

Rock Stars

INTRODUCTION

Bernard of Chartres, an 11th-12th century philosopher and teacher, said that we are like dwarfs on the shoulders of giants, so that we can see more than they and for a greater distance, not by any virtue of our own but because we are carried high and raised aloft by their stature.

All of us have our geological heroes, those giants on whose shoulders we stand. To encourage recognition of these luminaries and to provide inspiration for students and young professionals, the GSA History of Geology Division presents *Rock Stars*, brief profiles of our geological giants. If you have any comments on profiles, please contact Robert N. Ginsburg, University of Miami, RSMAS/MGG, 4600 Rickenbacker Causeway, Miami, FL 33149-1098, E-mail: rginsburg@rsmas.miami.edu.

—Robert N. Ginsburg, *History of Geology Division*



Karl Gilbert at age 19 (from Davis, 1926).

Model Survey Geologist: G. K. Gilbert

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It would have been hard to predict that a rather sickly, quiet boy from Rochester, New York, would become one of the most famous geologists to explore the American West, crossing Death Valley by foot and mule, fighting upstream through the Grand Canyon, crisscrossing the basins and ranges of Utah, Arizona, and New Mexico. Not only did G. K. Gilbert survive these many adventures (as well as the 1906 San Francisco earthquake), but his scientific reports based on this and other field work are some of the best geologic papers ever written. It seems that Gilbert's geologic career started as a series of fortuitous events, but a look at his early life reveals certain qualities that may have inclined him toward the profession.

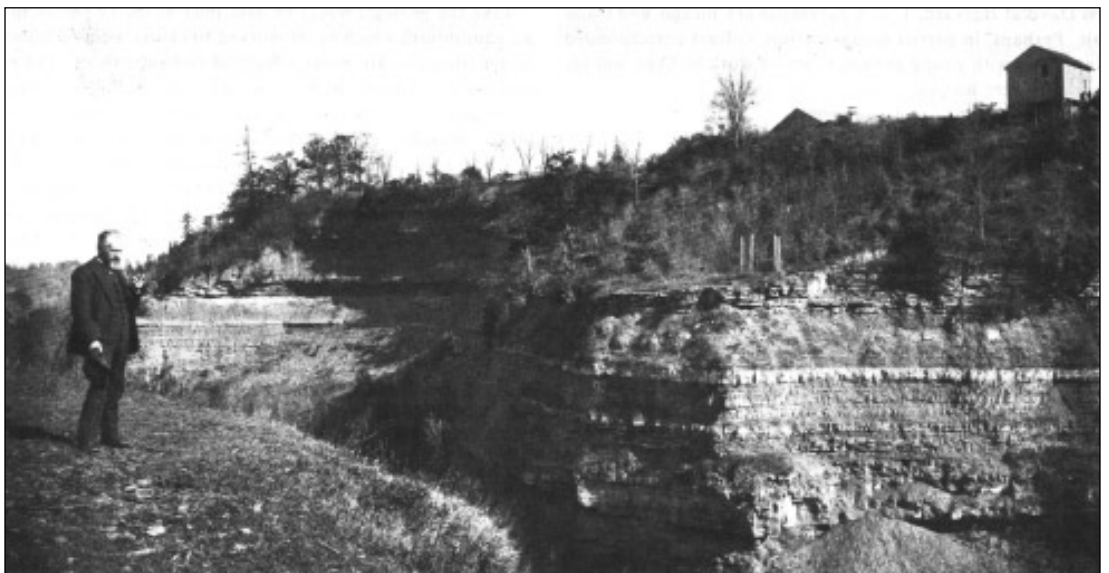
Grove Karl Gilbert, called Karl, was born in 1843 into a tightly knit family

who loved to spend the evening solving puzzles and riddles, and doing other mental gymnastics. His father was something of a family maverick, a self-taught portrait painter who barely eked out a living; thus Karl's family was too poor to afford much in the way of entertainment outside the home, which they called the "Nutshell." Karl seems to have had no problem entertaining himself, though—in addition to puzzle-solving, he liked to read, including popular magazines, and was particularly fond of boating; with a friend, he built several small boats, which they took on the Genesee River near Rochester. A quiet, intelligent child, Karl was very curious, and early on, he developed excellent powers of observation. His superb physical intuition is evident in this recollection of childhood boating experiences:

