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1987—SESQUICENTENNIAL OF GEOLOGY IN INDIANA

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FOREWORD

The following pages contain, more or less, the text of a colloquium lecture given in the Department of Geology, Indiana University, on April 28, 1986. The occasion was the presentation of one of the Richard Owen Awards, established this year and to be a continuing series, to commemorate the centennial year of the degree program in geology at Indiana University.

It is my feeling that many lectures do not make good published papers, or *vice versa*, and surely this one is no exception, as its oral presentation depended heavily upon the use of 71 slides, most of which could not have been reproduced satisfactorily in the medium used here. Despite misgivings on this score, I acceded to requests for copies of the lecture text, which is not to be regarded as a publication, lacking as it does proper citations of sources. Acknowledgment is due and here accorded to W.S. Blatchley for much helpful information that he provided in a paper entitled "A Century of Geology in Indiana" published in the *Proceedings of the Indiana Academy of Science* for 1916 and to W.B. Hendrickson for his 1943 volume *David Dale Owen, Pioneer Geologist of the Midwest,* Indiana Historical Collections, volume 27. Various passages are excerpted or modified from three papers that I prepared earlier.

In designating 1987 as the sesquicentennial anniversary for the beginning of geologic work in Indiana, I was somewhat concerned by the fact that Willis S. Blatchley, State Geologist 80 years ago and a person for whose accomplishments I have deep respect, was author of an article published in the *Proceedings for 1916 of the Indiana Academy of Science* entitled "A Century of Geology in Indiana." Even a person as little inclined toward mathematical approaches as I am known to be recognizes that the century preceding 1916 goes back nearly to the early 1800s, and I set out to determine what early geologic work Blatchley had in mind. These turned out to be William Maclure's 1809 and 1818 maps of the then United States; a description, largely non-geologic, of Wyandotte Cave; and topographic reconnaissance, not mapping, for canals, railroads, and turnpikes. I was comforted by Blatchley's words: "prior to 1837 there is but little record of work done toward utilizing the mineral resources or determining the geology of Indiana".

In that year, an act approved by the Indiana legislature on February 6 began:

> Be it enacted by the General Assembly of the State of Indiana, That the Governor be and is hereby authorized and required annually hereafter to appoint and commission a person of talents, integrity, and suitable scientific acquirements as Geologist for the State of Indiana, who shall receive in consideration of his faithful performance of his duties an annual

> salary not exceeding $1500.00 and necessary expenses not to exceed $250.00, to be paid as the salaries of other civil officers of the State.

Where to find a person of talents, integrity, and suitable scientific acquirements in any sparsely populated frontier State of the time might well have proved to be a problem, but Indiana was the home of a person so well fitted for the role that we must wonder whether the position was not created to utilize his talents. The man was David Dale Owen, one of the sons of Robert Owen, who had purchased the town of New Harmony on the Wabash River in Posey County in 1824.

New Harmony had been established in 1814 by a group of German extraction led by a man named George Rapp. They moved from a colony named Harmonie in Pennsylvania, and numerous letters written by them from the new Indiana settlement are datelined Harmonie, Indiana. It has been reported that Robert Owen changed the name to New Harmony when he acquired it, but a letter of 1815 from George Rapp to his son Frederick is datelined "Neu Harmony" using the German spelling "Neu" and ending the word "Harmony" with "y" instead of "ie". The Harmonists, during their 10 years, made no geologic contribution, but they built a physical base of operations in a wilderness, which their successors probably could not and surely would not have done. When Robert Owen, who was a successful industrialist and progressive thinker in New Lanark, Scotland, sought a site in America to test his ideas for social reform, the ready-made community of New Harmony was for sale and was purchased.

And how did it happen that David Dale Owen, as well as his brother Richard, became geologists? Surely, we must attribute the circumstance in considerable part to the aforementioned William Maclure, a Scot who in 1825 had become a partner with Robert Owen in the ownershp of New Harmony.

Self-trained in geology, Maclure accumulated a fortune in business at an early age and was then able to devote years to his avocations, geology and applied public education, with such success that he has been referred to as the father of American geology and the William Smith of America. The first chapter of Merrill's volume, *The First 100 Years of American Geology,* is entitled "The Maclurian Era, 1785-1819".

