Robert B. Hargraves *59—1928-2003

Rob Hargraves *59, a member of the Princeton University Geosciences faculty from 1961 to his retirement in 1994, died on March 21, 2003, at age 74, from viral pneumonia brought on by complications from radiation and chemotherapy. He was internationally known for his broad concern with geologic problems dealing with the full span of the 4.5 billion year history of Earth, as well as with other bodies in the solar system. The day before he entered the hospital for his final visit, he was finishing up work on a previously unanticipated type of rock magnetism with major implications for understanding the geological history of Earth, Mars, and the Moon. The broad scope of his work goes back to the start of his career, in South Africa, where the gold and diamond resources provided insights to the origins of some of Earth’s oldest rocks.

Hargraves was born on August 11, 1928, in Durban, Natal, South Africa of an American father and South African mother. He received a B.Sc. Hons at Natal University College in Geology and Chemistry in 1948, and began his professional career as a mining geologist in Africa. After moving to the U.S. in 1952 to work for Newmont Mining Corporation, he was drafted for service in the U.S. Army. In 1955, during his service, he married Sybil Sinclair, whom he had known in South Africa. Following his discharge in 1956, he entered graduate school at Princeton.

At Princeton, Hargraves undertook a Ph.D. thesis study of the petrology and paleomagnetism of the ancient igneous rocks and titanium deposits at Allard Lake, Quebec. Following graduation in 1959, he returned to South Africa, to the University of the Witwatersrand. He joined the faculty of Princeton University in 1961. During his long and fruitful career he combined the application of rock magnetism methods with petrology to uncover the origins and history of the rocks of the continental crust. His work took him and his students to many regions of North America, Europe, South America, Africa, and India.

His contributions to extraterrestrial geology came with his recognition of features in the South African Vredefort structure which he early, and controversially, attributed to meteor impact. Over 30 years later, he recognized the same features in the so-called Beaverhead impact feature in Montana/Idaho, and thus discovered one of the largest known impact sites on this planet. He was active in the petrologic analysis of lunar samples from the Apollo landings, many of which resembled the rocks he had studied for his Ph.D. work. He was principal investigator for study of the magnetic properties of Martian rocks on the Viking landing mission (1976) and on the Martian pathfinder mission (1999).

His broad scientific contributions frequently brought him into conflict with conventional wisdom, and he seemed to thrive on the controversies. Perhaps typical were his proposal that the ancient Earth was initially entirely covered by ocean, his work showing the relation of the diamond-bearing kimberlite pipes to hotspots in the mantle, and his proposal for how plate tec-
The first Mars lander was targeted for a dry floodplain where water had earlier brought rocks down from a wide area in the Martian highlands. However, photographs from orbit showed the proposed landing site to be full of huge rocks, large enough to poke holes in the Viking lander. NASA was unable to land, as planned, on July 4, 1976, to celebrate the 200th anniversary of the Declaration of Independence. As the scientists directing the mission were scratching their heads, Rob Hargraves pointed out that the rocks would get smaller further downstream. Additional photos verified Hargraves’ insight, and Viking I landed amongst smaller rocks, downstream, on July 20, the anniversary of the first moon landing.

Hargraves had a very simple but clever experiment aboard the Viking lander. It weighed one ounce, and no moving parts, consumed no power. He placed permanent magnets, one weak and one strong, on the base of the lander where they could be seen by the camera. The weak magnet could attract and hold strongly magnetic grains blown in by the Martian dust storms, such as the mineral magnetite. The strong magnet would hold a variety of weakly magnetic mineral grains and the camera could see the amount and color of the grains stuck to both magnets. More complex Viking experiments were managed by teams of scientists, but Hargraves was a one-man team. He could hold a team meeting while shaving.

Rob’s interest in magnetic minerals began soon after he started graduate school at Princeton in 1956. Measurements of magnetic fields recorded in ancient rocks were just beginning. Professor Buddington was particularly concerned with the ability of minerals to record and to retain magnetic orientations over hundreds of millions of years. Hargraves did his Ph.D. thesis on magnetic minerals from an ore deposit; crystals large enough to study with the techniques then available. Although Hargraves used, and improved on, a variety of “science machines” for measuring magnetic properties, he was not primarily a gadgeteer. His intellectual approach was that of a geologist. Instead of building a career by borrowing mass spectrometers from physics, chromatographs from chemistry, or group theory from mathematics, Rob was a geologist first and foremost. He borrowed from the other sciences when it was useful. Gerry Wasserburg at CalTech, not known for passing out compliments freely, said that, “Hargraves is the one geologist at Princeton who has his head on straight.”

