Herbert (“Herb”) R. Shaw, Scientist Emeritus with the Volcano Hazards Team of the U.S. Geological Survey (USGS), passed away in his home on 26 August 2002 from long-term medical complications related to congestive heart failure. With his passing, the USGS—and indeed the entire geoscience community—lost one of its most brilliant and creative scientists, whose work profoundly influenced investigations of igneous systems and cosmology. He was amazingly eclectic in his scientific interests, encompassing paleontology, hydrothermal alteration, experimental geochemistry and petrology, magma rheology, general volcanology, thermal modeling, nonlinear dynamics of the Earth and cosmos, and fractal geometry in linguistics.

Herb Shaw was born on 7 December 1930 in the rural community of Simi Valley, southern California, where he spent his childhood and attended a small high school (only ~100 students). In 1948, he began his geologic studies at nearby Ventura Junior College, California. Motivated by an inspirational professor at Ventura, Herb continued his undergraduate studies at the University of California at Berkeley, where he majored in geology (with a strong interest in paleontology), receiving his B.A. in 1954. He then remained at Berkeley for graduate studies, completing a doctoral dissertation in 1959 on mineralogical studies of the Bunker Hill mine, Idaho, under Prof. Charles Meyer. Upon completion of his dissertation, Herb joined the Branch of Experimental Geochemistry and Mineralogy (in Washington, D.C.) of the USGS in June 1959. In 1976, Herb transferred to the USGS Western Regional Center in Menlo Park, where he worked until retiring in 1995.

Although he was actively involved in various field-oriented projects in his early career with the USGS, through the 1970s and into the 1980s Herb Shaw was primarily known as an experimentalist, conducting innovative laboratory studies of hydrogen osmosis, hydrogen-gas fugacity, diffusion of water in rhyolitic melts, viscosities of magmas, and rheology of basalt. In collaboration with the staff of the Hawaiian Volcano Observatory (HVO), in 1965 he invented a rotational viscometer and made the first-ever field measurement of the viscosity of basalt in a borehole within the crusted-over Makaopuhi lava lake at Kilauea Volcano. In 1972, Herb published an empirical method to calculate melt viscosity from chemical composition—a landmark contribution that with modifications is still in use today. Beginning in the mid-1970s, Herb focused increasingly on the physics and dynamics of magma transport and their implications for igneous systems, from regional to Earth scales. His high-impact studies on flow rates of the Columbia River Plateau flood basalts, plutonic cycles of the Sierra Nevada batholith, and the Hawaiian-Emperor and other linear volcanic chains of the Pacific Plate were scholarly, insightful, and provocative. Herb Shaw was an extraordinary thinker, never settling for the conventional or mundane. Although often “ahead of their time”—and thus controversial—many of his publications were seminal, revolutionary, and not always immediately accepted by the geoscience community. Yet, his scientific ideas have withstood well the test of time.
Herb Shaw also inspired a number of younger colleagues, notably while a visiting Professor at Berkeley in the mid-1970s. During this time, Shaw greatly influenced many graduate students—including some current members of the USGS Volcano Hazards Team (Charles R. Bacon, Edward “Wes” Hildreth)—with his thought-provoking seminars, quick wit, and easy company. Also among these students was Frank Spera (now Professor at University of California–Santa Barbara), who pursued a career in magma rheology as a result of Shaw’s papers and personal interaction with Herb Shaw.

Herb’s work also had important practical applications in the USGS Geothermal Research Program. He and USGS colleague Robert L. Smith devised a useful model of igneous-related geothermal systems that linked the size, longevity, and cooling of magma reservoirs. This model and its ramifications served as the scientific foundation for the USGS’ national assessments of geothermal resources in 1975 and 1978. In the late 1970s, Herb was tapped by the Nuclear Regulatory Commission, when he served as a consultant to Sandia National Laboratories on risk-assessment methodology and strategies for management of high-level radioactive waste.

In 1980, Shaw turned to analyses of fault and stream branching, self-similarity, attractor theory, chaos, fractals, and other (then) unconventional approaches. Again, he was far ahead of mainstream thinking in applying multidisciplinary nonlinear dynamics to geological and cosmological processes. As a measure of his rapidly expanding intellectual horizons at that time, in 1982 he prepared a manuscript titled *Sociotectonics and the New Geology* intended for (but never published by) the journal *Science*. In this cutting-edge report, he outlined the “major questions of *socioscientific responsibility*” (italics mine) and emphasized that “research involving coupled social and geologic phenomena are crucial to the prognosis for humanity.” In a highly productive collaboration lasting into the early 1990s, Herb worked with Bernard Chouet (now a member of the USGS Volcano Hazards Team) and published a series of high-impact papers applying nonlinear dynamics and fractal theory to seismic tremor, gas-piston events, and magma transport at Kilauea Volcano. During this same period, Shaw and USGS colleague James G. Moore published a provocative article in *Eos* (1988) linking magmatic heat from the global mid-oceanic ridge system and the El Niño cycle. More recently, Herb produced a 688-page book titled *Craters, Cosmos, and Chronicles: A New Theory of Earth*, published by Stanford University Press in 1994. This monumental work was derived and extended from the key concepts and analyses expounded earlier in his 1987 *Eos* paper and in the unpublished manuscript for *Science*. While this ambitious and comprehensive volume is not easily read and understood by the casual reader, scholars in several different fields have pronounced it as one of the most compelling works in the twentieth century. For example, Dr. Alan Huffman, in his review of the book (1995, p. 279), stated that “…Shaw’s theory requires that we look at our planet’s history in a new and holistic way, bridging several disciplines, and using a nonlinear system of measurement…This book is a must read for all Earth scientists.”

The career-long contributions of Herb Shaw, the *scientist*, are well recognized and appreciated within and outside the USGS. He received the Meritorious Service Award of the Department of Interior in 1965 and was elected to Fellowship in the American Geophysical Union (1988) and as a Fellow of the Geological Society of America (1989). Less is known, however, about Herb Shaw, the *individual*, in part because he was a very private person and in part because, for most of his career, he had the habit of sleeping days and working nights. His friends and close associates knew him to be an approachable guy, generous to a fault, witty and engaging in conversation, extremely well-read, and an avid follower of the arts and culture scene. Herb also was a talented poet, gifted sculptor and painter, and a superb tennis player with a huge, if erratic, serve. In every aspect of his scientific and private life, Herb Shaw embodied the Renaissance man, and he will be missed by all those who knew or worked with him. He is survived by his daughter, Andrea Shaw Waggener, who lives in Ocean Shores, Washington.
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