zealously embraced by Lesley (in McCreath, 1879, p. 144–157). Today it is the accepted coal classification based on rank that is routinely employed by geoscientists.

In 1881, Frazer became General Manager of the iron ore mines of the Central Virginia Iron Company. In 1882 his thesis concerning southeastern Pennsylvania earned him the the degree of Docteur ès-Sciences Naturelles from the Université de France, the first such degree ever awarded to a foreign individual. Frazer continued to publish the results of his work in southeastern Pennsylvania through 1886. Notable among these papers are some of the earliest discussions of the complex geology along the Martic Line—the contact between the Piedmont and Lower Paleozoic sedimentary terrains in southeastern Pennsylvania (Frazer, 1878, 1885).

The remainder of Frazer's career was as distinguished as his years with the Second Survey. In addition to his involvement with the American Association for the Advancement of Science and the Geological Society of America, he was active in the affairs of the International Congress of Geologists and the Franklin Institute. Persifor Frazer accomplished more than most scientific men are able to do in a lifetime. Geology is certainly the beneficiary of his efforts, as was the American Association for the Advancement of Science and the newly founded Geological Society of America.

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J. Peter Lesley

by
Helen L. Delano

"J. P. Lesley, one of the most distinguished and lovable men of science in the United States, was born at Philadelphia on September 17, 1819" (Geikie, 1904, p. xlix). So began Geikie's anniversary address to the Geological Society of London in the year following Lesley's death.

Lesley (1819–1903), who was born Peter Lesley, Jr., but preferred the usage Geikie followed, should be remembered for his scientific contributions, as a prolific author and energetic editor, and chiefly as organizer and director of the Second Geological Survey of Pennsylvania.

His scientific work began in 1838 while working under James S. Whelpley of the First Geological Survey of Pennsylvania in the Pottsville anthracite field. By Lesley's own claim, this was the occasion of the birth of topographical geology, which is the only specialty in which he claimed expertise. In later work in the coal areas of Pennsylvania he continued as a pioneer in the study of the relationship of topography and geology and in the use of both topographic and structure contouring on geologic maps.

J. Peter Lesley, circa 1875.
(Photograph courtesy of the Smithsonian Institution Archives.)

After Whelpley left the Survey, Lesley continued to work in the Pottsville and Pocono areas. He stayed with the First Survey, working also in the bituminous basins in Fayette and Somerset Counties and in several of the northern counties, until 1841.

Lesley, like numerous other scientists of his time, combined interests in geology and theology. He originally studied for the ministry, and after his three years with the First Geological Survey of Pennsylvania, returned to the seminary. He was licensed as a minister by the Philadelphia Presbytery in 1844, and eventually became pastor of a Congregational Church in Milton, Massachusetts.

Between 1841 and 1851 Lesley did occasional drafting and other office work for Rogers' final report of the First Survey, including construction of a geologic map of Pennsylvania. He abandoned the

ministry and returned to Pennsylvania and the professional practice of geology, working for Rogers in 1851, and as a private consulting geologist from 1853. His consulting practice contributed much to the study of economic geology of coal, iron ore, and petroleum in Pennsylvania, and included investigations in iron manufacturing technology and coal geology of other areas. His work for the Pennsylvania Railroad in 1853 and 1854 included preparation of what is said to be the first geologic map that had topographic contours.

In 1856 he published *Manual of Coal and Its Topography*, in which he set forth the relationship between structural geology and topography. This was "the first to show how clearly and strongly the topography often indicates the geological structure through the varied effect of the outcrops of underlying basins or saddles of harder or softer rock-beds upon the form of the earth's surface, the mountains, hills and valleys" (Lyman, 1909, p. 464).

Lesley was Secretary of the American Iron Association from 1856 to about 1864, and published *The Iron Manufacturer's Guide*, a standard reference, in 1859. He delivered a series of lectures on *Man's Origin and Destiny Sketched from the Platform of the Sciences* at Lowell Institute, Boston, in 1866. He also served as editor of the U.S. Railroad and Mining Register from 1869 to 1873. He was on the faculty of his alma mater, the University of Pennsylvania, as Professor of Mining from 1859, Professor of Geology and Mining from 1872, and Dean of the Towne Scientific School from 1875 to 1885.

