# CALTECH NEWS

### PUBLISHED FOR ALUMNI AND FRIENDS OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY

Computers unravel secrets of historic art

### Tiny quakes: common prelude to major shocks

Major earthquakes in central and southern California have often been preceded by clusters of tiny ones, three Caltech seismologists have learned by studying earthquake records for the area.

The seismologists, Professor of Geophysics Hiroo Kanamori and Research Fellows Karen McNally and Mizuho Ishida, also have found the first evidence that anomalous clusters of small earthquakes preceded the San Fernando earthquake of 1971. Their findings offer encouragement that such earthquake swarms eventually may be used to predict larger earthquakes.

McNally, who studied the records of six moderate earthquakes ranging from Richter magnitude 5.0 to 6.5 in central and southern California, found that all were preceded by rela-



Karen McNally

tively large clusters of small earthquakes. These clusters included as many as 30 earthquakes between magnitudes 2.5 and 4.7 in seismically active areas, and as few as 6 earthquakes between magnitude 2.5 and 3.6 in seismically quiet areas.

The small earthquakes took place between 1 and 20 kilometers from larger earthquakes and from a few months to ten years before them.



Seventeen hundred years ago, sophisticated Persian artisans crafted this priceless silver and gold plate bearing the image of the ancient ruler, King Shapur. The secrets of their metallurgical techniques were lost long ago. In an effort to recover them, curators at the Los Angeles County Museum of Art brought the plate and other ancient Near Eastern art objects to be X-rayed by a high resolution internal scanner at Pasadena's Huntington Hospital. In the photograph, Caltech Professor of Applied Science Gilbert McCann and Jeannine Boyles of the art museum examine the objects as they are placed in the scanner. The device, which photographs tumors in the body with enormous precision, took internal pictures of the art objects to show how they were put together. It located seams, revealing how many pieces of metal were included and how they were joined. Then data from the scanner's two-dimensional photographs of cross sections of the art works were programmed into computers at Caltech. On a television screen, the computers created a detailed three-dimensional picture of the objects' interiors.

# Ancient trees reveal weather history

Trees keep a record within their wood cellulose of the climatic temperatures throughout their lifetimes, Caltech geochemists have discovered. By analyzing wood samples from 40 trees dating back to the last ice age, the scientists have learned that the climate in ice-free sections of the country at that time may have been even milder than today.

This is the finding of Caltech Professor of Geochemistry Samuel Epstein and his associate, Crayton Yapp. Epstein and Yapp have also gathered evidence that an analysis of tree wood cellulose can reveal where a tree gets its water, the prevailing humidity during its growth, and perhaps even a precise record of ancient cycles of drought and rain. The use of tree wood as a thermometer is based on the fact that the water taken up by a tree and incorporated into its wood at any point during its lifetime has a unique isotopic "fingerprint"; the fingerprint depends on the temperature in the region at that time. By analyzing successive growth rings of the tree, Epstein and Yapp have found they can obtain its temperature history. In their analysis, Epstein and Yapp measure the ratios of two isotopes deuterium and hydrogen - in the cellulose of the wood. This ratio is directly related to the ratio of deuterium and hydrogen in the water the tree used to build its cellulose molecules. The isotopic ratio in the water depends, in turn, on the

temperature at the time the water precipitated from the sky.

Water contains a mixture of  $H_2O$ and other types of water molecules, among them, two that contain deuterium, a heavy isotope of hydrogen. Deuterium-containing water molecules usually comprise about 3/100 of a percent of natural water and have slightly different physical characteristics than  $H_2O$ . The cooler the climate in a given region, the lower the concentration of deuterium-containing water in that region's rainfall.

"This change in concentration oc-

curs because deuterium-containing water molecules are less volatile than 'regular' water. Thus, they are more likely to condense out from a moisture-containing air mass as it passes through warm regions and deposits its water as rain," Epstein said. "This 'condensing out' leaves a lower fraction of deuterium-containing water for the rain in cooler regions."

From their analysis of wood from ancient trees — buried for thousands of years in sediments and other deposits — Epstein and Yapp assessed temperature changes over a period *Continued on page 6* 

McNally says her findings suggest that the small earthquakes may result from points of weakness or stress concentrations due to an impending large earthquake. Stress concentrations of this type occur in any material containing a particular area of weakness. For example, if a steel plate with a hole in it is subjected to stress, before a fracture occurs the stress will concentrate near the hole — the area of greatest weakness in the plate.

According to McNally, many mechanical properties affect a local faulting environment. These include how often a fault moves, how complex the fault system is, and the nature of the faulting mechanism itself. *Continued on page 4*  New Associates officers



New members of The Caltech Associates Executive Committee: Collis H. Holladay, Jr., treasurer; Dr. Henry L. Lee, Jr., vice president; Samuel P. Krown, secretary; George D. Jagels, president; and Joseph B. Earl, immediate past president.



Caltech senior John Pender and Beau Lee, BS '77, struggle for possession of the ball during a tense moment in the annual alumni-varsity basketball game. From left, other players are: George Fox, BS '69, MS '74; junior Bart Croes, sophomore Greg Blaisdell, sophomore Joe Zasadzinski, and Roger Noll, BS '62.

# In annual classic Varsity trounce alumni

After a closely contested first half, a determined varsity squad defeated the Caltech alumni 82-57 in the second annual alumni-varsity basketball classic. Last year the students narrowly defeated the alumni, 66-65. The varsity pulled well ahead of their opponents during the second half, after a first half which concluded with the students leading 36-32.

Fifteen alumni participated in the event. Traveling the farthest distances for the game were Leon Thomsen, BS '64, of Binghamton, New York, and Fred Newman, BS '60, of Sunnyvale, California. Working in Caltech's gymnasium, Newman in 1974 earned a place for himself in the Guinness Book of World Records by breaking the world record for the most consecutive free throws.

John Gee, BS '53, ranked as the most chronologically mature member of the alumni squad, followed by Dick Van Kirk, BS '58. Fresh from last year's varsity team were Peter Lu, BS '77, and Beauregard Lee, BS '77.

Alumni who live in the area met on three Saturdays before the game to practice. Those who live farther away showed up for the game and improvised. Bruce Wright, BS '71, was high scorer for the alumni with 12 points. Sophomore Greg Blaisdell was the varsity high scorer with 24 points.

Warren G. Emery, director of physical education and athletics, expressed appreciation to the alumni for the game. "The game was good for our athletic program and we're happy the alumni were willing to be a part of it," he said.

### **ALUMNI ACTIVITIES**

### March 3 and 10

California wine tasting program. Because of its continuing popularity, the program will again be featured on two consecutive Friday evenings. Sherry tasting, 8 p.m.; a talk on California wines by Bruce Hotra of the Huntington Market, 8:30 p.m., followed by wine and cheese tasting.

### March 9

The Gnomes' Founders Night. Cocktails, 6 p.m., dinner, 7 p.m., the Athenaeum. Speaker, Bruce Murray, director of JPL and Caltech professor Leroy E. Hood, the Ethel Wilson Bowles and Robert Bowles Professor of Biology, will speak on "Immunology and Disease."