Maclure's reputation was established before he came permanently to North America; his geologic investigations and publications in this country, including some of the first regional maps showing the eastern portion of the continent, added to his luster, but this work preceded his investment in New Harmony. In fact, some of it preceded the establishment, under Father George Rapp, of the Harmonists' colony there. Maclure's maps of 1809, before New Harmony was established, and 1818, after the founding of the Harmonist colony, show surficial rocks in Indiana and Illinois Territory to be Secondary, equating in modern terms to Paleozoic and Mesozoic and implying sedimentary origin. He continued to publish, mostly on topics of global scale, through 1832, but his work did not emphasize the geology of Midwestern North America, although the last two of his American papers were published in New Harmony.

It was Maclure, without doubt, who attracted other eminent geologists to New Harmony and gave the New Harmony cultural and scientific movement a geologic flavor that was unique in the New World. The most lasting impact that Maclure had on American geology may well have been the inspiration that he afforded to

the then-young David Dale Owen, a person of great talent but without specific direction of interest until about 1835, after Maclure's departure from New Harmony. Maclure himself, his immense collections, and the eminent scientists that he attracted to New Harmony, must have been major factors in Owen's decision to become a geologist. For this purpose he entered medical school at Cincinnati and received the M.D. degree, apparently with no intent of becoming a practicing physician but because he regarded medical training as the best method of filling the gaps in his scientific knowledge. He had already some expertise in chemistry, and he thought it necessary to master physiology and anatomy in order to work with the fossils that were the key to decipering the geologic record in the Midwest. In 1836, apparently between sessions of his medical training, Owen assisted Dr. Gerard Troost, then State Geologist of Tennessee, in a survey of that State. Troost, a Hollander, had spent a period in New Harmony during 1825 to 1827, when Maclure was there.

In the course of horseback traverses in 1837, Owen determined the stratigraphic succession of the bedrock and accurately placed the units in relation to the time scale that was evolving for systemic nomenclature in Great Britain. He correctly separated the systems that later became in America the Mississippian and Pennsylvanian, and he distinguished between the rocks that form the present-day Ordovician and Silurian Systems, even though the Ordovician System was not proposed by Lapworth until 1879. To accompany his report, Owen prepared in 1838 an outline map of the geology of Indiana that was never published but was deposited in the State Library, from which it must have been lost or taken shortly afterward, as I am aware of no reference to it except Owen's own in which he described the map in sufficient detail to establish the fact that the boundaries shown must have been essentially the same as those shown on a map printed in 1846 as part of an Owen paper published in England. To tie the European and American continents together stratigraphically, carrying on precedents set by Maclure and Samuel George Morton, may not seem today to have been a notable accomplishment, but we are speaking of an era in which much of the stratigraphic work was done in a manner that did not offer any correlation of the rocks described with strata elsewhere. Stratigraphic units were most commonly named at the time by their lithologic characteristics, and Owen's were no exception, but their boundaries accorded with those of the classical British systems. His coal formation was the equivalent of the Upper Carboniferous of Great Britain, now the Pennsylvanian System in North America. The map correctly separated the British Lower Carboniferous that became our present Mississippian System and the Devonian and Silurian Systems of the time. A boundary line that encircled the crest of the Cincinnati Arch delineated the then Lower Silurian that became the Ordovician System. In establishing the time relationship of these units with the classical British type sections, Owen extended traditional stratigraphic treatment into a region more than 6,000 miles from the home base and thus furthered the concept of global chronostratigraphy.

The Fenton and Fenton volume, *Giants of Geology,* commented unfavorably upon the tendency for geologists of that time to restrict their interests to the collection and identification of fossils, but they quoted from the first Owen report as follows:

> I have considered it my duty, while surveying a country so new as ours, to remember, that a State just settling, is like a

> young man starting in life, whom it behooves to secure to himself a competency, before he indulges in unproductive fancies. I have considered it the most important object, to search out the hidden resources of the State, and open new fields of enterprise to her citizens. That object effected, time enough will remain to institute inquiries (which a liberal policy, forbids us to overlook) of a less productive and more abstract character; inquiries which are interesting in a scientific, rather than a commercial, point of view.

