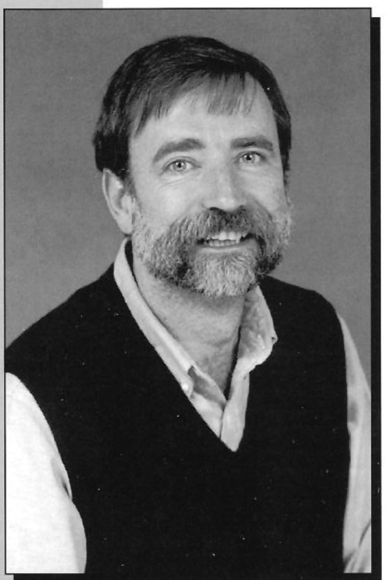
UCLA Earth & Space Sciences

Alumni Newsletter

1997 1998

Chair's Letter . . .

Much has happened in the department in the time since our last newsletter, and I'm delighted to take this opportunity to bring you up to date. I took over the reins of Earth and Space Sciences from outgoing Chair Bruce Runnegar last Spring—we enjoyed a smooth transition eased by an already efficiently running department. With his newly found spare time, Bruce spearheaded an initiative that led to our being selected from a highly competitive field as one of the five founding university members of NASA's Astrobiology Institute. The Institute brings together astrophysicists, biologists, geochemists, paleontologists, and planetologists to conduct research on the issue of life in the Universe and its cosmic implications. The interdisciplinary nature of E&SS faculty, plus Professor Runnegar's hard work, provided the critical mass for the UCLA proposal.



We have been awash with honors—testament to both continued excellence of veteran faculty and the emergence of our more recently recruited young stars. National Academy of Sciences membership was bestowed on J. William Schopf, adding to the many other honors accrued in an already distinguished career. Margaret Kivelson was made a member of the American Academy of Arts and Sciences; fitting recognition for her heroic efforts with the Galileo spacecraft, which culminated in the discovery of Jovian satellite magnetospheres. Jon Davidson was awarded the Wager Medal of the International Association of Volcanology and Chemistry of the Earth's Interior at their July meeting in Cape Town. Paul Tackley received a prestigious (and highly remunerative) David and Lucile Packard Foundation Fellowship to further his ground breaking research in planetary convection. Paul Davis became the 11th member of the active faculty to be named Fellow of the American Geophysical Union, an honor restricted annually to 0.1 percent of AGU membership. Charles Marshall spent his sabbatical last year supported by a Guggenheim Fellowship. Clarence Hall was awarded the Dibblee Medal for his remarkable contributions to field mapping. Wayne Dollase's exemplary teaching career was recognized with the UCLA Distinguished Teaching Award.

The department continues to be rejuvenated, with current faculty searches in neotectonics, non-linear dynamics, and space physics, and joint searches in biogeochemistry and geo/astrophysics. We came through an external review of our teaching programs with flying colors! The number of our undergraduates has stabilized at about 50, and their future prospects have never seemed brighter. We have established excellent industry contacts, who are hiring our students in numbers not seen in nearly a generation. As I write this letter, a bumper crop of 18 very promising new graduate students is arriving at UCLA to reinfuse our graduate program, which continues to be ranked in the top ten nationwide.

Keep your eye out for us in the news! An article describing the remarkable discoveries emerging from the department's W.M. Keck Foundation Center for Isotope Geochemistry is in the November issue of *Discover* magazine. In January, the next spacecraft to Mars will lift off from Cape Canaveral, and we will serve as mission control for the scientific program of the lander.

One of the most satisfying aspects of being Chair has been the opportunity to visit with dozens of alumni during a swing through Texas and trips to Orange county, Bakersfield, and Colorado. The response by former graduates to our inaugural Distinguished Alumni Lecture was very heartening and provided me with a terrific opportunity to get to know even more of you, and to discover what roles you wish to play in the future of the department. We greatly appreciate your generous gifts, particularly at a time when state support continues to dwindle. During the fifties, about two-thirds of the university budget came from state sources. Today that figure is only 23 percent! We're working hard, with your help, to keep the department in the fine shape that you remember it.

All the best for 1999!

Mark Harrison, Professor and Chair

Kata McCarville, Stephanie & Michael Tiffany, Ian Douglas—with Kata's Poleta map—Clem Nelson, Karen Cullen, Kim Bishop, and Steve Lipshie.

1978 Geology Field Camp 20th Reunion

The 1978 UCLA Geology Field Camp held their 20th reunion July 3-5, 1998. Students from the field camp class included Kim Bishop, Karen Cullen Larter, Ian Douglas, Kata McCarville, and Mike Tiffany. Stephanie (Baer)Tiffany, Steve Lipshie, and Emeritus Professor Clem Nelson also enjoyed the festivities.

Kata McCarville and Karen Cullen Larter began their pilgrimage to the past with visits to Tick Canyon and Rainbow Basin. They learned that the Tick Canyon area right around the borax mine is for sale—any buyers, out there?

Kim Bishop served as gracious host at Camp Bernasconi (formerly Camp Inyo), where he'd been teaching field camp to his students from CSULA. On July 4th, the Tiffany contingent took in the great skiing at Mammoth. Students from UC Santa Cruz and UC Davis field camps showed up for the annual Fourth of July softball game, which is now "clothing optional." After dinner, everyone enjoyed a wonderful "kitchen percussion" concert.

The reunion group performed a leisurely re-investigation of the Poleta Folds—Clem and Steve told the "real story." A bit of "natural history" was performed (we were afraid to ask), in honor of Clarence Hall. Some of Kim Bishop's new ideas on the geology of the Owens Valley were also explored. And the group was treated to the "classic" Nelson-Lipshie demonstration of the formation of the Coyote Warp, using just a pen knife and a sheet of notebook paper!

The evenings wouldn't have been complete without visits to Hot Ditch, where warm water eased old bones as reunioners thought of old friends, reflected on the past, and dared to dream about the future. Under a bright moon, a plan was hatched for a really big bash for the 25th field camp reunion. We think this is the only appropriate way to thank Charlie Buckley for all the work he put into organizing the 20th, even though he could not attend. So, all you denizens of 1978, mark your calendars for Independence Day of 2003—*no excuses!* ❑

On the cover: Fitted with hard hats and gas masks, participants of the Earth & Space Sciences Field Seminar walk into the steaming ampitheater of the active volcano on White Island, in the Bay of Plenty, New Zealand. Photo by John Hora.

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Distinguished Alumnus: Kenneth Hsü

Kenneth J. Hsü

El niño took just enough of a break between rainstorms to give us a lovely evening on February 18th, 1998, to honor **Kenneth J. Hsü** (PhD '54), an outstanding alumnus, at the Inaugural Earth and Space Sciences Department's Distinguished Alumni Lecture and Reception. About 150 E&SS alumni, faculty, students, and guests took the opportunity to renew their acquaintance with the department and old friends at the outdoor amphitheater of UCLA's Fowler Museum. After sampling the wine and goodies arrayed there, they proceeded indoors to the Lenart Auditorium, where **Jerry Winterer** (PhD '54) introduced Professor Hsü.

Hsü, Professor Emeritus of the Swiss Federal Institute of Technology, graduated with a PhD from UCLA in 1954, and went on to become one of the most distinguished, and arguably most provocative, alumni in the 70-year history of our department. Honors bestowed on Professor Hsü include: Foreign Associate of the National Academy of Sciences, the Wollaston Medal of the Geological Society of London, the Twenhofel Medal of the SEPM, and Honorary Fellowship in the Geological Society of America. His pioneering work on the Franciscan terrane set the stage for the interpretation of Californian geology in terms of plate tectonics. The legacy of his work on the mechanics of overthrusts and landslides is still felt. His geological synthesis of the closure of the Tethyan oceans led to an insightful interpretation of the evolution of the Neo- and Paleo-Tethys. Other contributions range from understanding the Late Cenozoic paleogeography of the Mediterranean Sea to the dynamics of lake systems.

His recent field research in his homeland of China substantially accelerated the growth of the Chinese geoscience community by challenging traditional interpretations and providing testable hypotheses. These interactions inspired Professor Hsü to consider the differences between the intellectual traditions of the west and China that led to their divergent paths in the development of science. His talk, titled ***"Why Isaac Newton Wasn't Chinese,"*** was an insightful and controversial analysis, and was as entertaining as it was stimulating. ❑

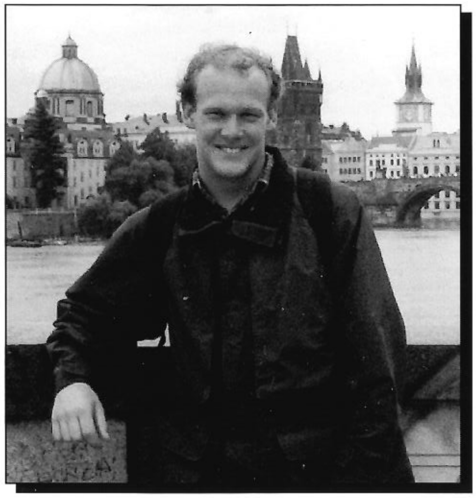
On/Off the Road, Again!

The Earth and Space Sciences Department is pleased to announce that we have been successful in raising sufficient funds for the purchase of our first field vehicle, a near new Chevy Suburban 4 x 4. As a result of reduced state support, UCLA's fleet service no longer provides off-road vehicles; making matters worse, rental agencies no longer permit off-road use of their 4-wheel drive vehicles. In order to continue to be able to access the localities most important to a modern field geology program, the department has been actively seeking private funding for a small fleet of field vehicles.

Our first purchase was made possible by very generous donations from **Charles Briscoe** ('32), with a matching gift from **Pacific Enterprises**; the **Exxon Corporation**; the **Mobil Foundation**; and **Norman Wagner** ('51) and his wife, **Trudi**. As the importance of field experience for young geologists is immeasurable, we appeal to all of you both for donations and for leads on good deals on appropriate vehicles, so that we can continue to build our field vehicle fleet.

Student Profile: Chris House

Geologist, microbiologist, chemist, paleontologist—graduate student **Chris House** epitomizes the new breed of earth and space scientist who will lead the field into the 21st century. They know that unlike academic institutions, Nature is not compartmentalized. To unravel its workings, each part—and how each affects the others—needs to be understood.