### March 29

Alumni Dinner — Earnest C. Watson Caltech Lecture. Cocktails, 6 p.m., dinner, 6:30 p.m., the Athenaeum. Lecture, 8 p.m., Beckman Auditorium. Speaker, William A. Fowler, Institute Professor of Physics, "The Case of the Missing Neutrinos."

### April 8

Open house at the Jet Propulsion Laboratory for Caltech alumni and their families. See story on this page.

# Donors, recipients lauded at scholarship dinner

Seven outstanding Caltech undergraduates, and representatives of firms making gifts to the Alumni Scholarship Fund, were honored at the Alumni Scholarship Award Dinner. Because of the firms' gifts, this year the Alumni Association was able to award three partial scholarships in addition to the four full alumni scholarships that it normally awards.

The alumni donors and their firms included Michael Agbabian, MS '48, of Agbabian Associates; Cydnor Biddison, BS '40, of Hillman, Biddison and Loevenguth; James R. Davis, BS '48, MS '49, of Converse Davis Dixon Associates; John R. Fee,

BS '51, of James M. Montgomery Consulting Engineers, Inc.; Carl B. Johnson, BS '37, MS '44, Eng '46, of Johnson & Nielsen Associates; Ralph S. McLean, BS '30, of McLean & Schultz, consultants; Albert A. Erkel, BS '45, of Erkel, Greenfield & Associates; and Return Moore, BS '47, MS '48, president, Moore & Taber.

Honored students were Eric Kaler, a senior majoring in chemical engineering, who received the Donald S. Clark award; Alumni Scholars David Crane, James Gerdes, and Scott Hochwald; and Engineering Scholars Jeffrey Carpenter, Javier del Valle, and David Shenton.



At the Alumni Scholarship Award dinner, Alumni Association President Dick Van Kirk bestows the Donald S. Clark Award on Eric Kaler, a senior majoring in chemical engineering

### GE grant honors alumnus

Thanks to the outstanding performance of Kiyo Tomiyasu, BS '40, as an engineer with the General Electric Company, Caltech is the recipient of a \$5,000 scholarship fund. This year Tomiyasu received General Electric's Charles P. Steinmetz Award for outstanding technical contributions to the company and society. An important feature of the award is a company grant of \$5,000 in the name of and designated by the recipient, to a college or university for the advancement of education in engineering or science.

Tomiyasu, a consulting engineer with General Electric who lives in Paoli, Pennsylvania, selected Caltech as the recipient and asked that the grant, a contribution to the Alumni Fund, be used to establish the Tomiyasu-General Electric Company Scholarship. Three annual scholarships will be made from the grant.

The scholarship is the second one at the Institute that is named for Tomiyasu. In June 1977 he established a scholarship in memory of his parents, with preference given students from Clark County, Nevada.

### Open house planned at JPL

and other space satellite vehicles will Since you can't travel into deep be on display. Alumni also can visit the control center for the deep-space network, where JPL monitors and controls all U.S. unmanned vehicles that fly into space. Coffee and doughnuts will be served during the morning.

of planetary science.

### March 17

San Francisco Chapter meeting. Cocktails, 6 p.m., dinner, 7 p.m., the Engineers' Club, the Hong Kong Bank Building, 180 Sansome Street.

May 13

Alumni Seminar Day. The Caltech campus.

### Northwest Area Foundation grant

Caltech has received a \$125,000 grant from the Northwest Area Foundation for medically related fundamental biological research. Thomas P. Maniatis, associate professor of biology, and Jean-Paul Revel, professor of biology, will share equally in the three-year grant, it was announced.

Maniatis plans to study the regulation of genes that control the synthesis of hemoglobin in mammals. Scientists believe that several human genetic disorders may be caused by defects in the genetic regulation of the protein portion of hemoglobin, called globin. Revel will study gap junctions — specialized contacts that mediate molecular exchanges between cells. For example, gap junctions couple heart cells, assuring that heart contractions are synchronized. space for your next vacation, a visit to the Jet Propulsion Laboratory may satisfy your urge to probe the outer limits of man's exploration. Caltech alumni and their families will have such an opportunity on Saturday, April 15, at a JPL open house from 10 a.m. to 4 p.m. Registration is limited to 1,000 persons, and reservations can be made through the Alumni Office.

At the laboratory, the guests will see a multi-media presentation about JPL, its history, current programs, and future plans, and a 30minute film, "The Universe," on the universe and the solar system and their origins.

Mockups of Voyager and Viking orbiters, the Viking Science Test Lander used for soil sample work,

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### Research reveals How nature varnishes her handiwork

Long before man began applying a glossy surface to his handiwork, nature was quietly varnishing rock formations in the desert. But while any paint store supplier can describe the contents of man-made varnish, the composition of nature's high gloss finish has remained a mystery. Now, two Caltech mineralogists, using advanced analytical techniques, have solved the puzzle.

George R. Rossman, associate professor of mineralogy, and Russell M. Potter, Caltech graduate student in geochemistry, have learned that nature glazes her desert scenes with a combination of fine clay and manganese and iron oxides, using the wind as a paintbrush.

A smooth black coating that accumulates slowly on formations ranging from small boulders to basalt flows to cliffs hundreds of feet high, desert varnish has puzzled naturalists for many years. On the underside where it is not exposed to the air, a varnished rock often acquires a glossy red-orange finish through interaction with water and minerals in soil. Even thousands of years ago, ancient man knew about desert varnish and used it as an art medium, chiseling through it to carve petroglyphs - symbolic pictures that exposed the tan or light gray stone underneath.

Because chemical analysis revealed the presence of manganese and iron in the glossy coating, scientists assumed that desert varnish was composed primarily of manganese and iron oxides, precipitated out of the rock through weathering processes. But they couldn't analyze the varnish structure more precisely because it is composed of particles too fine to be characterized by X rays, the main diagnostic tool of mineralogical investigation.

To solve the puzzle, Rossman and Potter relied heavily on infrared spectroscopy, which illuminates the samples with wavelengths of light longer than those visible to the naked eye and measures their transmission through the sample. Because each mineral absorbs a par-



ticular pattern of infrared wave-

lengths, the mineralogists could use this absorption "fingerprint" to identify the content of the samples.

In their analysis of the varnish, the scientists used rock samples from 20 locations in California, New Mexico, and Arizona. They studied samples of many different types: quartz crystals, quartzite, granite, basalt, rhyolite, feldspar, sandstone, and others.

To their surprise, they discovered that the main ingredient in desert varnish — a whopping 70 percent is clay, not manganese oxide. Manganese and iron oxides form the remaining 30 percent. The red coating on the underside of the varnished rocks, previously believed to be iron oxide, turned out to be 90 percent clay incorporating an iron oxide stain, similar to the iron or black finish on the rocks' exposed portions. All desert varnish, whether it formed on the side of a cliff or a 10-inch boulder, shares a similar composition.