The Fentons continued "a sane as well as practical rule, and one which made the man who framed it America's first great economic geologist."

Owen correctly predicted that commercial coal would not be found beneath the uppermost of the limestones that are now classified as Mississippian in age. He called attention to both limestone and sandstone suitable for building stone, to clays and shales usable for ceramic ware, to natural cement rock, to iron ores that would suffice for the small-scale recovery operations of that day, to rock units that could be fashioned into whetstones and rotary grindstones, and to sand and gravel deposits. Owen did not actually discover all of these mineral resources, as most had already been noted and used, but he placed the materials into a geologic order that permitted a scientific approach to their location.

As to the prospect for discovery of certain other types of mineral deposits, Owen observed:

> None of the precious metals will ever be found in Indiana unless in minute portion in boulders...

and

> It is not likely that anthracite coal will ever be found in Indiana...

The Owen survey failed to mention only two of the resources that have contributed in any substantial measure to the mineral economy of the State during the ensuring 144 years, petroleum—and we should remember that his work preceded the drilling of the Drake well at Titusville, Pennsylvania, by more than 20 years—and gypsum, which does not appear at the surface and was not discovered until the 1950s.

Political support was strong for continuation of the Indiana survey, but the opposition was strong also. Not until two days before the end of the 1939 legislative session was a bill for continuation approved, and it was amended to cover only 1 year instead of the proposed 3 years. Although the bill passed in February 1839, the Governor did not immediately appoint Owen for continued service, an action that has been attributed, inconclusively, to political rivalry between the then Governor and David Dale Owen's brother Robert Dale. Whatever the cause, reappointment was not offered until June, and by then David Dale Owen had become interested in, and was fairly assured of receiving, appointment as a geologist for the Federal Government. He declined the Indiana appointment. State-supported geological investigations in Indiana virtually ceased for a period of 20 years.

Certainly the geologic activities of David Dale Owen and a number of his professional colleagues, including his brother Richard, did not cease, but most of them did not concern Indiana geology. The new federal appointment was as principal agent to explore the mineral lands of the United States beginning July 31, 1839. Since 1807 it had been the policy of Congress not to sell, but to lease, public lands that contained mineral resources, and in order to make either disposition of federal lands in the lead-bearing region of Galena, Illinois, Dubuque, Iowa, and Mineral Point, Wisconsin, it was necessary to have a geologic appraisal. The House of Representatives called upon the President to communicate to Congress all the information in possession of the Treasury Department relative to the "location, value, productiveness, and occupancy of public mineral lands," and to cause such further information to be collected and surveys to be made as might be necessary. The President, Martin Van Buren, sent the Resolution to the Secretary of the Treasury, who referred it to the Commissioner of the General Land Office. This was James Whitcomb of Indiana, who turned to fellow Hoosier, David Dale Owen, to carry out the work.

Maclure had died in Mexico in 1840, and at the request of Maclure's heirs, Owen spent some time classifying the huge Maclure collection, to which he added many items from his own field work. He made a lengthy collecting trip along the Ohio River in 1841, and the resulting two tons of material exceeded the capacity of the building he was then using as a laboratory, the second in a series. Maclure's sister then gave him a large building, which had been constructed of sandstone and brick by the Harmonists for use as a granary. He remodelled it extensively, and it came to be known as The Laboratory. It contained storerooms, workrooms, and a large lecture hall, as well as exhibit space. In 1846, the noted British geologist, Sir Charles Lyell, with Lady Lyell were the guests of the Owens, and Sir Charles went into the field to see such features of interest as could be readily reached from New Harmony. Soon afterward, Owen and Joseph Norwood, who later became State Geologist of Illinois, explored central Kentucky, apparently on their own and without other financial backing.

In March 1847, the Congress created two new land districts and provided for their survey and offer for sale. Owen was appointed in April to survey the Chippewa Land District northeast of the Mississippi River and south of Lake Superior. It was an area the size of the State of New York and mostly without settlements or established transportation routes.