Chris House

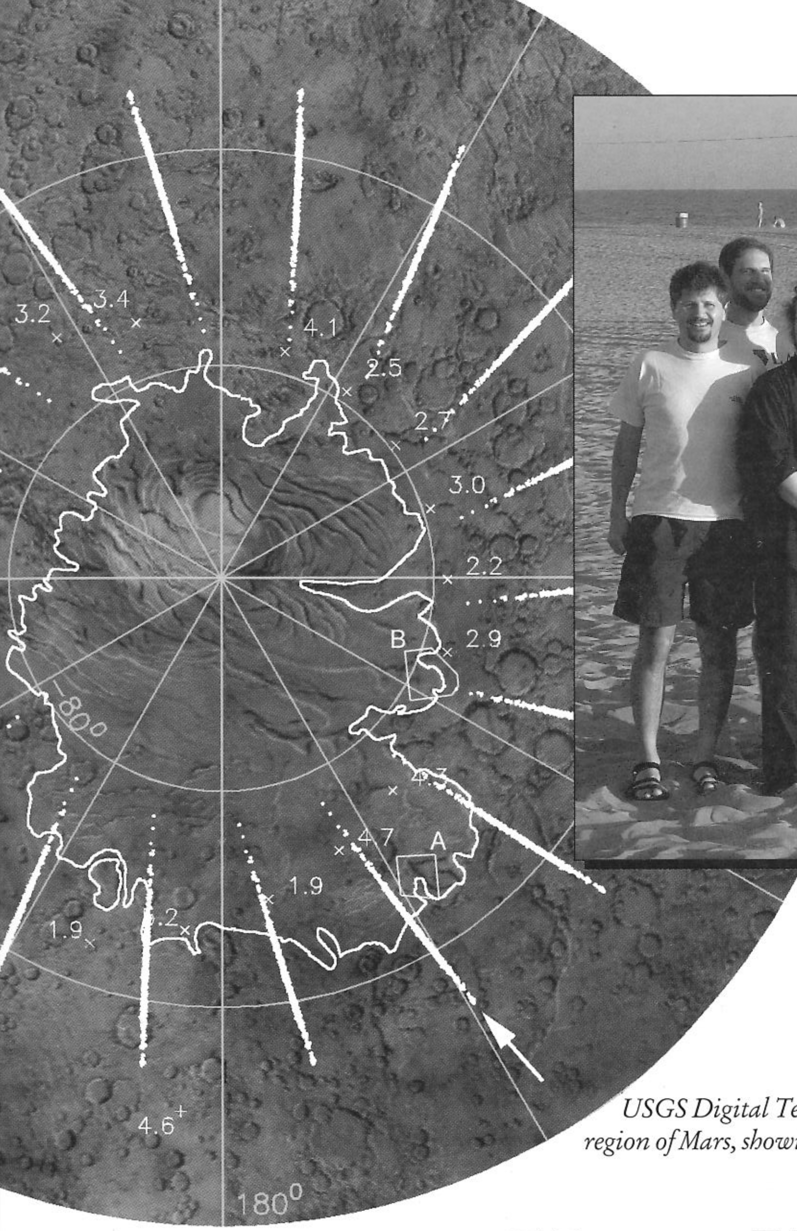
As an undergraduate in Biochemistry and Cell Biology at the University of California, San Diego, Chris conducted experiments on the chemistry of the beginnings of life under the tutelage of Professor Stanley Miller, renowned for his pioneering studies of organic compound synthesis under simulated early Earth conditions. This work led to a coauthored paper and two abstracts that appeared in 1996 soon after Chris entered UCLA and E&SS as a Graduate Fellow of the Center for the Study of Evolution and the Origin of Life (CSEOL) to work with Professor J.W. Schopf. The following year two more contributions were published, now addressing geologic and paleontologic questions. And in June 1997, Chris journeyed to the University of Regensburg, near Munich, to spend the summer and two months of the fall doing research at the Lehrstuhl für Mikrobiologie as a guest of the famed German microbiologist Karl Stetter (discoverer of the world's most heat-tolerant organisms). Chris has already worked side-by-side with senior world class scientists.

Chris' interests center on tracing the roots of life to its ancient Precambrian origins. Though fascinating and obviously important, this is a problem made difficult by the ravages of time and the biology of early evolution. Few terrannes, almost all severely metamorphosed, have survived from the earliest stages of planetary evolution; and the most crucial aspects of the oldest (3.5 Ga-old) fossils known—their physiology and biochemistry—can be discerned only dimly from their simple cellular makeup. Because the stable isotopes of carbon provide a geologically preservable clearcut signature of ancient physiologies, Chris' work focuses on the isotopic geochemistry of Precambrian organic matter. But to attack the problem he has added two novel twists. Together with scientists from the W.M. Keck Foundation Center for Isotope Geochemistry in the E&SS Department, he has devised techniques to analyze individual microscopic fossils using our highly sensitive ion microprobe (rather than conventional bulk samples). This work represents a significant research component of the NASA-funded Astrobiology Institute Initiative recently founded at UCLA. Second, to understand the compositions measured, he has carried out the first exhaustive isotopic study of relevant living microorganisms, archaeans and other primitive microbes cultured under controlled conditions at Stetter's Lehrstuhl in Regensburg—a meticulous study from which he played hooky at least once—visiting Prague, to the northeast (see photo).

Chris House's ongoing studies, innovative and notably interdisciplinary, can be expected to yield significant new insight into life's early history. His research, like that of many E&SS graduate students, is at the cutting edge of the science. ❑

Nathan Myhrvold to be Next Alumni Lecturer

We are pleased to announce our second E&SS Distinguished Alumni Lecturer: **Nathan Myhrvold** (MS '79). As chief technology officer reporting to Microsoft chairman and CEO Bill Gates, Myhrvold is best known as a superstar in the computing industry. But he's also an accomplished chef, mountain climber, and scientist, with a special interest in paleontology. Just this year, his collaboration with dinosaur expert Philip Currie on "Cyberpaleontology -Supersonic Sauropods" made him a finalist in the Computerworld Smithsonian Awards. At the age of 19, Myhrvold earned both a BS in mathematics and an MS in geophysics and space physics from UCLA, then went to Princeton University for a master's degree in mathematical economics and a doctorate in theoretical/mathematical physics. He was working on a postdoctoral fellowship under renowned cosmologist Stephen Hawking at Cambridge University, when he decided to try his hand at software development. After Microsoft bought his company in 1986, Myhrvold was hired as director of special projects, and in 1991 founded the corporation's basic research arm. The time, date, and title of Dr. Myhrvold's lecture is yet to be determined (it will probably be in late February), but it promises to be one of the highlights of the academic year. We look forward to seeing you there! (If you live outside California or north of Bakersfield, and you'd like to attend, please drop us a line requesting an invitation—just use your return envelope.) ❑



David Paige (left) and his team of researchers (from left): Stephen Wood, Ian McEwan, Anil Madhavapeddy, Mark Richardson, Ashly Leonard, Nick Ludlam, An Nguyen, Asmin Pathare, and Karen McBride, at their next favorite location, after the south polar region of Mars.

USGS Digital Terrain Model of the south polar region of Mars, showing the MVACS landing area.

Mars Mission Control

As January 3, 1999, the launch date for the Mars Polar Lander nears, Associate Professor of Planetary Science, **David Paige,** and his team of graduate students, undergrads, and other researchers are getting more and more excited. The launch will be nerve-wracking, and so will the touch down on the surface of Mars eleven months later, on December 3, 1999. But once they hear the signal that it has landed, they will be able to go into action and start operating the collection of instruments that make up the scientific payload known as MVACS (Mars Volatiles and Climate Surveyor).

In preparation, David and his team have been busy moving into the new Science and Technology Research building in Westwood, which will serve as the mission control for the operation of the payload. They are setting up a Lander mock-up and sandbox versions of the payload's instruments, with which they will practice the operations, and for visitors to see.

The goal of the Mars Surveyor Program is to gain an understanding of the Martian climate, that may someday allow human exploration of the red planet. It will certainly give us clues to the geologic and atmospheric history of Mars, and help us better understand Earth's climate, too.

The instruments on the lander will allow us to to see the planet as we never have before. From its south polar landing site, the lander will send back images from its camera, and sounds from its microphone—for the first time, we will not only see, but hear the landing site! The lander will also transmit daily weather information including wind, temperature, and humidity, and it will dig for subsurface ice with its robotic arm.

You can share the excitement of this mission by periodically visiting one or both of our two websites, as our journey unfolds at *http://www.exploringmars.org* or at *http://www.mvacs.ess.ucla.edu.* ❑

Life on Mars?

Laurie Leshin

For a brief time in August 1996, the attention of the world focused on a rather non-descript potato-sized igneous rock with the cryptic designation ALH84001. Why was this rock the center of attention? A team of investigators, led by David McKay from NASA's Johnson Space Center, announced their conclusion that rare carbonate minerals in this meteorite contain evidence of past life on Mars. Earth & Space Science's W.W. Rubey Faculty Fellow ***Laurie Leshin*** *has been leading UCLA's efforts to unravel the history of this fascinating rock, and to try to understand if there could have been (or could still be!) life on our planetary neighbor. Professor Leshin recently returned to her native state to accept a tenure-track position on the faculty of Arizona State University.*

How do we know this meteorite came from Mars?

ALH84001 is one of twelve collected samples that have been blasted off the Martian surface in the past 15 million years that eventually made their way to Earth to fall as meteorites. The best evidence that these rocks are Martian comes from trapped gases in the meteorites which are an exact match for those in the current Martian atmosphere. The Viking missions in the mid-1970s analyzed the composition of the Martian atmosphere in some detail, and we see the "fingerprint" of this distinctive gaseous reservoir in the meteorites. No other reservoir in the solar system has the same fingerprint.

Would you describe a little about the history of ALH84001?

First of all, its history on Earth—it was found by UCLA Earth & Space Science graduate **Roberta Score** (BS, '78) in the Allan Hills (ALH) region of Antarctica in 1984 (thus the "ALH" and "84" in its name) during the annual expedition of the Antarctic Search for Meteorites (ANSMET) Program. Six of the twelve meteorites from Mars were found in Antarctica. ALH84001 is a sample of the ancient crust of Mars, made up almost entirely of the igneous mineral orthopyroxene. Some regions of the rock contain the major minerals crushed to tiny grains by at least one shock event. The carbonates in ALH84001 make up only about one percent of the rock, and are often found in these crushed zones. They are complicated in terms of their chemistry, with compositions ranging from pure calcite ($CaCO_3$) through more Fe-rich regions, and finally to nearly pure magnesite ($MgCO_3$). All this chemical variation occurs over very small spatial scales ($<$0.1 mm) in the individual carbonate occurrences.

What evidence cited by the NASA team shows this meteorite contains evidence of past life on Mars?