When I was a boy I noticed that by rocking a skiff I gave it a forward motion. That led to the trial of other impulses, and I found that by standing near the stern and alternately bending and straightening my legs so as to make the skiff rock endwise, I could produce a forward velocity of several yards a minute. If I stood on one side of the medial line, the skiff moved in a curve. The motions I caused directly were strictly reciprocal, the departures from initial position being equaled by the returns. The indirect result of translation was connected with reactions between the water and the oblique surfaces of the boat.

Karl finished high school at the age of 15 and, because he showed academic promise, went on to the University of Rochester, with some financial sacrifice from his family. His clothes were quite shabby and his social life restricted, but

Gilbert along the Genesee River near Rochester, New York. (Photo published in Yochelson, 1980, courtesy of USGS Photographic Library.)



he seems to have borne cheerfully and with an even temper whatever hardships came his way. He enrolled in the classical curriculum, centering on mathematics, Greek and Latin, and rhetoric and logic. Because he was fairly frail, a condition set by his father for his attending college was a program of regular outdoor exercise, and this may have inclined Karl toward geology, which was one of the minor subjects he took. His professor was Henry A. Ward, founder of Ward's Natural Science Establishment, which at that time was called Cosmos Hall. Ward collected geological and zoological specimens and supplied them primarily to museums and schools.

Karl graduated from college in 1862. Probably because he was physically weak and also perhaps because he was disinclined toward conflict, he did not enlist for military duty in the Civil War, nor was he drafted, though his name came up twice. He had debts to pay off from college, so he took a job teaching public school in Jackson, Michigan, where his older sister lived. But Gilbert had so much trouble handling unruly schoolboys that he quit even before the school year ended!

Age 19, out of a job, and with no particular idea of what to do, Karl returned to the family home in Rochester. Soon he found work at Ward's Cosmos Hall, where for the next five years (1863–1868) he catalogued samples, and, as he gained experience, collected specimens and helped mount exhibits in museums. He was left in charge of a mastodon excavation on the Mohawk River when the excavation director, James Hall, wrenched his hip. Because the skeleton was incomplete, in addition to directing the excavation, Gilbert had the opportunity to visit and study other mastodon skeletons in Boston; later he studied other fossil exhibits in New York. On these trips he had opportunities to meet with professional geologists. Also during this time, he studied mathematics, anatomy, and geology at home in the evenings.

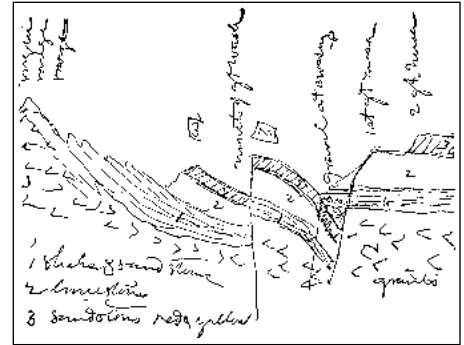
Although much of his Cosmos Hall work involved fossils, Gilbert was more interested in physical geology than in paleontology. In general, he was more attracted to processes and principles than to "facts" and catalogues. But he realized that careful, detailed description of physical evidence and a creative imagination were necessary to solve the geologic puzzles that confronted him. While excavating the mastodon, he became fascinated with potholes in the river bed, and conducted a detailed survey of 350 of them in order to determine their origin and the rate of retreat of the associated waterfall. He published both a popular account of the mastodon excavation and a technical report on the potholes, his first two publications. Gilbert later recalled that his potholes study was what attracted him to further work in geology.

