NEWS FROM THE SALINIAN BLOCK

Earth Sciences at Santa Cruz

Fall 1994

Earth Sciences Comes Home to a New Building

There's no place like home, and the faculty and students of Earth sciences at UCSC have had their wish come true. The dedication ceremony for the new Earth and Marine Sciences Building will take place November 12, with special Earth sciences events November 11–13.

Located just below Natural Sciences 2 and above McHenry Library, the $29.5 million building is home to the departments of Earth and marine sciences, the Institute of Tectonics, the Institute of Marine Sciences, and affiliated biologists.

With 84,000 assignable square feet, the building consists of two lab blocks and an office wing. It also contains a 270-seat lecture hall, two 50-seat classrooms, and five spacious teaching labs. Additional features include a TA consultation room, doubled collections storage capacity, a small mineral museum that will be open to the public, and a unique atrium to display collections.

"The completion of this building has been the most singular event in the history of our department, a once in a lifetime opportunity," says Professor of Earth Sciences James Gill, the associate vice chancellor for research at UCSC. According to Gill, who was chair of the department during the planning phase, the building was the vehicle by which Earth sciences has enjoyed five years of accelerated growth. "The faculty got to design their own labs, but more than that, it created momentum and visibility and the opportunity to grow, to add faculty and equipment."

Earth sciences was somewhat buffered from budget cuts in recent years because of equipment funds related to the building, says Gill. "We maintained optimism and forward thinking that's anomalous on a campus that is downsizing."

Previously, it was often necessary for students and staff to go elsewhere to use specialized equipment, says Gill. Now, however, with the new labs and state-of-the-art equipment to fill them, the department is better equipped in several research areas than all but a few universities in the world. The building brought with it the opportunity to compete for Federal equipment funds. Earth scientists have won over $500,000 in Federal grants to buy teaching and research-related equipment, including: two gas-source mass

continued

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spectrometers; an inductively coupled plasma mass spectrometer; rock magnetism equipment; an electron microprobe; and portable seismometers. The department also upgraded the electron microscope facility and spent several hundred thousand dollars in computing systems.

Some of the research equipment is shared by faculty in neighboring disciplines, such as the gas-source mass spectrometer used by James Zachos, assistant professor of Earth sciences, and Christina Ravelo, assistant professor of marine sciences.

Concurrently, the new building made it possible to hire new faculty—attracted, naturally, by the opportunity to establish sophisticated new labs. (See "New Faculty," page 6.)

The momentum and optimism was especially important because the same year the department occupied the building it lost one-third of its faculty—including three to retirement, two to part-time administrative positions (Gill and Gary Griggs), and Shirley Dreiss. The first day in the new building there was a memorial for Dreiss, who had just finished packing her office for the move the day she was killed in an auto accident on Highway 17 (See page 4).

The new building allows the entire Earth sciences department to be housed under one roof and out of the trailers behind the Applied Sciences Building. The new arrangement will foster closer contacts between researchers. A distinctive feature of the structure is the conscious separation of faculty offices from the labs.

"The completion of this building has been the most singular event in the history of the department, a once in a lifetime opportunity."

"We thought about where the important scientific communication takes place, and concluded it was more important to have offices next to our colleagues than to the labs," Institute of Marine Sciences Director Gary Griggs says. "We had to change from an individual to a community approach. If each researcher built their own complex, it would put them further from colleagues."

As building committee chair, Griggs had to balance many concerns. "We had to make sure the space fit the special needs of faculty members, but was also generic enough that another researcher could move in as faculty left or retired." Of course, everyone wanted an office with a window, too. "My sense is the laboratory and office arrangement is working out," Griggs says. "Everyone is excited and happy about the building."

While the customized labs are delighting researchers, the teaching facilities, together with new equipment, are improving undergraduate education in the program as well. For example, a teaching lab can be dedicated to one activity, Gill says. As alumni will remember, in the old Applied Sciences building, geology students frequently had to put all the microscopes away because the next class might be working with sand on the tables. Now a teaching lab is devoted to student microscope work.