Lesley was chosen in 1874 to become State Geologist of the Second Geological Survey of Pennsylvania. The success of the Second Survey was due in large part to his leadership and management. His emphasis was always on the practical and descriptive aspects of geology rather than the theoretical. His firm belief that the results of the Survey should be immediately and widely available to the public governed his publication philosophy and led to the large number of "Reports of Progress" of the Second Survey, all of which were edited by Lesley. The details of his mode of operation are outlined by Dodge (1988, this volume), and are described in greater depth by Jordan and Pierce (1981) and Dodge (1987).

In the mid-1880's, when the formation of the Geological Society of America from Section E of the American Association for the Advancement of Science (AAAS) was being contemplated, Lesley was near the peak of his professional standing. He was largely occupied with running the Survey, although he turned some of the administrative responsibility over to C. A. Ashburner as First Assistant Geologist in 1885. He somehow found time for an extraordinary level of activity in a variety of scientific societies. Lesley was an ac-

tive member of the AAAS from 1849, and served as its president in 1884, when he also led a field trip from the Philadelphia meeting to the anthracite country near Schuylkill Gap. At the same time his duties as Librarian and Secretary for the American Philosophical Society continued. That affiliation dated from 1856, and Lesley had edited the Proceedings and Transactions of the Society. As Librarian, he cataloged the library using cards and organized it by a classification system of his own devising. He gave up these duties only to become Vice-President of the Society from 1887 to 1898. He was also a Foreign Correspondent and later a Foreign Member of the Geological Society of London, and a Corporate Member of the National Academy of Sciences.

Lesley's status as an Original Fellow of the Geological Society of America and his affiliations with most of the other scientific societies of the time indicate that he was supportive of the new society and its goals.

J. Peter Lesley spent his last productive years writing *A Summary Description of the Geology of Pennsylvania*, the final reports of the Second Survey. Two volumes and part of a third of this work were finished when his health broke down in 1893, at the age of 74. His life ended quietly in Milton, Massachusetts, in 1903.

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Franklin Platt

by
Albert D. Glover

Franklin Platt (1844–1900) "was a superior man intellectually. He had a phenomenal memory, strong prejudices, and was not easily persuadable. He shunned the society of ladies and emotional influences. He was discreet, politic, and calm in judgment, with a great power of estimating the relative value of things. In person, he was tall and spare, with usually a slight stoop, and of fair complexion." Thus Professor Persifor Frazer wrote of him in 1901.

Franklin Platt, a member of several scientific societies, and an Original Fellow of the Geological Society of America, was born in Philadelphia on November 19, 1844. After attending local schools, he entered the sophomore class at the University of Pennsylvania in 1860, but left at the end of the college year. He served as a private in the militia regiment of Philadelphia, known as the "Gray Reserves," from June 26 to August 1, 1863, when the Confederate Army invaded Pennsylvania. In 1864, Platt received an appointment as an aide on the U.S. Coast and Geodetic Survey, and was one of the topographers under the command of General Poe, who accompanied Sherman's army in its famous "march to the sea."

Franklin Platt, circa 1880.

After the Civil War, Platt studied geology under Benjamin S. Lyman in Philadelphia. Lyman was a nephew of Susan Lyman Lesley, the wife of J. Peter Lesley, who later was to become the State Geologist of the Second Geological Survey of Pennsylvania. In 1870, Platt was associated with Persifor Frazer, who then was teaching natural history and chemistry at the University of Pennsylvania. Frazer also later became a member of the Second Survey.

