Memorial to William "Bill" Back (1925–2008)

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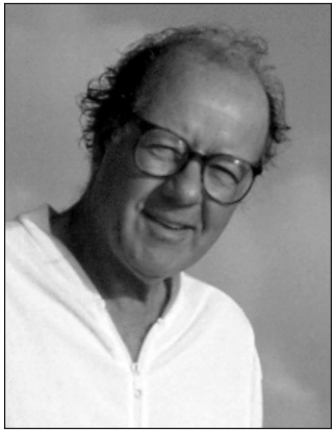

Each of us has a vivid recollection of our first personal encounter with Bill Back. For us, as for many other hydrogeologists and geochemists, that recollection is one of his welcoming manner and supportive encouragement. For Janet, a new faculty member at the University of Virginia, a first conversation with Bill at the 1982 Geological Society of America Annual Meeting culminated with his confident statement backed up by sparkling eyes and an infectious smile, "You should come to Reston and get involved in research with us." Bill's gracious invitation was followed with real opportunities to take up summer residence at the U.S. Geological Survey (USGS), learn from the leading research hydrologists in the world, and engage in field research in many carbonate terranes. For Mary Jo, moving from a research associateship in organic geochemistry at the University of California, Los Angeles, Bill was her first supervisor at the USGS in 1975. His advice was, "Apply what you know to groundwater." Thus began several collaborative investigations on how organic contaminants interact with aquifers. For Bill, the satisfaction of bringing new scientists into the study of hydrogeology was payment enough.

Bill Back had a long and productive career with the Water Resources Division of the USGS where he made innovative contributions to the understanding of the geochemistry of hydrogeological systems. A thorough exposition on his multifaceted impact on the science of hydrogeology and groundwater geochemistry written by Mary Jo Baedecker and Warren W. Wood was published as a historical note in *Ground Water* (2009), v. 47, p. 314–318: "William 'Bill' Back: An Incisive Geochemist and a Great Mentor."

Bill was born on 9 August 1925, in East St. Louis, Illinois. He studied at the University of Illinois (A.B., 1948, geology), the University of California at Berkeley (M.S., 1955, geology), Harvard University (M.P.A., 1956), and the University of Nevada at Reno (Ph.D., 1969, hydrogeology, under the direction of George Burke Maxey). Bill started his career with the USGS in 1946 with an initial summer appointment in Washington, California, and Alaska while he was an undergraduate student. He continued to work for the USGS until his retirement in 1997 from the National Research Program in the Hydrologic Sciences at the USGS headquarters in Reston, Virginia. During his career with USGS, Bill was recognized with the Interior Department's meritorious service award in 1982 and the distinguished service award in 1987. Other recognition includes the M. King Hubbert award of the National Ground Water Association in 1995 and the C.V. Theis award of the American Institute of Hydrology in 1997.

Bill taught as a part-time adjunct faculty member at George Washington University from 1975 until approximately 1986. Bill served the international community through appointments to the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Food and Agriculture Organization, the United Nations Development Program, and the U.S. Agency for International Development. With him throughout 57 years of working, traveling, and raising four children, his wife Connie survives him and continues to live in Honolulu, Hawaii, where Bill died on 31 January 2008.

Some of the first research published by Bill Back for which he received considerable recognition was his work on hydrochemical facies—the concept of understanding water chemistry by mapping its evolution along a flowpath. Bill's interest in the geochemistry of carbonate systems started early in his career and was greatly influenced by his association with Victor T. Stringfield. His work with Vic and several USGS colleagues in Florida gained recognition and led to the publication of numerous papers, many of them co-authored with Bruce B. Hanshaw. Bill and Bruce led multiple field trips to Florida and the Yucatan Peninsula as they explored the relationship between the state of chemical thermodynamics in groundwater and the hydrodynamics of groundwater flow. As the techniques of carbon dating of groundwater and geochemical modeling were developed, Bill and Bruce collaborated with Meyer Rubin, L. Niel Plummer, and others from the USGS and at various universities to understand geochemical processes along flowpaths in limestone aquifers in a more quantitative manner. It is their work on carbonate systems for which Bill and Bruce received the O.E. Meinzer award. Bill continued his work on carbonate systems for the remainder of his career, and he developed many other research interests including the geochemistry of contaminated environments, hydrogeology of North America, and how water affected Native Americans.

