
Volume 70, Number 24
December 15, 2006
ELSEVIER
Geochimica et Cosmochimica Acta
JOURNAL OF THE GEOCHEMICAL SOCIETY AND THE METEORITICAL SOCIETY
A Special Issue Dedicated to Larry A. Haskin
Mouse
ΣREE = 0.066 ppm
Mouse / Chondrites
Rare-earth ionic radius

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Geochimica et Cosmochimica Acta 70 (2006) 5899–5903
Geochimica
www.elsevier.com/locate/gca

Larry A. Haskin (1934–2005)

This issue of *Geochimica et Cosmochimica Acta* is dedicated to Larry A. Haskin, who died on March 24, 2005, at the age of 70. Larry was a geochemist, physical chemist, planetary scientist, mentor, teacher, farmer, husband and father, administrator, story teller, photographer, birder, and a good guy to have around. Beginning with papers entitled "On the gold contents of rocks" (DeGrazia and Haskin, 1964) and "Rare-earth distribution patterns in eight terrestrial materials" (Schofield and Haskin, 1964), Larry was author or coauthor of 44 articles published in this journal (including 16 papers occurring in the lunar *Proceedings* supplements, 1970–1981). Papers in this special issue have been submitted by Larry's students, colleagues, and friends.

Larry described the focus of his work as follows: "To further precise, accurate geochemical analysis; gain quantitative understanding of trace element behavior through rock analysis and geochemical modeling, with experimental work to provide modeling parameters and better understanding; and introduction to the application of some methods of physical chemistry to geochemical work (neutron activation analysis, electron paramagnetic resonance, silicate electrochemistry, planetary Raman spectroscopy)."

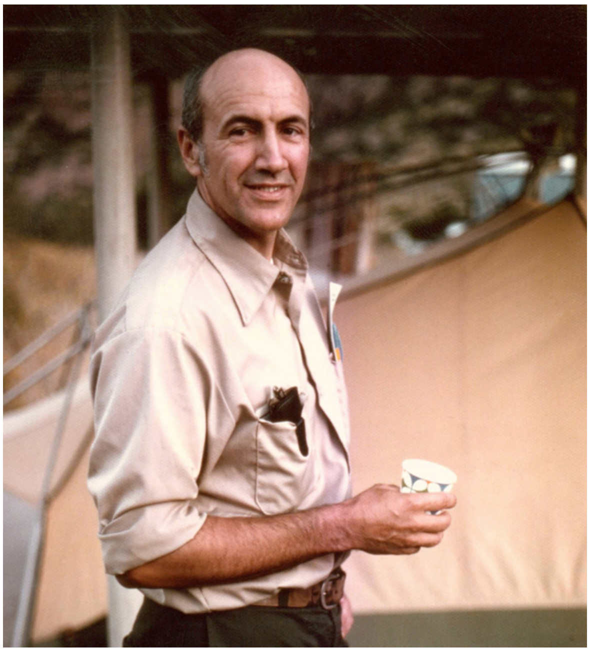
Larry was born and raised on a dairy farm between Olathe and Lenexa, Kansas, on August 17, 1934. In high school he was mainly interested in agriculture and law but was curious about chemistry from reading the names of chemicals on fly- and weed-spray cans. He said that his decision to major in chemistry at Baker University was impulsive, but one that turned out to suit him. He earned a Ph.D. degree in physical chemistry from the University of Kansas in 1960 under the direction of F. Sherwood Rowland. Larry's thesis was entitled "Analysis for uranium by neutron activation and reactions of energetic recoil tritium with solvent mixtures." During his graduate-school days, he analyzed some limestones for uranium by neutron activation (Haskin et al., 1961). He credited this diversion as the one that led to his interest in rocks and geochemistry.