Robert Hargraves was an intelligent guy, but there are lots of bright kids out there who do not turn into outstanding scientists. Even among scientists, Hargraves was unusual. Part of it stemmed from his early education and field experience in Africa: dealing with rocks more than a billion years old. Virtually all other geologists of his generation learned that “the present is the key to the past.” This was called the doctrine of uniformity: given enough time, virtually all the ancient geologic record could be generated by processes actively operating today. For rocks younger than half a billion years, uniformity worked for almost all of the rocks almost all of the time. Especially for rocks older than 2.5 billion years, Hargraves felt that uniformity had to be tested on a case-by-case basis. In one instance, Hargraves pointed out that as the Earth’s internal radioactivity slowly decays, the Earth’s interior gradually cools down, and rocks therefore show greater strength. Looking back, he suggested that very ancient continental rocks might have been too hot and too weak to stand above sea level; there would have been a globe-encircling ocean. After pondering this for a while, someone asked about what was written in the first chapter of Genesis. There was an unseemly scramble to locate a Bible; most geologist’s offices are not equipped with Bibles.

Another artifact from Rob’s undergraduate education concerned continental drift. He was a student at the University of Natal in Durban, where the geology department consisted mostly of L.C. King. Hargraves later reported that the opening line of the first geology course he took was, “Did you know that the South Pole used to be at Campedown?” Campedown was a small railway station near Durban. King was among the handful of geologists, almost all of them in the southern hemisphere, who carried the flag for continental drift from 1920 to 1960. Hargraves said later that if you were to have only one teacher, L. C. King was the right one.

Rob was able to come to the United States because his father, an American, had carefully registered at the American consu-
late each year to preserve his citizenship. At Princeton in the late 1950s, Hargraves’ fellow graduate students teased him mercilessly about continental drift. They and their professors all knew that continental drift was a failed hypothesis. After 1960, Rob enjoyed the last laugh.

Although he grew up in South Africa and — after graduate school — he was at the University of the Witwatersrand, Rob was a persistent critic of apartheid. He even named a major geologic feature the Reitz Ring, after an early critic of the South African government. Some of Rob’s friends were concerned that he might eventually be arrested, but despite his many trips back to South Africa, that never happened. A standard attraction at Princeton geology parties was getting Hargraves to do a Zulu warrior dance. (Natal is in Zulu territory.) Incidentally, Rob was not the caricature scientist with thick glasses and pocket protector. He initially held the record for the race from the basement janitor’s room to the fifth-floor tower office. Until age 55, he could (and did) beat any of the graduate students at squash. Until his last illness, he was the most skilled golfer in the department.

While he was at the University of the Witwatersrand in the early 1960s, Rob received a letter suggesting that the cryptic Vredefort ring in South Africa might be the result of a giant meteorite impact. Several other South African geologists had received, and ignored, earlier versions of the same letter. Hargraves went into the field and found distinctive shatter cones formed by shock waves coming out of the Vredefort ring. At the moment, Vredefort is listed as the Earth’s largest verified meteorite impact structure. Rob’s fascination with meteorite impacts continued. It was a standing joke that you could show him any map or aerial photograph and he would find hints of circular structures.

Of his many involvements with meteorite impacts, the least expected came in 1990 in western Montana. While working on a mineral exploration project, Rob came across spectacular shatter cones. He later showed that the shatter cones extended over a wide area and named the impact after the Beaverhead River. Beaverhead is now considered to be among the dozen largest meteorite impacts on Earth, and possibly among the five largest. Western Montana was supposed to be well-mapped territory in 1990.

Rob seemed to be of two minds about the Alvarez hypothesis that a meteorite strike at Chicxulub on the coast of Yucatan killed the dinosaurs. He was always happy for an impact structure to be identified and understood. However, he also contributed to the alternative hypothesis that volcanic eruptions in India killed the dinosaurs. Rob rode the Glomar Challenger drillship across the Indian Ocean tracking the later volcanic lavas from the source that began under India.

While Hargraves was at the University of the Witwatersrand, he turned his attention to the South African gold deposits. More than half of all the gold mined in the world came out of the Witwatersrand. An earlier generation of geologists interpreted the gold as a deposit emplaced in the rocks by hot geothermal water. Rob was attracted by the alternative idea that the gold had been washed into sedimentary deposits by rivers: the gold was simply a placer gold deposit but the river ran more than two billion years ago. Hargraves carried out a program of mapping detailed sedimentary structures in the mines. (The Witwatersrand mines are the deepest mines in the world, more than 10,000 feet deep.) He showed that the richest gold ore streaks were aligned with the ancient stream directions recorded in the sediments. The prevailing opinion today is that the Witwatersrand gold deposits are ancient placers, although the hydrothermal alternative keeps trying to crawl back aboard.