McKay and his colleagues cited four lines of evidence, all associated with features of the carbonate minerals in ALH84001. However, it is important to keep in mind that all of these observations also have plausible explanations that have nothing to do with life. First, they found organic material, specifically polycyclic aromatic hydrocarbons (or PAHs), associated with the carbonates. Second, they noted iron oxide and sulfide minerals within the carbonates. These minerals are sometimes secreted by microbial organisms on Earth. Third, they showed photographs of tiny, elongated structures on broken surfaces of the carbonates which they hypothesized were "nanofossils." And finally, they claimed the carbonates formed at low temperatures in a water-rich environment, consistent with a "biological" scenario.

What about these alternative explanations you mentioned?

PAHs are not particularly diagnostic of life. They are found in everything from interstellar clouds to diesel engines, and could have come from the ice in Antarctica where the meteorite sat for 13,000 years after it fell to Earth. Most geologists know that iron oxides (magnetite in this case) and sulfides are very common inorganic minerals on Earth, and subsequent studies of these minerals in ALH84001 cast doubt on a biological origin for them. The nanofossils are so-named only on the basis of their shape, however nothing like cell walls or other definitive biological characteristics have been observed within them. Because they are so small (about 0.0001 mm in size), they are very difficult to analyze. Some scientists have argued that the nanofossils are actually analytical artifacts. In any case, the structures are significantly smaller than any accepted bacterial organism known on Earth. Finally, there is the issue of the environmental conditions of carbonate formation. Scientists from the McKay team had concluded the carbonates formed at low temperature based on a bulk analysis of the different isotopes of oxygen (^{18}O and ^{16}O) in the carbonates. The ratio of these isotopes changes as a result of changing environmental conditions, and this group interpreted their results to indicate low temperatures of zero to 80 degrees Centigrade for carbonate formation. The conclusions were quite different however, when the chemical compositions of the carbonates were examined on the micrometer scale. Ralph Harvey (Case Western Reserve University) and Hap McSween (University of Tennessee) found indications in the proportions of magnesium, calcium, and iron in the carbonates that they could have formed at much higher temperatures, up to about 600 degrees Centigrade. I was left wondering how two studies could come to such different conclusions. This is what originally got me interested in this problem.

What was your approach to resolving the problem?

I was concerned that there was a disconnection between the scale of the two studies. In the case of the oxygen isotope study, the samples consisted of thousands (or more) of individual carbonate occurrences in the rock, all analyzed together in a conventional technique using phosphoric acid to dissolve the carbonates and analyze the oxygen that was liberated in that treatment. Conversely, the chemical studies of Harvey and McSween used an electron microprobe to analyze individual carbonates at the scale of less than 0.01 mm. I thought it was important to try to perform oxygen isotopic analysis on the same spatial scale as was done in the chemical composition analyses to draw a direct connection (if there was one) between the chemical and isotopic composition of the carbonates.

How can you do that?

We have a world-class instrument for performing isotopic analysis on the microscale at UCLA. It is called an ion microprobe, and it resides in the W.M. Keck Foundation Center for Isotope Geochemistry in the E&SS Department. It uses a beam of cesium ions to blast a very tiny hole in the sample. We can then analyze the oxygen isotopic composition of the sputtered-out material in the mass spectrometer, which is also a part of the ion microprobe. The measurements are very challenging—we typically analyze about a million times less sample than in more conventional analysis techniques, and we have to worry about correcting for shifts in the measurements caused by the ion beam bombardment. We worked very hard to make sure we had all the analytical issues under control before attempting to analyze the Martian carbonates.

What did you discover when you analyzed the carbonates with the ion microprobe?

We found that the ratio of ^{18}O to ^{16}O varies by about two percent in different carbonate areas. This may not sound like a lot, but it is actually a huge variation to find over small spatial scales. Similar variations are rarely found on Earth. Also, we found what we had hoped—a correspondence between the oxygen isotopes and the chemical compositions of the carbonates. Finally we have a link between the two studies which came to different conclusions. We now know that both the chemical and isotopic composition of the carbonates vary together, so any scenario invoked to explain the carbonate formation must also explain this observation.

So what can we say about the conditions of carbonate formation based on your observations?

We can come up with a few possibilities. One is to suppose the carbonates formed from a large water-rich reservoir. In this case, the temperature must have been changing during the time the carbonates were forming to make the observed two percent variation in oxygen isotopes. We find that the temperature had to vary by more (and probably much more) than 125 degrees Centigrade. Alternatively, we can cause this variation by precipitating the carbonates from a very limited amount of carbon dioxide. In this case, the carbonates could have formed even at relatively high temperatures of more than 500 degrees Centigrade. We still have more work to do to figure out which of these scenarios is correct. Still, we conclude that neither one of our possible environments is consistent with a biological scenario for carbonate formation in ALH84001, and thus that the carbonates in this meteorite probably do not, in fact, contain evidence for ancient life on Mars.

Does this mean there is no hope for finding life on Mars?

Absolutely not! There are plenty of reasons to be optimistic. My own work on other Martian meteorites suggests that there is a large reservoir of water in the Martian crust which interacts with its rocks in the Martian hydrologic cycle. Groundwater environments such as these are good places for life to thrive below the Martian surface. Some scientists even think that life on Earth could have started in such hydrothermal environments on our own planet. So we have every reason to keep exploring for life on Mars, especially in ancient rocks, because the presence of ancient dry river valleys on Mars indicates that the planet was warmer and wetter early in its history than it is today.

What is the next step in exploring for life on Mars?

Most importantly, we need the right samples to study. Unfortunately, nature has provided us only twelve Martian rocks, and all except ALH84001 are geologically young. Also, they are all igneous rocks. These would not be the rocks we would explore for evidence of Martian life if we had a choice. We need to go to Mars and bring back samples, preferably of ancient sediments, to really begin to answer our questions about Martian life. We hope to do that with a mission scheduled to launch in 2005, but it is very technologically challenging, and we are trying to do it on a very limited budget. Mars missions these days cost less than it cost to make the movie "Titanic!" If the samples from Mars missions show evidence for life on Mars in the past, we will need to send humans to explore for evidence of living organisms on Mars today. Because any environment where life could exist today would probably be far beneath the surface where liquid water is stable, it would be very difficult to access using robotic spacecraft. But first, we just need to get some proper samples back to our labs on Earth for analysis. *I can't wait!* ❑

Tectonic Tidbits

Professor **Didier Sornette's** research spans the seemingly multifarious fields of the behavior of financial markets to the fundamental nature of earthquakes. The glue that links these various studies together is the new research field of "complexity." His principal research themes are the recognition of log periodic behavior and self-organized criticality in geophysical phenomena. In the course of examining the seismic record for log periodic signals, he was struck by the accumulating contradictions inherent in the longstanding friction-rupture earthquake paradigm, which stimulated him to propose an entirely new theory of earthquakes. His theory proposes that a fraction of the elastic energy accumulated adjacent a fault is stored as chemical energy. The "explosive" release of this energy unlocks the fault that is then free to continue rupturing virtually free of friction. ❑

Time heals all wounds—even cracks in Earth. According to Professor **John Vidale**, the network of tiny cracks left by a quake slowly heal in the following years.

Understanding how much these breaks have sealed up could help geologists predict the timing and magnitude of future quakes. Earthquakes create tiny cracks that penetrate and surround a fault. In turn, these are thought to affect the behavior of the fault and the size of the next quake, because strong rock with few cracks will release more energy when it fractures in an earthquake. Vidale and his colleagues tested how sound waves travel along the Johnson Valley fault in the Mojave desert, which ripped apart during the magnitude 7.5 Landers earthquake of 1992. In 1994 and 1996, the team set off explosions in a 30-meter borehole, then timed shock waves in both directions along the fault. They found that the waves traveled about one percent faster in 1996 than in 1994—indicating that there were fewer cracks in the rock. New technology made the observations possible. "Ten years ago, a handful of people would have been unable to deploy eighty instruments in a few days and record the ground motion for an entire week at a time," Vidale says. "The necessary precision, a few milliseconds in absolute time, is made possible by timing from satellites, which also became possible just a few years ago." ❑

WANTED! *LA-based Alum to Assist Students with Career Placement*

Is there a retired geologist or geophysicist—with a lifetime of experience in industry—available part-time to provide our senior undergraduates with career guidance and links to the professional world? Our capable-but-overworked adminstrative and counselling staff simply cannot provide the level of support required to effectively aid our students in the area of job placement. Our students would benefit greatly from the mentorship of someone with industry experience, and they repeatedly ask for this connection.

We can offer you a friendly environment and the satisfaction of helping the present generation of UCLA graduates begin to make their contribution to the world. Interested? Please contact Barbara Widawski at (310) 825-1100.

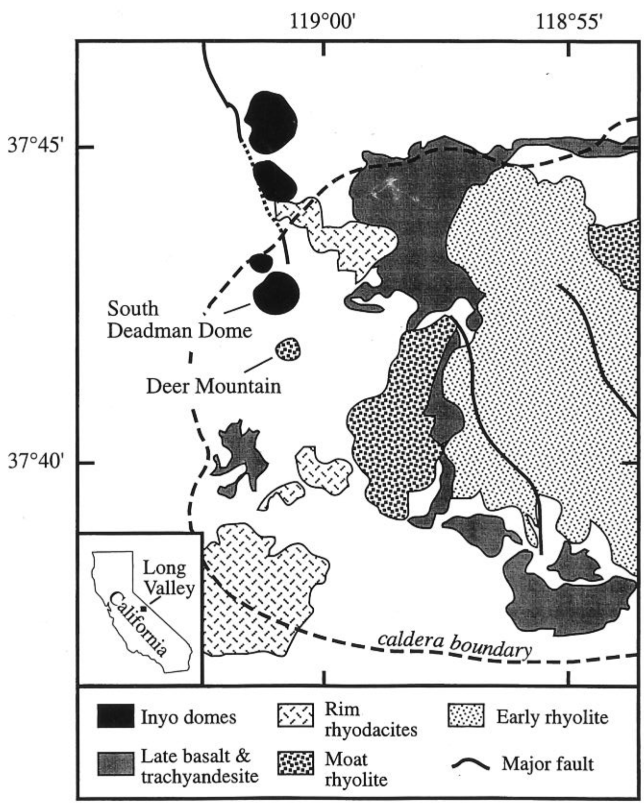
Volcanic Unrest in eastern California

Mary Reid

In addition to being a popular destination for E&SS fieldtrips, the Mammoth Lakes area of eastern California, located on the flanks of the Sierra Nevada, is a major tourist attraction because of its deep powder, high mountain lakes, and proximity to southern California. Beginning last summer, vigorous seismic activity and ground deformation returned to the level of activity that marked the early 1980s, when a series of magnitude 6 earthquakes rocked the area. Now, as then, the geologic unrest foretells of the possibility that a volcanic eruption is imminent.

