Memorial to Edwin B. Eckel
1906–1989

ERNEST DOBROVOLNY
Denver, Colorado
and
WALLACE HANSEN, G. D. ROBINSON, W. S. TWENHOFEL, OGDEN TWETO, DAVID VARNES, ROBERT YATES

The passing of Edwin B. Eckel was mourned by his many friends and colleagues around the world. Ed Eckel, born in Washington, D.C., January 27, 1906, the oldest son of Edwin C. Eckel and Julia Dibblee Eckel, died September 28, 1989, in Lakewood, Colorado. His survivors include sons Edwin G. Eckel of Wallace, Idaho, and Robert R. Eckel of Fresno, California; a brother, Richard Eckel of Banner Elk, North Carolina, 12 grandchildren, and 3 great-grandchildren. He was preceded in death by his wife, LaCharles Q. Goodman, whom he married in 1931; and by another son, C. Richard Eckel.

Ed's formative years were spent mainly in Washington, D.C., where he attended grade school and high school. He lettered in track at Lafayette College and earned an undergraduate degree there in chemical engineering. To the enhancement of the profession, as it turned out, he switched from chemistry to geology ar received a masters degree in 1930 from the University of Arizona. Later he took addition graduate work at the Colorado School of Mines while stationed in Golden with the U. Geological Survey. During the course of his varied career, Ed had a positive influence on the liv of the many individuals who profited from his kindly advice and direction, his deep sense responsibility, and his truly lovable nature. A few of his contributions to society as a scientist ar his warmth as a human being are expressed in "Portrait of Ed Eckel" (*The Geologist*, 1974, v. I no. 5). It seems fitting that this evaluation of Ed's career by a few of his close associates ar colleagues be updated and modified here as a lasting remembrance of this great man.

FIRST USGS YEARS, by Robert Yates. The first half of Ed Eckel's career, beginning whe he joined the U.S. Geological Survey in 1930, was devoted to investigations of mineral deposits the western part of the United States. He produced reports on the brown iron ores of easte Texas and on the geology and ore deposits of the La Plata district, Colorado, and he helpe compile the geologic map of Colorado. In addition, he investigated 36 potential dam site scattered throughout nine western and two eastern states, for the Bureau of Reclamation, Arm Engineers, Indian Service, Idaho Department of Reclamation, and the Conservation Division the Geological Survey. These excursions into engineering geology convinced him of the need f more extensive work in the comparatively new field of geology applied to civil engineering and s the stage for the latter part of his career.

In 1939, Ed began the first field study of quicksilver mining districts as a part of the new created Strategic Mineral Program of the Survey. For the next two years, he worked in th quicksilver districts of the California Coast Ranges and then returned to Washington, D.C., to a as commodity geologist for mercury, a position he held until 1944. Ed's interest then, as alway

was mainly people and what geology could do for them. When he mapped a mine, his concern was not where the ore came from, but where more ore could be found.

Ed's appreciation of people led to his belief that if you give someone an objective and the freedom to obtain that objective, that person will usually produce. This was the way he ran the mercury program. His success was measured by the fact that all projects undertaken yielded published reports. All geologists under him were firmly indoctrinated with his philosophy that "the report's the thing." Ed's personal way of writing a report was to take paper and pencil and slump on a sofa, where for several days he mulled over organization and cogitated on emphasis. Finally, when everything was clearly in mind, he moved to the desk and filled sheets of paper in feverish haste.

INTO ENGINEERING GEOLOGY, by David J. Varnes. During World War II, Ed was technical representative to Engineer Intelligence in the European and Mediterranean Theaters of Operation. In this capacity he studied the quicksilver industry of Italy and the geology of underground factories in Germany.

He started the USGS Engineering Geology Branch in 1945 and aided in bridging the gap separating engineers and geologists. There was a lack of knowledge—geological as well as engineering—of the mechanics, recognition, and control of landslides; there was little understanding on the part of geologists about facts and observations needed on maps for use by engineers, and engineers did not appreciate how geologic maps could provide background data for their work. Through his own efforts and those of his colleagues, he directed work that brought the two disciplines closer together.

Among the landslide investigations undertaken while Ed was chief of the Engineering Geology Branch were those in reservoir areas (Lake Roosevelt and Ft. Randall Reservoir), in coastal areas (Pacific Palisades, Martha's Vineyard), in urban settings (La Paz, Anchorage, Los Angeles, San Francisco Bay area, several Chilean cities, Rapid City), and in a variety of mountainous areas (southwest Colorado, east-central Utah, Jackson Hole, and the Colorado Front Range). These studies added to our knowledge of this socially and economically important geologic process.