In 1854, the Kentucky Assembly approved a geological survey of that State, and the Governor selected Owen to head it. In 1857, the Governor of Arkansas offered Owen appointment as State Geologist for a first survey of that State, and Owen accepted the appointment, after arranging with the Governor of Kentucky to continue direction of the Kentucky survey without salary. The first report of the Arkansas survey, covering the years, 1857 and 1858, was published in 1858, at a time when the fourth, and last, of Owen's Kentucky reports was still in preparation.

During the years of Owen's involvement in surveys of the territories and of Kentucky and Arkansas, efforts had continued to resume State-supported geologic work in Indiana. These efforts were successful in 1859, when the General Assembly approved a Geological Survey under the supervision of the State Board of Agriculture. The board wished no one but Owen to supervise the work, and Owen

accepted the assignment with the provision that his brother Richard would begin the study and pursue it until the Arkansas survey was completed. Richard Owen conducted a 65-day field season beginning in September and returned to New Harmony with 1,000 pounds of specimens. David Dale Owen reported to the State Board of Agriculture in Indianapolis in January 1860 on the progress of the work and plans for the following season, during which Richard Owen concentrated principally on the Coal Measures.

David Dale Owen had in the meantime further complicated his life by undertaking the construction of a new laboratory in New Harmony to replace the old granary. He designed every aspect of it and supervised the construction. Since the 1854 field season in Kentucky, he had been in poor health from constant bouts with some fever, and to these miseries were added those of acute rheumatism in October 1860. His biographer, W.B. Hendrickson, recounted that Owen was bedfast and dictating the second Arkansas report to two secretaries. His personal physician warned him, "Doctor, if you go on thus you will die in a week." Owen's reply was, "I only want 13 days to finish." He continued dictation until three days before his death on November 13, 1860, at the age of 53. J.P. Leslie wrote to James Hall, "Poor Owen is dead, suicide!", which in a sense was true. As Hendrickson observed, "David Dale Owen literally worked himself to death."

The second Indiana survey was completed by Richard Owen (1862), who was appointed State Geologist succeeding his brother. That the report, except for sections credited to Dr. Robert Peter, Prof. Leo Lesquereaux, and Mr. J.P. Leslie, was largely Richard Owen's work is clear, as shown by such entries as a response to an inquiry from Cannelton, Indiana, regarding the durability of sandstone for building:

> The freestone of Edinburgh, Scotland, which has stood for centuries unimpaired in buildings and bridges, is from the Coal Measures. And I may add a large granary, erected at New Harmony forty-five years since by the Germans, is from the higher series of the Coal Measures. It seems as substantial as the first day, except at one place where some salted meat by being piled against it, caused some scaling and crumbling.

Kenneth Owen and I examined, a few years ago, the sandstone in the building and speculated upon its probable source. It seems likely, in view of the transportation facilities of the day, that it came from the locality a short distance below New Harmony on the Wabash, where a ledge of sandstone forms the rapids that permitted the Harmonists to use water power in their mill. Exposures in the adjacent bluff retain no evidence of quarrying, but the stone resembles that used in the building. Whether based on this advice or not, the Mansfield sandstone is prominent in the architecture of Cannelton.

The second Owen survey was funded only for the period 1859-1861. In May of the latter year, legislation made the State Geologist a member of the Indiana University faculty *ex officio* and several published references during the 1860s refer to Richard Owen by that title, although a supporting organization and appropriation did not exist, and he was not paid directly by the State.

On March 5, 1869, the Indiana General Assembly approved:

> An Act providing for a Geological Survey and for the collecting and preserving of a Geological and Mineralogical Cabinet of the Natural History of this State, and Creating the Office of State Geologist, defining his duties, fixing his salary, and appropriating a sufficient sum of money to defray the necessary expenses of said Survey and for the collection and preservation of said Cabinet.

A new organization named the Department of Geology and Natural Science was established under the State Board of Agriculture, and Edward Travers Cox of New Harmony, a former associate of the Owens in various investigations, was named to head it, which he did for ten years, turning out ten annual reports published in seven volumes that contained much information on a wide variety of subjects but in the opinion and words of Blatchley "...contained little that was new or impressive." Blatchley attributed this deficiency to the fact that so many of the individual papers were county reports done by Cox's assistants, with much overlap and repetition of content.