It was a long five years of planning and construction not without its headaches (See sidebar, this page), but the result is gratifying, says Griggs. "The good reputation of the department established by the alumni allowed us to push for the building," he adds.

Dedication events for the building are set for Saturday, November 12, with the formal dedication ceremony scheduled from 1:30 to 2:30 P.M. in the building's main lecture hall, room B206. Speakers will include Jim Gill, UCSC Chancellor Karl S. Pister, and Mike Field, chief of the Branch of Pacific Marine Geology of the U.S. Geological Survey.

In a private ceremony earlier in the day, members of the Institute of Tectonics will honor the W. M. Keck Foundation by unveiling plaques for two laboratory facilities: the W. M. Keck Seismology Laboratory and the W. M. Keck High-Intensity X-Ray Facility. The new names recognize nearly $1,000,000 in grants from the Keck Foundation to the Institute of Tectonics since 1986.

—Gary Kliewer

The First Lesson from the Earth Sciences Building

No structure the magnitude of the Earth and Marine Sciences Building goes up without unforeseen complications, but imagine the chagrin of the contractors when the ground collapsed beneath the building destined to house the geology department.

"The builders knew, of course, that the core area of the UCSC campus had a high potential for problems with cavern and fissure collapse," says Gerald Weber, engineering geologist and lecturer in Earth sciences. They also knew limestone lay near the surface in the area north of the building site, based on a geological hazards map completed by Weber several years earlier which also suggested that limestone was deeper than 50 feet at the building site.

Drilling by a geotechnical firm indicated apparently stable soils down to 50 feet over most of the area with a soft soil zone in the middle of the building site. The soft zone was compaction grouted. No problem—in rolled the heavy construction equipment.

After the excavation and the foundation construction, December rains saturated the ground. A gaping hole opened up under the footing for the north lab block and grew…and grew. Before long a twelve- foot wide footing at the base of the Earth Sciences Building was hanging over a growing void. "The void space lay between soft, high, marble pillars, pointing up, like fingers of a hand," Weber recalls.

At one point three sets of geologists, two geotechnical engineers, and the contractors were involved in the investigation. The soil had settled in an area about 20 feet across and 25 feet wide. Weber says no one is to blame. The collapse reflects the difficulty of working in karst terrain with 20-20 hindsight. Perhaps the excavation cuts went too deep, perhaps the soft zone should have been more fully investigated. Engineering geologists are always dealing with probability, he says, and it would be "phenomenally expensive" to drill test borings every five feet to get a complete picture of what hides underfoot. "The first lesson," according to Weber, "is that the campus geology is so complex, it is almost impossible to accurately map it in the detail needed to assure there will be no foundation problems." Eventually, the unexpected chasm was grouted and filled with concrete. "Every time we do a foundation, it's an adventure, because we have no idea what we will find," Weber says. No one understands better than the occupants of this building that we never *really* stand on stable ground.

Letter from the Chair

Dear Alumni and Friends:

The theme for this year's newsletter is change. The years since the last newsletter have been marked by large planned and unplanned events. The Earth sciences faculty have undergone many transitions, including new arrivals and early retirements, and we are actively searching for two new faculty (hydrogeology and Earth history).

There have been some exciting staff changes too. We hired a new thin-section technician, Bruce Tanner, and a mass spectrometer specialist, Zenon Palacz. Ed Boring was hired as the department's first full-time computer coordinator and Dan Sampson has rejoined the department as an Instruments Specialist, predominantly working with the XRF, XRD, and the new ICPMS microprobe.