The scientists concluded that most of the coating collects from sources outside the rock rather than from material leached out of it, as many geologists had believed. One reason for this conclusion is that varnish is found covering quartz crystals, whereas quartz contains no manganese that could have contributed to the finish.

### Sabersky honored

Rolf H. Sabersky, BS '42, MS '43, PhD '49, professor of mechanical engineering at Caltech, has been awarded the Heat Transfer Memorial Award of the American Society of Mechanical Engineers. Sabersky received the honor for "outstanding contributions to the early development of boiling heat transfer and to an understanding of heat transfer to complex fluids . . . (and) for his vision in defining future opportunities and needs for research in heat transfer."

### From a meteorite: clues to the solar system's creation

Scientists at Caltech, probing chemical and physical records of early solar system processes preserved in a meteorite, have uncovered evidence that a supernova may have exploded in the vicinity of our solar system near the time of its formation.

Their findings provide the first hard data to support the theory that a supernova explosion may have triggered the formation of the solar system from a low-density cloud of interstellar gas and dust. Additionally, their findings give new insight into the astrophysical processes occurring during the birth of the solar system.

The scientists are Dimitri Papanastassiou, Malcolm McCulloch, Typhoon Lee, and Gerald Wasserburg, all of the Division of Geological and Planetary Sciences. They base their findings in part on an examination of material from the Allende meteorite, a two-ton object that fell in northern Mexico in 1969. The meteorite contains calcium and aluminum-rich material believed to represent the first matter condensing from the collapsing cloud of gas and dust created by the exploding supernova.

The Caltech scientists discovered "isotopic anomalies" in three elements - calcium, barium, and neodymium - which had not been detected before. Each element in nature consists of a mixture of isotopes atoms different from one another in weight but not in chemical properties. The mixture of isotopes for each element, observed in mineral samples from the earth, moon, and meteorites, is almost always in a fixed proportion that represents the average ratios of these isotopes when they were incorporated into the solar system.

### An astrophysical mix

The discovery by the Caltech geologists of deviations from this average in the material from the Allende meteorite proves that the interstellar gas and dust that made up our solar system were not a uniform mix at first, but contained material injected from astrophysical sources.

The discoveries of anomalies in calcium, barium, and neodymium, along with previous discoveries of anomalies in magnesium, indicate that a supernova probably was the cause of isotopic deviations in many elements. According to theories of nuclear physics, many of the anomalous isotopes of calcium, barium, and neodymium detected by the scientists could only have been produced by the "rapid neutron capture process" of isotope formation that occurs in very hot exploding stars. The scientists' measurements indicate that from 0.1 percent to 1 percent of the chemical elements in the solar system may have been produced by the supernova, which probably was about ten times the size of our sun. Using a nuclear "clock" - the ratio of magnesium 26 to other magnesium isotopes in the meteorite material - the scientists dated the explosion of the supernova to less than two million years before the solar system was formed.

# Students pick Caltech's outstanding teachers

After months of being rated by their teachers, Caltech students strike back once a year when they rank faculty members for the Teaching Quality Feedback Report, a 65page booklet covering 183 courses. Based on their ratings, the ASCIT Board of Directors names six faculty members as recipients of awards for teaching excellence on the basis of clarity of presentation, course material, and personal interest in students, among other factors.

This year — the second that the teaching excellence awards have been given — the honored faculty members were Robert G. Bergman, professor of chemistry; William H. Corcoran, professor of chemical engineering; David C. Elliot, professor of history; Holly Jackson, assistant professor of English; Edwin S. Munger, professor of geography; and Rodman W. Paul, Edward S. Harkness Professor of History. ASCIT President Bert Wells says the honors were instituted to emphasize the high value that undergraduates place on outstanding teaching. Bergman, whose research is in organic and transition metal organometallic chemistry, won an award for his course, "Chemistry of Covalent Compounds." Corcoran, who is vice president for Institute relations as well as a member of the chemical engineering faculty, was cited for his courses "Optimal Design of Chemical Systems" and "Design of Chemical Systems."

Historian Elliot, whose studies include European organizations, the liberal party in Scotland, arms control and national defense, and London's 1660 Restoration period, was commended for his "Introduction to Europe" classes. Jackson's special interests, reflected in her awardrated Shakespeare courses, are Renaissance drama, poetry, and prose; Milton; and the British novel.

Munger's African studies cover the 40 sub-Saharan countries on that continent. He was given high ratings for his courses, "Political Geography of Developing Countries" and "African Studies." Paul received praise from Caltech students for his "American Life and Thought" classes. His research and publications have centered on the history of California and the American West.

### This fire hose is no metaphor



Caltech students have long used the phrase, "drinking from the fire hose," to describe their need for rapid assimilation of the facts pouring from their professors' mouths. These winter undergraduate students in Rolf Sabersky's fluid mechanics class were given a more literal demonstration of fire hose technology. Sabersky wanted to demonstrate for the students the force that water jets can produce, and the Pasadena Fire Department was happy to cooperate. Firemen brought their equipment to campus so students could feel the tremendous pressure of water jetting from a nozzle. Here, members of the fire department provide backup support for sophomore Anthony Lomax who holds the hose.

# At retirement dinner Caltech pays tribute to Robert Gray

Bob Gray calls the first half of his life B.C. — that is, Before Caltech. And, he says, "The second half has been the better one."

Paying tribute to that "better half," last December more than 300 friends and colleagues gathered at Pasadena's Huntington Sheraton Hotel to honor Robert D. Gray's 37-year career as director of the Institute's Industrial Relations Center and as builder of the center's broad program of management seminars, conferences, and workshops.

It was a full-fledged retirement celebration — complete with warm handshakes and hugs, formal eulogies and humorous accolades, as well as a large turnout of distinguished leaders of business, industry, and education from throughout southern California. Among the dinner guests were Arnold O. Beckman, PhD '28, chairman emeritus of the Caltech Board of Trustees, and Caltech Trustee Earle M. Jorgensen.

"Bob Gray has removed the coefficient of mystification from management." This praise from William H. Corcoran, BS '41, MS '42, PhD '48, vice president for Institute relations, referred to Gray's continuing emphasis on human relations as the key to progress in management.

In the same spirit, Victor V. Veysey, BS '36, former U.S. Congressman and Assistant Secretary of the Army (civil works), who was appointed to succeed Gray when he retired as director of the center last fall, promised "to continue to work in the field of management with emphasis on interpersonal relations."

Gray, who is also professor of economics and industrial relations at Caltech, will continue teaching.

Gray's assessment of himself as a "workoholic" was substantiated by a whimsical monologue, "A Day in the Life of Robert Gray," given by J. Kent Clark, professor of English.

"A man is defined by what he does routinely," Clark said and proceeded to describe the events of December 23, 1942 — Gray's wedding day - in which Bob went to the office and got so involved that he was late to his wedding.

Gray was also commended for his contributions to management policy as a member of the Board of Administration of the California State Employees Retirement System (1956-63); of the California State Personnel Board (1944-63); and currently as a member of the Employment Services Board of the state's Employment Development Department.