In 1879, legislation replaced the Department of Geology and Natural Science with a Department of Geology and Statistics. The salary of the State Geologist was lowered appreciably, as were the operating funds, and the duties were vastly expanded in nongeologic directions. Cox declined to continue, and John Collett, who had served as an assistant to Cox, was appointed and accepted. The new department lasted only two years, and in 1881, a Department of Geology and Natural History was established. The term of appointment for the State Geologist was increased from two to four years. Collett continued in the position and turned out four annual reports.

And now, some forty-odd years into the 150 that we are reviewing, we have reached that point at which we can say something definite about geologic **education** in Indiana, as distinguished from geologic investigations. At Indiana University, courses that included some geology were taught at least as early as 1853, but, in the fashion of the day, they were termed natural science or natural philosophy. The Rev. Mr. Robert Milligan offered such training during 1853 to 1855, and Theophilus Wylie did so from 1855 until 1861.

Samuel Bannister Hardin's *Indiana University 1820-1904* first listed geology as a subject of instruction in the early term of the senior year for the "regular" course of instruction in 1856. Those students who pursued the "scientific" course for the Bachelor of Science degree also studied geology, but the record does not show whether the instruction was separate or different from that for regular students. During this period, the scientific course occupied three years and the regular course four, the difference being omission of the Ancient Languages. By 1865, it was specified that the geology in the senior year made use of Dana's textbooks. In 1868, the scientific course was lengthened to four years, and the former "regular" course was renamed the "classical" course. It continued to include geology in the final term, as did the scientific course, but the science students at sophomore level were also taking physical geography, which we may suspect to have included physiography.

In 1875, the classical course covered mineralogy and lithological geology at the junior level and paleontology at the senior. The scientific course had miner-

alogy and lithological geology at the junior level and stratigraphic geology, paleontology, and dynamical geology at the senior.

From the time that Richard Owen was appointed Professor of Natural Philosophy and Chemistry in 1864, we may be sure that geology was included in the instruction. His title was changed to Professor of Natural Science and Chemistry in 1874. Theophilus Wylie's history of Indiana University says that Richard Owen "gave instruction principally in Geology, Mineralogy, and Chemistry, and during vacancies in the Modern Language Department he taught German and French." Professor Harry Day, in a paper presented last year at the Indiana Academy of Science, said "...Owen was the first teacher of chemistry, physics, or geology at Indiana University to publish scientific papers." With Owen's retirement in 1879, such geologic instruction as was given, so far as we can determine, was offered by David Starr Jordan.

David Dale Owen's famed collection of 85,000 specimens was acquired by the University in the 1860s. It was lost, along with the University's library and administrative records and all scientific equipment and supplies, in 1883, when the Science Building burned. The loss was responsible for the decision to move the University from the location that it had occupied since its establishment in 1820, five blocks south of the Courthouse Square, to a new one five blocks east of the Courthouse. There, the Board of Trustees purchased a 20-acre tract known as Dunn's Woods, a part of the Dunn farm. Contracts were let and construction started in 1884 for the two first buildings, Owen and Wylie Halls, both to be important to the Department of Geology and the Geological Survey. Owen Hall was named in honor of Richard, David Dale, and Robert Dale Owen, Wylie Hall for Andrew Wylie, the first President of Indiana University, and for Theophilus Wylie, then Professor of Physics.

The year 1886 heralded introduction of the major subject system, and one of the courses of study leading to the B.S. degree was in Biology and Geology. Such dual or multiple designations were accompanied by liberalization of an elective system that had begun in 1868, although then affecting only languages. For some years after 1886, geology was one of the elective subjects that satisfied a science requirement for the A.B. degree.

In April 1885, the Board of Trustees had created a Chair of Botany and Geology, and a Department of Geology was established for the 1885-1886 academic year with the appointment of John Casper Branner as Professor of Geology, Instructor in Botany, Curator of the Museum. Three courses were listed, and a geology laboratory and museum were set up on the second floor of newly completed Owen Hall.