After Hargraves joined the Princeton faculty in 1961, he expanded the effort in paleomagnetics. Through a friend in the physics department, he married the spinner magnetometer to the lock-in amplifier. As a result a local company, Princeton Applied Research, was—for a decade—the world’s leading manufacturer of rock magnetometers. Because Guyot Hall was full of magnetic noise and steep magnetic gradients, a nonmagnetic building was built behind Eno Hall. The small building, which still exists, is officially known as the Rock Magnetism Laboratory; everyone calls it Hargraves Hall. Unfortunately, the original astatic magnetometer was disassembled 20 years ago. It was an amusing contraption operated by pulling strings from the other end of the room while observing the results through a telescope.

Rob’s technician, Naoma Dorety, capably processed through the magnetometers thousands of specimens from all over the world. In addition, there were some extraterrestrial samples of great interest. As samples came back from the Apollo lunar landings, the fine-grained samples went to several magnetometer labs, but not to Princeton. However, some of the coarse-grained lunar rocks came to Princeton for a study of the petrology. Rob Hargraves illicitly obtained the first paleomagnetic results on a lunar rock. Turns out the fine-grained material did not contain a clear magnetic record but the coarse-grained rocks gave good results. The present-day Moon does not have a magnetic field, therefore Moon rocks were not expected to contain a magnetic record. Hargraves sent the theorists back to their scratch pads and computers.

The most exotic material ever measured in Hargraves Hall was small white grains from the Allende meteorite. On chemical grounds, these grains were inferred to be the first solid materials to condense in the Solar System as the solar nebula cooled. One morning, Rob announced the strength of the magnetic field in which those grains cooled, 4.6 billion years ago.

Rob Hargraves was always teaching; he was not constrained to a room with a blackboard. One summer morning in Montana, he was leading a group of summer-hire students working on a gold exploration project when the group happened on a sizable outcrop of a coarse-crystalline black ugly rock. Rob stopped the show to announce that the rock was a lamprobphyre and gave a half-hour talk explaining about lamprobphyres, their
significance, and their possible relevance to gold exploration. One senior geologist in the group paid very little attention because he knew that in a petrology book, lamprophyres rated only about half a page somewhere around page 317. However, the students listened. It happened that one of the students, Peter Fiske ’88, took his general examination (for candidacy to the Ph.D.) at Stanford a few months later. During the exam, the faculty committee pushed across the table a sample of a coarse-crystalline black ugly rock with the question, “What do you think that is?” Fiske took one quick look, announced, “That’s a lamprophyre” and started giving Hargraves’ lecture. The Stanford examining committee had to watch their best pitch sail over the fence for a home run.

All geologists from South Africa are supposed to be fascinated by diamonds; Hargraves was no exception. Rob was an occasional consultant to de Beers; in particular he showed how magnetic records in the rocks could contribute to understanding how and when diamond pipes were emplaced. One of his later enthusiasms concerned “carbonados,” fine-grained multicrystalline diamonds. Although not at all common, carbonados are valued as cutting tools because they do not exhibit the cleavage directions found in single-crystal diamonds. Rob’s inference, combining his several interests, was that carbonados might have been formed beneath major meteorite impacts. During the last month of Hargraves’ life, Japanese researchers announced that they had produced synthetic carbonados by carrying out the normal diamond synthesis very quickly. Their paper ended by pointing out the possible parallel to natural carbonados.

Hargraves proposed many interesting questions that have yet to be resolved. One of the deepest: Does plate tectonics, as we know it today, explain the rocks older than 2.5 billion years? The rocks are obviously different but it is not clear whether a minor modification of plate tectonics will suffice or whether something completely different is required. Rob suggested scum tectonics.

When the Viking I and Viking II landers for Mars were being built, NASA asked for the signatures from those who developed the mission. The signatures were photographically reduced in size and attached on plaques on the spacecraft. Rob Hargraves’ autographs rest safely at two locations on Mars.

Hargraves (continued from p. 1)

tonics might have worked in the Precambrian. He applied skills for the detailed study of individual rock specimens towards finding answers to the major unanswered questions of planetary histories. He authored over 100 articles in the geologic literature. Honors include: NASA Medal for Exceptional Scientific Achievement in 1977, and Co-winner, Jubilee Medal of the Geological Society of South Africa, 1987.