What is the eruptive history of the Mammoth Lakes Area?

For over 2 million years, the Long Valley area has been subject to volcanic eruptions, the most catastrophic of which was eruption of the Bishop Tuff 760 thousand years ago. That eruption reshaped the landscape well to the south of the present location of Bishop, and distributed ash as far east as the Great Plains. Following this eruption, volcanism was initially focused within the confines of the Long Valley Caldera, but late Pleistocene volcanic vents, especially those associated with Mono-Inyo Craters, have extended activity beyond Mono Lake. The most recent eruption occurred 250 years ago on Paoha Island right in Mono Lake.



What does this suggest about the likely impact of future eruption?

The volcanic hazards that one anticipates for a particular eruption depend on the nature and location of the event. SiO_2-rich eruptions, like those that frequent the Long Valley volcanic center, tend to produce ash flows and to be accompanied by creation of lava domes. The recent geologic history of Mono-Inyo Craters suggests that such eruptions might devastate only a few km^2, so that its impact would depend on the precise location and timing of the eruption. For example, an eruption during winter months could be accompanied by flooding and mudflows. Less SiO_2-rich eruptions also occurred intermittently in the western portion of Long Valley caldera between 220 and 50 thousand years ago. Because these kinds of lavas tend to flow rather than erupt, such an event would more likely be damaging to property than be life-threatening.

Where is eruption most likely to occur?

If the recent geologic past in the Long Valley volcanic system is any indication, the probability of eruption is greatest near Mono Craters, an area to the north of the caldera that is relatively unpopulated. Eruptions associated with Mono Craters occur every few hundred years and, as is often the case for volcanoes that erupt frequently, individual events have small eruptive volumes. From this it has been estimated that the likelihood of eruption in any particular year is less than 1%, comparable to the likelihood of a magnitude 8 earthquake on the San Andreas fault system. The most recent seismic activity and crustal uplift are, however, located in an area where eruptions have not occurred for more than 50 thousand years. For this reason, the ongoing volcanic unrest could either reflect a background level of disturbance to a volcano which is otherwise quiescent or be the harbinger of a major eruption. Seismic activity has been most intense in the southern part of the caldera along a trend that extends eastward from Mammoth Lakes and approximately parallel to Highway 395. Topographic bulging tends to be most pronounced near the center of the caldera, to the east and north of Mammoth Lakes and has caused Highway 395 to rise since 1980. To the west of Mammoth Lakes, the landscape is pockmarked by dead and dying conifers that have been suffocated by the high concentrations of CO_2 in the soil gas, the result of discharge from beneath Mammoth Mountain, the major center of volcanism within the caldera for the past 200 thousand years. The broad area affected by unrest may not accurately reflect the actual geographic distribution of magma beneath the caldera, which, considered together with the long hiatus in volcanic activity, make it difficult to predict the likely impact of an eruption within the caldera itself.

What do we know about how much magma is beneath Long Valley?

In any given eruption, only a fraction of the magma that has accumulated at depth may be erupted. The extent to which the residual magma subsequently shrinks as it solidifies or grows by addition of new magma from below depends on how much magma has already accumulated and on the continuing magmatic flux to the volcanic system. Although we know from the chemistry of the volcanic rocks that the magma beneath Long Valley Caldera is not simply leftover from the body that produced the Bishop Tuff, magma could have been accumulating beneath the caldera since that eruption. Geophysical evidence is permissive of, but does not require, fairly large (tens to hundreds of km^3) of magma beneath the western portion of Long Valley caldera. Even so, some petrologists believe that large volumes of silicic magma may be generated relatively quickly (on timescales of a few thousand years) by crustal melting, which could make extrapolations from the past activity of the volcano tenuous. At UCLA, we are exploring the crystallization histories of magmas with the goal of understanding the thermal evolution of magmas; this information may have some bearing on the volume of magma beneath Long Valley.

What kind of analyses do you use to determine crystallization history of a magma?

To investigate the crystallization histories of magmas, we make use of the fact that the decay of ^{238}U to its stable daughter ^{206}Pb occurs through a series of geologically short-lived isotopes. Crystallization can disrupt the radioactive equilibrium that normally characterizes the decay chain by preferentially incorporating some of the U-series nuclides in the mineral. In particular, ubiquitous but rare minerals like zircon and allanite concentrate either ^{230}Th or ^{238}U with respect to the other nuclide, and radioactive equilibrium returns at a rate that is dictated by the half-life of ^{230}Th (75 thousand years). At equilibrium, the abundance of ^{230}Th with respect to ^{238}U is very low, less than $2x10^{-5}$, so that an extremely sensitive instrument is required. We've developed a new method for dating young minerals in volcanic rocks, using the the high resolution ion microprobe in the W.M. Keck Foundation Center for Isotope Geochemistry at E&SS, with which we achieve high yields and resolution of ^{230}Th, in addition to being able to actually date individual crystals.

What have you found?

We studied two rhyolites that erupted between Mammoth Lakes and the northern margin of Long Valley caldera to the north and somewhat to the west of the area of magmatic unrest. One erupted only 650 years ago, whereas the other erupted approximately 115 thousand years ago. Despite the 100-thousand-year difference in eruption age, the rhyolites are compositionally similar and could have been derived from the same magma chamber. We discovered that, rather than yielding ages of eruption, the zircons from both lavas gave predominantly 230-thousand-year ages. This indicates that the the zircons must have crystallized more than 100 thousand years before eruption of the older of the two lavas!

The long interval between zircon crystallization and eruption suggests that the magma was either derived from a long-lived silicic magma chamber or by melting of about 230-thousand-year-old igneous rocks, during which zircons were incorporated but otherwise little affected by the melting. Rather than clustering at 230 thousand years, the allanite ages are distributed from values that are nearly as old as those of zircon to values consistent with the eruption age. This is consistent with a model of quasi- continuous mineral growth and redissolution as fresh hot magma is introduced to the magma chamber. We think the pattern we see could simply reflect protracted cooling and crystallization of a long-lived silicic magma system. Whatever the specific physical properties of the magmatic system beneath the caldera, it is evident that the present volume of magma and/or the flux of magma to the upper crust has been fairly large in order to keep the upper crust beneath the caldera near magmatic temperatures for more than 200 thousand years. ❑

Comets, Asteroids, and Atmospheres

William I. Newman

*Working with Professor **William Kaula**, several students, and colleagues from other institutions for over a decade, Professor **William I. Newman** has been developing new tools for simulating the dynamic workings of the solar system and using these tools to investigate several fundamental questions, including issues germane to the formation of the atmospheres of the terrestrial planets.*

The dynamics of comets and asteroids is vital to understanding the evolution of the planets, and it is becoming increasingly clear that they may have played a fundamental role in shaping our atmosphere, as well. This has become the focus for much of our research. First, I developed a new method that fully exploits the capabilities of today's supercomputers to deal with Newton's equations of motion. We can now simulate the dynamics of the sun and the giant planets forward and backward in time for nearly a billion years without producing more than one degree of error in their individual positions. Together with former students **Collette de la Barre** (PhD '93) and **Kevin Grazier** (MA '95, PhD '97), we have explored the issue of solar system niches. We found that modest amounts of planetesimal material could reside near the Lagrange points of Saturn. And an especially ambitious survey of potential niches in the outer solar system, using as many as fifty workstations simultaneously, was undertaken to look at 120,000 test particles over one billion years. (Collette is now with the Department of Defense, and Kevin is Cassini Science System Manager at JPL, juggling navigation issues with science objectives for the Cassini spacecraft.)

The issue of cometary impacts is particularly topical and controversial. With colleagues from Los Alamos, we have explored the technical feasibility of building a hybrid synthetic aperture radar system to discover distant incoming comets, and developed a simple model for the interaction of cometary "ejecta curtains" with the Venus atmosphere, and showed how the 100's to 1000's of km-size East-West oriented paraboloidal deposits seen enveloping over forty craters could have been formed. What is especially exciting now is the outcome of my theoretical investigations of the explosion associated with impacts the size of the one that killed the dinosaurs 65 million years ago—the so-called K/T event (at the Cretaceous-Tertiary boundary). We are now exploring even larger impacts as a possible explanation for some anomalies in the Venus atmosphere. A single comet some tens of thousands of times larger than K/T could deliver gases from the outer solar system rich in different isotopes to Venus, yet not be massive enough to significantly remove its existing atmosphere.

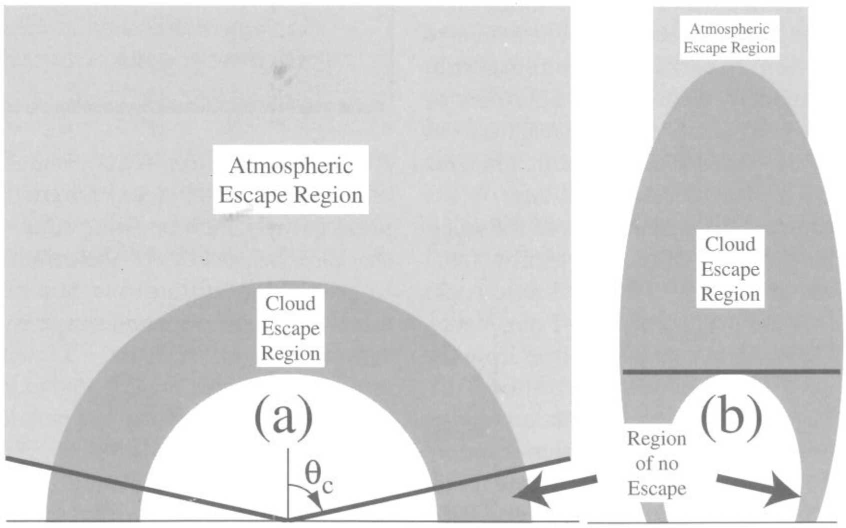


Figure 1. (a) Conventional model for an impact event; (b) New theoretical model. The new model predicts that comets, even those of K/T size, would continue to add gas to planetary atmospheres.