A special thanks to all of you who contributed to the Earth Sciences Special Needs Fund, the interest from which supports students to attend our summer field camp or other student research projects. We especially thank Dr. Gerald Weber who is the founder of this fund. We were able to invest the endowment recently and continue to work toward the $20,000 corpus goal. Also thanks to all of you who have contributed to our departmental general fund, which makes such things as our reunions possible, to the Aaron and Elizabeth Waters Fund, whose interest goes each year to the most meritorious thesis proposal in the department, and to our Tea Endowment. This last fund was established with remaining funds from the sale of Loma Prieta earthquake slides. Thanks to Alumni Daniel Orange and Jeff Marshall for their creation of the sets and management of the sales. Interest provides refreshments for a weekly afternoon tea, which fosters interdisciplinary discussions in the department in addition to a routine social gathering (that our dean approves of!).

Please send us a note or stop in for a visit and let us know what is happening in your lives.

Thorne Lay
Department Chair

Updates On Some of the Earth Sciences Faculty

Bob Anderson and his graduate students work on a variety of processes in a range of landscapes using an array of tools. Kirsten Menking interprets the Owens lake core, revealing both long-term and short-term climatic variations. Also in California, Alex Densmore is carefully mapping the trace of the Ash Hill fault, and played the key role in the establishment of a GPS network across the several faults in the Lone Pine area of Owens valley this summer.

Greg Dick and Jim Repka work in the Mancos shale badlands east of Capitol Reef National Park in Utah. With Dan Sampson, Greg deployed a set of home-made acoustic sensors to capture the hydrographs of rare flash-floods in the area. It actually rained hard enough to cause runoff through the array… while they were there! Never thought they'd be so happy to see 4mm of rain. Using 10Be and 26Al, they can for the first time establish absolute ages of the fluvial terraces along rivers in the West. Eric Small has his eyes on the high surfaces of the West's mountain ranges such as the Sierras, the Winds and the Rockies. These high, smooth surfaces have been a puzzle for years. Lou Giplin is completing his work on the paleoseismicity of Kodial Island (he likes mucking about in the peat), and the post-1964 vertical deformation as read through the tide gages. Carol Creasy, formerly a Shirley Dreiss student, is getting ready to document race metal contaminants in a groundwater plume from a local manufacturer.

With graduate student Peter Weiler, **Rob Coe** recently spent a month in the field collecting paleomagnetic samples in Papua New Guinea. This NSF funded project is to work out the kinematics of the recent (and still ongoing) collision of the Finisterre island arc terrane with the Australia-New Guinea margin. Some of the most active tectonics in the world are exhibited there: uplift rates of millimeters per year of the arc rocks and vertical-axis rotations of 90 degrees of rocks less than .8 m.y. old in a thrust sheet in the suture zone. Rob and Peter had a great time flying and walking to remote areas of the mountains to collect samples, and everywhere were overwhelmed by the hospitality of people in the villages, who put them up in their huts and guided them to the areas where they needed to work.

Jim Gill's research group works mostly on the processes and time scales of magma genesis which recently focused less on island arcs and backarcs than on mid-ocean ridges, Atlantic ocean islands, and continental volcanoes.

Student Charlie Dunlap is studying one of the largest volcanic eruptions in the last millennium. You may have seen pictures of the volcano as a backdrop behind the recently deceased Great Leader, Kim Il Sung.

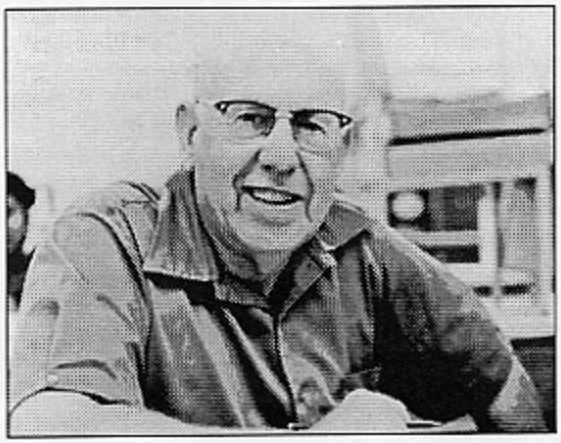
Student Craig Lundstrom combines studies of MORB genesis and isotope ratios with experimental measurements at LLNL of the distribution coefficients for U-Th-Ra under mantle conditions. The isotope work relies on high-precision mass spectrometry, something achieved at UCSC but at few other universities in the world thanks to the work of our ace instrumental specialists Zenon Palacz, Dan Sampson, and Walter Schillinger.