He is survived by his wife, Sybil, his daughters Monica Jane, Allison Maude, and Colleen Sinclair, and four grandchildren.
Perhaps with the growing renown of the 19th hole celebration at the Hargraves Open House, the annual team competition evolved, from golfers plus one non-golfer, to, eventually, a golfer plus three non-golfers. This was played with a Greensome format, whereby whoever hit the shot chosen could not play the next. Tony Dahlen, Faculty was a member of the winning team in 1982. Crowding of the course and the ensuing slow play, however, drew complaints from the Springdale Club membership, and the competition was reduced to nine holes in 1988.

Staged last by the Hargraves in 1989, (28 participants) it was played in pouring rain. Nevertheless, everyone completed their nine holes, won by Van Mount *89, Dan Thompson *92, Lois Koehnken *90 and Frederica Moser. The course was otherwise deserted. A good time was had at the 19th hole.

Bless their hearts Bob and Tonalee Key, staff, continued the tradition through 1991. But times were changing, and today the Department seems indifferent to the Superbowl let alone who won the Ryder Cup. Serious stuff, geoscience these days—not much time or opportunity for team play!!

This is a contribution prepared earlier this year by avid golfer Rob Hargraves '59 Faculty (1961-1994), who once combined his love of golf and geology with an article on the geology of golf courses.

Around the Department

Have you checked the departmental website lately? Try it <http://geoweb.princeton.edu/>.

We will miss Hans-Peter Bunge, Faculty, who will leave Princeton to assume the chair of geophysics (C4) at the Ludwig-Maximilians University Munich, Germany, effective July 1st, 2003. We will say goodbye to Peter and spouse Sara Carena, graduate student, at the Alumni Reception on May 31.

James Hall, post-doc has moved to the Carnegie Institute in Washington, DC, after working with Tullis Onstott, *81 Faculty for three years at Princeton.

A new postdoc working with Satish Myneni, Faculty is Juraj Majzlan from the University of California, Davis, who holds both Hess and NSF Fellowships. He will be working on the chemistry of Fe and Al nanoparticles in the environment.

New AOS Technical Staff members are: Hongchun (Carrie) Zhang from City University of New York working with Lie-Yaw Oey, Research Scientist; and Jennifer Simeon, Oregon State, who joins Jorge Sarmiento, Faculty. Also joining Sarmiento as Research Staff is Brian Arbic, MIT/WHOI. Joining as Research Associates (formerly called post-docs) are Thomas Reichler, UCSD/Scripps working with Paul Kushner, Lecturer; and Agatha de Boer, Florida State working with Danny Sigman, Faculty.

Bethany Bowman, who managed the Geoscience Library’s course reserves has left for Houston, where her spouse begins a post-doc at Baylor College of Medicine.

Alumni/ae Departmental Lectures: In October, Jane Selverstone ’78, University of New Mexico, lectured on Rheologic cycling in space and time in an Alpine shear zone, and Ken Deffeyes ’59 Emeritus Faculty on Hubbert’s Peak; in November, John Shaw *93 Harvard University, held forth on Earthquake source characterization in strong ground motion prediction: A comprehensive approach to hazard assessment in urban areas; in February, Eliza Richardson ’96 lectured on Earthquake scaling relations from mining-induced seismicity; in March, Linda Warren ’97, Scripps/UCSD, spoke on Systematic determinations of earthquake fault planes from analysis of long-period spectra; and in April the schedule calls for Joe Kirschvink *79, CalTech, on A methane fuse for the Cambrian explosion: Carbon cycles and true polar wander.

News

Bill Heroy '41 is now living in a retirement community a mile from the Duke University campus in Durham, NC. He recalled that he and spouse Dorothy were the first married graduate student couple in the Geology Department 65 years ago. Bill remembers that in 1941 he went to work for Texaco for $0.68/hour and spent 3 months finding that job. He sent his Ph.D. hood to the department for use by current graduate students.
The December 4, 2002, Princeton Alumni Weekly reported the death of Frank Jacobeen '47 in Class of 1947 Notes. Since The Smilodon received an e-mail from Frank on January 6th, an urgent e-mail went out to Frank. Still here on Earth, he replied I AM VERY MUCH ALIVE. He related that he had worked 15 years for Shell Oil, 15 years for Washington Gas Light Company, five years as an independent—all as an oil and gas exploration geologist. Subsequently, he worked part-time for the Virginia Geological Survey and then about four years in environmental work for Virginia Department of Environmental Quality. Good to have you back, Frank! <jacobeen@juno.com>

Thanks to Bill Pool *56 who alerted us to the honorary degree that Fred Roots *49 recently received (see Honors).