Our prior concept of the effects of a K/T-size impact was largely confined to a paper published by Ann Vickery and Jay Melosh. Their simple theoretical model assumed that the effect of such an explosion would be to produce a flow pattern in the atmosphere where only the gas that resided below some critical angle would be unable to escape. The underlying rationale in this model was that the mass of the vaporized impactor and target material would be so great that the atmosphere would provide only inconsequential resistance to the flow. I proposed that the interaction of the impact-associated blast with the enveloping atmosphere would result in an initially hemispherically expanding atmospheric shock wave, similar to that predicted by the Vickery/Melosh model. However, once the shock had expanded to a height of about 8 km, the characteristic scale height of our atmosphere, I expected that the shock would expand most rapidly in the direction of least atmospheric resistance, namely straight up. Meanwhile, the ongoing shock heating of the enveloping atmosphere would convert the energy of the vaporized impactor into thermal energy that would quickly rise into the vertical corridor that was formed (Figure 1).

I considered some theoretical work performed by the Russians, notably Kompaneets, and was able to obtain an exact solution to the equations which describe the trajectories of the particles swept up by the blast wave. My theory, in contrast with the Vickery/Melosh model, suggests that virtually no atmosphere, vaporized impactor, or target material would escape from the Earth (Figure 2).

A test of the competing theories was now in order. Again enlisting the collaboration of Los Alamos colleagues, we adapted a computational scheme from a code used to assess the shock propagation and yield of early nuclear tests to this task. This was a non-trivial undertaking, as the code was designed to deal with events six orders of magnitude smaller than that of K/T! However, the outcome of the test was unmistakable (Figure 3).

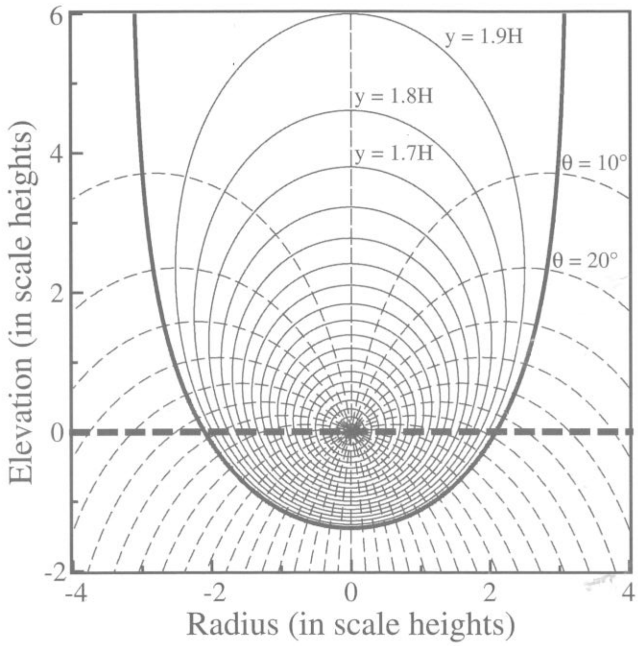


Figure 2. Mathematical model, including the extension of the work of Kompaneets. The solid ellipsoidal lines describe expansion of the blast into the enveloping approximately isothermal atmosphere. The heavy paraboloidal line shows the shock at late time. The light dashed lines, orthogonal to ellipsoidal contours, describe the analytic particle trajectories, showing that little material is eroded from the atmosphere. The heavy horizontal dashed line describes the ground, for impacts on a terrestrial planet surface, with light solid and dashed lines below describing the expansion of the shock and the trajectory of particles below the point of explosion that is relevant to comet impacts onto a giant planet.

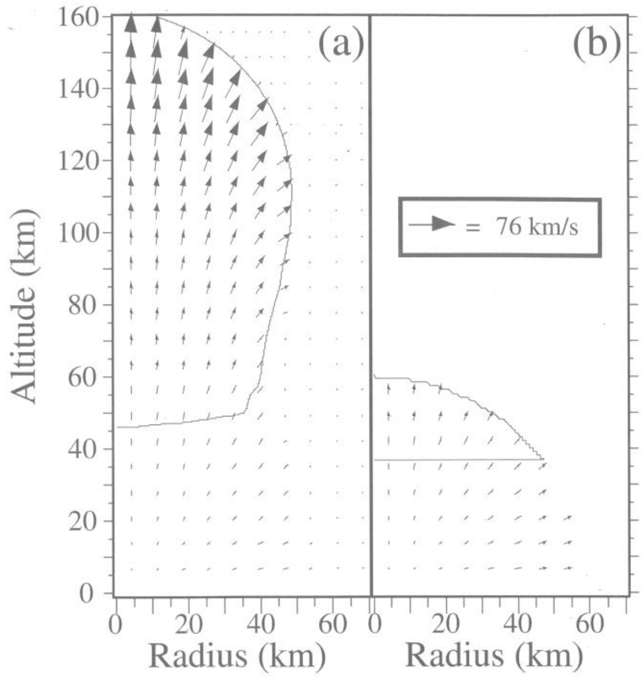
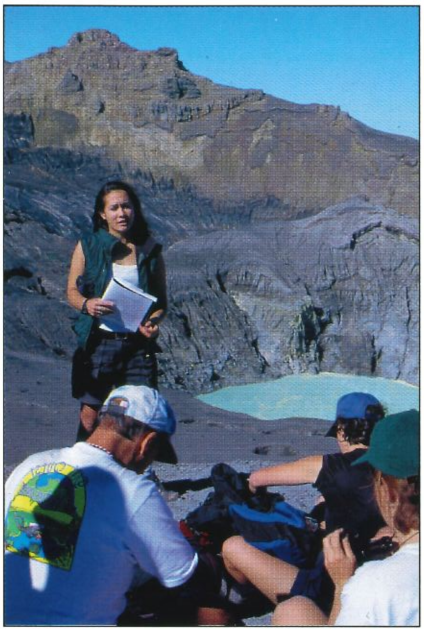


Figure 3. Plot showing velocity vectors around 4 s after K/T on Earth using CAVEAT on a CRAY-YMP (a) in contrast with Vickery and Melosh model (b). The escape velocity is 11.2 km/sec; a solid line employed in both panels identifies the hyper-escape velocity flow regime in the first principles simulation (a) and the hemispherical blowoff model (b). Our model (Figure 2) is in much closer agreement with the trajectories and the shock outline in the first principles calculation.

Our new theoretical model was fundamentally correct, and the common conception of hemispheric blowoff was simply wrong! Cometary impacts are a major source of volatiles into planetary environments, and the question, "Where did our atmosphere as well as that of Venus come from?" is now resolved. Mars, however, remains an open question. In order to maintain freely running water, as inferred from the various Mars landers, it must have had at one time an atmospheric pressure comparable to ours. A K/T-size impact on Mars would introduce new material to its atmospheric inventory, not deplete it. Could Mars, like the Earth, have been exposed early in its history to a very large-size impactor?

Is there a comet in our future? To be sure—yes, but the likelihood of a K/T-size event remains small for the foreseeable future. It is unlikely that we will be visited by one for millions of years. But smaller impacts, with significant economic, social, and other effects, represent a real threat. By studying these enigmatic objects, we will be better able to deal with their potential for disaster, and at the same time, better understand the origin and evolution of our planet and solar system. ❑

Figure 1. At the summit of Ruapehu, Tania Welch describes the geology and volcanology as part of her class project, with Crater Lake in the background.



PHOTOS BY JEREMY BOYCE AND JOHN HORA

Figure 3. Emerald Lakes from Red Crater, looking north on the Tongariro crossing. The glaciated Oturere valley is to the right.

Figure 2. The group in front of the < 2,000-year-old Ngauruhoe Cone, on the Tongariro crossing.

Figure 4. Carbonized wood in the Taupo ignimbrite 50 km south of the vent for the flow, here examined by Amy Young.

New Zealand Report

Jon Davidson

Fourteen undergrad and grad students took part in the first offering of the E&SS Field Seminar to the North Island of New Zealand, where we focused on superb volcanic geology, local and regional tectonics, geomorphology, and geothermal processes. Our first base was at Turangi, at the south end of Lake Taupo, from where we could visit the principle composite cones of the North Island. On day one, we hiked to the summit of Ruapehu led by local expert, John Gamble (Victoria University of Wellington). The ski lift gives access to the upper slopes, then a long and gentle climb through boulder fields and lava flows leads to the ash-draped summit of the volcano (Figure 1), with the aquamarine sulfur-stained crater lake perched precariously above lahar-ravaged valleys of the eastern slopes.

The second day involved a trip to the classic Tongariro traverse, led by Barbara Hobden (University of Waikato, Hamilton). The route ascends a glacial valley past the steaming young cone of Ngauruhoe (Figure 2), then provides spectacular views of volcanic features such as Red Crater (Figure 3). The long descent passes Ketatahi hot springs, on sacred Maori ground. The highlight of day three was the outcrop of the 1800-year-b.p. Taupo ignimbrite, bristling with carbonized logs that had been swept up in the pyroclastic flow and carried some 50 km from source (Figure 4). The next three days were spent examining the well-exposed ignimbrites from Taupo (< 26 ka) and Whakamaru (~ 340 ka) volcanoes. Here we had the benefit of experts Colin Wilson and Bruce Houghton (Institute of Geological and

Figure 5. Boiling mudpots at the Waiotapu geothermal area.

Figure 7. The group examining sulfur-encrusted ash from a recent eruption on White Island.

Figure 6. The spectacular summit of Tarawera; the chasm is a series of craters formed in the 1886 eruption, and the red scoria was formed in that eruption, draping over the white rhyolite of the 700-year-old dome complex, which forms the bulk of the mountain.

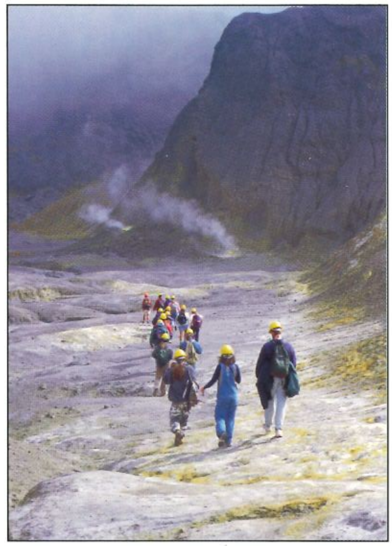


Figure 8. Walking into the steaming amphitheater of White Island.

Nuclear Sciences), who helped us reconstruct the events of the Taupo eruption. Despite a cyclone causing some bad weather in Taupo, we were not prevented from doing lots of geology. The skies had already cleared by the time we headed north, stopping at the Waiotapu geothermal area (Figure 5).

Further north, near Rotorua, we enjoyed a spectacular day on Tarawera (Figure 6), site of a violent eruption in 1886, which opened up an elongate series of craters across the rhyolite domes that form the mountain, and south westward into Lake Rotomahana. The following day, we took a boat to the active volcano of White Island in the Bay of Plenty. Fitted with hard hats and gas masks, we explored the eerie steaming and bubbling amphitheater (Figures 7 and 8), which is the site of many vents and fumaroles, and opens on the south side to the sea. Particularly interesting was the dusting of wet ash, and occasional bomb craters resulting from a small eruption only a few days earlier.