In 1973 the Alcoholism Council of Greater Los Angeles gave him the



Robert Gray and Victor Veysey with Carel Otte, Jr., MS '50, PhD '54, at Gray's retirement dinner.

Clark called the event a three-way wedding. Gray, he said, was already married to CIT and the Industrial Relations Center, and now he was marrying Mary.

Gray received other tributes for his development of the center's management library of 8,600 volumes and 45,000 pamphlets; for the more than 300 papers on management-related subjects produced at the center; and for the system of employee polls that he created.

annual Thomas P. Pike Industry Award, and the same year he received the Phil Carroll Award from the Society for the Advancement of Management.

Institute colleagues of Gray who shared the platform with Corcoran and Clark were C. J. Pings, BS '51, MS '52, PhD '55, vice provost and dean of graduate studies, who acted as master of ceremonies, and Robert F. Christy, acting president.

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Meetings: Engineers' Club, 16th floor, Hong Kong Bank Bldg. San Francisco, Informal luncheons every first Thursday at 11:45 a.m. Contact Harrison Sigworth, 894-5557 on Thursday morning

San Francisco Peninsula luncheons: Ming's Restaurant, Palo Alto. Luncheons fourth Thursday of every month at 12 noon. Call Hugh Dubb, 415/421-2674, for information or reservations.

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# Can foreshocks predict earthquakes?

### Continued from page 1

Seismologists are not ready to use the earthquake swarms as predictive tools until they have a better understanding of these mechanical properties.

The discovery by Ishida and Kanamori that small earthquakes preceded the 1971 San Fernando earthquake has lent further support to the idea that "foreshocks" eventually may be used to predict earthquakes. Until now, seismologists had not believed there was any exceptional foreshock activity before California earthquakes, even though many earthquakes in other areas are preceded by foreshocks. Explaining the seismic records of the 1971 earthquake, the scientists found: relatively low, random activity before 1961; high activity from 1961 to 1964 (this period corresponds to the inferred onset of the "Palmdale Bulge," the uplifting of a large area near Palmdale); an almost complete absence of activity within 15 kilometers from the epicenter of the earthquake from 1965 to 1968; and a resumption of activity around the epicenter from 1969 until the 1971 earthquake.

Kanamori, these earthquakes gave higher-frequency readings on the seismographs than usual, indicating they stemmed from fault structures under higher stress. The wave forms from the earthquakes were also different from those previously seen in this area.

"The seismic network is far more extensive than before the 1971 San Fernando earthquake," Dr. Kanamori said. "My feeling is that if our network had been as extensive then, analysis would have revealed the kinds of anomalous activity that might enable prediction."



During this last period, five small earthquakes occurred very near the site of the main shock. According to



Moving from the laboratory onto television, Harry Gray and his hydrogen research were featured on the "Today" show. Here, Gray and his undergraduate chemistry class view a tape of the feature. Students were laughing at a scene showing Gray lecturing when a hydrogen-filled balloon burst and threatened to dislodge his glasses. Gray is the William R. Kenan, Jr. Professor and professor of chemistry.

#### Placement Assistance To Caltech Alumni

The Caltech Placement Service may be of assistance to you in one of the following ways

(1) Help you when you become unemployed or need to change employment.

(2) Inform you of possible opportunities from time to time

This service is provided to alumni by the Institute. A fee or charge is not involved

If you wish to avail yourself of this service, fill in and mail the following form to

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Please send me: (Check one)

An application for placement assistance.

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# From rocks to buildings It's all uphill for Caltech climbers

When Dave Rearick, PhD '60, took a break from studying one evening while he was a Caltech student, he embarked on an adventure that exceeded his expectations. An enthusiastic climber of buildings, mountains, and almost anything else, he decided to limber up by scaling the east face of Gates Laboratory. He would return to solid ground via a little trap door on top of the building.

Unfortunately, the trap door was locked that evening and Rearick's studies were pressing him, so he downclimbed his route - an event much riskier than ascending the structure. This operation involved lying, in the dark, on a sloping ledge near the top and groping with one foot for a small horn on the building's ornamental stonework. Rearick reached the ground safely, setting a new example of Caltech students' dedication to their studies.

Rearick left Caltech for the University of Colorado, Boulder, where he is an associate professor of mathematics. He no longer climbs buildings ("There are too many mountains to climb around here") and besides, he says that the structures at his institution are uniformly constructed of sandstone. For a climber, they offer few aesthetic challenges.

Rearick is one of the legendary figures in a long history of Caltech climbers — a history that predates by many years an upsurge in climbing interest on many campuses that coincided with the ecology movement. Rearick's feat is challenged by that of Tom Weaver, BS '74. Protected by ropes that were controlled by friends on the roof, Weaver, as a freshman mathematics student, scaled Millikan Library in broad daylight without mechanical aids, becoming the first and only student to do so. Weaver's 6-foot, 4-inch frame enabled him to fit into a niche between two parallel walls and to reach the summit with no aids other than his back, hands, and shoes.

Climbing continues to excite the fancy of Caltech students, just as it did in Rearick's and Weaver's days, but today most of the climbing takes place in more isolated locations. Professor of Electrical Engineering and Applied Physics Charles Wilts teaches a rock climbing class, given through the physical education department, that attracts 30-40 applicants whenever it is offered. Wilts, intent on paring the group down to 15 or 20 members, weeds out some of these applicants on the basis of seniority at the Institute. Others drop out of their own volition when they stare up at their first sheer rock surface and contemplate climbing it. Those who do enroll in the course receive a thorough orientation by a master climber on the techniques and teamwork of the sport. As a young man, Wilts climbed avidly and gained fame in alpine circles by scaling Lost Arrow in Yosemite National Park in three days — the first person to make the ascent in that time interval.

sibilities of falling, the need for teamwork. For climbing is a team sport, he emphasizes, one in which partners must depend on one another for their safety as they do in few other activities.

Then the class members head for Stoney Point, an area of sandstone cliffs in Chatsworth in the west San Fernando Valley, or to Big Rock in the Perris Lake recreational area. There the students pair off in teams and take turns getting the feel of the other person's weight at the ends of a rope. Although their climbs are short, they offer basic experience in finding small niches, ledges, and toe holds, in learning to master weight

fallibility of equipment, the pos- choose between two routes that require two to six hours to surmount; then they walk down the rock's backside.

> With Wilts as their mentor, they are in the hands of a veteran at this site. He is the author of A Climber's Guide to Tahquitz, now in its fourth edition.

> Wilts says that a variety of reasons attract students to rock climbing. Most of these reasons meet with his approval. Not so that of the student who wanted to take the class in order to overcome his fear of heights; Wilts refused his application.

"A lot of people like to go out into the wilderness and enjoy it," Wilts



On a rock climbing class outing, junior Steve Trabert leisurely scales Big Rock near Riverside.

says. "Just being there is enough for some of them, but others need a goal. Climbing supplies the goal."

James R. Campbell, an electronics engineer who helps Wilts teach the course, adds that rock climbing offers a special attraction for technically oriented problem solvers. "Climbing is the thinking person's sport," he says. "It requires total concentration. A climber has to figure out how to get from where he is to where he wants to be, over some pretty challenging terrain."