Postdoc and alumnus Fred Hochstaedter, student Sue Shallenberger, and Jim will soon lead an oceanographic expedition to the Izu backarc south of Japan to continue studies of the geochemistry of subduction processes. Student Aaron Reyes applies U-Th-Ra techniques to studies of groundwater geochemistry while alumna Terri Cook studies the origins of sulfide chimneys on the Juan de Fuca Ridge. These two are helping Jim make the greatest departure from his igneous past into a more applied, environmental future.

Continued on page 7

IN MEMORIAM

Aaron C. Waters



The founding chairman of UC Santa Cruz's program in Earth sciences and one of the leading figures of the geological sciences in this century, Aaron Clement Waters, died in Tacoma, Washington, on May 18, 1991 at age 86. Thus was brought to a close a brilliant career as petrologist, structural geologist, and educator—a person who leaves a permanent imprint on geological education at UCSC.

Aaron came to Santa Cruz in 1967 as the first and only faculty member in the Earth sciences department and a founding member of Crown College. During this early period he was remarkably successful in securing state approval of our Ph.D. program, despite the period of severe budget constriction. Earth sciences at UCSC would not have subsequently flourished were it not for his strenuous activities in these first few years of our program.

Aaron's geological interests included volcanology, igneous petrology, mineral resources, lunar geology, and the tectonics, geology, and geomorphology of the Pacific Northwest. His many published papers on the latter region have significantly advanced our understanding of the Cascades and adjoining areas.

In a lifetime of major achievements, perhaps Aaron's greatest contributions were in education, especially his role in developing outstanding programs in the Earth sciences at Stanford, Johns Hopkins, UCSB, and UCSC.

Aaron's honors included selection as a Guggenheim Fellow, election to the National Academy of Sciences in 1964, and election to the American Academy of Arts & Sciences in 1966. In 1982, the Geological Society of America selected him to receive their highest award, the Penrose Medal, a tribute which honors an "eminent researcher in pure geology."

Those who knew and worked with Aaron remember him as forthright and vigorous, a person of enormous vitality and a pointed sense of humor. Behind what seemed to some a gruff persona, he was a kind individual who remained enormously supportive and helpful to students and colleagues. In turn, he expected the best from them in terms of effort and accomplishment. Students always knew that Aaron had faith in them, often more faith than they had in themselves.

In addition to his wife Elizabeth, Aaron is survived by two daughters, Susan Hansmann of Tacoma and Sharon Catron of California; and by three grandchildren. Aaron requested that no services be held. Contributions to the Aaron and Elizabeth Waters Student Research Fund at UCSC, care of the Earth Sciences Department, UCSC, Santa Cruz, CA 95064, are preferred. This fund, established when Aaron retired from UCSC in 1972 from donations by his former students, colleagues, and friends, is given annually to that student or students judged by the faculty to have submitted the most outstanding Ph.D. thesis proposal.

Shirley J. Dreiss

Professor of Earth sciences and chair of the department at UCSC, Shirley Dreiss, died in an auto accident in the Santa Cruz Mountains on December 14, 1993. She will be missed for her good cheer and the quality of her contributions to the academic community by friends and colleagues around the country.

In 1979, upon completion of her Ph.D. from Stanford, Shirley was hired as an assistant professor of Earth sciences at UC Santa Cruz. Her active teaching record with the department included introductory groundwater, soil mechanics, numerical methods in groundwater, field methods in hydrogeology, and various graduate seminars on current topics in these areas. Shirley supervised more than 20 graduate students working on an impressive variety of topics.