We enjoyed a traditional Maori Feast and became acquainted with the culture of the island's original settlers. After visiting the geothermal features of the Waimangu Volcanic Valley, we headed north to Auckland, where we were joined by another friend and local expert, Ian Smith (University of Auckland), who provided an overview of the Auckland volcanic field. We wish to thank the Office of Instructional Development and the E&SS Department for financial support of this exciting new class. ❑

Class of '97: Graduates, faculty, and awardees at the 1997 E&SS Department Commencement Celebration Brunch.

Honors and Awards—1997

Wilbur B. Sherman Scholarship

Awarded to undergraduate and graduate students for demonstrated academic achievement, this scholarship was endowed by Department alumnus Wilbur B. Sherman (BA '40).

Nicole Lautze
Tim Lin
Kelley Moore

John W. & Frances R. Handin Scholarship

Presented to undergraduates for scholastic excellence, this award was endowed by Department alumnus John W. Handin (BA '42, MA '48, PhD '49) and his wife, Frances.

Jean-Pierre Williams

Joseph Murdoch Scholarship

Awarded to an undergraduate for academic excellence, this scholarship honors the memory of distinguished Department faculty member, Joseph Murdoch.

Alice Ormsbee

Walter S. Harris Summer Field Award

Conferred for scholastic excellence to summer field students, this award was endowed by Mrs. Charlotte Harris Johnston in memory of Department alumnus Walter Stephen Harris (PhD '58).

Kevin Andras **Jeremy Boyce**
Garrett Mozingo **Douglas Steding**

ESSSO Graduate Student Symposium/Amoco Best Speaker Award

Paul Kapp
David Potter

Earth & Space Sciences Degrees Conferred 1996-97

Doctor of Philosophy

Deborah Simone Bass *Residual Water Frost in the North Polar Region of Mars* (Professor Paige) *Geology*

Byeon-Gak Choi *Ion Microprobe Studies of Oxygen Isotopic Compositions of Magnetite in Type-3 Chondrites* (Professor Wasson) *Geochemistry*

William Bruce Moore *Lithospheric Thinning by Mantle Plumes: Observational Constraints and Numerical Models* (Professor Schubert) *Geophysics & Space Physics*

David Russell Potter *Long-term Postseismic Relaxation in Southern California: Evidence from a Geostatistical Analysis of Geodetic Data* (Professor Jackson) *Geophysics & Space Physics*

James Todd Ratcliff *Thermal Convection with Temperature-Dependant Viscosity: A Numerical Investigation of the Effects of Variable Viscosity on Thermal Convection in Geophysical Contexts* (Professor Schubert) *Geophysics & Space Physics*

Erik Anthony Schultes *The RNA Folding Problem and Nonhistorical Constraints in RNA Evolution* (Professor Schopf) *Geology*

Kelly Ann West *Perspectives on the Diversification of Species Flocks: Systematics and Evolutionary Mechanisms of the Gastropods* (Prosobranchia: Thiaridae) *of Lake Tanganyika, East Africa* (Professor Marshall) *Geology*

Master of Science

Laura Jean Borton (By Comprehensive Examination) *Geophysics and Space Physics*

Kevin Robert Grazier (By Comprehensive Examination) *Geophysics and Space Physics*

Tung-Shin Hsu (By Comprehensive Examination) *Geophysics and Space Physics*

Emil Lawrence Kepko (By Comprehensive Examination) *Geophysics and Space Physics*

Kyna Edana Mallery (By Comprehensive Examination) *Geophysics and Space Physics*

Thomas William Momary (By Comprehensive Examination) *Geophysics and Space Physics*

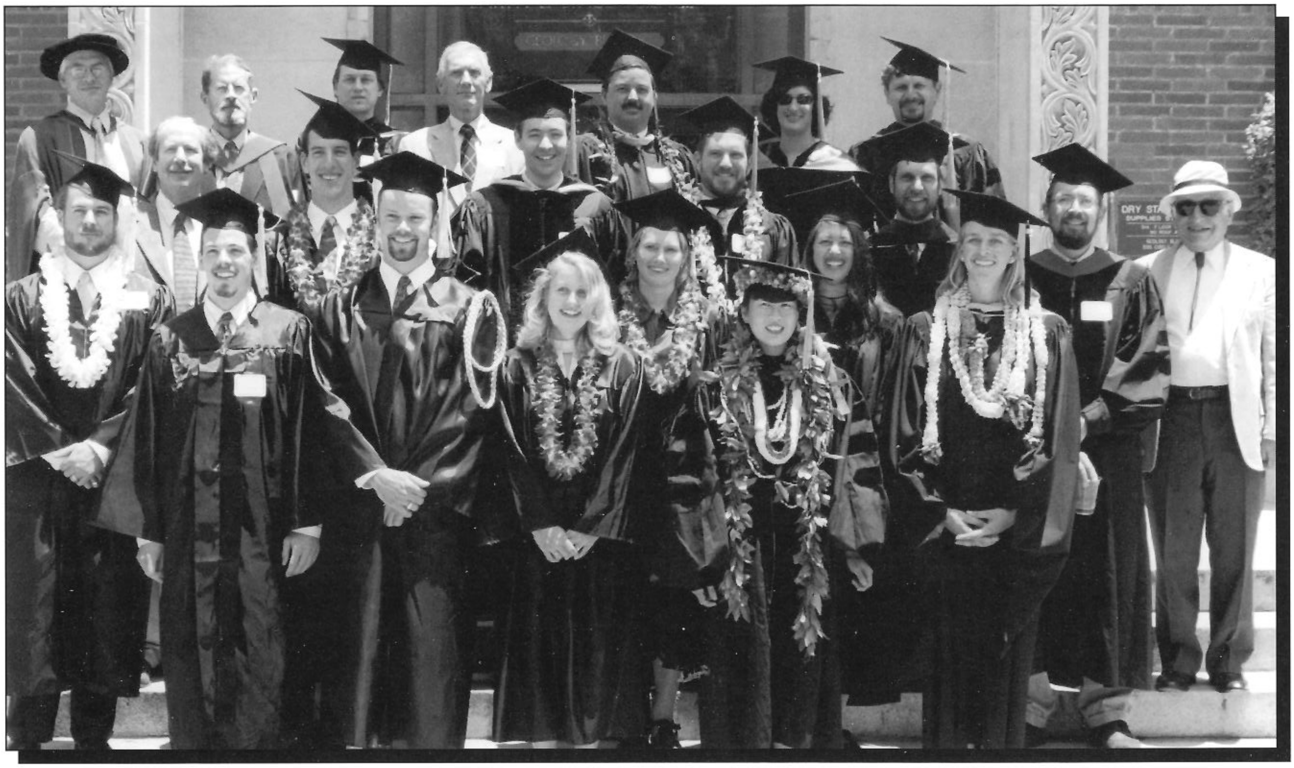
Michael Murphy *Structural Development of the Cogin Thrust Belt, South Central Tibet; Implications for the Uplift Plateau* (Professor Yin) *Geology*

Jennifer Alice Newbury (By Comprehensive Examination) *Geophysics and Space Physics*

Leslie Kay Tamppari (By Comprehensive Examination) *Geophysics and Space Physics*

Bachelor of Science

Kevin Thomas Andras *Geology*
Jeremy Welles Boyce *Geology*
Sergio Gutierrez *Engineering Geology*
Casey Lee Jensen *Engineering Geology*
Kristen Shizue Kawakami *Engineering Geology*
Christopher Harley McGinness *Earth Science* (BA)
Marco Alexis Mendoza *Geology*
Garrett Patrick Mozingo *Engineering Geology*
Jin Sang Ok *Earth Science*
Gustavo Robles *Engineering Geology*
Aaron Keith Snow *Geology*
Douglas John Steding *Geology*
Alexis Lauren Walker *Earth Science*
Elizabeth Marie Witton *Engineering Geology*



Class of '98: Graduates, faculty, and awardees at the 1998 E&SS Department Commencement Celebration Brunch.

Honors and Awards—1998

Wilbur B. Sherman Scholarship

Awarded to undergraduate and graduate students for demonstrated academic achievement, this scholarship was endowed by Department alumnus Wilbur B. Sherman (BA '40).

John Hora

Eugene B. Waggoner Scholarship

Awarded to an undergraduate for academic excellence, this scholarship honors the memory of Department alumnus Eugene B. Waggoner (BA '38, MA '39).

James Fortuna

John W. & Frances R. Handin Scholarship

Presented to undergraduates for scholastic excellence, this award was endowed by Department alumnus John W. Handin (BA '42, MA '48, PhD '49) and his wife, Frances.

An Nguyen

Clem Nelson Summer Field Award

Conferred for scholastic excellence to summer field students, this award is generously supported by Professor Emeritus Clem Nelson's former field students and associates

Nicole Coan

Sabins/Chevron Summer Field Award

Through the generosity of long-time Department friend and Adjunct Professor, Floyd Sabins, and Chevron Oil Company, this award is conferred for scholastic excellence to summer field students.