To return our attention now to the Geological Survey, Cox and Collett had been dutifully listed as faculty members *ex officio* in the University catalogs without, so far as I can determine, having any involvement with the academic program. Collett had been appointed to a 2-year term by a governor who was a Democrat and a 4-year term by the next governor, who was a Republican. A Democrat was elected governor in 1884, and, apparently unsuccessful in finding a qualified geologist in his own party, appointed Maurice Thompson, who was a civil engineer and a successful author of fiction. He served only three years, from 1885 to 1888. Two annual reports were issued during his tenure, and their geologic high points were new information concerning the thickness and character of the

glacial drift, a confused misunderstanding on the part of both S.S. Gorby and Thompson of the Niagaran reefs at the surface in northern Indiana, and the first accounts of the discovery of natural gas.

Thompson resigned before his term was completed but after the election of 1888, and the outgoing governor appointed S.S. Gorby to fill the position. The new governor was a Republican, but the legislature remained firmly in the hands of the Democrats, and they set out to remove as much as possible of the governor's authority. A bill, passed over the governor's veto, abolished the Department of Geology and Natural History and the appointive office of State Geologist connected therewith and established a new Department of Geology and Natural Resources, to be headed by a Director **elected by the General Assembly.** The legislature then appointed (not elected) Gorby State Geologist. The new governor refused to recognize the act, and in March of 1889, he appointed Collett to the post. Gorby declined to give up the office, and Collett apparently did not press the issue. In November, the Supreme Court held that the legislature had no power to create an office and then fill it; the choice must be made by the governor or by popular election. Gorby managed to hold on until 1890, when he was nominated by the Democrats and won the election. His six years in office were more notable politically than geologically.

The sixth State Geologist of Indiana, Willis Stanley Blatchley, was, in my judgement, the greatest builder of program strength during the first century of the period covered by this study. He served from 1895 to 1910—longer than any of his predecessors. Time in office is surely a factor in establishing a program, but from the beginning of his tenure he demonstrated an unusual ability to identify and attract capable scientists, either to work for his organization or to publish the results of their investigations in the annual reports without being paid. The authors of the papers in annual reports issued during the Blatchley years constitute a merit list in geology. To avoid comparison and unintentional ranking, I list a few of them in alphabetical other: George Ashley, one of the first and greatest coal geologists; E.R. Cumings (to be mentioned further in this paper); August Foerste, the sage of the Silurian; T.C. Hopkins, author of valuable reports on the geology of the industrial minerals and a turn-of-the-century sedimentary petrologist before the term was used; E.M. Kindle, stratigrapher and paleontologist in the Silurian and Devonian rocks and bibliographer and cataloguer of literature and fossils; and C.E. Siebenthal, expert on building stones and cement and the geology of the rock units used for both. Blatchley was primarily an entomologist rather an a geologist; he established an enviable record of productivity with meager funds— the sign of an able administrator.

In the election of 1910, Blatchley was defeated by Edward Barrett, who served two 4-year terms during which an increasing proportion of the published work was in the form of county soil surveys. This concluded the period during which the office was elective.

During the latter years of the 19th century and the early part of the 20th, much of geologic interest was accomplished outside the State-supported program and the academic institutions. In the 1880s, A.J. Phinney was the author of various papers in the annual reports of the organization that by then had come to be called the Indiana Department of Geology and Natural History, but Phinney's most notable achievement in Indiana geology was done under the aegis of the

Federal, rather than State, government and published in 1890 by the then relatively new U.S. Geological Survey in its 11th Annual Report. It was the 160-page paper entitled "The Natural Gas Field of Indiana"—one of the earliest and best in the annals of petroleum geology.

We cannot claim any Indiana affiliation for Frank Leverett, but surely he spent much time in Indiana doing geologic work for the United States Geological Survey, and it was in Indiana and other Midwestern States that he conducted much of the field work leading to early precepts of continental glaciation and distribution of glacial materials. His works and maps were published, beginning before 1900, in annual reports and monographs of the U.S. Geological Survey, and for Monograph 53, his co-worker and co-author was Frank B. Taylor, who was a native of Fort Wayne. The Laverett and Taylor manner of depicting glacial geology was notable in lending pattern and reason to the materials and to the events responsible for their distribution.