Campbell appreciates climbing, not only because of the challenge of reaching a destination but because it feels so good once you get there. "When you've anchored yourself at a good stopping place and you're bringing your partner up, you can look around at the scenery as you shift your concentration and it's like the whole world has been recreated for you," he says. "You notice lots of little details — like a spider crawling across a rock or the shapes of the tree tops — that you wouldn't have been aware of before you climbed." Wilts adds that many students enroll in his class because they enjoy hiking and climbing and they want to enjoy these activities safely. "They want some knowledge of roped climbing because they don't want to risk getting themselves into a predicament," he says. "They don't intend to continue training after they master the basics."

Although Wilts's classes continue to attract an avid group of climbers, their adventures don't match those of Rearick, who scaled Gates during a study break. Nor do they match the antics of members of the Alpine Club during the late 1960s. These ardent climbers mastered the south chimneys (rectangular recessed areas) of Booth Computing Center, the south-southeast chimney of Steele, the west face of Kerckhoff, the north chimneys of Booth, and almost every other building surface on campus that offered possibilities.

They were responsible for giant footprints on the east side of Millikan and for an Alpine Club meeting notice attached 20 feet down from the top. Intent on staying alive, they were noted for conducting thorough research before a climb. They made careful notes of hazards like chemical fans on top of laboratories, and ledges made slippery by years of chemical solvent deposits from vents.

Today the Alpine Club is relatively inactive and building climbing is at a low ebb. The campus architects may be partly to blame, Wilts believes. The newest buildings on campus (like the Beckman Labs and the Mudd Building) are virtually unclimbable because of ledges that overhang the top. "They don't offer realistic routes for climbers," Wilts says. "The architects have spoiled the fun."

But even so, an observing visitor around dusk may occasionally note a human fly attached to ropes, discretely making his way up the side of Dabney or Gates or Steele, indulging in the thinking person's way to take a study break.

### Corcoran named AIChE president

William H. Corcoran, vice president for Institute relations and professor of chemical engineering at Caltech, was named president of the American Institute of Chemical Engineers at the organization's 70th annual meeting in New York City. He assumed the office on January 1.

He has long been an active leader in the organization, which consists of chemical engineers in industry, education, and government. In 1974, he was named a Fellow of the Institute. That year he was also given its Founder's Award, made to a member of the AIChE who has had "an important impact on chemical engineering; whose achievements . . . have advanced this profession . . . and who has had a long and distinguished record of service to the profession." Corcoran has conducted a wide range of research in chemical engineering, including topics in applied chemical kinetics, transport processes, rocketry, and biomedical engineering. He is author or coauthor of more than 70 scientific papers and two books.



Wilts begins his classes by outlining on a blackboard some technical facts and figures about climbing. He describes the physics of climbing and he stresses its hazards - the

Protected by a rope that has been anchored by his partner, Ken Herkenhoff climbs Big Rock.

distribution, in securing ropes firmly, and in building up confidence.

Sometimes, when there is sufficient interest, Wilts teaches a secondyear class which features climbs at Tahquitz Rock in the San Jacinto Mountains, which he terms "one of the best climbing spots in southern California." There Techers can

# Students work in labs, classrooms These part-time jobs offer more than money

### by Winifred Veronda

Senior engineering major Gregory Bone is working his way through college, Caltech fashion. Bone designs integrated circuits and teaches undergraduates in an engineering laboratory.

Tom Brikowski, a junior majoring in geology, earns money to meet rising college costs by operating a mass spectrometer for geochemist Clair Patterson. Brikowski analyzes the concentrations of industrial lead in a remote Sierra meadow.

James Jacobs, a junior majoring in chemistry, works part time creating a library of computer programs to analyze statistics for the social sciences department.

Scott Bishop, a junior biology major, helps Assistant Professor of Biology David Van Essen analyze the visual systems of Rhesus monkeys.

These young people face a problem common to college students throughout the country: how to get an education when college costs are rising and aid money is dwindling. For them and for many others, a part-time job — supported in part by federal funds — helps provide an answer.

All of these students are participants in the federally sponsored College Work-Study Program. This program underwrites 80 percent of the salaries of students who work part time on their campuses. Caltech began to offer jobs through college work-study in 1976. Ray Owen, vice president for student affairs and dean of students, feels that the program meets an important need.

"As educational costs go up, more and more young people need financial aid to come here," he said. "This need has made a change in our attitude about jobs for our students. We used to prefer that they not work. Caltech's academic program is demanding. We wanted them to spend all of their time on their class work or in school activities, and we felt we could meet their financial needs through aid.

"Now, jobs are becoming an essential part of the financial aid package that we offer. This is true throughout the country. We're learning that students can work eight or ten hours a week without hurting themselves academically. In fact, taking a part-time job on campus often increases their motivation.' National studies support this conclusion, Owen says. "Studies indicate that students who have jobs on their campuses feel more a part of their schools than students who don't work," he explains, "and they do better classwork as a result. So Congress has been increasing workstudy funds and decreasing student loan allocations - especially since it has had problems on some campuses with loan defaults." Although students who hold part-time jobs do well academically, Owen explains that Caltech does not want freshmen to work. "Adjusting to the Institute and its academic demands is generally rough," he said. "We want freshmen to make this adjustment before they take jobs. So we try to meet their first-year financial needs with other kinds of aid."

He says that Caltech tries to make certain that students who do need financial help are not crowded out of the campus job market because of the College Work-Study Program. "We know a few non-needy students who have part-time jobs on campus," he says. "What we're learning is that if a professor wants to hire a student who isn't eligible for workstudy funding, he'll go ahead and do so." He adds that the Financial Aid office has set up a fund that pays 60

percent of the salaries of foreign students who are not eligible for the federal program.

Whenever possible — and in about 70 percent of the cases - students are matched with jobs related to their academic work. Some conduct laboratory research, some tutor in Caltech's Saturday program for high school students who are gifted in science and mathematics, some become teaching assistants, and some grade papers.



In the laboratory of geochemist Clair Patterson, junior Tom Brikowski prepares a sample of organic material from a Sierra meadow for analysis in the mass spectrometer. The sample will be tested for pollution by industrial lead

### Ancient trees as thermometers



### Continued from page 1

ranging from 9,500 to 22,000 years ago. This was the period when glaciers covered much of North America and then retreated, establishing climate patterns as we know them today. Epstein and Yapp discovered that the cellulose of trees that grew at or near the time of maximum glaciation (from 14,000 to 22,000 years ago) was richer in deuterium than the cellulose of trees living today. This suggests that conditions were milder, on the average, and that winters were warmer and summers cooler. Cooler summers are suggested by other botanical data. Such a climate would mean that the huge ice sheets would melt in the summer, and would grow more rapidly in the winter because air flowing over them from the ocean would remain more humid and contain more potential snow to feed the ice caps.

In a number of instances, a parttime job has inspired students to think about shifting their career goals. Says Tom Brikowski, who analyzes lead concentrations in soil for Clair Patterson, "I was planning to become a field geologist, but this work has made me think seriously about going into research. I'd advise any student here to get a job in a research lab, even washing test tubes. There's no better way to learn about your own interests."