Gilbert learned in the spring of 1869 that a second geological survey of Ohio was being organized, and, quite boldly, decided to go in person to ask then-governor Rutherford B. Hayes for a survey job. Upon being told that only Ohioans would be hired, he persisted by visiting J. S. Newberry, director of the survey (and a professor at Columbia School of Mines), who told Gilbert the same thing, but offered him a volunteer position, at \$50/month expenses. Gilbert accepted this excellent opportunity in July 1869 and was an impressive enough worker that the next year he was offered a salaried job. His duties included conducting field work, drawing fossil plants and fish (at which he excelled), and writing reports. Newberry also employed Gilbert to help him prepare college lectures, and introduced him to several eminent geologists.

Newberry had experience on some early western surveys, so in 1871 Lieutenant G. M. Wheeler asked him to recommend a geologist for a geographical survey west of the 100th meridian; Gilbert was a natural choice. This survey was one of four competing surveys (Hayden, King, Powell, Wheeler) conducted in the early 1870s, which eventually were merged into the U.S. Geological Survey (USGS) in 1879. The Wheeler survey was ambitious, focused on military and engineering goals, and full of adventures and mishaps; Gilbert gladly moved to the Powell survey in late 1874. Gilbert had met John Wesley Powell in Washington, D.C., while working on the Wheeler reports. Gilbert and Powell became close intellectual comrades, freely exchanging ideas and support over the course of their careers. They were two of the six geologists originally hired onto the USGS, and Powell became its second director (1881–1894).

Gilbert's detailed field notebooks indicate that he was in general good-natured and even-tempered in the field, putting up with many hardships; for example: "Today my mule gave out with hunger & fatigue & I had to walk several miles, but she finally recovered so as to bring me into camp at nine o'clock, which was but an hour later than the rest." Gilbert drew cartoon sketches of his mule and of his observations, later redrawing certain views to use in scientific publications. He even put a sketch of his mule in one of his reports from the Powell expedition.

Gilbert's years on the Wheeler and Powell surveys resulted in several classic studies. He recognized the block-fault nature of the Basin Range (his term) and laccolithic nature of the Henry Mountains. The latter study also includes an essay on land sculpture emphasizing dynamic equilibrium among various parameters—slope, runoff, bedrock, etc. Then, as head of the Great Basin Division of the USGS, Gilbert studied Lake Bonneville, producing a synthesis of physiog-



Gilbert's 1871 field sketch of geology at the mouth of Colorado Canyon, near the Arizona-Nevada border (reproduced in Davis, 1926, from Gilbert's notebook).

raphy, structure, paleoclimatology, sedimentology, and geophysics. Subsequently, after some time as head of the Appalachian Division and in other administrative duties, Gilbert returned to the West to study problems caused by hydraulic gold mining in the Sierras. This work resulted in two more classic studies—one of sediment transport, and another we would today call an "environmental impact" analysis.

Best known for applying quantitative techniques to physiographic problems, his well-written and well-reasoned publications show insight into a broad range of fields—survey techniques, glacial geology, lunar studies, earthquakes, method and philosophy of science. An extremely generous man, he was influential from individual to administrative levels; quite self-effacing, he was eager to give others credit. Nevertheless, he is the only person to have been appointed president of the Geological Society of America *twice* (1892 and 1909), one measure of his esteem.

Puzzle-solving, curiosity, keen observation, drawing skills, creativity, ability to get by on a low budget—these were family-established traits that set G. K. Gilbert on the road to a career in geology. Add to those his physical intuition, classical and mathematical training, cheerfulness and generosity, and a stamina that went beyond his natural condition, probably driven by his developed interest in geology. The result was a long and distinguished career of a man who was well respected—and perhaps more important, well liked—by those who knew him. ■

For Further Reading

Davis, William Morris, 1926, Biographical memoir Grove Karl Gilbert, 1843–1918: National Academy of Sciences Memoirs, v. XXI, 303 p.

Pyne, Stephen J., 1980, Grove Karl Gilbert, a great engine of research: Austin, University of Texas Press, 306 p.

Yochelson, Ellis L., editor, 1980, The scientific ideas of G. K. Gilbert: Geological Society of America Special Paper 183, 148 p.