Frank Taylor has received less recognition than might have been expected for proposing, in 1910, some two years before Alfred Wegener, reconsideration of continental drift, which had been suggested much earlier by Francis Bacon in 1620 and Antonio Snider in 1855 without receiving serious attention. Both Taylor and Wegener were impressed by the jigsaw fit but had problems in explaining the mechanism. Wegener became noted for his advocacy and Taylor did not, in part because he lacked a DuToit. Doctor Johnson, it may be argued, would probably have been well recorded in history without Boswell, but Wegener, equally probably, would not have without DuToit, just as Hutton's views might have had much less impact but for Playfair.

During the same turn-of-the-century decades that we have been reviewing, the academic program in geology grew slowly after the Department was established. Branner stayed only six years, and the first graduate of record was Edward M. Kindle, who received the A.B. degree in 1893, by which time Associate Professor Vernon F. Marsters was in charge of the department. Kindle was appointed Instructor for the year 1893-1894, and for the first time, the department had a two-man faculty. John F. Newsom joined the faculty as Instructor in 1894-1895, replacing Kindle. A third faculty member, Edgar R. Cumings, was added as Instructor in Paleontology for the 1897-1898 year, beginning the longest service record in the departmental faculty. Doctor Cumings became head of the department in 1905 and retired as Emeritus Professor in 1944.

The first Master of Arts degree was awarded in 1899 to James Arra Price. The name of the department was changed to Geology and Geography in 1900, but the word geography was dropped from the title in 1904. J.W. Beede became Instructor in 1901-1902.

In 1902, the department moved from Owen Hall to the fourth and fifth floors of the new Science (now Lindley) Hall. The department's first doctoral degree was awarded in 1913 to J.J. Galloway, who was then appointed Instructor. The number of faculty reached four in 1916-1917, when W.N. Logan and C.A. Malott were appointed as Associate Professor and Instructor, respectively (J.J. Galloway had left to join Columbia University at the end of 1915-1916).

Indiana State government underwent massive changes, when a reorganization act was passed early in 1919 and took effect in April of that year. The Indiana Department of Geology and Natural Resources was abolished, and its responsi-

bilities were assigned to a Division of Geology within a newly created Department of Conservation. Because the office of State Geologist was elective, it had to be placed on the ballot in 1918, even though it was virtually certain to terminate. The victor was Louis Roark, who was a new faculty member in the Department of Geology. The office to which he was elected ceased before inauguration. In the new arrangement, the Division heads were appointive, and the governor designated Wm.N. Logan, who had joined the Indiana University faculty with the 1916-1917 academic year, to head the Division of Geology concurrently with his academic duties. With Logan's appointment, there began the closest alliance between the University's Department of Geology and the State program that has ever existed. An office that managed such regulatory matters as drilling permits and plugging of wells continued in Indianapolis, but the office of the State Geologist, as the position continued to be called, was on the Bloomington campus. Faculty members and students carried out most of the investigations, many of them through summer field parties. The annual reports that had been issued for so many years and that had included, in single-volume bound form, all the year's publications, became brief administrative accounts of the year's activities; scientific papers were issued, generally separately, within a numbered Department of Conservation series that included publications from other divisions. An exception was the *Handbook of Indiana Geology* (Pub. 21), which contained six parts and ran to 1120 pages. Included were C.A. Malott's "The Physiography of Indiana," in which he named and described seven bedrock physiographic regions that cover all of southern Indiana south of the Wisconsinan glacial boundary and extend, recognizable from subsurface records, beneath the thickening glacial drift to the north. Doctor Malott preferred to term himself a physiographer rather than a geomorphologist, and I believe that he was correct in doing so. He had the unusual ability to describe terrane in a manner that made it recognizable to persons seeing it for the first time. In the 64 years since Malott named the physiographic units, no changes have been made in their designation, possibly because Malott described them so well. Another part of the *Handbook* is John Robert Reeves' paper, "Preliminary Report on the Oil Shales of Indiana," a work that has received much attention during the past decade of energy concerns.