On July 1, 1874, Franklin Platt was appointed an Assistant Geologist with the Second Geological Survey of Pennsylvania, and was assigned with three aides to the Clearfield and Jefferson District. The report area included all or parts of nine counties and was published as Report H (Platt, 1875). Only a reconnaissance of the area was possible in so short a time. Platt generally agreed with the existing geologic map of the area published in 1858 by the First Geological Survey of Pennsylvania. However, based on his work in Venango County, Platt considered the Tionesta Series (above the Seral of Rogers) of Elk and McKean Counties as mapped by the First Survey to be correlative with the Sharon Series (the Umbral of Rogers), and he deleted the Tionesta Series from his stratigraphic column.

From 1874 to 1881, Platt compiled reports on the geology of the coal basins from Somerset County to the north-central coal fields in Bradford, Tioga, Potter, Lycoming, and Sullivan Counties. He concluded that the coal basins in Sullivan County (Sherwood and Platt, 1880) lay outside or south of the First Coal Basin, an important fact that was missed by the First Survey. He also included several coal analyses in this report, which showed that some Sullivan County coals absorbed water readily after having been dried, and he suggested that such coals may yield inferior coke.

In his earlier reports, Platt listed the Brookville coal, two Kittanning coals, and three Freeport coals in the Lower Productive Measures. In Report T (Platt, 1881b), he changed his classification to agree with the stratigraphy in the Allegheny River sections. As a result, there now were three Kittanning coals and two Freeport coals, the Lower Freeport of his early reports being renamed the Upper Kittanning coal.

In 1880, in response to a legislative mandate, Platt prepared a report on the waste in anthracite mining. In Report A2 (Platt, 1881a), he explained that up to 30 percent of the total anthracite seam thickness could be slate or bone and was thrown out as refuse. He also explained that large blocks of coal called pillars were left to support the roof, and where the roof was bad, the top level of coal was left to support the roof. Finally, he pointed out that coal was lost in breaking, screening, and loading the smaller sizes of anthracite sold for house fuel. He estimated in the report that only 27 to 60 percent of the total seam was shipped to market, the rest having been lost in mining or breaking.

There were indications of Franklin Platt's managerial abilities as early as 1878, when he was placed in charge of the Survey while Lesley attended the International Congress of Geologists in Paris. Then, at a meeting of the Board of Commissioners in 1880, Lesley

recommended that "the Anthracite Survey should have an accredited head (Mr. F. Platt) known to all the operators, to inspire their confidence and prevent duplicate applications for data" (Board of Commissioners, 1880).

Platt left the Second Survey on March 1, 1881, when his salary ceased. He did geological work in Nova Scotia, and later that year prepared a report (Platt and Platt, 1881) on the coal lands of the Rochester and Pittsburgh Coal Company in Jefferson County with his brother William, who had resigned from the Survey in July. The Platts considered the coals in Jefferson County to be of superior quality and sought to develop commercial mining there. They were successful in attracting the necessary finances to purchase land, to build a railroad, and to engage a large work force (Cooper, 1982). Coal from the first mine at Beechtree, Jefferson County, was shipped on July 1, 1883.

Franklin Platt helped establish the regional stratigraphy of the Coal Measures for a large area in western and north-central Pennsylvania. He aided in establishing a mapping program in the Anthracite region. He recognized the commercial possibilities of Jefferson County coals, and was one of the founders of a large coal company which is still operating.

He was highly regarded by his peers. The science of geology and the newly formed Geological Society of America benefited from his efforts.

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John James Stevenson

by
Thomas M. Berg

Ever and always student, teacher, and mentor, John James Stevenson (1841–1924) sat faithfully at the knee of Nature, learning about the earth and the dynamic processes that produced what he saw. He was the *observer par excellence*. Professor Stevenson was a tireless educator, beginning at the age of 23, and continuing a lifetime of teaching both in the classroom and in informal and formal communication with his colleagues. As mentor, Stevenson influenced fledgling geologists as well as his own peers. One of his most important professional accomplishments was his persistent and successful motivation and guidance of those who founded the Geological Society of America.