After nine months at Georgia Tech in 1959–1960 and a summer at Argonne National Laboratory working on the effects of angular momentum on compound nuclear reactions, he was appointed Instructor in the Chemistry Department at the University of Wisconsin-Madison in 1960. He was promoted to assistant professor in 1961, associate professor in 1965, and, professor in 1968. Larry taught mainly freshman chemistry and graduate-level radiochemistry courses. A subbasement radiochemistry lab and roomful of γ-ray spectrometry equipment for NAA (neutron activation analysis) were the heart of the research laboratory. Larry was hired at Wisconsin with the expectation that he would research hot-atom chemistry. From the beginning, however, he developed techniques for analyzing rocks by neutron activation and used the acquired data to understand how trace elements behaved during rock-forming processes. This type of real-stuff research was less "basic" and more "applied" than his more-established chemistry-department colleagues were accustomed to. When in story telling mode, Larry would credit his promotion with tenure to Harold Urey. Urey had been invited to give a lecture at the department. Although Larry did not know Urey, Urey must have known of Larry and, Larry believed, sensed Larry's predicament. Sometime during his visit Urey walked into the department office and announced, "I want to see Larry Haskin." Larry claimed that his promotion happened shortly thereafter.

Larry was one of the founders of the field of rare-earth-element geochemistry. Some of the earliest NAA data on the concentrations of REE (rare earth elements) in basalts, sediments, meteorites, and tektites came from Larry's lab at Wisconsin and Roman Schmitt's lab at Oregon in the early 1960's. "Dispersed and not-so-rare earths" (Haskin and Frey, 1966) became a must-read primer in rare-earth geochemistry. REE data obtained by Larry's research group for the "chondrite composite" (Haskin et al., 1968a,b, 1971a,b) and "North American shale composite" (Haskin and Frey, 1966; Haskin and Haskin, 1966; Haskin et al., 1968a; Gromet et al., 1984) became the standards of normalization for plots of "REE patterns." Larry always chuckled at his success in an early paper of getting a REE plot with an ordinate axes labeled "Mouse/Chondrites" past the reviewers (Haskin et al., 1966a).

In the late 1960s Larry became one of the first NASA-funded principal investigators for study of anticipated samples from the Apollo missions to the Moon. Although lunar sample studies dominated his efforts in the 1970s, Larry was simultaneously working on environmental geochemical issues and trace-element fingerprinting of obsidian artifacts. In October, 1973, ten months after the last

0016-7037/$ - see front matter
doi:10.1016/j.gca.2006.07.038



Larry on a camping trip in October, 1974. (Photo by Randy Korotev.)

Apollo mission, Larry and his entire research group (3 post docs, 3 graduate students, and 1 technician) moved from Madison to Houston, where Larry became the Chief of the Planetary and Earth Sciences Division at the NASA Johnson Space Center, succeeding Paul Gast (1930–1973). Larry's major accomplishment at JSC was to begin the task of securing the lunar sample collection for future researchers by building a safer, modern curatorial facility and moving a portion of the collection away from storm-prone, low-elevation Houston. Larry missed academia and was delighted in late 1976 to accept an offer to become Professor and Chairman of the Department of Earth and Planetary Sciences, Professor of Chemistry, and a fellow of the McDonnell Center for the Space Sciences at Washington University in Saint Louis. His mission was to build a small department into a first-class department of earth and planetary sciences. In 1986, Washington University promoted him to the position of Ralph E. Morrow Distinguished University Professor. He officially retired at the end of 2002 but worked full time until a few months before his death from myelofibrosis, a bone marrow disease for which he had been treated for more than 15 years. Although clearly in pain, he nevertheless entertained the audience with jokes during the thesis defense of his last Ph.D. student, Ryan Zeigler, in late December, 2004.

Some of Larry's research during the 1970s and 1980s bridged lunar geochemical systems and terrestrial analogs of lunar geochemical systems (e.g., Haskin et al., 1977; Lindstrom and Haskin, 1981; Haskin et al., 1983; Haskin and Salpas, 1992). With students and post-docs, he developed better methods and models for understanding how trace elements behave in rock-forming situations (Norman and Haskin, 1968; Cullers et al., 1973; Paster et al., 1974; Morris and Haskin, 1974; Schreiber and Haskin, 1976; Haskin and Korotev, 1977; Haskin, 1983; Haas and Haskin, 1991; Steele et al., 1992; Jolliff et al., 1993; Jolliff and Haskin, 1995; Moss et al., 1996). Larry and his associates adapted electrochemical techniques used in aqueous solutions to study trace elements in silicate liquids at 1500 °C (Semkow et al., 1982, 1985; Colson et al., 1990, 1991, 1995). They showed that electrolysis of lunar soil could produce oxygen gas and iron and silicon metals efficiently for use in space (Lindstrom and Haskin, 1979; Haskin and Colson, 1989; Haskin, 1992; Haskin et al., 1992).

