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JOSEPH HOOVER MACKIN

1905—1968

A Biographical Memoir by

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DEEP IN THE HEART of Antarctica is a huge windswept plateau that bears the name Mackin Table. It was mapped and so designated by four of Hoover Mackin's former students—Dwight Schmidt, Paul Williams, Willis Nelson, and Arthur Ford—as a tribute to a great teacher of earth science. It is an impressive memorial to a man who was a dominant figure in American geology for more than three decades.

Joseph Hoover Mackin was born November 16, 1905, in Oswego, in upstate New York. He was the youngest of seven children of William David Mackin and Catherine Hoover Mackin. His father, who died when Hoover was only seven years old, was of Irish descent, his mother of German descent. Despite the early death of his father and despite the fact that he spent two years immobilized in a cast after being stricken with poliomyelitis at the age of four, Hoover's early years quite evidently were happy ones as the youngest child in a closely knit family. He outgrew the effects of his childhood illness and developed into a powerfully built youth of great energy. He played football—as a lineman—both at Oswego High School and Oswego Normal School, and between studies and sports he still found time to work at various jobs.

After graduation from Oswego High School in 1924 and two years at Oswego Normal School, the young Mackin left upper

New York State to enter New York University. Initially, he intended to become a journalist, but switched from journalism to geology after hearing lectures by Professor George I. Finley. He received the B.S. degree in geology from NYU in 1930 and then entered the graduate school of Columbia University. His professed major interest at that time was in petrology, but he soon came under the stimulating influence of Professors Douglas Johnson and William Morris Davis, leading American teachers of the science of landforms. From then on, Mackin's course was set: He would become a geomorphologist. He was granted the M.A. degree by Columbia in 1932 and the Ph.D. in 1936.

In 1929, at the start of the Great Depression, Mackin was married to Esther Fisk, daughter of longtime friends of the Mackin family in Oswego. In the years following, as a student, he worked at many odd jobs—in a telegraph office, as a painter, as a sandhog in subway construction, and as a tutor. In 1933, however, the young couple achieved a considerable level of affluence as the result of the award to Mackin of a $1,600 fellowship.

In 1934, after completing all requirements for the doctorate at Columbia other than a thesis, Mackin accepted an appointment as an instructor at the University of Washington, there to begin a distinguished career as a teacher that was to span thirty-four years—twenty-eight years at Washington and six years as Farish Professor of Geology at the University of Texas at Austin.

Mackin always considered himself a geomorphologist, though a glance at his bibliography reveals far greater scope to his actual research activities. His doctoral thesis dealt with the origin of surface features of the Big Horn Basin in Wyoming. In it he introduced the concept of lateral planation by a stream essentially at grade, producing gravel-mantled terraces as the stream gradually deepens its valley, as opposed to formation of terraces by stream dissection of earlier alluvial plains.

Mackin's further analysis led to publication in 1948 of what is the most well-known of his contributions to geomorphology, the classic paper, "Concept of the Graded River." In this paper Mackin refers to "the almost telegraphic rapidity with which the first phases of reaction of a graded stream to a number of artificial changes are propagated upvalley and downvalley"—a warning of profound importance to stream engineers. In later pages of the same paper, Mackin makes the warning more explicit: " . . . the engineer who alters natural equilibrium relations by diversion or damming or channel-improvement measures will often find that he has a bull by the tail and is unable to let go . . . ." This statement illustrates both Mackin's gift for pithy expression and his willingness to extend the implications of scientific research into the realm of human affairs.

Throughout his career, Mackin chose to concern himself with the consequences of man's activities on the natural environment, and he often exerted a little-known but profound influence on proposed developments. He became something of a *bête noire* to engineers, but to their credit it must be pointed out that he was called upon often for advice. As a small but specific example of his influence, he pointed out that the engineering plan to "save" Ediz Hook, a scenic sandspit on the north side of the Olympic Peninsula, if put into effect, might well result in the complete destruction of Ediz Hook in the next major storm. His private report on the situation resulted in cancellation of the intended work. Clearly, Hoover Mackin was an environmentalist before that term was coined.

One of Mackin's earliest papers was written with E. B. Bailey and based on a brief field trip taken while Mackin was still a graduate student and the famous British geologist was in this country on a visit. The paper dealt with the complex folding in the Pennsylvania Piedmont and the use of b-lineation in structural analysis. This paper was perhaps the first attempt to apply the concepts of recumbent folding and nappe structure to geologic interpretation of the piedmont. Since then, these concepts have been shown to be widely applicable, even though the specific area of the Mackin–Bailey paper remains a subject of controversy, as indicated by Mackin's 1962 "Note" in the *Bulletin of the Geological Society of America.* A by-product of the initial study was Mackin's 1950 paper on the "down structure" method of viewing and interpreting geologic maps. The principle employed was not new, but nowhere had it been expressed so concisely; it remains required reading for the beginning student of structural geology.