J. J. Stevenson, 1892.
(Photograph courtesy of the Library of Congress.)

Born in New York City on October 10, 1841, J. J. Stevenson began his education at the age of four, and was able to read Greek, Latin, and Hebrew by the age of eight (White, 1925). He graduated from New York University in 1863 as a Phi Beta Kappa. He received his master's (1866) and doctorate (1867) degrees from New York University, and was awarded an honorary LL.D. degree from Princeton in 1893 (Anonymous, 1897). Stevenson was clearly well-read. His earliest lecture notes of 1864 indicate that he had read Lyell's text and the works of many other eminent scientists of his time.

As a student of Nature, his most valuable classroom was the great expanse of the out of doors—the field. Stevenson loved to travel. His early teaching career was punctuated by extensive, detailed geological investigations in Ohio, Colorado, New Mexico, Pennsyl-

vania, Virginia, and West Virginia. His reports for the Ohio and Pennsylvania Surveys, and the reports for the Wheeler surveys west of the 100th meridian, are comprehensive, and reflect the great breadth of his interest and observational ability. Stevenson enjoyed "testing" theories, and probed dynamic processes of nature as he carried out his investigations. His interpretations, deduced from careful observations, were often far ahead of his time. While working in southern Colorado for the Wheeler survey, he correctly interpreted that the present configuration of the southern Rockies resulted from multiple deformational events rather than a single uplift (Stevenson, 1875):

> The Rocky Mountain system, then, is the result of four especially marked upheavals, the first at the close of the Carboniferous, the second at the close of the Trias, the third at the close of the Cretaceous, and the Fourth during the Tertiary.

From the beginning, Stevenson was a student of coal. In his very first geology lectures, he said: "The deposit of coal was the great epoch in the history of the earth . . . Hence it is that coal stands as a boundary of high animal life on one side, and of low animal life on the other. Therefore it is the great epoch in geological history" (Stevenson, 1864, unpublished lecture notes). He examined peat and coal in his travels throughout the Appalachians and the Rockies, and in Europe, especially France. He read and evaluated every conceivable paper and document on coal and coal formation. Stevenson's treatises on the Carboniferous of the Appalachian basin (1903, 1904, 1906, 1907) and on the origin of coal (1911, 1912, 1913) still stand as monumental works to be read and absorbed by students of coal geology today. In his last major treatise on coal titled *Interrelations of the Fossil Fuels*, he gave an indication of the depth of his investigation (Stevenson, 1916, p. 21):

> In preparing for these studies, the writer has travelled scores of thousands of miles in foreign regions . . . and, in this land, he has made examinations in almost all of the coal-producing states. But life is short and distances are great; . . . to secure the knowledge necessary for intelligent discussion of the subject, [one] must collect and compare . . . the observations reported by others. This has been attempted; several thousands of reports, notes, memoirs, and monographs have been read and . . . digested, in so far as they contained matter bearing on the problems at hand.

Stevenson's insatiable thirst for learning clearly spread to his students. His deep-set eyes and strong brow evinced a determination to find the truth and reveal it with candor. "His students loved and trusted in him, because they knew he was master of his sub-

ject and possessed sympathy and the 'milk of human kindness' for them" (White, 1925, p. 103). I. C. White claimed (1925) that had it not been for the teaching influence of Stevenson, he might have continued preparing for a career in medicine. Stevenson taught at West Virginia University from 1869 to 1871, and accepted the chair of geology and natural history at New York University in 1871, remaining on the faculty there until retirement. He was secretary of the faculty at New York University from 1886 to 1888, and under his management the science courses were significantly amplified, and the geological museum was built up largely through his contributions (Anonymous, 1897). Stevenson retired from teaching in 1909, but he continued to be deeply concerned about the quality of education: "A graduate should show full knowledge of his responsibility as a man, should have learned the importance of prompt, honest performance of his work, whatever it may be; should be able to think clearly; should have acquired knowledge and the ability to utilize it" (Stevenson, 1921, p. 422).