She was considered by her peers to be one of few groundwater hydrologists whose research encompassed a broad range of hydrogeologic problems. Her research interests included: stream-aquifer interactions in alluvial valleys; hydrologic factors triggering shallow hillslope failure; quantitative modeling of flow in karst aquifers; fluid flow in accretionary prisms, and variable-density groundwater circulation in arid basins on Mono Lake, California.

Shirley's honors and service include: Department chair 1991-93, Birdsall lecturer 1991-92, Cordellerian Section Hydrogeology representative to GSA 1989-91, association editor of *GSA Bulletin*, editor of *Geology* 1990-93, a member of the first review panel for the NSF hydrology section, member of the coordinating board of the California Water

Resources Center and of the National Academy of Sciences Committee to review the EPA EMAP program, and panel member of Sedimentary and Geochemistry Proceedings Thematic ODP Panel 1989-92.

One of Shirley's particular strengths was writing and speaking clearly to an interdisciplinary audience and also on an individual level. She possessed enormous energy and enthusiasm.

Shirley is survived by her husband, David Freyburg, professor of Civil Engineering at Stanford University, her parents of San Antonio, Texas, and two brothers. A Dreiss memorial fund is being created by GSA. For more information on the fund please contact Dr. Lenny Konikow, U.S. Geological Survey, National Center, MS 431, Reston, VA 22092.

For full-length versions of these memorials, contact the Earth Sciences Dept, UCSC, Santa Cruz, CA 95064.

LOST ALUMNI

Periodically, we receive a list of alumni for whom no current information exists in the system. We are circulating this list among the faculty to get updates where possible, but we could really use your help. In addition to permanent and/or temporary address and phone numbers, we'd like to know what our alumni are doing. So, if you could help us "find" these folks and give us an update on yourself, too, we would greatly appreciate it. Thanks in advance.

Thomas H. Albracht	'81
Richard H. Alden	'86
Lauren K. Beggs	'86
Bradley J. Bergman	'88
Donna K. Blackman	'82
Joyce R. Blueford	'80
Gabriella C. Borsay	'88
Jeffrey D. Borum	'78
Kimberly A. Brown	'82
Remelle E. Burton	'88
Carrie E. Carpenter	'75
Percy Chirinos-Arias	'89
Andrea Coffman	'74
Steven J. Cone	'74
Roy E. Couzin	'80
Paul C. Denton	'77
Tova F. Diamond	'80
Julia L. Diridoni	'87
James F. Dolan	'88
Patricia-Anne Dresser	'93
Christopher Ducharme	'84
Gennard F. Durso	'85
Eric J. Eilar	'76
Georffrey S. Elliott	'80
Karen M. Fant	'71
Vincent Fessio	'74
Walter D Floyd	'77
Joseph W. Frey	'80
Paul T. Fuller	'73
Brian M. Gwinn	'90
Holly Hadlock	'82
Joel F. Hadsall	'87
Lawrence F.O. Hanlon	'87
Paige L. Herzon	'79
Christopher R. Hiller	'83
Michael J. Hoare	'78
Steffen M. Hodges	'81
Alan Howard	'77
Marie D. Jackson	'76
Marjorie G. Jones	'77
Michael M. Kelly	'86
Abdul W. Khodair	'75
Ellen J. King	'77
Rick L. King	'80
Rob B. Leslie	'80
Samuel Longiaru	'87
David L. Longstreth	'88
Susan Marie Maida	'82
Randall A. Marrett	'84
Christine McDonald	'88
Tom O. McElroy	'83
Mary C. Milling	'78
Mark E. Minard	'82
Michael D. Moore	'86
Nina M. Morgan	'75
Charles C. Norton	'82
Taxiarchis Papadopoulus	'75
Galen Peterson	'83
Vincent R. Ramirez	'78
Paul M. Rankin	'88
Linda D. Roberts	'87
Stephen D. Rosen	'80
John D. Rosenthal	'81
Tatiana Sabelin	'76
David Shelley	'86
Michael B. Simpson	'80
Richard D. Slack	'81
Krin Anne Smith	'76
Henry Snyder	'73
Sandra Stansbury	'74
Christian Stolte	'86
Robert M. Stuart	'75
Christine Sunzeri	'75
Jill E. Tagudin	'88
Robert J. Talbot	'80
Steven B. Thomas	'76
Susan A. Thomas	'78
Patricia R. Thompson	'90
Jim D. Toney	'85
Patrick Vaughan	'78
Michael K. Veseth	'80
Susan J. Weller	'86
Deborah E. Wise	'82
Gregory Wroblicky	'85
Lee W. Zontine	'75