Larry was an enthusiastic and inexorable visionary who was unafraid to dive into unknown waters. In the mid 1990s he became convinced that it should be possible, at any point on the lunar surface, to pick up a rock and calculate the probability, for each nearby crater or basin, that the rock was part of the ejecta deposit of that crater or basin. He spent a significant part of his last ten years developing a model for lunar crater ejecta deposits that could answer the questions he asked as a geochemist (Haskin et al., 2003). On the basis of such modeling and the just-available data on the distribution of thorium on the lunar surface obtained by the Lunar Prospector mission (1998–1999), Larry proposed a somewhat heretical model that challenges the simple, dichotomous "mare-highlands" view of lunar geology and some important portions of the 30-plus years of interpretation of geochemical and geochronological data on Apollo lunar samples (Haskin, 1998; Haskin et al., 1998, 2000; Jolliff et al., 2000). He hypothesized that (1) the Moon differentiated asymmetrically, creating a "unique lunar geochemical province," one rich in incompatible elements that he dubbed the "High-Th Oval Region" (later, "Procellarum KREEP Terrane"), (2) the last basin-forming impactor to strike the nearside of the Moon, that which formed the Imbrium basin, happened to target the anomalous terrane, and (3) Th-rich ejecta from the impact was distributed over the face of the Moon and dominates incompatible elements (including all isotopes of geochronological importance) in polymict samples (regoliths and breccias) of the Apollo sites, all of which were within easy reach of Imbrium. (Larry acknowledged in the first paper that none of these ideas were really new, just disregarded.) The author, as well as reviewers of Larry's papers, persisted for more than a year in attempting to convince Larry that his model was inconsistent with accumulated wisdom about the Moon. Larry, however, was more concerned with accounting for the big-picture observations and data than he was with accumulated wisdom based in part on interpretation of subtleties in petrographic textures and 1% differences in calculated crystallization ages. The (now-converted) author predicts that most of the aspects of Larry's hypothesis will withstand the tests of time.

In 1994 Larry had a casual conversation with Alian Wang, a physicist and spectroscopist working in our department. Alian mentioned that a Raman spectrometer could be made very small with modern technologies. As a physical chemist, Larry knew the potential of Raman spectroscopy for mineral characterization (Haskin et al., 1997; Wang et al., 2004). The primary focus of the last ten years of his professional life was to build and fly a Raman spectrometer for use on robotic missions to Mars—the "Mars Microbeam Raman Spectrometer" or MMRS (Wang et al., 2003). Although the MMRS was not flown as part of the Athena payload, Larry's work led him to be a member of the Athena science team for the Mars Exploration Rovers missions. Despite his deteriorating health, Larry spent several months of the last year of his life in Pasadena as a MER science-team member asking hard geological questions of his younger colleagues. The last manuscript that Larry drafted was on the water alteration of the rocks and soils at Gusev Crater, Mars (Haskin et al., 2005).

Larry was a Guggenheim fellow at the Max Planck Institute for Nuclear Physics near Heidelberg in 1966–1967, and he received NASA's Exceptional Scientific Achievement Award in 1971. He served on numerous NASA committees, including the Lunar Sample Analysis Planning Team, Physical Sciences Committee, Lunar Advisory Committee, Lunar and Planetary Review Panel, Solar System Exploration Committee, Solar System Exploration Management Council, Lunar Exploration Science Working Group, Exploration Science Working Group, Space and Earth Sciences Advisory Committee, and NASA Advisory Council as well as several NRC committees, including Mercury Review Panel, U.S. National Committee on Geochemistry, and Committee on Planetary and Lunar Exploration. He served as president of the Geochemical Society (1987–1989). In 2000 he received a recognition that he valued most. He was among nine Washington University faculty who received the first Outstanding Faculty Mentor Awards following nomination by current and former students. Larry's most lasting legacy is the cadre of enthusiastic younger scientists that have had the opportunity to work with him. Larry is survived by his wife (and early scientific colleague) Mary (Haskin and Gehl, 1962, 1963a,b; Haskin and Haskin, 1966, 1968; Haskin et al., 1977), children Dierk, Rachel, and Jean, and four grandchildren.

Associate Editor: Frank A. Podosek

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Received 20 July 2006
accepted in revised form 31 July 2006

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