Stevenson's vast knowledge, invaluable acumen, and unique capability as teacher readily equipped him to be mentor for individuals and for organizations. He spoke out for excellence in teaching and just compensation: "The office of professor should be restored to its former dignity; it should be regarded as all-important, and college should become a place for study, not for play; a place where faithful students will be honored" (Stevenson, 1915, p. 31). As mentor for his geological colleagues, Stevenson rendered an enormous service by doing most of the critical organizational work when the Geological Society of America was founded. He was among the original 13 founders, and was Secretary of the Committee of Organization in 1888. Of his efforts, White (1925, p. 100) said:

> At that date in the history of geologic science there were many personal differences and antagonisms among American geologists, which required the greatest tact and skill as a harmonizer to secure the necessary cooperation and support for the new organization in order that its success might be assured. This difficult task was solved in a masterly way by Secretary Stevenson . . .

Ten years after the founding of the Geological Society of America, then President of the Society, Stevenson said (1899, p. 91): "We close our first decade justly gratified by success and full of hope for the future . . . In not a few instances misunderstandings have been removed and coldness or suspicion has been replaced by personal friendship."

In his lifetime, especially in his later years, Stevenson was a mentor for society at large. He held strong conservative views, and was

a champion of hard work and earned freedom. He regarded socialism, communism, and even organized religion as failures. He placed his greatest hope in learning (Stevenson, 1922, p. 250): "Education is urged by many and without doubt, its defenders are right, for the only means of relief is in some training which will enable men to see things as they are." John James Stevenson died on August 10, 1924.

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Israel Charles White

by
John A. Harper

Israel Charles White (1848–1927) was a student and protégé of John J. Stevenson. Both were present at Cornell when the Geological Society of America was founded. White, a native West Virginian, had originally intended being a physician; however, he developed a keen interest in geology when he took Stevenson's geology course at West Virginia Agricultural College (now West Virginia University). After graduating in 1872, White spent two years teaching public school and preparing research papers in geology. Stevenson was very impressed by his former student's abilities and published work. In 1875, when Professor Stevenson was hired as an Assistant Geologist for the Second Geological Survey of Pennsylvania, he quickly selected White to be his field assistant.

With Stevenson, White began the task of identifying, correlating, and mapping the various coal seams exposed in the area of Pennsylvania lying south of the Ohio River and west of the Monongahela River. When the work was accomplished, State Geologist J. P. Lesley was so impressed with White's work that he promoted the young man to Assistant Geologist and assigned him the task of mapping the geology and coal resources of the counties bordering Ohio north of the Ohio River.

I. C. White, circa 1880.

White did an enormous quantity of work, spending summers in the field and then writing his reports after returning to West Virginia University, where he began teaching in 1877. In his report on Lawrence County, he pointed out a major problem of miscorrelation between western Pennsylvania and eastern Ohio stratigraphy. In his report on Erie and Crawford Counties, he confirmed the lack of large coal reserves in those areas, and provided evidence that the Venango Third oil sand of drillers in Venango County was the same rock unit as the nonproductive sandstone quarried for building stone in Erie. When his work on western Pennsylvania was finished, White was assigned to map the geology and

mineral resources of the eastern counties bordering New Jersey. Because of the perceived lack of valuable mineral resources in the eastern Pennsylvania area, the main results of White's work were stratigraphic in nature.

As a result of his work in northwestern and northeastern Pennsylvania, White made several significant observations on glacial geology. His contributions may have been more notable, however, were it not for Lesley's quick hand in editing manuscripts. In at least two cases White proposed explanations for buried glacial valleys that Lesley excised from the published Second Pennsylvania Geological Survey reports. For example, White proposed an interesting concept to explain the differences in the deeply buried valley of the Susquehanna River on opposite sides of the terminal moraine near the Columbia-Luzerne County boundary. White maintained that this glacial valley disappears at or near the moraine and proposed that the weight of the ice sheet and its sediment load depressed the earth's crust to a greater extent than in those areas south of the ice movement. Lesley, unimpressed with new explanations, deleted White's speculation and published in its stead an editor's note (Lesley, in White, 1883, p. 27):

> I omit from this report the conjectures to which the facts above mentioned give rise, because they have neither scientific nor practical value. Until we have obtained more facts it is useless to indulge in vague speculations concerning causes.

