

Memorial to Francis J. Pettijohn 1904–1999

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His life spanned most of the 20th century and he influenced many. By the time he finished high school, Francis Pettijohn knew he wanted to be a geologist. All his academic training was at the University of Minnesota (B.A., 1924; M.A., 1925; and Ph.D., 1930), where Professor Grout was his advisor and the Precambrian of Minnesota was the great center of geologic interest, studied through fieldwork, thin sections, and a few wet chemical analyses. The titles of Francis's M.S. and Ph.D. theses, "Phosphatic Pebbles of the Twin City Ordovician and Their Geologic Significance" and "The Conglomerate of Abram Lake, Ontario and Its Extensions: A Study of Pre-Cambrian Sedimentation and Structure," indicate his interests. Francis taught briefly as a graduate student at nearby Macalester College but spent 1925 to 1927 at Oberlin College in Ohio. His article "Geology at Oberlin a Half Century Ago," published in the Oberlin alumni magazine in 1980, is a fine insight on a small Midwestern geology department in the late 1920s. While at Oberlin, Francis married Dorothy Bracken, and they had three children—Norma, Clare, and Loren. Francis developed his teaching skills and explored the beaches of Lake Erie, but he spent some of his summers in the North Woods. In 1927–1928 he was a Fellow at the University of California, where he became acquainted with Andrew E. Lawson, from whom he learned much.



In 1929, Francis moved to the University of Chicago, started a program in sedimentary rocks with two sedimentology courses, and at night he taught chemical microscopy (following in the footsteps of Lucien Cayeux). He and W.C. Krumbein published *A Manual of Sedimentary Petrology* in 1938, a landmark book that was recently reprinted, and *Sedimentary Rocks* (1949), which established his reputation worldwide. His most famous paper at that time was "Archean Sedimentation" published in the *GSA Bulletin* in 1943. In 1946 Francis was promoted to full professor. During these Chicago years he directed some 12 Ph.D. students and spent nearly every summer in field studies in the Lake Superior region for the Michigan and U.S. Geological Surveys and the Geological Survey of Canada. This work was primarily field mapping, but during World War II, he helped miners in the Upper Peninsula of Michigan with magnetometer surveys, core logging, and general stratigraphy—iron ore production geology—an experience that gave him a lifelong interest in banded iron formations. He found these practical applications very satisfying. During these prewar Chicago years he was active with the National Research Council in Washington, the forerunner of today's National Science Foundation, and often commented on how stimulating these small meetings were. Someone would bring along a puzzling rock and a wild discussion would break out. Later he edited the *Journal of Geology* for six years and traveled abroad, mostly to international meetings.

When he was 48 years old, Francis moved to The John Hopkins University in Baltimore in 1952, where he remained for the rest of his life, becoming emeritus in 1973. He left Chicago because fieldwork was considered old-fashioned. At Johns Hopkins, Francis discovered the Appalachians, had new colleagues, and had the most productive part of his career. He published *Paleocurrents and Basin Analysis* (1963) and *Sand and Sandstone* (1972) (later translated into Russian and Chinese), and he revised *Sedimentary Rocks* (1976) for the third time. He also published *Atlas and Glossary of Sedimentary Structures* (1964) and *Memoirs of an Unrepentant Field Geologist* (1988), helped edit *Studies of Appalachian Geology: Central and Southern* (1970), and *A Century of Geology, 1885–1985, at the Johns Hopkins University* (1988)—a most remarkable record for someone who was also department head for six years. He also supervised 26 Hopkins Ph.D. students, went to NSF meetings in Washington, had three children in high school and/or college part of this time, and found time for music and extended vacations on freighters. While at Johns Hopkins, he received many foreign visiting geologists who came to the United States at the invitation of the U.S. Geological Survey. With all of these activities, Francis found time to be a Geological Society of America Councilor and to serve on several advisory boards.

During his lifetime Francis received many honors: fellow and Penrose Medal awardee of the Geological Society of America, the American Academy of Arts and Sciences, and the Society of Economic Paleontologists and Mineralogists; corresponding member of the Geological Society of Finland; member of the U.S. National Academy of Sciences; honorary fellow of the Geological Society of India; honorary member of Humane Letters (Johns Hopkins University); and an honorary Doctor of Science degree (University of Minnesota). He also received the Twenhofel Medal of the Society of Economic Paleontologists and Mineralogists, the Wollaston Medal of the Geological Society of London, the Penrose Medal of the Geological Society of America, and the Sorby Medal of the International Association of Sedimentologists.

Francis experienced significant family tragedies. Both his wives died—Dorothy Pettijohn in 1989 and Virginia Romberger in 1996. Francis is survived by a brother, a sister, his three children, seven grandchildren, and four great-grandchildren.

Much of Francis's retirement was almost as active as his earlier years at Johns Hopkins. He revised several books, published two memoirs, continued to participate in NSF meetings, and attended some national geological meetings.

Considering the facts of his life, some questions come to mind: What were the significant geological influences and the special qualities and viewpoints that guided his career?; what was his influence, and how was it transmitted?; and how well does his life span reflect the great changes in both America and geology of the 20th century?