Ed's desire to apply geological knowledge of slope processes to rational engineering practice found expression in 1950 in the formation, under his leadership, of a Landslide Investigations Committee of the Highway Research Board, an arm of the National Research Council. Ed found that highway engineers were "not afraid to ask," and many extended discussions—some heated, some frigid—led to better mutual understanding. Ed's patience, thoughtfulness, fairness, technical knowledge, and sheer industry led the group into a sustained productivity that resulted in the publication in 1958 of Highway Research Board Special Report 29, *Landslides and Engineering Practice*. The work was a major contribution to the literature on landslides and was widely used throughout much of the world.

Through all Ed's work ran the theme of seeking effective human communication and bridging gaps between those who obtain and those who use geological information. To express this we can do no better than to repeat some of Ed's own words—words by which he lived and induced others to follow:

> This is the essentially human problem of how to present geologic facts to engineers so that they will understand and use them to maximum advantage. This is a subject in itself, yet one that must be solved. It ranges from the discovery and training of potential engineering geologists, through methods of presenting our data, to research on the psychology of salesmanship. Suffice it to say now that the essence of the problem is the need for *conviction by demonstration*. The geologist and engineer think differently and work differently. The engineer thinks concrete facts and figures, he reasons from *cause to effect*, and he depends very largely on what he can see and measure. The geologist normally reasons from effect to cause, and is perhaps all too conscious that his is an inexact science. If he is as skillful and brave as he should be, however, and if he has observed and understood enough facts, he should be willing and able to predict the geologic conditions and their meaning to the engineer. If he continues to make such predictions accurately, he will, by *demonstration*, bridge whatever gaps there are between himself and the engineer. (Presidential address delivered before the Colorado Scientific Society, December 18, 1950).

PARAGUAY PROJECT, by Ernest Dobrovolny. In 1951, the Paraguayan government asked the U.S. State Department for guidance in establishing a geological survey. Ed was selected as technical advisor. After being in the country a short time, he refined his charge of providing advice on the establishment and maintenance of a Department of Geology and Mines to include the related problems of staffing and training engineers and geologists for such a department. He also prepared a report on the geology and mineral resources of Paraguay as a USGS Professional Paper, a report that is still the major reference to the geology of Paraguay.

MINERAL SIDELINE, by Ogden Tweto. At times nearly hidden in the bustle of Ed's activities was an abiding affection for minerals. This affection had early expression in his first four published papers, all on mineralogical subjects. It did not come into public view again until the publication in 1961 of the 399-page *Minerals of Colorado* (USGS Bulletin 1114). While he was working in other fields, Ed brought *Minerals of Colorado* to fruition 30 years after its conception. It was a spare-time labor of love, and for a year or two Ed could be found on weekends in a corner of the USGS library at the Denver Federal Center, relaxing from the cares of the work week by writing on a topic that fascinated him. Few relax so productively.

NUCLEAR INVESTIGATIONS, by W. S. Twenhofel. In July 1956, the U.S. Atomic Energy Commission asked the U.S. Geological Survey for geological and geophysical advice on the feasibility of underground nuclear testing in order to prevent all explosion products, including radioactive material, from venting to the atmosphere. Ed directed Survey investigations before the first nuclear test in 1957, an assignment that fell to him naturally because of his demonstrated leadership in the field of engineering geology.

Ed perceived the underground nuclear test as a challenge for the geological profession, because it included not only the opportunity to apply geological principles to a novel engineering problem, but also the opportunity to investigate the behavior of rock under extreme temperature and pressure.

Before 1957, no large explosions, either nuclear or chemical, had been deliberately contained. On the contrary, large explosions had been designed to break rock to a free surface. Therefore, at the request of the Atomic Energy Commission and with Ed's guidance, the U.S. Geological Survey designed and conducted two contained chemical explosions at the Nevada test site that provided a calibration scale to predict behavior and effects of the nuclear test made in 1957.

The nuclear test was highly successful; there were no visible fractures on the ground above the explosion, and no radioactivity escaped to the atmosphere. Ed and his USGS co-workers deserve much credit for the painstaking studies that laid the geological groundwork. Since that first test, many hundreds of subsequent underground nuclear explosions have been successfully conducted by the Atomic Energy Commission, and Ed Eckel had a major role in many of them.

In 1958, the United States halted nuclear testing in accordance with a moratorium with the Soviet Union. From 1958 to 1961, the period of the moratorium, Ed returned to his duties as chief of the Engineering Geology Branch. In 1961, when nuclear testing was resumed, Ed was named chief of the Special Projects Branch, newly created to meet the nuclear test requirements of the Atomic Energy Commission and the Department of Defense. Ed directed scores of geologists, geophysicists, and hydrologists working on nuclear investigations during this period. He was responsible for developing a multidisciplinary team approach to earth science problems that was the forerunner of many subsequent successful USGS teams.