White later complained that his "brilliant discovery in *isostacy* even before that word was coined, died at a few strokes of Dr. Lesley's unsparing 'blue pencil'" (White, 1923, p. 335).

Probably White's greatest contribution to geology was the revival of interest in the anticlinal theory of oil and gas accumulation first published by Hunt (1861). The original theory gained little attention and support, mostly because Lesley vehemently opposed it. Lesley was well aware from the work of Second Pennsylvania Survey geologist John F. Carll that the best producing fields in Pennsylvania were situated in areas of little or no structure. With his power as State Geologist in the world's leading oil-producing area he proceeded to undermine the theory until it was nearly forgotten. White (1892) restated the theory after successfully demonstrating its value to oil and gas exploration by applying it to the discovery of the Mannington oil field in West Virginia. The "anticlinal theory" is still one of the most highly regarded and relied upon concepts in the petroleum industry today.

White worked for the Second Geological Survey of Pennsylvania from 1875 until 1883. During that time he authored or coauthored nine volumes of Survey reports on geology and paleontology, and

established for himself a reputation as an outstanding scientist, educator, and original thinker. From 1883 until 1888 he spent his field seasons working for the U.S. Geological Survey. He taught at West Virginia University from 1877 until 1892, when he left to go into private business. White was quite successful in consulting and was well known as a shrewd businessman. He charged large fees for his services and quickly became quite wealthy. He was a recognized expert in geology and mineral-resource exploration and evaluation; he consulted on numerous projects in the United States and Mexico, and spent the years 1904 to 1906 in service to the Government of Brazil performing a survey of coal and petroleum resources. He organized and served as the first head of the West Virginia Geological and Economic Survey from 1897 until his death in 1927, and for all but two years of his tenure he refused to accept any form of remuneration.

White was involved in a large number of civic and professional organizations, including the Kiwanis Club, the Association of American State Geologists, and the American Association of Petroleum Geologists. He served as Vice-President of the American Association for the Advancement of Science, and as Chairman of Section E, Geology, during the period 1906–07. One of the founding members of the Geological Society of America, White devoted much of his time and resources to keeping the Society operating successfully. He was President in 1920, but his greatest role was as Treasurer, a post he held for 15 years (1892–1907). During that time he built up a publication fund of over $10,000, while refusing to accept reimbursement for his services or for expenditures he incurred. I. C. White was generous to his profession, and at the time of his death he was widely admired and highly regarded by his peers and his fellow West Virginians alike.

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Arthur Winslow

by
Sandra D. Blust

Arthur Winslow (1860–1938) came to the Pennsylvania Geological Survey in 1881, "almost immediately after graduating from the Massachusetts Institute of Technology, where I had enjoyed the inspiration of contacts with Wm. B. Rogers, who was then still directing the affairs of the Institute. To go from him to the field of work of his talented brother, Henry D. Rogers, was an auspicious introduction to my chosen field of work" (Winslow, 1936). He spent the next three years compiling the maps of the anthracite fields of northeastern Pennsylvania.

In 1936 when George Ashley, then State Geologist of the Fourth Survey, invited Winslow to the centennial reunion of Survey workers he replied that, though unable to attend for reasons of health, he sent the following remembrances of his association with the Pennsylvania Survey.