For other students, the part-time job brings practical, career-related experience. Says Eric Etheridge, who works for Physics Professor Jerome Pine in microcomputer and software design, "I'm putting what I've learned at Caltech into practical application. I have a chance to be original and creative. There aren't many places where I could have gotten a job so closely related to my academic work so early in my career."

Adds Scott Bishop, whose job involves neurobiological research, "I'm going to do graduate work in neurobiology, so I'm conducting the type of research that I'll be doing then. I'm getting hands-on experience, and I love it."

Greg Bone, who teaches an undergraduate engineering laboratory, says he's learning more through this experience than in some of his classes. "You have to know material better to teach it than to take tests," he says. "The chance for these kinds of jobs is one of the best opportunities Caltech offers."

For professors, too, the workstudy program brings special rewards. Says Assistant Economics Professor Forrest Nelson, who hired James Jacobs to develop computer programs for statistical analyses, "He picked up my roughly defined concepts and gave them form. He came back to me with many more results than I'd expected. In this respect, he's a typical Caltech undergraduate."

Happy students, happy professors, happy administrators. The federal government may have achieved the impossible: a program that pleases everybody.

### Paul: WHA president

Rodman W. Paul, the Edward S. Harkness Professor of History at Caltech, is the new president of the 2,400-member Western History Association. Active on the executive council and editorial board of the 16-year-old professional society, Paul will head the WHA until October 1978.The WHA concerns itself mainly with the history of America west of the Missouri River, but its interests also embrace the Appalachian and Mississippi Valley frontiers. Its membership includes history buffs and free-lance writers as well as professional scholars. The organization publishes the scholarly Western Historical Quarterly and sponsors a popular quarterly called American West, owned and published by the American Broadcasting Corporation. Paul has been a Caltech faculty member since 1947.

Samuel Epstein

# The Munger Africana Library From Angola to Zambia in 100 languages

Africana Library in Caltech's Baxter Hall is a big Denoyer-Geppert map of Africa that must be updated annually. Just as that troubled continent's politics, economics, leaders, and spokesmen change, so do the names of nations and their geographical areas. An average of 60 names on the map change every year. No wonder it's been hard for the average American to keep up on African geography.

The Munger Africana Library enjoys an enviable reputation as an extraordinary resource for all kinds of information about the nations in sub-Saharan Africa. Its location at Caltech may seem somewhat bewildering, because the Institute's major claim to fame is not as a center of African studies. And it is quite different from most university special libraries in that it does not belong to any part of the institution in which it is housed.

The collection of 26,000 items ranging from Angola to Zambia — is the property of Edwin S. Munger, Caltech's only professor of geography. He started the collection of books, journals, manuscripts, letters, maps, pamphlets and other ephemera, and works of art while he was a student at The University of Chicago. He made his first trip to Africa in 1947, financing the trip with the winnings of some serious (that is, non-penny ante) poker playing during World War II.

Munger spent the year 1949-50 at Makerere University in Uganda on the first Fulbright to the British Commonwealth. After receiving his doctoral degree from Chicago in 1951, he joined the American Universities Field Staff program to continue his investigations of political change in Africa. This program involved a series of two-year stints in the field interspersed with a year back in the U.S. reporting to member universities.

### A famous map

Caltech was one of the schools on Munger's lecture schedule. He says that the first time he visited the Institute (in 1951) he was directed to the office of Dean of the Faculty Earnest Watson. The dean, who was a noted bibliophile, looked up and said, "You're the man who's interested in Africa, aren't you? I have something for you." He then presented Munger with a famous map of Africa by Ortelius, published in 1570. Munger, speechless, he says, at the generosity and thoughtfulness of the gift, decided on the spot that Caltech was a most remarkable place. Two other people who came to know Munger and to appreciate his scholarship on his three subsequent visits were Hallett Smith and Lee DuBridge, at that time division chairman and president of Caltech, respectively. They both wanted Munger for the Institute, so in 1961 they offered him a faculty appointment. Munger accepted their offer ---he liked Caltech - but with the proviso that they make space available for his books, which he felt were essential for first-rate teaching. He also felt that the Institute could not be

One of the exhibits in the Munger expected to buy them; by this time the collection had grown until it threatened to overwhelm his office and his home. When the Donald E. Baxter, M.D., Hall of the Humanities and Social Sciences was completed in 1971, the Africana Library moved into a generous ground floor corner.

If that sounds like a simple moving operation, it shouldn't. There wasn't anything simple about it. Even then, the collection included thousands of items, none of which had ever been cataloged. No one, including Munger, really knew what was there. Obviously, the collection had to be insured, and so after the items were placed on the shelves by country, the Caltech photographer took pictures of them as a stopgap identification measure. Librarian Charlene Baldwin started to bring order out of chaos.

### Finding out what he has

The situation has improved since then. In 1973 the former editor of the Geographical Review in New York, Wilma Fairchild, turned up in Pasadena — and in Munger's office looking for part-time work. She was later joined by librarian Judy Nollar, and the two have spent the last two or three years "finding out what he has." They have completed an inventory of the books and sorted out duplicates. Some 20,400 books are now cataloged by country, well over 6,000 of them dealing with South Africa alone. Subject and author catalogs are among Munger's plans for the future.

Creating these catalogs will be no simple matter. The books in the library are written in more than a

investigations and primary collections of folklore. Besides the books and journals, the library has "vertical files" clippings, tourist folders, xerox copies of material, cut-up journals.

hundred languages and have tre-

mendous scope and depth. Some of

them are old missionary studies, and

they include some original linguistic

The rapid changes in every African country's political situation make the vertical files a gold mine for current information, and they are in constant demand by the political scienmanuscripts and letters. One document, for example, was written by Vasco de Gama in 1510, and another is from Angola and is dated 1690. All the letters have yet to be annotated, and the maps and works of art are only now being classified.

The library is, of course, for the use of scholars, and some of them are Munger's own students; last spring 63 (almost 10 percent of the undergraduate student body) were enrolled in his elective course, African Studies. The Africana Library and its original source material make



In the Munger Africana Library, Edwin S. Munger studies one of the 26,000 items in his collection: a book of the East India Company dated 1658.

tists on the Institute faculty. Needless to say, there's work to be done on them, too, and Ned Munger's garage has piles of newspapers waiting to be clipped. There are also



it possible for those students to practice "real" scholarship, and Munger urges them to publish the results if possible. Some succeed. Several years ago Alex Lidow wrote an essay (which placed third for Caltech's George Green Prize) on a long unpublished letter from the Griqua Chief Adam Kok in 1851, complaining about his treatment by the Boers. Maurice Zwass was the first undergraduate ever to give a paper before the Liberian Studies Association at the University of Indiana on his historical and biological detective work on a letter written by a black American missionary from Liberia in 1847, the year the nation was founded.

