

Memorial to Edwin Dinwiddee McKee

1906–1984

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Grand Canyon scenic panoramas are a succession of spectacular, awe-inspiring, kaleidoscopic landscapes for the fortunate earthly visitor who has witnessed the color and mood changes from sunrise to zenith to sunset, from season to season, canyon rim to river. A parallel to this succession is the lifetime and milestones of a mentor and friend, Eddie McKee. His canyon story started in 1927 with ancient landscapes (1931) and the Coconino Sandstone (1934) and ended with the Supai Group (1982, 1983). His remains are laid to rest among the peaceful pines along the canyon rim.

Edwin Dinwiddee McKee, noted Grand Canyon geologist, naturalist, and teacher, was born September 24, 1906, in Washington, D.C., where he lived his youth as the "All-American Boy." His introduction to science came from his mother's influence. The skillful field teaching of a Miss Bartlett opened Eddie's eyes to natural science. She was a botanist in the village of Canaan Street, New Hampshire, where the family spent summers during World War I. The two McKee boys, John and Eddie, were fortunate indeed to have François Emile Matthes—Yosemite–Rainier–Grand Canyon civil engineer, topographer, and geologist of the U.S. Geological Survey—as the scoutmaster of Boy Scout Troop 1 in Washington. Eddie earned 54 merit badges. Matthes led Eddie toward geology and the Grand Canyon. John became a civil engineer.

The Grand Canyon was raised to national park status in January 1919. Dr. John C. Merriam, vertebrate paleontologist and president of the Carnegie Institution, was directed to develop public education at the park. François Matthes (Bright Angel quadrangle topographer, 1902–1903, published in 1932) recommended young McKee to Merriam. In 1927 Eddie was given the opportunity to prepare and install educational exhibits, including a topographical model, for the planned Yavapai Point observation station and trailside museum at the head of the Kaibab trail. McKee worked at this project during the summers of 1927–1929. During this time he came in contact with David White, Charles Gilmore, N. H. Darton, Herbert Gregory, and Douglas Johnson.

McKee attended Cornell University because of Heinrich Ries, head of the geology department. He graduated in January 1929. He had previous training at the U.S. Naval Academy and some course work at George Washington University. At Cornell, Charles M. Nevin sparked Eddie's interest in sedimentary geology and the scientific method through innovative laboratory experimentation. Nevin and Ries suggested the Coconino Sandstone as a thesis for graduate studies.

At age 22, McKee became park naturalist at the Grand Canyon when Glen Sturdevant, the park naturalist at the time, drowned crossing the Colorado River on January 20, 1929. Eddie served from spring 1929 to the end of 1940. During this time he married Barbara and their three children were born, while Eddie pursued graduate studies at the University of Arizona, 1930–1931, the University of California at Berkeley, 1933–1934, and as a cooperative park service fellow to Yale University, 1939–1940.

The Grand Canyon was a perfect field laboratory for young, enthusiastic McKee, who was at the right place at the right time. As Hans Cloos put it in his *Conversation with the Earth* (1954), "Geology is the music of the earth," and the Canyon was Eddie's symphony to enjoy, in the style and cadence of Grofe's "On the Trail." Even Eddie's hiking style was springy, bouncy, and sprightly. He served the public during visitors' season and did exploratory field research and academic studies at every opportunity. His professional career as a national park naturalist dealing with visitors from all over the world had profound influence in Eddie's life. His attributes of congeniality and gregariousness, as well as his efforts to perfect popular scientific communication, served him well during his lifetime. The rugged canyon terrain taught him the rigorous mental and physical discipline needed to organize and implement the field research programs that burgeoned from his fertile mind. This discipline included keen observation and perception, note-taking, and improvisation of simple field and laboratory tools, as well as collecting, cataloguing, describing, and synthesizing. Integration and interpretation of the data were his hallmark, culminating in the lucid written report, of which he became a master.