Member of a number of professional societies, Bill was particularly influential in the International Association of Hydrogeologists (IAH) where he was a long-time chairman of the Karst Commission. Formed in 1970, the commission came into being as a network of academicians, practicing hydrogeologists, and water resources professionals elucidating the scientific basis for and promoting the professional practice of sustainable management of karst water resources. Through visits to the great karst regions of the world, Bill developed or deepened relationships with Henri Paloc of France (who preceded him as chairman of the Karst Commission), Emilio Custodio of Spain, Neven Kresic of Yugoslavia, Josef Zoetl of Austria, Paul Marinos of Greece, and Gultekin Gunay of Turkey, to name a few. Bill co-authored research papers, participated in joint field trips, or convened scientific symposia with the majority of the individuals on the Karst Commission of the 1980s. Bill would later co-edit a collection of papers representative of their efforts to understand the world's karst regions: IAH volume 13, *Hydrogeology of Selected Karst Regions of the World* (1992). Collaboration with IAH president Ramon Llamas led to the U.S./Spain Cooperative Agreement that involved USGS colleagues Leonard F. Konikow, Blair F. Jones, and Thomas C. Winter as well as university collaborators William C. Ward and Janet S. Herman, all of whom helped direct the research projects of Spanish graduate students. Bill's field research on hydrogeochemical evolution of coastal limestone aquifers in Spain served as a late-career bookend to his earlier work in Florida and Mexico with USGS colleague and friend Bruce Hanshaw.

Among the connections made through the Karst Commission, the most consequential was that between Bill and Yuan Daoxian, director of the Institute of Karst Geology in Guilin, China. With China just beginning to open up to international scientific exchange, Daoxian made his first foreign contact with Bill, an acknowledged international expert in karst hydrogeology. In 1981, Bill was part of an American scientist delegation to China that established a cooperative agreement between USGS and the Ministry of Geology of China. In 1983, Bill and Daoxian co-convened a technical session at the American Association for the Advancement of Science

meeting, and they followed Daoxian's introduction of Chinese karst to America with a sweeping tour of the karst regions of the United States. The crowning event of this mutual effort to foster the international exchange of knowledge with China was the IAH Congress in Guilin in 1988. The degree to which Chinese hydrogeologists communicate with the wider world and the extent to which international scientists have come to understand the spectacular karst region of China stem directly from Bill's tireless efforts to foster an international exchange.

Bill Back began his sustained, career-long involvement with the Geological Society of America (GSA) with membership in 1955. He was 34 years old when the Hydrogeology Division was initiated by George Burke Maxey and Phillip E. LaMoreaux Sr. in 1959 during the GSA Annual Meeting in Pittsburgh. Bill promptly became involved with the new division. He acted as division secretary/treasurer from 1964 to 1966 when Allen F. Agnew, Vic Stringfield, and Stanley W. Lohman were division chairs. Bill himself went on to be second vice chair in 1984 (when George M. Davis was chair), first vice chair in 1985 (when Grover H. Emrich was chair), and chair in 1986. These people, along with other early division leaders (many of whom were also from USGS), including Joseph S. Rosenshein, Paul R. Seaber, David A. Stephenson, Ralph C. Heath, Harry E. LeGrand, and Warren W. Wood, to name just a few, formed the core of Bill's connection to GSA. Bill's contributions were recognized with all of the division's awards: the O.E. Meinzer award in 1973, the Birdsall lecturer in 1979—just the second year that the distinguished lectureship existed—and the distinguished service award in 1988. For Bill, though, his affiliation with the Hydrogeology Division was "all about the people." His sustained dedication to service in the division served as a model for others to become more involved in their professional society, bringing new generations of hydrogeologists into what grew to be the most active division within GSA. He demonstrated time and again the importance of the meeting in making connections among people by introducing students to future mentors, young scientists to senior investigators, and academicians to consultants. Somehow, Bill seemed to know everyone, and he helped us all to recognize the value in building relationships in our professional community.

