

Notable Contributions of Early Indiana Geologists

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David Dale Owen was not the first geologist to visit Indiana, nor the first to live in Indiana, but he was probably the first to whom the name Indiana geologist can be applied accurately, and his contributions were major, in considerable part because his observations were applied to virgin territory. The pre-Owen knowledge, or lack of it, is revealed by William Maclure's map of 1818 (6) on which all the bedrock west of the Appalachians was shown as Secondary, equating in modern terms to middle-to-late Paleozoic.

In 1837 the State Legislature authorized the designation of a geologist for the State of Indiana, and Owen was appointed by the Governor. During that year and the succeeding one, Owen made horseback traverses that resulted in his assignment of the bedrock units to the Paleozoic systems already established in Great Britain. All the systemic boundaries remain where Owen placed them. He also correctly separated the systems that later became in America the Mississippian and Pennsylvanian, and he distinguished between the present-day Ordovician System and the Silurian System, even though his work preceded the Sedgwick-Murchison controversy, and the Ordovician System was not proposed by Lapworth until 1879 (4). To accompany his reports 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 (8), 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 on a map printed in 1846 as a part of an Owen paper published in England (9).

Owen's brief work of the 1837-39 period was followed by a hiatus of 20 years in State-supported geologic activities, except for a few studies by Ryland Brown, Geologic Agent for the Indiana Department of Agriculture. A second episode of activity by David Dale Owen began in 1859, but it concluded soon afterward with his death in 1860, appointment of his brother Richard to succeed him briefly, and then another suspension of any State-supported program in geology.

The geologic effort that succeeded the Owen surveys was established in 1869 as an organization named the Geological Survey of Indiana. Unlike the two earlier episodes of activity, the Survey was a unit of State government, whereas the Owens had been appointed as individuals to fulfill specific assignments. The new Survey was headed by Edward Travers Cox, an assistant of David Dale Owen during and in surveys for the United States government of the upper Mississippi Valley and areas within other states. His principal contribution, in my view, was the establishment of a sound and continuing State geology program. The annual reports issued during Cox's 10 years in office covered the mineral resources recognized to that time and offered the first specific

information designed to encourage development and to attract industry to the state.

Next in chronological order, I would point to the work of A. J. Phinney, who in the 1880's 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 by the U.S. Geological Survey (10). 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.

The sixth State Geologist of Indiana, Willis Stanley Blatchley, was, in my judgement, the greatest builder of organizational strength during the period covered by this study. He served from 1895 to 1910—a longer period 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 to his organization. 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 order: 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.

To shift now from bedrock to unconsolidated deposits and the processes that formed them, we can hardly regard Frank Leverett as an Indiana geologist, 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 (5) his co-worker and co-author was Frank B. Taylor, who was a native of Fort Wayne. The Leverett and Taylor manner of depicting glacial geology was notable in lending pattern and reason to the materials and the events responsible for their distribution.

Frank Taylor has received less recognition than might have been expected for proposing, in 1910 (12), 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.

A turn from glacial geology to geomorphology and physiography is not abrupt. Clyde Arnett Malott, who spent a productive life studying the geology of Indiana, made his own contributions to knowledge of the State's glacial geology, and he was a sound stratigrapher, as evidenced by his work with Meramecian and Chesterian rocks, among others, but I would place his unique accomplishments in two other fields—karst processes and geomorphology, and descriptive physiography. In the former field, he utilized the Mississippian karst terrane of southern Indiana and some other Midwestern regions to formulate concepts of underground drainage and its development in numerous, generally short, papers published principally in the Proceedings of this Academy. His other unusual achievement to which I refer was to name and describe (7) seven bedrock physiographic provinces that cover all of southern Indiana south of the Wisconsin 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 half-century since Malott named the physiographic units, no changes have been made in their designation, possibly because each unit is as Malott described it. I cannot be objective about Malott's accomplishments, as it was his enthusiasm for geologic work and his ability to transmit that enthusiasm that drew me into the field. I am not alone.

Approaching now perilously close to the 50-year-ago limit that I have set arbitrarily for this review, I call your attention to the fundamental works on reefs and their environment by E. R. Cumings, long-term faculty member and chairman in the Department of Geology at Indiana University, and R. R. Shrock, an undergraduate and graduate student in that department in the 1920's. Doctor Cumings was well-known long before the reef work was undertaken for his research in paleontology and stratigraphy, particularly of Ordovician and Silurian rocks. Doctor Shrock went on to other triumphs as faculty member at the University of Wisconsin, where he was co-author with William H. Twenhofel of the text *INVERTEBRATE PALEONTOLOGY* (13) on which many of us were reared. Later he was co-author with H. W. Shimer of the revised *INDEX FOSSILS OF NORTH AMERICA* (11) and became a faculty member and ultimately departmental chairman at the Massachusetts Institute of Technology, but these were achievements that post-dated the period covered by our review. The work on reefs, beginning with a paper in 1927 in the Proceedings of this Academy (1), followed in 1928 by Publication 75 of the Indiana Geological Survey (2), and another with greater geographic coverage in the same year in the Bulletin of the Geological Society of America (3), have joined the ranks of classics. Reef geology, largely neglected since Darwin's day, was principally of academic interest at the time of the Cumings and Shrock studies, but there are few subjects of greater significance in petroleum geology today.

Numerous efforts of the past 50 years may merit inclusion in a list of notable contributions when they come of age and can be evaluated in the light of history.

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