The Colorado River has exposed an almost continuous Paleozoic section along the canyon walls and within the gorge about normal to the axis of the Cordilleran geosyncline to the west. Early in McKee's professional career as a naturalist at the Grand Canyon, he set out as his lifetime program to research this section and to familiarize himself with the fauna and flora of the park along the way. He followed in the footsteps and spirit of Major John Wesley Powell, his hero. Eddie sought to understand the transgressions and regressions of the sea across northern Arizona through sea-level changes and epicric crustal movements, lateral and vertical marine-continental lithofacies and biofacies transformations, cycles of sedimentation of diverse facies, and great varieties of sedimentary structures—especially the spectrum of stratification, and the fruits of sedimentary analysis—paleogeographic and paleoecologic reconstructions. All are clearly demonstrated in his writings.

The results of this boundless energy for the Paleozoic-Mesozoic (part) sedimentary record in the Grand Canyon as documented by McKee are Cambrian Tapeats Sandstone, Bright Angel Shale, Muav Limestone (1945); Mississippian Redwall Limestone and Chesterian strata (1969, 1982); Pennsylvanian Supai Group (part) (1982); Permian Supai Group (part) (1982), Coconino Sandstone (1934), Toroweap and Kaibab Formations (1938); and the Triassic Moenkopi Formation (1954). Ordovician and Silurian strata have not been recognized in the Grand Canyon. Mapping of the Devonian Temple Butte Limestone was never completed by Eddie; it has received some attention, but more in-depth study is needed. The Permian Hermit Shale was well documented by David White (1929), whom Eddie assisted in the field.

McKee's Grand Canyon park naturalist career lasted until the end of 1940. At that time, he was to be transferred to Yosemite Park, so he resigned. He served as park naturalist for less than 12 years; yet the remarkable published record of Grand Canyon geological history represents more than 55 years of field study and creative thought. Eddie became assistant director in charge of research at the Museum of Northern Arizona in 1941; there he continued field studies throughout the summers of 1942–1953. From 1942 on, he was also on the faculty of the University of Arizona, where he advanced to professor in 1950 and was head of the department of geology from 1951 to 1953. McKee was chief of the Paleotectonic Map Section of the U.S. Geological Survey in Denver from 1953 to 1961. During this time, he was responsible for reports on the Jurassic (1956) in time for the International Geological Congress in Mexico City, as well

as the Triassic (1960), Permian (1967), and Pennsylvanian (1975) Systems. He contributed to the Mississippian (1979), the last report of the series. After 1961, McKee was a research geologist, officially retiring in 1977; however, he continued his Survey affiliation and maintained his office and laboratory activity for geological research until the time of his death.

Eddie's insights into the sedimentary realm to understand origin, processes, and factors for quantification resulted from his focus on the "frozen" ancient record, probable dynamic Holocene analogs, and empirical experimental replication. He studied ancient rocks on all continents except Antarctica. He examined Holocene environments at every opportunity in places such as the Colorado River delta, the lagoon and tidal flats of Cholla Bay, Sonora, Kapingamarangi Atoll in the Pacific Ocean, Namibia in south-west Africa, the Orinoco River in Colombia and Venezuela, and the Middle East. His laboratory experiments started in the classroom under Nevin at Cornell (1928–1929); continued at the Museum of Northern Arizona, Flagstaff (1943–1944), the University of Arizona (1950–1953), and the U.S. Geological Survey in Denver (1956–1984) in the "Sedimentary Laboratory—Model studies of stratification and primary structures" that Eddie built. There he conducted innovative flume and tank experiments.

McKee's perceptive field observations and experimentation produced a model study of the types of cross-stratification and their significance (1953). Recumbent cross strata are another example. Eddie first noticed this structure in fluvial Cretaceous Nubian Sandstone of Libya and Egypt and equivalent rocks in Ethiopia and Jordan (1962). He reproduced it experimentally (1962; Andrews, 1985), and it was soon recognized in Holocene bank sediments of the Red River, Louisiana (Harms, Mackenzie, and McCubbin, 1963). Another example, climbing-ripple structure, was first noted along the Colorado River below Yuma, Arizona, by McKee (1939) and then in Jurassic sandstone in Jordan (1962) and was produced in the laboratory (1965, 1966). Charles Nevin's influence was indelible in Eddie's mind throughout his professional career. Thus, he could firmly establish and quantify the parameters leading to his clear understanding of the origin of an array of sedimentary features in ancient rocks and modern sediments.