In World War II, Mackin became affiliated with the U.S. Geological Survey, an organization with which he was to retain close ties for the remainder of his career. As part of the Survey's wartime emphasis on sources of strategic minerals, Mackin studied quicksilver deposits near Morton, Washington, and placer deposits containing radioactive minerals in Idaho. His major effort, however, which continued after the end of World War II, was on the iron deposits of the Iron Springs district of Utah. The results of this study comprise one of the finest contributions to the science of ore deposits of the past three decades. The first paper, written within the space of a few days as a guidebook for a Utah Geological Society field conference, almost surely is the most widely referenced informal publication in economic geology literature. In it and in later papers, Mackin demonstrated beyond reasonable doubt precisely *where* the iron that forms the major economic deposits of the district came from, *how* it was separated from the parent body of intrusive quartz monzonite, *why* it was deposited in adjacent limestone in the particular places now found, and *when* this process took place in the igneous and structural history of the area. In the course of the study, Mackin was to demonstrate that in certain types of magmatic flow, phenocrysts and inclusions become oriented normal, rather than parallel, to the direction of magma movement; a leading authority on granite tectonics ranks the brief guidebook discussion as the most incisive and definitive treatment of the subject of magmatic flow in the English-language literature.

That contributions of such significance to the understanding of ore deposits and of granite tectonics could be made by one who classed himself as a geomorphologist, and who disclaimed any competence as a student of economic geology and igneous petrology, must seem remarkable to those who did not know the man. But careful examination of Mackin's papers will reveal that these scientific advances were achieved by the same kind of thinking and analysis he had used in assessing the dynamics of surface processes. The mass of twenty million-year-old quartz monzonite, the source of the ore fluids, was not in Mackin's eyes a dead body: He had the imagination necessary to visualize it during its emplacement as a fluid silicate melt, the ability to analyze its probable behavior and to predict the likely consequences, and the observational capacity to locate the critical evidence. Aside from its contribution to granite tectonics, this study remains perhaps the only documented example in world literature of the exact genetic relation between an igneous intrusion and an associated hydrothermal ore deposit.

Mackin's work in the Iron Springs district led him by progressive stages, involving several of his students, into the broader problems of the volcanic and structural history of the Great Basin of Utah and Nevada. An area of some 3,000 square miles was mapped at a scale of 1:62,500 or larger, and an additional 7,000 square miles was mapped in reconnaissance. On the basis of this work, a regional stratigraphy of the ignimbrite sequences was established using a technique based on quantitative measurement of phenocryst content. Mackin concluded, in agreement with the very early work of Gilbert, that the characteristic block faulting of the area was due to "dominantly vertical displacements of comparatively rigid blocks," rather than to compressive forces, and he suggested that these movements were a consequence of the withdrawal from depth and surface extrusion of the estimated 50,000 cubic miles of silicic volcanics. In the 1960 paper in which these views were presented is a promise of another paper, "to follow shortly," in which the concept was to be developed more fully; this paper, unfortunately, never appeared.

Mackin's basic philosophy in scientific endeavor is expressed in his 1963 paper, "Rational and Empirical Methods of Investigation in Geology." In it he reveals a basically traditional approach—the "rational" method, patterned after G. K. Gilbert, T. C. Chamberlin, and Douglas Johnson. This method of problem-solving involves a close interplay between observation and deductive reasoning, with emphasis on the use of logic to establish multiple working hypotheses and ultimate definition of the critical diagnostic data required for choice of conclusions. Mackin viewed with considerable skepticism what he referred to as the "empirical" (or "engineering") method, in which emphasis is laid on accumulation and subsequent treatment of large amounts of quantitative data. This often has been taken to mean opposition by Mackin to the quantitative approach in scientific problems, and perhaps the criticism was justified to some extent, particularly when applied to his attitude toward quantification in his own field of specialization, geomorphology. On occasion he was known to dismiss modern developments in geomorphologic research as the work of "numerologists." Yet any examination of Mackin's own research will reveal him to have been a diligent, careful observer. The geologic maps that support Mackin's analysis of ore deposition in the Iron Springs district, for example, are models of detail and accuracy; they are quantitative to a high degree. Mackin's point, however, is that geologic problems, like those of biology and other complex sciences, present an almost infinite number of elements susceptible of measurement, and that the "rational" method is necessary to select for observation those that are critical. In private conversation, Mackin often spoke disparagingly of the "shotgun" approach to problems, and in his 1963 paper he quotes with approval James Gilluly's statement that "most exposures *provide answers only to questions that are put to them.*" Mackin was not basically "antiquantitative"; he simply demanded of himself and his students that the data-gathering be preceded and continually accompanied by intensive logical analysis of the phenomenon under investigation.