> My work while in the survey was of a quite subordinate character, first with H. M. Chance at $60.00 per month, principally in drafting for his report on mining methods, and later with C. A. Ashburner on the mapping of the anthracite fields. I was connected with the Survey from 1881 to 1884, and it was to me a very interesting experience. . . .
>
> My first location was at Wilkes Barre, that then small place in the beautiful Wyoming valley. My work there was, principally, in the office, over the draughting board, varied by descents underground into the great coal mines of the vicinity. . . .
>
> I made various excursions and reconnaissance all over this region, generally on foot, climbing its rugged hills through the thick underbrush, following outcrops and what not. . . . Among other projects I made a geological cross section on foot down the Lehigh River, using the railroad as a base line and counting the rails between outcrops. At one time I conducted a vernier survey from Drifton to Pottsville in order to tie together the central and southern coal fields. . . .
>
> An amusing incident I remember occurred in Wilkes Barre, where an astronomical observation was conducted by Prof. Doolittle of Lehigh University, I believe, to determine the exact latitude and longitude of that place as a check on our mapping. When the work was completed the professor made his report, a monument was erected in the court house yard with the figures of latitude and longitude inscribed thereon, as the official result of the observation of the Second Geological Survey. Hardly was this exposed to public scrutiny than caustic criticisms appeared. One correspondent to the local paper denounced the results as grossly inaccurate, stating that he could give a better longitude result with his grandfather's old turnip watch. Great was the furore aroused. Ashburner rushed hot foot and indignant to the scene. An investigation followed. The explanation developed that the figures transmitted by Prof. Doolittle had been expressed by him in hours, minutes and seconds, and these had been groven on to the monument as *degrees*, minutes and seconds. Great was the humiliation that followed, and hasty veiling of the monument for erasures and correcting.
>
> (Winslow, 1936)

Ashburner used stadia measurements for most of the field surveys in the Anthracite District. Because mining engineers questioned the accuracy of stadia measurements, Ashburner asked Winslow to prepare a description of this theory and application. Winslow's report was published as Appendix B to Ashburner's 1883 report on the eastern end of the Southern Anthracite field (Winslow, 1883, p. 325–326, footnote).

Arthur Winslow, 1892.
(Photograph courtesy of the Library of Congress.)

Following his work in Pennsylvania, Winslow did consulting work in North Carolina and Arkansas. While in Arkansas he also served as a member of that state survey, and again was a colleague of John C. Branner (Winslow, 1936). In 1888, the year in which the Geological Society of America was founded, Winslow became State Geologist of Missouri and served until 1894. He was among the 13 State Geologists named as Original Fellows of the Geological Society of America (Geological Society of America, 1889, p. 583). Winslow returned to consulting after 1896 and was engineer, business manager, and later president of Liberty Bell Gold Mining Company. Winslow's bibliography, compiled by Alfred C. Lane (1939), includes mainly notes and articles concerning mapping techniques and mineral deposits of the various states.

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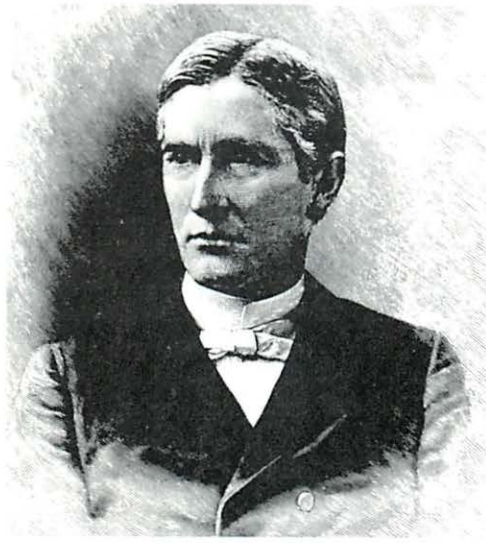
George Frederick Wright

by
Rodger T. Faill

The terminal moraine of the Wisconsinan glaciation brought George Frederick Wright (1838–1921) to Pennsylvania, working as a geological volunteer for the Second Survey for several months in 1881. His vocation was theological, but his inquiring mind and archeological interests drew him into glacialogy. Although the quantity of work he did for Pennsylvania was marginal, his cooperative efforts with Professor H. Carvill Lewis contributed significantly to Report Z, *Report on the Terminal Moraine in Pennsylvania and Western New York*. As J. P. Lesley wrote in his letter of transmittal to Governor Pattison, "the report . . . is greatly enhanced by the fact that two good observers checked and verified each others' observations at almost every point" (Lesley, in Lewis, 1884, p. vii).