Eolian dunes became a major research pursuit in McKee's lifetime program. Study of wind versus water germinated in McKee's mind at the Grand Canyon with the origin of the Coconino Sandstone. This led to studies of sand dunes and sand seas (eolian desert, coastal, carbonate dunes, and sand sheets) around the world. Eddie developed his own style of sand dune research patterned after Bagnold's classic wind studies. This is illustrated in his field observations of the structures of the White Sands National Monument dune field of New Mexico (1966, 1975), where he cut transverse trenches 40 feet high (!) through the dunes to examine their internal patterns. Tad Nichols of Tucson was his photographer and field companion. Subsequent studies were done in the Southwest including Sonora, Mexico, and the great sand dunes of Colorado, as well as along the Gulf Coast, in Libya (1964), in Brazil (1972), in Saudi Arabia (where he was a consultant), in Namibia (1982), and on carbonate dunes of the world (1983). These studies culminated in the global sand seas monograph (1979), which includes NASA Landsat satellite photography and dune analysis of the world. Eddie was affectionately titled "Mr. Sand Dunes" by his friends in the Middle East and Africa.

Edwin McKee's honors included election to fellowship in the Geological Society of America, 1937; life trustee and the Edwin D. McKee Chair established in 1983 at the Museum of Northern Arizona; honorary D.Sc. degree from Northern Arizona University, 1957; president, honorary member, and William H. Twenhofel Medalist of the Society of Economic Paleontologists and Mineralogists, which dedicated a symposium to

him; Certificate of Achievement from his alma mater, Cornell University, in 1982 (Cornell does not confer honorary degrees); Department of the Interior Distinguished Service Award in 1962; honorary member of the Colorado Scientific Society and Rocky Mountain Association of Geologists; Powell Lecturer of the American Association for the Advancement of Science, and Powell Centennial guest speaker at the Grand Canyon; Gurley Lecturer at Cornell; American Association of Petroleum Geologists Distinguished Lecturer; invited speaker at the Brazilian Geological Congress; invited lecturer to the USSR Academy of Sciences in Moscow, Leningrad, and Tashkent; invited speaker to the Institute of Ecotechnics in Katmandu, Nepal; an award and room named in his honor at Pike's Peak Community College, Colorado Springs, Colorado; Group Achievement Awards from NASA and Skylab IV Apollo-Soyuz Team Project; and nine fossil species named in his honor.

McKee enjoyed leading field trips, serving on committees (often as chairman), organizing and contributing to symposia, attending international geological congresses and other meetings, directing overseas expeditions, consulting, and social functions.

Eddie and Barbara McKee shared a rich life together; his success has been her joy and reward. Barbara was doing biological field studies in the Grand Canyon when they met; they were married December 31, 1929. Barbara was his cheerful companion thereafter, throughout Eddie's studies around the world. They had three children: William, born in 1931; Barbara, born in 1932; and Edwin H. "Ted," born in 1935. Eddie and Barbara shared a common interest in natural history. This was reflected to all who knew them during memorable visits to their home.

Eddie liked people. He especially enjoyed sharing the fruits of his travels and researches, and his personal magnetism touched many friends throughout the world. He was a gentle, uncomplicated, straightforward man with great wit and a youthful curiosity about life and nature. McKee could charm with his wholesome anecdotes, which he told slowly and deliberately. He focused his sharp, sparkling eyes on his listener to gain attention and chuckled with the humor of the punch line. His scientific writings were carefully prepared with clarity of thought (Andrews, 1985), and they serve as a model of preciseness and lucid communication. Eddie McKee's gifts to the profession and to the public will long continue to serve and guide us. What a treasure we have had in this talented, creative human being!

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