One offshoot of the library is the Africana Library Notes, a bimonthly publication. The Notes were started in 1970 with transcripts of talks by distinguished visitors to Munger's seminars. They now include unpublished historical manuscripts and current field research. The latest issue, number 43, features a color photograph of a stone bird from the Zimbabwe ruins and contains a long interview Munger had with Rhodesian nationalist Ndabaningi Sithole. Ned Munger made his 42nd trip to Africa in 1977. In the 13 years overall he has spent in Africa, he has been in every country and the major offshore islands of the continent. And everywhere he goes, he searches for additions to the Africana collection. His favorite tale is about meeting his old friend President Azikwe of Nigeria on his knees before some bookshelves in the third subbasement of a bookstore in Zurich. Turned out they were both looking for Africana.

Drop day-the final day for students to drop classes-was commemorated at Caltech this year with unusual flair. A television movie, "The Initiation of Sarah," about a college student with the ability to move objects via psychic powers, was being filmed on campus, and one scene featured the attempt to drop a piano on a victim. Students and staff gathered to watch as the piano was hoisted, via natural technology, to the arches between Gates and Dabney, and then toppled.

# PERSONALS

#### 1935

BYRON N. INMAN, MS, retired from Du-Pont on August 31 after 41 years. He was project engineering superintendent for the Memphis plant. He writes, "I moved to the Seattle area to be close to most of my relatives and enjoy the beautiful country, do some sailing, and start a small development project in the combined fields of chemical and mechanical engineering."

### 1936

ROBERT G. HEITZ, a research fellow with the Dow Chemical Company, was awarded the John Fritz Medal for 1978, the highest award in the engineering profession, in November at the annual meeting of the American Institute of Chemical Engineers in New York City. Recipients are chosen by representatives of professional engineering societies. Among the previous recipients are Alexander Graham Bell, Thomas Edison, and Guglielmo Marconi. The 41-year Dow employee has served in research with the company's Western Division in Pittsburgh and Walnut Creek, California, since 1939. Heitz's accomplishments include research in hollow fiber technology, as well as development of the first major thermal process for producing perchoroethylene and carbon tetrachloride; development of a unique solution process for producing high-density polyethylene; and a number of developments which figure prominently in Dow's current line of agricultural products.

ANGUS E. TAYLOR, PhD, has retired to the Berkeley area with Mrs. Taylor and an accumulation of titles: chancellor emeritus of UC Santa Cruz, university provost emeritus of the UC systemwide administration, and professor of mathematics, emeritus, of UCLA and UC Berkeley. His service to the UC system spanned 39 years.

#### 1937

ARTHUR HEMMENDINGER, PhD, retired in June 1977 from the staff of Los Alamos Scientific Laboratory where he was group leader in neutron and radiation physics.

### 1938

ELBURT F. OSBORN, PhD, retired on June 30, 1977, as Distinguished Professor, Geophysical Laboratory, Carnegie Institution of Washington. He will continue his research program involving high-temperature, high-pressure experimentation on the origin of volcanoes.

### 1944

WARREN G. SCHLINGER, MS '46, PhD '49, was elected a fellow in the American Institute of Chemical Engineers for his contribution to coal gasification technology. He also received the AIChE's Southern California Section Technical Achievement Award in 1976 for outstanding accomplishments in developing new hydrocarbon processing techniques. Schlinger is manager of Texaco Inc.'s Research Laboratory in Montebello, California. He lives in Pasadena.

### 1945

DUDLEY B. SMITH was elected president of the International Licensing Executives Society at its annual world congress in Tokyo. He is senior licensing coordinator for the Celanese Corporation and lives with his family in Larchmont, New York.

MERRITT A. WILLIAMSON, MS, was awarded the 1977 Chancellor's Cup from Vanderbilt University, where he is Orrin Henry Ingram Distinguished Professor of Engineering Management. The award is for "the greatest contribution outside the classroom to student-faculty relationships." formed in 1971. A main product is the cryogenic vaporizer system, utilizing lowemission, flameless combustion. The company will move into a new Huntington Beach plant in mid-1978.

### 1953

RICHARD M. JAFFE has started a practice in the San Francisco Bay area as a management consultant specializing in corporate strategy. Formerly a management consultant with a Boston group, he was most recently director of corporate planning for Kaiser Industries and Kaiser Steel. He lives in Moraga, California.

### 1954

JOE H. MULLINS, MS, PhD '59, has been named director of the Switching Operations Systems Laboratory at Bell Labs in Columbus, Ohio. Here he is responsible for design and development projects concerned with centralizing and automating administration of the telephone switching network. Mullins joined Bell Labs in 1967.

### 1956

WILLIAM K. PURVES, formerly professor and head of the biological sciences group at the University of Connecticut, has been appointed the first Stuart Mudd Professor of Biology at Harvey Mudd College, Claremont, California.

### 1958

WILLIAM M. KERN writes that in December he married Charlotte Cho-Lan Lee, an attorney, and "I think this occasion warrants a notice in the *Caltech News*." Kern is senior development engineer at S&S Corrugated Paper Machinery Company in Brooklyn, New York, where he is responsible for control systems.

ALLEN KLINGER, MS, was promoted to professor in the UCLA computer science department in July 1977. He has been working on man-computer interaction with image data. He lives in Westwood with his wife, a son, 10, and a daughter, 1.

### 1960

STANLEY A. SAWYER, PhD '64, writes: "I am a visiting professor (half-time) in the department of mathematics at the University of Washington in Seattle, and have been spending at least half of my time working on mathematical problems in population genetics. For the previous two years I was chairman of the mathematics department at Yeshiva University in New York City."

#### 1961

ALEXANDER F. GOETZ, MS '62, PhD '67, and CHARLES ELACHI, MS '69, PhD '71, are principal investigators at JPL for two of the six scientific instruments chosen by NASA for the first shuttle flights (to be launched in July 1979) with a scientific payload on board.

EDGAR F. KIEFER, PhD, professor of chemistry at the University of Hawaii, lectured to his undergraduate organic chemistry class on Halloween while dressed head to toe as Darth Vader. He says his inspiration derived from reading about a similar stunt by Caltech Professor Harry Gray, but that "it took the dark lord from 'Star Wars' to provide a role model with which I could identify." He describes the re-creation of the costume from scrap metal and plastic as "one of the most satisfying things I've ever done; wearing it provided such an overwhelming sense of power I could hardly bear to take it off." charge, after a stroke in 1975. He writes, "I will be going to school to take many of the courses I didn't have time for at Tech, and also thinking seriously of how I might be of some service to the world in the near future. It is with sadness that I leave IBM, but with thousands of hours that I had not counted on available to me."

### 1963

NICHOLAS J. TURRO, PhD, received the Freda and Gregory Halpern Award in Photochemistry from The New York Academy of Sciences at the annual meeting in December. He was recognized for his outstanding contributions to the general theory of photo reaction and for his studies of the differences in the chemistry of singlet and triplet state ketones. Turro is professor of chemistry at Columbia University.

#### 1965

TOM K. GREENFIELD has been appointed coordinator of student services research and counseling psychologist in the Student Counseling Center at Washington State University in Pullman.