A Christmas note from Ralph Moberly '50 *56 says he is retired at the University of Hawaii, but will be teaching part-time for a while.

Now Jay Lehr '57 has been busy. He's determined never to retire, and willing to end his career in his 90's as a greeter at Wal-Mart. He is very prolific in publishing. He oversees the monthly publication, Environment & Climate News, for which he is science director and writes some articles. In 2000 he edited McGraw-Hill's Handbook of Environmental Science Health & Technology, and has another handbook off the presses (see Books). Presently Jay has four books under contract, and continues to hold a skydiving record having jumped from an airplane in Ohio for 294 consecutive months—6 months short of 25 years—a goal he should reach by July.

Bill Brown *57 wrote Peggy Cross, Smilodon Editor 1972-2002, a note to thank her personally for all her loyal and vital service to the department. As he said people like Peggy have been the glue that has kept the graduates together. <cwbrown2@citcom.net>

Bob Torgerson '59 is working for Electrical Distribution Design, Inc., in Blacksburg, VA, supplying software workstations for electrical utilities. <bottorg@yahoo.com>

Back in Israel Reg Shagam *56 e-mailed that he presented a poster at the Israel Geological Society's annual meeting at a Dead Sea resort hotel. He was devastated by the report of Rob Hargraves *59 passing and in Reg's words, “What a prince of a man he was and what an outstanding intellect.”<rshagam@bgumail.bgu.ac.il>

An update from Harry Jarvis '59. In 1998 he retired from Occidental Oil and Gas after 35 years in the oil business. He recently build a house in Bakersfield, CA, to be near their family. In retirement, he consults, mainly in Latin America, plays golf, fly fishes, and works with the California Fish & Game helping protect and restore habitat for the California Golden Trout living in high Sierra streams. Then there are the 4-5 weeks per year in their cabin on a trout river in the Patagonia of Argentina. <hjarvis@aol.com>

Dick Chase *63 retired in 1988 from the Department of Earth and Ocean Sciences at University of British Columbia. Since then he has been lecturing and enjoying life in Vancouver on 10 forested and clifffy acres on Galiano Island, about three hours from Vancouver in the Gulf Islands. <rchase@eos.ubc.ca>

Dick Chase *63 also reports that at the Guyotgrads Hawaii reunion in 2002 it was decided to hold the next reunion in 2005 in Western Canada, likely centered on Canmore, Alberta, and likely in September after Labor Day. The subcommittee to produce a more detailed announcement is comprised of Canadians: Roy Stuart *56, Les Coleman *55, Finn Campbell *58, Dick Chase *63 and Curry Palmer *63. The latest year of the graduate classes targeted for the next reunion should be 1968.

Further, Dick Chase *63 reports that Bill Barnes *63 lives in Victoria, BC <mbarnes@islandnet.com>.

Alan Marshall *68, managing director of Xplore Pty, Ltd, Nedlands, Western Australia, wrote to Peggy Cross to acknowledge her sterling efforts in keeping him in touch with his Princeton contemporaries and the development of the department. <nala1928@yahoo.com.au>

The new First Vice President of the Society of Exploration Geophysicists is Wayne Pennington '72. For the last eight years he has been professor of geophysical engineering at Michigan Technological University.

Jack Horner, Curator 1975-83, returned in March to give a Vanuxem Public Lecture on Dinosaur Research in the 21st Century. The new president and chief executive officer of Harris Bank, the Chicago subsidiary of the Bank of Montreal, is Frank Techar '78.

Jim Kellogg *81 feels he may be overcommitted as departmental chair at University of South Carolina, Columbia, SC, as Editor of the Journal of South American Earth Sciences, and trying to keep up with teaching and research. Jim's research includes measuring elastic locking prior to an expected great Andean trench earthquake in Ecuador and looking for “silent” earthquakes—giant earth movements too slow to detect with seismometers. <kellogg@sc.edu>

Peter Fiske '88 was in town in March to give a Career Development Workshop to graduate students and post-docs sponsored by Career Services at the University based on his highly successful book, Put Your Science To Work.