As a teacher of earth science, Mackin was almost without a peer during his lifetime. His lectures were models of clarity, and they were delivered with a completely infectious intensity and enthusiasm, whether given to the beginning freshman class or to a group of advanced graduate students. He was remarkably adept at blackboard illustration; with chalk in one hand and eraser in the other he could truly make geologic processes and geologic history come to life. He encouraged divergent views—provided they were based on good, logical thinking—and detested the mere parroting of textbook or classroom notes. In his famous—infamous, to some—course in map interpretation, he surprised students continually with an "A" grade for the wrong answer reached by careful analysis and reasoning, and a "C" or worse for the right answer based on an inadequate or improper approach. Logical thinking was paramount, and of necessity the survivor of "map interp" acquired both the ability to think clearly and a thick skin—valuable assets for his professional years ahead. For Mackin could be cutting in criticism, though always in a way that made it evident that his concern was for the development of the student.

Mackin was a gregarious man and typically was the center of discussion groups in the field or at meetings. His views always were expressed crisply, concisely, and with humor. He loved a good argument and he started many; in one of his papers he remarks that "it is more important that a working hypothesis be provocative than it be right." He was often on the attack—but he attacked ideas, not people, and his vigorous and sometimes earthy remarks never left a residue of ill will.

Stories of Mackin's personal idiosyncrasies would fill a book—everyone who knew him would have contributions. He was a model train enthusiast and at times had tracks throughout the living areas of his home. He was fearsome at the wheel of a car, generally driving with one hand and waving the other as he analyzed the geomorphology of the rapidly passing terrain to his terror-stricken passengers. He was the proverbial absent-minded professor: He habitually lost or mislaid keys, forgot where he had parked his car, wore mismatched socks (and even shoes), and left personal items strewn from one end of the country to the other. But he was a delight to be with; to use the old cliché, there was never a dull moment when Hoover Mackin was around.

In addition to teaching and research, Mackin was extremely active in scientific affairs, even after he was afflicted with cardiac malfunction in the mid-1960's. He was chairman of the Earth Sciences Division of the National Research Council from 1963 to 1965; delegate of the National Academy of Sciences to the 1967 meetings of the International Association of Hydrologists in Istanbul and of the International Union of Geodesy and Geophysics in Zurich in the same year; and he was the keynote speaker at the Symposium on Pediments, held in Budapest early in 1968. He participated actively in the early planning and design of the lunar geology experiments as a member of the U.S. Geological Survey team sponsored by the National Aeronautics and Space Administration, and he initiated the idea of a sampling tube to be driven into the lunar soil. Throughout his career Mackin was a sought-after speaker; he was a guest lecturer at many universities, and he was the Distinguished Lecturer for the American Association of Petroleum Geologists in 1953 and National Lecturer for Sigma Xi in 1963. Mackin was a member of the National Academy of Sciences, the Geological Society of America (Council, 1950–1953; chairman of Cordilleran Section, 1950), the Society of Economic Geologists, the American Geophysical Union, the American Association of Petroleum Geologists, the American Association for the Advancement of Science, and Sigma Xi.

Mackin died on August 12, 1968, at the height of his career and while preparing to serve as delegate of the U.S. National Committee on Geology to the International Geological Congress to be held in Prague later in 1968. He is survived by his widow, Esther Fisk Mackin; a daughter, Barbara Catherine Barker, wife of Dr. Daniel Barker, of the geology department of the University of Texas; a son, Robert Fisk Mackin, a design engineer; and two granddaughters.

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KEY TO ABBREVIATIONS

Am. J. Sci. = American Journal of Science
Bull. Geol. Soc. Am. = Bulletin of the Geological Society of America
J. Geol. = Journal of Geology
U.S. Geol. Surv. Bull. = United States Department of the Interior, Geological Survey, Bulletin
U.S. Geol. Surv. Profess. Paper = United States Department of the Interior, Geological Survey, Professional Paper
U.S. Geol. Surv. Trace Elem. Memo. Rept. = United States Department of the Interior, Geological Survey, Trace Elements Memorandum Reports
Wash. Dept. Conserv. Div. Mines Geol. Rept. Invest. = Washington Department of Conservation, Division of Mines and Geology, Report of Investigations

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