Alumni In Memoriam

Along with this "lost alumni" list, the Alumni Association included those of our alumni who have passed away. Unfortunately, we can offer you no more than their name; but we felt you might appreciate having at least that information in order to give them remembrance.

Sandra Schulz Buford	'74
Charles B. Clarke	'74
Richard William Devine	'75
Jaime Rogelio Gonzalez	'86
Gary Edwin Kuhn	'78
Cynthia Joan Neal	'76
Larry Jay Towery	'78

Alumni: The artist of this design is also "lost." We could use your assistance in locating "M.C. Jackson."

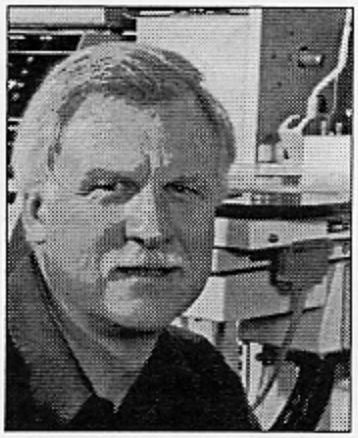
NEW FACULTY

A. Russell Flegal

The primary focus of Russ Flegal's current research is on the biogeochemical cycle of lead in preindustrial and contemporary environments. This includes studies of lead cycles in the world's oceans, Mediterranean Sea, Great Lakes, European Alps, and Antarctic. Those studies involve analyses of lead concentrations and stable isotopic compositions in aerosols, water, sediments, and organisms. The concentration measurements are used to quantify the magnitude of anthropogenic perturbations, and the isotopic composition measurements are used to identify natural and anthropogenic sources.

Flegal is also involved with research on the biogeochemical cycling of other trace elements in aquatic systems. This research is focused on the cycling of heavy metals and rare Earth elements in the San Francisco Bay estuarine system and the northeast Pacific coastal zone.

A. Russell Flegal

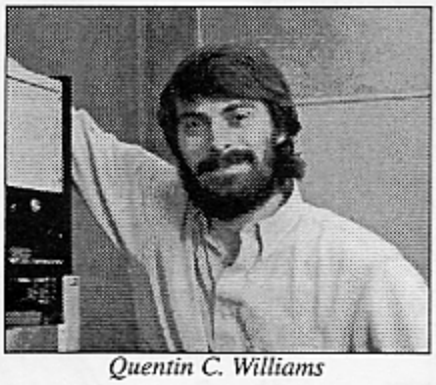


Susan Y. Schwartz

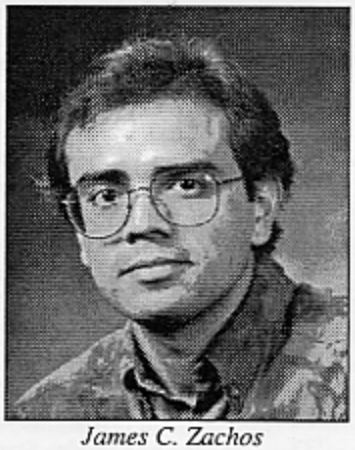
Susan Schwartz's research interests presently focus on determining the spatio-temporal distribution of earthquake moment release and understanding the factors that influence its localization. By comparing the positions of maximum moment release at different locations possessing different fault-zone characteristics and seismic behavior, Schwartz hopes to gain an understanding of the factors that control the localization of these regions of maximum stress.