Significant Influences. Professor Grout introduced Francis to serious fieldwork in the Precambrian of the Lake Superior region. In a department where the Precambrian was king, we might wonder why Francis selected two sedimentary thesis topics, phosphate pebbles and a conglomerate. Could it be that this choice was also the direct consequence of growing up in the Midwest, on its cratonic basins with many outcrops, diverse Paleozoic layer-cake stratigraphy, oil wells, and Pleistocene cover? Until he moved to Johns Hopkins, the Lake Superior region was not only his first love—you might say he learned his geology there—but almost entirely his only database of experience, with the exception of a year of many field trips to Berkeley. Professor Grout also emphasized to Francis the importance of simple and clear expression, something that Francis subsequently developed to a high art as editor of *The Journal of Geology*. At Berkeley, Andrew Lawson showed Francis how to critically analyze an article: What is the key question? What methods are used to answer it? Is the evidence there, and is it analyzed correctly? His California experience showed Francis the value of the field as a teaching laboratory, and because he had to take petrography and petrology classes a second

time, Berkeley gave him an exceptionally strong background for his later thin-section studies of sedimentary rocks. At Oberlin and Chicago Francis improved his explanatory skills through teaching and widened his Lake Superior Precambrian database. But the move to Johns Hopkins greatly expanded it. The central Appalachians became his modern-sediment equivalent, where sedimentology could be applied so much easier and with more telling results in comparison to earlier applications in the Lake Superior region. His early time at Johns Hopkins also coincided with a period of rediscovery from Sorby of sedimentary structures and their hydraulic interpretation, paleocurrents, great new insights into depositional systems, and basin analysis and the arrival of plate tectonics. Francis was very much aware of how this new intellectual environment at Johns Hopkins stimulated him and summed it as *new rocks + new people = new ideas + enhanced productivity*. At the time, there were 26 Ph.D. students at Johns Hopkins. Although he failed to practice it fully, he often said that it might be good for the entire profession if everyone had to move every 10 years.

Throughout most of his academic career Francis was at first-class institutions that valued research. Thus, he associated with talented people. At Chicago they were Norman Bowen, J Harlen Bretz, Heinz Lowenstam, and Hans Ramberg, among others (W.C. Krumbein and Larry Sloss were graduate students there), and at Johns Hopkins they were Ernst Cloos, Hans Eugster, Steven Stanley, and Aaron Waters (Paul Hoffman and Earle McBride were graduate students, and Roger Walker was a NATO Fellow). In addition, he worked for many years with state and federal geological surveys, which provided summer income, logistics, and publication outlets. A good example of the latter was his classic USGS Professional Paper 440S, "Chemical Composition of Sandstones—Excluding Carbonate and Volcanic Sands." Thus, his career demonstrates that a talented, dedicated, and energetic person in the right environment will almost always succeed. Maybe it was not so hard for Francis to accomplish so much after all.

Qualities and Viewpoints. The following special qualities and viewpoints were typical of Francis and served him well throughout a spectacularly successful, long life. Francis had sufficient self-confidence that he could fully appreciate and easily work with talented people and learn from them. He had the ability to read an article critically (thanks to Andrew Lawson). He persuaded with good observations, rationality, and tact. Conversely, even though Francis had some strong opinions, he was conservative in his expression of them. Francis followed the rule, "Clarity of expression is best achieved by simplicity of expression." His favorite short and simple rule was, "Only outcrops keep geologists honest," which goes far to explain the common-sense attitudes seen in his writing. Francis had a great love for geology and an appreciation of its historical development. He believed that a full life includes dedication to one's family, research, and profession. Francis had enough energy and good health for all of the above.

His Influence and How It Was Expressed. Francis's influence on the profession was great and extended worldwide. Even as late as 1998, 25 years after he retired, his publications were cited 57 times; from 1990 to 1998, they were cited 497 times. His influence was transmitted through his books, his key articles, and his many students and visitors. Many of his students became prominent in the U.S. and Canadian Surveys, the U.S. petroleum industry, and university teaching. Many people had the opportunity to work with him and watch how he approached and resolved geologic problems—by asking questions that could be answered by the direct study of rocks or sediments rather than questions based on general physical, chemical, or geological principles. Right or wrong, his analysis of a problem always employed a strong internal logical consistency and a full review of the prior literature.

Changes in a Long Lifetime. When Francis received a Ph.D. in 1930, there were only half a dozen or so geological journals in North America. Today they are numerous, electronic publishing is rapidly growing, and specialization, funded research, instrumentation, and governmental funding are all important. Consider how much longer it takes to obtain a Ph.D.

now than in 1930, and that post-Ph.D. fellowships today are widely believed to be essential for a good academic job. Modern sediment study is commonplace today, and planetary and marine geology both loom large in the geosciences, but soon may be overshadowed by the search for data on global climatic change. Computers are everywhere. Most important is that plate tectonics gave geology a unity that it never had before.

Francis was a bystander to all this in the sense that, like most of us, he did not learn, develop, or directly use or approve of all of these developments. But in another sense he rode the waves of 20th century change. The clarity of his writing, with its emphasis on rocks, his ability to identify the key question, good working conditions, his many students, and his love of geology sustained Francis through a long and spectacularly productive life, all the while spreading his influence to every continent. Yet he still attended to profession and family. His was a model life for us all.

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