G. Frederick Wright, circa 1890.
(Engraving reproduced from Popular Science Monthly, 1892, v. 42, preceding p. 258.)

George Frederick Wright was trained for the clergy. After graduating from Oberlin College in 1859, he entered the Oberlin Theological Seminary. With the outbreak of the Civil War in 1861, he enlisted with the Seventh Regiment of Ohio volunteers, but a bout of pneumonia shortly thereafter ended his military participation. Graduating from the Seminary in 1862, Wright became a Congregational pastor, first in Bakersfield, Vermont, and after 1872, at the Free Church in Andover, Massachusetts. In 1881, he returned to the Oberlin Theological Seminary as a Professor of New Testament Language and Literature, a position he held for 26 years until his retirement in 1907.

Wright had no formal geological training. Bakersfield, Vermont, sits on a sandy outwash plain and has eskers nearby. These attracted Wright's attention, and he went on to study the remarkable eskers and kames around Andover and surrounding areas in northeastern Massachusetts. His publications drew the attention of J. P. Lesley, who hired Wright in 1881 to work closely with Lewis in mapping the glacial terminal moraine that stretches across northern Pennsylvania. With encouragement from friends in Ohio, Wright continued tracing the terminal moraine from Pennsylvania across Ohio and Indiana into southern Illinois. He was commissioned in 1884 by the U.S. Geological Survey to complete his mapping westward to the Mississippi River. It was during these studies that he developed the idea of an enormous ice dam across the Ohio River at Cincinnati which created a 20,000-square-mile lake during the Illinoian glacial stage.

Wright began soon thereafter his excursions to other parts of the world to study present-day glaciers. In 1886, he traveled to Alaska, making a survey of the Muir glacier, in which he established that it had retreated 20 miles since it had been discovered a century earlier. In 1892, he visited Alpine glaciers and numerous archeological sites in western Europe. Two years later, he studied glaciers in southern Greenland. In addition to two subsequent trips to Europe, Wright traveled around the world, passing through northern China, Siberia, and Turkestan. It was from this trip that he concluded that Pleistocene continental glaciation had never covered central and northern Asia.

Throughout his active professional life, George Frederick Wright published extensively on the results of his studies and travels. He was also actively involved in editorial responsibilities for several journals. In addition, he combined his theological training and his archeological and geological experience in a long-continued attempt to understand the antiquity of early man.

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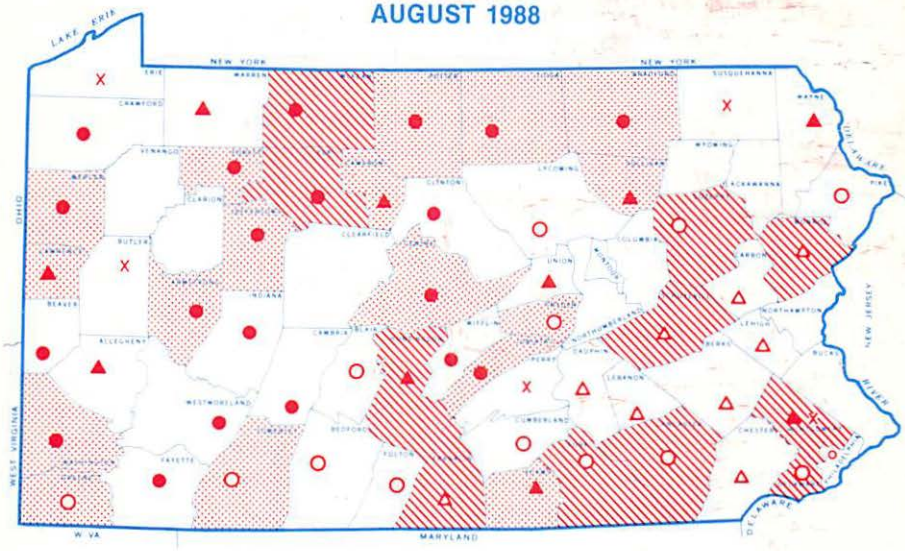

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Above last year	Below last year	Above last year	Below last year					
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