Bill acted as historian of the Hydrogeology Division for many years. In that role, his curiosity about the origin of new ideas was successfully melded with his desire to bring new professionals into the field. Bill believed that young scientists benefitted from an understanding of the major ideas that arose in the past. His sincere commitment to appropriately educating the rest of us about our scientific roots is evident in his publications. In 1979, Bill and Dave Stephenson co-edited the *Journal of Hydrology*'s *Contemporary Hydrogeology: The George Burke Maxey Memorial Volume*, a retrospective look at the scientific contributions of the person who co-founded the Hydrogeology Division. An assessment of the historical hallmarks of the broader field of study was published in 1983 as an influential, two-volume set of *Benchmark Papers in Geology* co-edited with R. Allan Freeze. Although many of the collected papers were known to the community, Bill's commentary on the intellectual place in which each paper fit in the evolution of the science of hydrogeology was especially illuminating. A later publication in 1997 with Janet Herman was a personal selection of 100 significant papers in hydrogeology from which Bill hoped young scientists would learn the history of their profession and seasoned professionals would discuss their own agreement or disagreement with the list.

Bill was passionately committed to giving young scientists a chance at professional success. In Bill's estimation, success was more likely for a person welcomed into a supportive professional society. A lasting legacy of Bill's service to the GSA Hydrogeology Division is the historical mug series. Each year, Bill identified a deceased scientist whose contributions to hydrogeology remain important today. He prepared a small biographical pamphlet inserted into a limited edition of coffee mugs printed with the person's photograph, and shamelessly forced the mugs upon division members as recognition for cash donations to support research expenses

for deserving graduate students. The first mug was launched in 1992, with the assistance of Edward R. Landa, in recognition of Henry Darcy. Subsequent honorees included O.E. Meinzer, C.V. Theis, T.C. Chamberlin, and M. King Hubbert, among others. The inspiration for the mugs was a series on chemists produced by a laboratory gas supplier. Along the way to launching the historical mug series, Bill and his lunchtime partners on the project, most notably Lori Severin, learned the meaning of "microwave safe," about specialty shipping boxes, and that, even with mugs, there are "galley proofs." The Hydrogeology Division continues to carry on Bill's tradition of producing mugs under the direction of the historical committee. Bill's commitment to supporting and encouraging students was obvious to all, and in 2008, the Hydrogeology Division enthusiastically passed a resolution to name henceforth a graduate student research award the "Bill Back Graduate Student Research Award."

Bill was an inclusive professional in a young field of science. This combination of his personality and the immature state of hydrogeology resulted in his having great impact on the developing careers of an incredible number of today's hydrogeologists working in academia, government, and industry, in the United States and around the world. We recognize the geochemical tools he gave us to elucidate groundwater resources, the awareness he championed for scientifically informed public policy impacting water supplies, the international communication he advocated for the good of current and future science and policy, and the mentoring he generously offered to so many. Bill, however, never wanted recognition for the knowledge and support that he provided to others. Instead, Bill routinely claimed that he was entirely the beneficiary of numerous competent collaborators. He repeatedly, in speaking and writing, expressed his thankfulness about the personal relationships he was able to develop over the course of his career. In accepting the C.V. Theis award, he wrote about it in contrast to "an honor that I cherish even more […,] the close association and friendship of hydrologists… throughout the world. Many of you have heard me say repeatedly how fortunate I am to have had the colleagues and co-authors that I have. Without them this award could not have been granted." In fact, the large number of award acceptance speeches given by hydrogeologists and geochemists who credit Bill Back with being critically important to their intellectual or professional development cannot be accurately tallied. Truthfully, without Bill Back, the maturity of the scientific field and the stature of the profession of hydrogeology would not be what they are today.

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