A final example of the University-State agency cooperative effort to which I refer is the Indiana Department of Conservation Pub. 75—*Geology of the Silurian Rocks of Northern Indiana*, one of a triumvirate of papers by E.R. Cumings, Chairman of the Department of Geology at the time, and Robert R. Shrock, who addressed this audience as the first Owen Award speaker. The three papers were fundamental works on reefs and their environment, and they have joined the ranks of classics. Reef geology, largely neglected during much of the time since Darwin's day, was principally of academic interest at the time of the Cumings and Shrock studies, but its significance to petroleum geology brought it to the forefront in the 1940s.

In describing the relationship between the Geological Survey and the Department of Geology during the 1920s and 1930s, I have mentioned a number of the principal players. The geology faculty was augmented by John R. Reeves and Wm.N. Tucker in 1921, by Arch Addington in 1923, and by Ralph Esarey in 1924. Wm.D. Thornbury was appointed Instructor in Geography in 1927, and J.J. Galloway returned from Columbia University as Professor in 1932. Several of those mentioned were here for only a few years, and the general size of the geology

faculty was four or five until the Second World War. With Doctor Logan's retirement after the 1935-1936 academic year, Ralph Esarey became State Geologist and served until 1945.

Life changed considerably, and for the better, for the department and the State Geologist in 1937, when both moved to Owen Hall, this time having the entire building and being very pleased.

Near the end of the Second World War, President Herman B Wells proposed to the Indiana Department of Conservation that the Geological Survey and the Department of Geology be directed by a single head and that the geology faculty constitute most of the professional staff of the Survey. Research Associateships were to be supplied through the Conservation budget, as were funds for field expenses. The search for a new head resulted in the selection of Charles F. Deiss, then head of the Department of Geology at Montana State University at Missoula, to be Chairman and State Geologist. He arrived in 1945 and began immediately to build staff. One of his best expressions was that the unspecified emoluments were the most persuasive in recruiting faculty and professional staff of high quality. By this he meant supportive services of high quality, such as drafting, photography, instrument making, and analytical capabilities. The Geological Survey grew under his direction to a staff of about 50 in a dozen years. Faculty expansion began immediately. Three of the faculty in the combined Department of Geology and Geography were teaching geology in the year before Doctor Deiss was appointed. Geography became a separate department with the 1946-47 academic year, and W.D. Thornbury, who had until then been principally engaged in geographic instruction, remained with the Department of Geology. Faculty size reached a plateau of 11 members by the early 1950s and remained at about that level until the 1960s. The curriculum expanded even more rapidly. Sedimentation, glaciology, and geomorphology appeared in the University catalog in 1946; petrography in 1947; optical mineralogy and sedimentary petrography in 1948; principles of geochemistry in 1949; and problems in applied geophysics in 1950. Field training, which had previously consisted of a local mapping course, was conducted at Red Lodge, Montana, during the summers of 1947 and 1948, and construction of our own Field Station in the Tobacco Root Mountains went on concurrently with the new course Field Geology in the Rocky Mountains in 1949. One of the students in that year's course told me that they ate as much sawdust as food. The rapid expansion of both organizations had posed imperative space needs to which Indiana University responded valiantly. The two organizations were occupying parts or all of 11 buildings when consolidation into the present quarters took place in 1962 for the Department and 1964 for the Survey.

I choose to close the account at this post-war period, being very leery of historic judgement before the episodes and results have seasoned.

As epilogue, we might contemplate how a frontier state established in 1816 turned so early in its history to geology as an aveune to economic progress and a vital part of its system of higher education, and I should say that it was fortuitous rather than a result of planning. That fortuity began on the banks of the Wabash when William Maclure became a partner in the New Harmony venture. George Browning Lockwood, in a 1902 volume named *The New Harmony Communities* commented:

> While the Rappite regime is less interesting, and vastly less important, then the Owenite period, it affords a strong back-

ground for the later experiments, the failure of George Rapp's success standing out in vivid contrast to the success of Robert Owen's failure.

The Harmonist colony was materially productive, so much so that departure and a new start elsewhere became necessary to preserve their objectives, and their legacy was a material one. The Owen experiment foundered in its formative months, but it left a legacy of science, culture, and education that is identifiable two decades after its sesquicentennial anniversary.