Adrian Keller **Ian MacMillan**

ESSSO Graduate Student Symposium/Amoco Best Speaker Award

Eric Cowgill

Earth & Space Sciences Degrees Conferred 1997-98

Doctor of Philosophy

Ronald David Baker, II *A Numerical Investigation of Convection and Gravity Waves in Venus' Atmosphere* (Professor Schubert) *Geophysics & Space Physics*

Ben Castellana *Geology, Chemostratigraphy, and Petrogenesis of the Avachinskiy Volcano, Kamchatka, Russia* (Professor Davidson) *Geology*

Pi-Jen Chi *Dynamic Behavior of Dayside Magnetic Pulsations* (Professor Russell) *Geophysics & Space Physics*

Kevin Robert Grazier *Stability of Niches in the Outer Solar System: A Numerical Investigation* (Professor Newman) *Geophysics & Space Physics*

Kurt Michael Knesel *Strontium Isotope Systematics During Melting in the Continental Crust* (Professor Davidson) *Geochemistry*

Janet Arlene Leventhal *Green-Pyroxene Xenoliths of the Cima Volcanic Field: Geochemistry and Tectonomagmatic Implications* (Professor Reid) *Geology*

Hong Liu *Path and Site Effects on Localized Damage Caused by the 1994 Northridge Earthquake* (Professor Davis) *Geophysics & Space Physics*

David Alan Rothstein *Thermomechanical Evolution of the Eastern Peninsular Ranges Batholith, Baja California, Mexico* (Professor Manning) *Geology*

Master of Science

Robert Edward Johnston *Kinematic Evolution of Uinta Mountains: Implications for Laramide Orogeny* (Professor Yin) *Geology*

Steven Peter Joy *Occurrence Rate of Short duration Rotation Discontinuities in the Solar Wind* (Professor Kivelson) *Geophysics & Space Physics*

Laura Elaine Maley (By Comprehensive Examination) *Geology*

Shunxing Xie (By Comprehensive Examination) *Geophysics and Space Physics*

Matt A. Yeager (By Comprehensive Examination) *Geology*

Bachelor of Science

Karl Barclay Beutel *Earth Science*
Randie Seo Yeon Choi *Earth Science, Biology*
Cristina Noel Engler *Geology*
Jennifer Jean Hulbert *Geology*
Adrian Michael Keller *Engineering Geology*
Bryan Christopher Kerr *Applied Geophysics*
Emmett Marvin Keyser, IV *Geophysics & Space Physics*
Gabrielle Maxine Littman *Earth Science*
Tung Chou Lui *Engineering Geology*
Rolando J. Manuel *Earth Science*
Terrence Lee Northrup, Jr. *Geology*
Ryan Steven Rose *Engineering Geology*
Jean-Pierre Williams *Geophysics & Space Physics*

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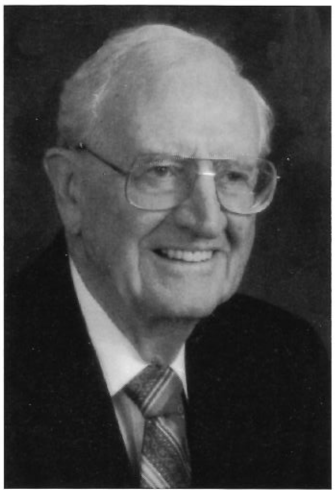
Alumni News

In efforts to reach out to alumni, Mark Harrison, Chair of Earth & Space Sciences, Roberto Peccei, Dean of Physical Sciences, and Meredith Goodwin, Director of Development, visited alumni in several cities in Texas in 1997; they also attended a reception at the Stockdale Country Club in Bakersfield, which was hosted by ***Rod Nahama*** *(BA, '55) and his son,* ***Joe Nahama*** *(BS, '87); and paid a visit to Denver. Thanks to all of you who attended the Distinguished Alumni Lecture, presented by* ***Kenneth Hsü*** *(PhD, '54) in February of 1997. Please come visit the Department whenever you're in the area!*

1932

Jerome J. O'Brien, BA, celebrated his 90th birthday on October 6th, 1997. Unless you count "petroleum transfer engineer" (pumping gasoline) for Standard Oil while he studied at UCLA, his first job in the oil industry was with Sunset Oil Company as a helper on a rotary rig. Only six years later, he became Sunset's chief geologist. Jerry married Mary Heno Payne in 1939, and in 1942, became a consulting engineer for Franco Oils, Ltd., in Canada; then he was a partner in the Shamrock Drilling Company in Los Angeles. He moved on from there to become the Texas-Oklahoma manager for Jergins Oil Company where he eventually became executive vice president of the company, then on to president of a successor oil company, Monterey Exploration Company. He was elected "Oil Man of the Year" in 1957, and was president of TIPRO (Texas Independent Producers & Royalty Owners Association). He was appointed director of the Oil and Gas Division of the Department of the Interior by Stewart Udall in 1961, serving during JFK's presidency. In 1980, Jerry and Mary moved back to San Antonio; he enjoys golfing and trips to Palm Springs, and is still active in oil and gas exploration.



Jerome J. O'Brien

1938

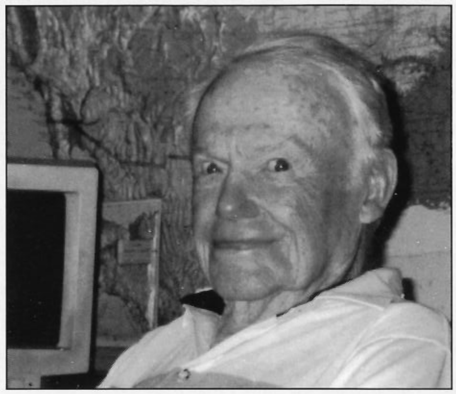
William R. Cabeen, Sr., BA (MA, '39), traveled extensively to places like Peru, India, Argentina, Canada, and sites across the United States when he was an independent oil producer. He now lives in Brentwood.

1939

William A. Griffin, Jr., BA, began his career at Daniel Industries in Houston shortly after graduating from UCLA, working his way up to becoming Chairman. In 1980, he retired to allow the new generation to take over. Since his retirement, he has become a major investor in three start-up companies. One of these, Enfab, manufactures ceramics used in "fracing"—a process whereby tiny pellets of material are added to a liquid that is pumped into existing oil and gas wells to hold open fissures in the rock, so that the maximum amount of oil or gas can be extracted. He winters in his home in Palm Springs.

Joseph W. Kean, Jr., BA, is doing well at the age of 80. He is a survivor of World War II and the Korean War, and is a retired Lieutenant Colonel, US Marine Corps, and Naval Aviator.

Harold H. Sullwold, BA (MA, '40; PhD, '59), closed his office in Carpinteria and is enjoying retirement.



Steve Daviess

1940

Steven N. Daviess, BA (MA, '42), had the distinction of tutoring Jackie Robinson. (Robinson was the first black player to play in the major leagues when he joined the Brooklyn Dodgers in 1947—fifty years ago—and was a four-sport letterman at UCLA, competing in football, basketball, track, and baseball. UCLA's home baseball field for the last 17 years has been the Jackie Robinson Stadium.) Steve modestly tells us that he was only one of several geology students who tutored UCLA's athletes—it seems the coaches had decided that Geology 1 was a "snap course," so the athletes all took it to fulfill the science requirement. When it turned out not to be such a snap after all, several grad students were called in to help. This was only one job Steve had while working his way through college. He left for school with $100 in his pocket, and he "never looked back!" He worked for five years in the reserve book room of the Ralph Reed Library, and was there at the inception of the Geology/Geophysics Library.

1940

Wilbur B. Sherman, BA, thinks very highly of UCLA's Geology faculty, and credits them with having taught him his unique observation skills. He resides now in Dallas.

1943

Robert M. Norris, BA (MA, '49), returned last year from visiting his grandchildren and "their folks" in Australia. He enjoyed seeing the hot, red interior of Australia during the height of summer, and seeing folks with whom he did research there in 1969.

1944

Robert G. (Bob) Maynard, MA. After service in World War II and attending graduate school, Bob worked for 29 years as both an oil & gas and hard mineral explorationist with Sun Oil Company. He retired in 1978, but worked as a full-time consultant to the Sun and Arco companies until 1988.

1947

Donald W. Gresser, BA, worked in the oil business for 35 years at Shell Oil, and retired ten years ago. He lives in Houston.

Robert D. Trace, MA, worked for the US Geological Survey from 1942 until he retired in 1977. His wife, Elsie, died in February, 1997.

1948

Andrew Lee Diehl, BA, and his wife, Merilyn, have moved back to California after having lived "just about everywhere else" for the last 38 years.

Robert R. Smart, BA, worked for Mobil Oil for many years, and now resides with his wife, Anita, at their home in San Clemente.

1949

Edgar W. Wellbaum, BA, is very busy these days working as a liaison between oil and gas businesses/property owners and regulatory agencies; he started in this line of work when the federal environmental guidelines were passed by Congress right before he had to obtain licensing for the Alaska Pipeline Project. He's also involved in real estate.

1951

Gerald G. Cooper, BA, started his career in middle management at Mobil Oil, where he was involved in a number of large and small discoveries. He left to do oil exploration in the Rocky Mountains and California. He then became president of a small oil company, which did very well in what he describes as "the oil heyday." He now works as a consulting geologist, and is still exploring, mainly in the Rockies.

1952

Donald R. Lindsay, MA, is a retired petroleum geologist. He is now teaching workshops on "Evolution as a Unifying Theory" to science teachers in Kern County.

1953

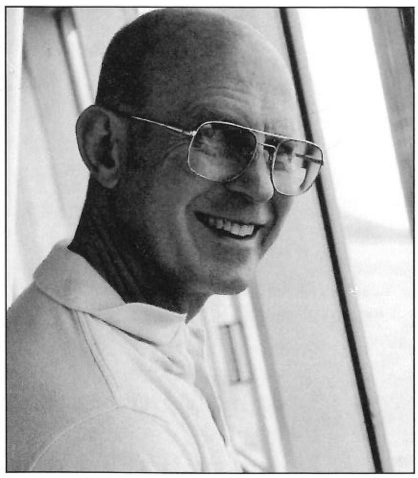
Don Hagen, BA, (MA, '57), is in great health, enjoys skiing, is still married to his wife, Nancy, has been "totally retired" since 1990, and now lives near Sandpoint, Idaho. He has been in touch with his classmates, **Dave Gross** ('58) and **Paul Merifield** ('58), and traveled to the southwestern US National Parks.

1954

Augustin L. Canut, BA, is president of Alcoil Exploration, Inc. Reminiscing about the department in the 1950s, he recalls helping to move the department from the attic of the old building into the new Geology Building.

1956

William L. Adams, MA, retired from Union Pacific Resources Company in Fort Worth, has served on the University of Kansas Geology Advisory Board and on the Board of TCU. Two of his sons have formed a company to utilize 3-D computer searches to locate new sites for drilling into existing wells whose oil has not been depleted during earlier drilling, and getting good results.

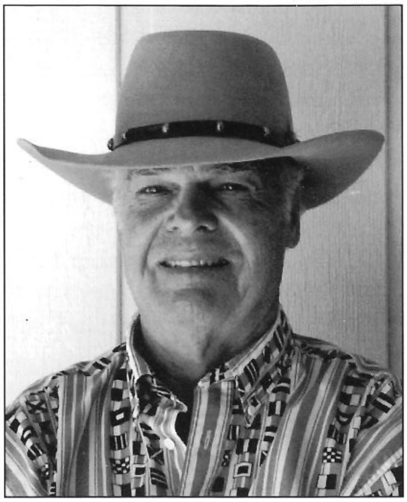


Bob Horning

B. Brick Robinson, MA, has retired from the petroleum industry after 42 years, having worked for two "major" oil companies and one "independent." His area of operation ranged from Asia to most of the petroleum-producing states of the United States. He tells us that he was fortunate to have been able to progress up the ranks from "weevil" to Executive Vice President of Exploration and Production.