Interest in the seismotectonics of the Santa Cruz Mountains, Cape Mendocino, and Costa Rica has involved Schwartz in several seismic field experiments deploying PASSCAL digital instruments. Data collected during these various experiments are being used to obtain improved earthquake locations, focal mechanisms and crustal velocity structures. This information is necessary to improve our understanding of the complicated tectonics in these interesting areas.

Susan Y. Schwartz



Quentin C. Williams



James C. Zachos

Quentin C. Williams

Quentin Williams's research is centered on experimentally examining the structural and thermodynamic properties of minerals, melts, and fluids at both ambient and high pressures. In particular, the melting relations of deep Earth materials, the ability of deep Earth minerals (and melts) to retain water and carbon dioxide, the mineralogy of subduction zone materials, and the structural constraints that determine whether silicate magmas buoyantly rise or sink at different depths in the Earth are among his primary interests. Such properties not only control the thermal regime in the deep Earth (and thus the driving force of plate tectonics), but also are vital in determining the mechanisms and degree to which the planet has differentiated.

Williams uses a high-temperature diamond anvil cell, a device by which pressures corresponding to those present throughout the deep Earth may be generated. He examines the bonding properties of materials in situ at simultaneous high pressure and temperature. Such data yield insight into the local bonding environments of ions in crystals, melts, and solutions, and the changes in these environments with pressure and temperature.

Williams is a National Science Foundation Presidential Faculty Fellow (1993-98).

James Zachos

Jim Zachos's research interests encompass a wide variety of problems related to the biological, chemical, and climatic evolution of late Cretaceous and Cenozoic oceans. He is a paleoceanographer who measures the chemical compositions of fossils to reconstruct past changes in marine temperatures, ocean circulation, continental ice-sheets, nutrient distributions, marine productivity and carbon cycling.

Zachos and his students are currently participating in several projects oriented towards understanding the nature of rapid and extreme climate transitions in Earth history. They are also using the oxygen isotope ratios of marine microfossils to ascertain the timing and extent of continental glaciations during the early Cenozoic, some 35 million years ago. They are searching for evidence that indicates Antarctic ice-sheets were periodically advancing and retreating in response to orbitally influenced changes in Earth's climate.

Recently, Zachos and a group of graduate students began sampling rain and ground waters and examining speleothems from local caves for the purpose of reconstructing pre-historic climate of the central coast of California.

Zachos is a 1994 recipient of a National Science Foundation Young Investigator Award and was a 1993 JOI-USS AC distinguished lecturer.

Curricular Changes

Our number of Earth sciences majors is the largest in the UC system, both relatively and absolutely, and is increasing. Also, we are in the top 10 percent nationally (16 percent for graduate student enrollments). It appears that the main cause of growth has been the addition of courses in the areas of Earth History/ Global Change and Surficial Processes/ Environmental Geology over the last few years and, for graduate students, the acquisition of additional faculty in these areas. In response to these research areas of interest as well as societal concern in these areas, there are three tracks to the B.S. in Earth sciences at UCSC beginning Fall 1994: Earth History/Global Change, Surficial Processes/Environmental and structural Geology, and the Solid-Earth.

Updates On Faculty—Continued from page 3

Gary Griggs's research and that of his research group is focused in the coastal zone and ranges from how fast the shoreline of California is disappearing to how effective engineering structures are in allowing or halting erosion and what impacts those structures, such as seawalls, have on the shoreline and beaches. As people regionally, nationally, and globally migrate to the world's coasts, the demand for land and impact on beaches, shorelines, and the coastal zone continues to increase. The supply of sand to beaches, the alongshore transport of sand, and the ways in which we control land use and deal with coastal geologic hazards are all topics under investigation.