### 1966

PHILIPPE L. MAITREPIERRE, MS, PhD '69, his wife, Marie, and their two children moved from Paris to Albertville in the French Alps (near Geneva and Grenoble) last February. He has a new position as head of stainless steel research at the Ugine-Aciers Research Center. U.-A. is a leading specialty steel company and a branch of the multinational Pechiney-Ugine-Kuhlmann Company. He writes that his new job has already led him to Japan and Chicago. At the October meeting of the French Metallurgical Society, he was the recipient of the yearly RIST award for metallurgical research. He and his family hope to visit California and especially Caltech in the next two years, he says.

WALLACE L. OLIVER writes, "I am pleased to announce to my fellow alumni the birth of my daughter, Helen Elizabeth, on August 17, 1977." Oliver is a senior patent attorney for Standard Oil Company of Indiana in Chicago.

DAVID B. POSNER recently completed his postgraduate training and on January 1, 1978, was appointed assistant professor of medicine at the University of Maryland School of Medicine.

### 1967

GREGORY R. SHUPTRINE writes from Australia, "My position as superintendent of technical services at Australian Oil Refining continues to be a challenge, a very enjoyable one. The major change to my life in the last three years, however, has been from the arrival of my first child, a daughter, named Rebecca, in March 1976."

#### 1968

ERNO S. DANIEL received his MS and PhD in chemistry from UC San Diego and his MD from the UCLA School of Medicine. He writes, "I am completing my residency in internal medicine at UCLA and have accepted a position as internist with the Santa Barbara Medical Foundation Clinic in Santa Barbara, California, as of August 1, 1978." He married Martha Peaslee, a cardiology nurse from Stillwater, Minnesota, in August 1976. Their first child, Kristina Elizabeth, was born on October 13, 1977.

NORMAN M WHITELEY received his PhD

### 1971

RONALD J. LIPINSKI received MS and PhD degrees in nuclear engineering from the University of Illinois at Urbana in 1973 and 1976. After a year with the reactor analysis and safety division at Argonne National Lab, he will soon begin work with the fast reactor safety program at Sandia Laboratories in Albuquerque, New Mexico.

### 1974

RICHARD L. BAKER writes, "In August 1976 I returned from a most rewarding two-year mission to northwestern Argentina for the Church of Jesus Christ of Latter Day Saints (Mormon Church). You can imagine my feelings when I heard of the 7.4 earthquake there on November 23. I lived for 5 months in Caucete — the small town hit hardest by the quake. While there I wondered many times what would happen to the adobe building I slept in, should there be a severe tremor." After returning to the U.S., Baker joined Hughes Ground Systems Group in Fullerton, California, as a member of the technical staff and a participant in the firm's fellowship program. In June he will receive his MS in electrical engineering from USC and will then continue for a PhD in communications. He adds, "For all you ex-Rudds, BD married someone else, so I'm still looking .... "

ANITA CRAFTS-LIGHTY received her PhD in biochemistry from Cambridge University, England, in January. She is a senior scientific officer with Ranks, Houis, McDougall Research Ltd., a large bakery company, at their research center in High Wycombe. In August 1975 she and ROGER A. LIGHTY, BS '72, were divorced.

### 1975

SYLVAN A. JACQUES, MS, received his PhD from the department of astrogeophysics at the University of Colorado, Boulder, in December. He is a visiting scientist for the National Center for Atmospheric Research, High Altitude Observatory, in Boulder.

### **OBITUARIES**

### 1916

KENNETH W. RICH on December 10 in Bakersfield, California.

### 1920

DONALD D. SMITH on October 10 in Newport Beach, California.

### 1921

GERALD A. LAVAGNINO on September 22. He was retired and living in Lakeport, California.

TRUMAN F. McCREA in July. He had been living in Rogue River, Oregon.

### 1926

ROGER B. S. BRYAN of a heart attack in August. He lived in San Diego.

### 1931

ADAM T. ZAHORSKI in August. He is survived by his wife.

### 1944

HALE FIELD in June of cancer. He had lived

### 1946

JULIAN D. COLE, MS, Eng, PhD '49, received the I.B. Laskowitz Award for research in aerospace engineering sciences, support systems, and components from the New York Academy of Sciences at the annual meeting in December. Cole, professor of engineering and applied sciences, mechanics and structures department, UCLA, received a gold medal and certificate of citation for basic research in aerodynamics.

### 1948

BENOIT MANDELBROT, MS, Eng '49, who has been an IBM fellow since 1974, has used his fellowship to write a book, *Fractals: Form*, *Chance, and Dimension*. Mandelbrot lives in Yorktown Heights, New York.

EUGENE B. ZWICK is president of Zwick Energy Research in Santa Ana, California,

ALBERT W. "BUZZ" MERRILL, MS '62, has been working since 1967 as a communication systems analyst at the Aerospace Corporation in El Segundo. Recently he began to work on his own as a financial consultant and tax preparer. He writes "Most of my time I spend assisting with est (Erhard Seminar Training) which is very satisfying. My relationships with my family are great and I'm going with a wonderful girl who loves and I love totally."

### 1962

SIDNEY R. COLEMAN, PhD, was the recipient of the Boris Pregel Award for research in nuclear physics and nuclear engineering from The New York Academy of Sciences at the annual meeting in December. A contributor to the field of elementary particle physics, Coleman is a leader in the development of modern field theory. He is professor of physics at Harvard University.

HOWARD T. HILTON left IBM as a senior engineer in November 1977, via a medical disin biochemistry from Harvard in 1974. He has been working for DuPont in Wilmington, Delaware, marketing the automatic clinical analyzer, which automates blood chemistry tests in hospital laboratories.

### 1969

JEFFREY C. HECHT announces the birth of a second daughter, Jolyn, on July 31, 1977. He is managing editor of *Laser Focus* magazine in Newton, Massachusetts.

### YILMAZ E. SAHINKAYA, PhD, and his fam-

ily are in Sunnyvale, California, after spending three years in Turkey, where he completed compulsory military service for the Turkish army. In Turkey, he helped to organize a high-technology company providing control systems and computer consulting services to one of the country's largest industrial companies. He was general manager of this company, BIMSA, when he returned to work for a former employer, Control Data Corporation. He is a senior consultant on energy and simulation services with CDC. in Balboa since 1951. After working briefly as a civil engineer, he turned to his greatest love, yacht designing. His professional career in this field included a stint with Willard Boat Works when he designed the Vega 30 and Vega 40. He won major trophies in the 1954 and 1957 Newport-to-Ensenada races with a gaff-rigged cutter, Renegade, his first yacht. Following his death, a fleet of yachts with his friends on board cruised in silent tribute to off-shore waters, where his ashes were scattered at sea.

WAYNE C. TIMM, MS, on November 17, 1976.

#### 1945

LAWRENCE D. ELY at Redondo Beach, California. He was a retired U.S. Air Force colonel and is survived by his wife, Katherine, his daughter, Barbara, and his son, Daniel.

### 1950

ALBERT E. McLELLAN, MS '51, in early 1977.