A first-year science teacher in middle school in Durango, CO, Cathy Cullicott '89 writes to tell us it’s been fun, but she's been incredibly busy. <cullicott@animas.net>

John Suppe, Faculty, tells of running into Brian Sax '94 walking into the Waco, Texas, Hilton. Brian is going great guns putting together a conglomerate of electric power companies, taking advantage of opportunities of deregulation.

Completing her Ph.D. at MIT Eliza Richardson ’96 joined the research staff at Penn State. As of this July she will be assistant professor in the Department of Geosciences at Penn State. <eliza@essc.psu.edu>

Still living in Stuttgart, Germany, Matt Hoehler *98 is working on his Ph.D. at the university and traveling quite a bit. <mhoehler@iwb.uni-stuttgart.de>

Robert Putnam *99 is now the team leader for the Pit Su-
Honors

Fred Roots ’49 Science Advisor Emeritus, Environment Canada was awarded the degree of Doctor of Science, honoris causa, by Carleton University, Ottawa, Ontario. This was “in recognition of an outstanding contribution to public service as an advisor to Canadian and international organizations in pioneering scientific research, and in polar exploration.”

The American Geological Institute presented Dick Fiske ’54 with the 2002 Award for Outstanding Contribution to Public Understanding of the Geosciences. “After overseeing a vast amount of geological contributions to the National Museum of Natural History as director from 1980 to 1985, he continued to encourage public understanding of volcanism through collaborative efforts with his colleagues.”

Tony Dahlen, Faculty, was awarded the Lehmann medal by the American Geophysical Union (AGU). The medal is awarded “not more than every other year in recognition of outstanding contributions to the understanding of the structure, composition, and dynamics of the Earth’s mantle and core.”

The AGU has elected as a Fellow, Jorge Sarmiento, Faculty, for “modeling studies and data analyses that have led to fundamental advances in our understanding of the global carbon cycle and its anthropogenic perturbations.”

The department has established the Arnold Guyot Graduate Student Teaching Prizes. In the evaluation considerations were given to length of service, student course evaluations, and the overall contribution to the development of the undergraduate laboratory curriculum. Each Award comes with a monetary prize and honorary certificate. Silver Awards went to Sara Carena and Sergio Speziale, and a Bronze Award went to Raffaella Montelli. Congratulations.

Alumni/ae Reception at Reunions

The Department will host its annual reception for those returning for Reunions Friday, May 30
3:15 - 5:00 PM in Guyot Hall
3:15 - 4:00 PM:
“The plume controversy resolved—Jason Morgan was right after all.”
Guust Nolet will show some spectacular new images.
4:00 - 5:00 PM Reception
Come visit with the faculty and students.

Books


For busy environmental professionals, this one-stop source of cutting-edge answers offers time-saving access to all of the best engineering methods in remediation.

The Founding Fish, by John McPhee ’53, 2002, Ferrar, Straus & Giroux, 368 pp., $25.00

McPhee presents his obsession with shad fishing in bold and spirited prose, laced with humor. His adventures in pursuit of shad occasion the kind of writing—expert and ardent—at which he has no equal.

Deaths

Aniruddha De ’61
September 30, 2002

Harry Whitfield Dodge, Jr. ’52
August 1, 2002

Robert Bero Hargraves ’59
March 21, 2003

John Leisenring Kemmerer, Jr. ’33
November 14, 2002
PLATES & PLUMES
A retirement celebration for W. JASON MORGAN
October 10-11, 2003

After 44 consecutive years at Princeton, *Jason Morgan* '64 has announced his retirement, effective February 1, 2004. He began as a graduate student in Robert Dicke's group in physics. Jason came to the Geology department initially as a postdoc with *Walter Elsasser, Faculty 1962-68*, and in 1968 he joined the department faculty.

As all *Smilodon* readers know, a scientific revolution began with the introduction of sea-floor spreading by the late *Harry Hess, *32, Faculty 1934-1969*. During the 1960s the revolution grew and was capped by Morgan's discovery of plate tectonics in 1967. Since that time, most of geology has been reorganized to fit into the plate tectonic paradigm. *Morgan's* later inference that volcanic hotspots are the surface expression of convective plumes, rooted deep in the mantle, is not yet fully assimilated.

We will hold a symposium on active research frontiers nucleated by *Jason's* discoveries. Is there a globe-encircling 20th plate in the upper mantle with holes drilled in it? Did the birth of the Reunion plume kill the dinosaurs? Stay tuned and save October 10-11. We will post bulletins, a reservation form, and plans for celebratory festivities on the department web site <http://geoweb.princeton.edu> as they become available.