Recent activities of **Karen McNally** include work on the seismic vulnerability of southern California and shaking from the largest earthquakes to be expected along the San Andreas fault, in cooperation with engineers, seismologists and emergency planners. Recent research with UCSC Ph.D. graduate Xinping Liu and UCLA researcher Zheng-Kang Shen has focused on earthquake slop in oblique subduction zones and the question of whether or not slab pull contributes to the degree of slop partitioning. Research with UCSC Ph.D. graduate Marino Protti-Quesada on the large (Mw=7.0) 1990 Costa Rica subduction zone earthquake revealed evident for earthquake triggering and complex rupture processes. A highlight was a visit to Costa Rica for a ceremony honoring 10 years of seismographic network monitoring by UCSC and Universidad Nacional de Costa Rica, hosted by UCSC alumni Eduardo Malivassi and Federico Guendel.

During the past year **Casey Moore** and two graduate students Harold Tobin and Gretchen Zwart sailed on an ODP cruise off Barbados; here they worked to install fluid pressure and temperature monitoring devises in two bore holes penetrating the subduction zone plate boundary. Two former Santa Cruz students Audrey Meyer and Mike Underwood were also on this cruise. With graduate students Phil Teas and Jennifer Thornburg, Casey is starting to study how faulting affects fluid flow in an oil field in the Los Angeles Basin. Jim Sample, UCSC alumnus, now professor at Cal State Long Beach, was instrumental in fostering this project and is involved in the analysis of cores crossing faults in the oil field. Casey and his students hope to learn how faults block and channel fluids while assisting with more efficient production of the oil remaining in their field.

Justin Revenaugh's current research involved application of techniques developed within the context of oil and gas exploration to delineation of Earth structure using earthquake-generated seismic waves. Atop the list of projects Justin is working on is an effort to map heterogeneity within the crust and upper mantle beneath southern California using scattered waves. Strong scatterers can pose significant seismic hazard and are very poorly understood; this work is providing insight into their numbers, locations, and relation to regional geology. By extending coverage into the upper mantle he hopes to learn more about the complex dynamics of mantle flow and plate motions. A second project, just begun, will look at structure deep within the mantle beneath the Andes. He hopes to compare the contrast the deep structure of this convergent margin with the Himalayas.

The day after hooding Ph.D. student Marino Protti-Quesada at commencement ceremonies last June, **Susan Schwartz** had a baby boy, Griffin Reed Lay (Earth Sciences Professor Thorne Lay is father). In addition to the new baby, Susan received some other good news this summer. She was successful at matching her faculty state-up funds with an NSF grant to purchase state-of-the-art portable seismic and GPS instrumentation. As soon as the equipment arrives, Susan together with graduate students Mike Hagerty and Renate Hartog will deploy the seismic stations in an array across the San Andreas Fault to study the evolution of this fault system in the San Francisco Bay area. A second planned project together with graduate students Mike Hagerty, Lillian Soto-Cordero and former student Marino Protti-Quesada (now at the National University in Costa Rica) involves deploying the equipment in Costa Rica to investigate plate motions in the Central America/Caribbean region and the physical processes of volcanic eruptions.

During February 1994, **Eli Silver** with Lon Abbott, Leslie Kahn, Brian McAdoo, Marino Protti-Quesada, and Joe Galewsky, all UCSC students or alumni, participated in the first cruise on which the D/V ALVIN dove to depths in excess of 4,000 meters. By pushing the limit to 4,500 meters, they were able to dive to the axis of the Middle America trench in a successful search for fluid vents formed by squeezing the accretionary prism during subduction.

They also discovered the coldest region yet reported on the ocean floors, that is, having the lowest heat flow anywhere on Earth. The explanation is still a mystery.

Dear Alumni: Please take a moment to let us know where you are and what you are doing. Thank you.

Name: _____

Mailing Address (circle: Home or Business): _____

Telephone: _____

Employer: _____

Duties: _____

Recent achievements or news: _____

_____

Can you tell us anything regarding the whereabouts and activities of other UCSC alumni in the Earth sciences?

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_____

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