1959

Robert R. (Bob) Horning, BA, is in exploration geophysics. After fulfilling his active duty obligation in the Army, he earned an MS in electrical engineering at the University of Nevada at Reno. He then began a 30-year career with UC at the Lawrence Livermore and Los Alamos national laboratories, retiring in 1993. In celebration of retirement, he earned a second MS, this one in geology, from the New Mexico Institute of Mining and Technology in 1997—just for the fun of it! After defending his thesis, Bob set out on field trips to the Central Montana Alkalic Province and the Yavapai terrane of northern Arizona. Bob and his wife, **Susan** (Clark, BS nursing, '61), live north of Santa Fe, where they raised their two daughters, Lisa and Robin. They enjoy traveling, and recently toured the Panama Canal and Carribean region. (The photo here was taken on the cruise ship along the Panamanian coast.) They plan tours of Alaska, the eastern Mediterranean, and northern Europe. Bob plans to teach classes in "geology for fun" at local colleges.



Vern Larson

Robert E. MacDougall, MS, worked for a mining company for twenty years after he graduated. He has recently been involved in the financial side of the oil and gas industry, buying companies and properties.

1965

Vern Larson, BA, geology, (MSCE, CSULB) retired in 1991 after working for 35 years with the State of California—18 years with the Division of Highways as Assistant Geologist for District VII and 17 years with the Department of Occupational Safety and Health, the last eight years as the Senior Engineer of the Mining and Tunneling Unit. Vern came out of retirement in 1994, and is now the Port Insurance Administrator and OCIP Safety Manager for Sedgewick, a broker, at the Port of Los Angeles. In June 1997, he was awarded the Associate Risk Manager designation. Vern and his wife, Marilyn, enjoy taking cruises; so far, they've taken trips to the Caribbean, Mazatlan, and Europe. They are planning to take a cruise to Alaska next year.

1966

John Warme, PhD, is continuing his work on the late Devonian "Alamo Impact Event" in Southern Nevada; shocked quartz, shocked bedrock, impact spherules, and tsunami deposits are all helping to complete the picture.

1967

Dale S. Kunitomi, BS, "continues to survive" as an oil and gas consultant (after ten years) in Camarillo, California. Dale toured the Kamchatka Penninsula in 1996, and still has occasional contact with some fellow alumni.

Kenneth L. Lister, BS, (MS, '70), presented his latest paper, "Closure of a Site Used for Disposal of Waste Pesticides and Mixing of Rodenticide Baits," in March of 1998.

1969

Bob Presley, PhD, continues his work on large marina pollution monitoring programs such as the NOAA "Status & Trends." He is at the Texas A&M Oceanography Department.

1980

Robert Tucker, MS, lives in Cairo, Egypt, developing offshore oil fields for the Gulf of Suez Petroleum Company. He and his wife, Barbara, have two children, ages 10 and 7. They enjoy scuba diving in the Red Sea and traveling in Europe, and get back to the States for the summers. **Jon Vaitl** (BS '77) and **Bill Krebs** (BS '70) are with Amoco in New Orleans and Houston, respectively.

1984

Tim Thompson, BS, considers 1995 to be, "a very good year," as that was both when he married his wife, Heidi, and received his promotion to VP/Principal at Integrated Water Technologies, Inc. He works on groundwater resources development; artificial recharge; regional groundwater basin analyses; and studies wetlands for water quality improvement in the western United States and abroad.

1991

Dana K. Polacsek, BS, is working toward his Master's degree in structural geology at the Colorado School of Mines, and is a newly elected member of Tau Beta Pi, the engineering honor society. Dana is working in the structural studies group of the Yucca Mountain Project of the USGS Water Resources Division.

In Memoriam

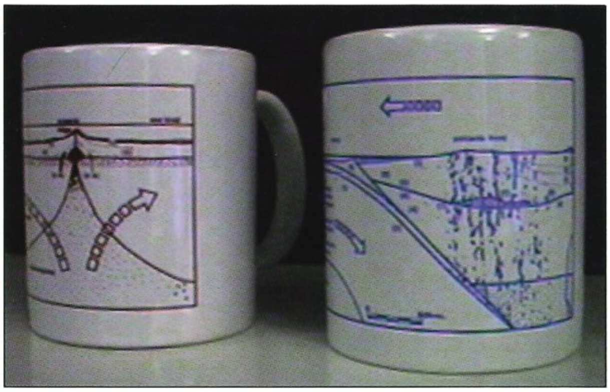
Darrel L. Kirkpatrick (BA, '42) retired oil geologist and operator, died at the age of 82 on July 27, 1998, at Bakersfield, California, after a brief illness. [by L.F. Ivanhoe]

Donald J. Mackenzie (BS, '76) died in 1993 at the age of 47. He finally lost the battle he was fighting against recurring seizures related to a brain disorder. Don had been living in Tucson at the time of his death. [by Steve Baele]

Evelyn Putnam, widow of **William Putnam,** Emeritus Professor and Chair of the Department, died on July 20, 1998, at the age of 91. [by Mary Watson]

Robert G. Wilson (PhD, '68) died on February 15, 1997, at the age of 79, after a 20-year struggle with Parkinson's Disease. He had been at NASA headquarters for seven years, and had retired from Rockwell, his main employer. [by Margaret Dean Wilson]

Tectonometamorphimugs now available!



The W.G. Ernst Scholarship fund was established on the occasion of Gary Ernst's 65th birthday. At that time, as a memento to Gary, **John Goodge** (PhD '87) had a set of coffee mugs emblazoned with Gary's famous diagrams of metamorphic mineral parageneses in subduction-zone and mid-ocean ridge tectonic settings. These diagrams, along with Gary's writings, were instrumental in placing metamorphic processes in a plate-tectonic context through the 1960's and 70's. By popular demand, a quantity of "Tectonometamorphimugs" are now available. These are 11-oz. white ceramic coffee mugs, one with a subduction zone diagram in blue, and the other with a spreading ridge in red. A set of two mugs will be sent to donors of $25 or more to the W.G. Ernst Scholarship fund for as long as supplies last. Please send checks payable to "The UCLA Foundation/Ernst Scholarship Fund" in the envelope enclosed in this newsletter.

Please help us find a lost soul . . . We've lost contact with:

Adams, John '52
Afiattalab, Firooz '79
Agee, Flint '33
Anderson, Karen '95
Anderson, Richard '56
Anderton, David '80
Ardavanis, Jerome '53
Arthur, Carlene '71
Bailey, William '31
Baranyi, Thomas '58
Bartow, John '64
Beh, Richard '51
Binder, Michael '73
Bird, Cyril '57
Blanchard, Gerard '96
Blanks, Bobby '59
Block, Marta '77
Block, Susan '73
Brooks, Tennant '42
Brooks, Thomas '81
Bush, Gordon '56
Chen, Richard '92
Cheng, Hsueh-Cheng '71
Christler, Harold '37
Clements, James '65
Coates, Donald '69
Cooper, Earl '39
Corvino, Claude '77
Cuong, Pham Giem '79
Czel, Louis '58
Dailey, Donald '60
Delsasso, Richard '56
Eganhouse, Robert '82
Ellsworth, Gregory '75
Emerson, William '49
English, Todd '85
Erickson, Harold '58
Ericson, Lars '59
Farmy, Hossein '53
Flanagan, Kevin '96
Foley, Walter, Jr., '43
Fouda, Ahmed Ali '73
Freedman, Karen '78
Freitag, Arthur '59
Gauntt, Grover '42
Grady, John '47
Grouard, Mabel '26
Gunther, Richard '76
Haaland, Ryan '90
Hagerman ,Gerald '60
Haines, Laurie '84
Halliburton, Erle '41
Halpern, Henry '81
Hamelin, Douglas '28
Hangen, Donald '52
Hanson, Bruce '53
Hanunian, Heather '74
Hardey, Gordon '58
Hart, Robert '67
Harville, Lee '69
Haw, Bruce '51
Hayward, Kirk '81
Helstrom, Bruce '65
Higgs, Don '51
Higley, James '59
Hill, Harold '42
Ho, Changming '91, '93
Hoblit, Albert '53
Hood, Russell '53
Hope, Robert '66
Hopkins, Alfred '50
Howell, Doralee '59
Hughes, Donald '59
Ihnen, Steven '78
Jackson, James '60
Johannsen, Peter '86
Johnson, Stuart '66
Karpinski, Anthony '63
Keller, Margaret '72
Klein, Marti Lynn '78
Knaup, Thomas '70
Krohn, David '56
Lacy, Kevin '80
Landberg, Leif '60
Lander, Arthur '58
Landry, John '54
Leach, Jack '53
Learned, Robert '62
Levy, Morton '57
Lewis, Thomas '49
Linker, Jon '84
Lumsden, William '55, '57, '64
MacKersie, William '48
Mead, Roy '34
Meier, Thomas '76
Mitchell, Stanley '33
Morejohn, Albert '51
Morelan, Alexander '85
Morley, Earl '56
Mostovoy, Barry '58
Muradian, Lynn '83
Musselwhite, Donald '84
Nissenbaum, Arie '69
Olaechea, Julio '60
Olin, Norman '61
Oliver, Garnet '38, '40
Ong, Marie '91
Orvis, Charles '57
Petrie, Jerome '50
Petrowski, Nila '74
Pine, Gordon '61
Popenoe, Frank '60
Raines, Gary '74
Rashoff, Jeffrey '85
Ratliff, Rudolph '71
Reinen, Elizabeth '79
Richter, Jean '85
Robbins, Howard '48
Robertson, James '60
Robertson, James '54
Robinson, Donald '58
Rogers, Mark '79
Rose, Donald '59
Roth, Jim '56
Roubanis, Aristides '62
Sams, Richard '64
Scribner, Melvin '51
Smith, Cassius '74
Smith, Robert '50
Smith, Susan '83
Smith, Todd '85
Sonneman, Howard '56
Sorensen, Karen '87
Sroka, Paul '70
Surany, Andrew '80
Swegle, John '66
Tahara, Thomas '66
Tanner, Richard '79
Thompkins, Gary '60
Torkelson, Olai '36
Truhlar, John '58
Uehara, Stanley '66
Uren, Edward '52
Van Zele, Mathilda '56
Varney, Fred '35, '37
Wall, Barrie '80
Walls, Donald '59
Wardenaar, Suzanne '73
Weir, Gordon '47
Williams, Jerry '57
Wise, Henry '39
Xu, Yuyao '94
Yaw, Agyakwa '87
Yonkman, George '57
Yudovin, Susan '79