

# Geology News

Department of Geological Sciences ▲ University of Colorado at Boulder ▲ Summer 1991

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## Ted Walker (really) retires

**T**ed Walker completes a distinguished career at CU this Spring. Ted actually retired five years ago but hired on as a half-time professor. Many of you may not have read Larry Warner's write up of Ted's career in his book "Profile of a Department: Geological Sciences" (for sale from the department for \$12); here is what Larry wrote:

"Turning to the four postwar recruits who still retain faculty status, T. R. Walker was the first to arrive, joining the Department in 1953. Walker grew up in Madison, Wisconsin, and was educated at the University there, completing a Ph.D. in 1952, following service in the Navy. He was employed briefly with the Illinois Geological Survey as a groundwater geologist, while negotiating for an appointment in Boulder. The Department decided it needed a groundwater person, and Ted got the job. However, it was soon apparent that Walker did not plan to follow a career in groundwater, his first love being sedimentology, a field he was forced to share for a time with Warren Thompson. As Thompson tapered off on work with advanced students and approached retirement, the entire program in sedimentology fell to Walker. His courses in sedimentation and sedimentary petrology were highly rated by students for effective presentation and authoritative coverage. He was chosen for a University Teaching Excellence Award in 1982. His colleagues chose him to chair the Department for the period 1972-1975.

Although he disavowed a major interest in groundwater, one of his principal contributions in the late fifties had to do with a groundwater contamination problem related to waste disposal by the Rocky Mountain Arsenal. The Arsenal attempted to dispose of liquid waste remaining from nerve-gas experiments conducted during the war by pooling the liquid in evaporation ponds. However, the ponds leaked, contaminating the groundwater regime in the area and resulting in damage to crops and livestock on nearby ranches. Ted was able to show from detailed studies that the contamination was traceable to the ponds. As a result of his studies, the Arsenal abandoned the evaporation method in favor of a deep disposal well, drilled to the basement complex near Derby. Injection of the fluid under pressure ultimately resulted in the Denver earthquakes, which received wide attention during the middle and late sixties. The three largest shocks occurred in 1967-1968, ranging in magnitude from 5.0 to 5.5. One might argue that Ted was indirectly responsible for inducing the earthquakes, although he has never been credited officially with that achievement.

Walker's major research activity has been in regard to the origin and significance of red beds, an effort which has earned him the title of "Red Bed Ted," as well as international renown. His interest in the subject was kindled during the mid-fifties while he and Larry Warner

ran the summer field camp for Advanced Field Geology near McCoy. Studies conducted by Ted and his students on red strata in the Minturn formation led him to conclude that the contained hematite pigment was not a detrital product derived from an iron-rich regolithic provenance, as had long been supposed, but resulted from complex post-depositional reactions in which the iron was derived from mafic minerals contained in the original sediment. During the following two decades, financed mainly by grants from the National Science Foundation, Ted pursued his investigations in many parts of the world, including North Africa, the Middle East, western Europe, Mexico, and South America, as well as in various parts of the United States and Canada. An important aspect of his work, on which he collaborated recently with Ed Larson, involves dating paleomagnetism in red sedimentary rocks. Since the magnetism relates to the iron pigment, which may have formed long after deposition of the sediment, the magnetic age may not correspond to the age of the stratum, as tacitly assumed by most investigators.

Ted's work has resulted in his being recognized as one of the world's leading authorities in his field. Resulting from this recognition, he has received numerous awards and special appointments. He was a Visiting Research Professor at Scripps Institute of Oceanography (1962-1963), at the Swiss Federal Institute of Technology (1968-1969), and at the Scott Polar Research Institute, England (1969). On more than 100 occasions he has been invited to lec-

ture and to participate in seminars, symposia, and conferences in the United States, Canada, England, Switzerland, West Germany, and the Netherlands. He has served in a variety of posts at the regional and national levels in a half dozen professional societies, most recently as President of the Society of Economic Paleontologists and Mineralogists (1982-1983).

As Walker approaches ultimate retirement a few years down the line, his pace is more relaxed. Although he has reduced his teaching schedule to half time, he continues to refine his courses and to indulge in petrologic and geochemical studies of the effects of post-depositional mineral alteration on the properties of sandstones."

To the above we can add several more observations. One lasting memory of Ted's Baja days (see photo) was the invention of the Baja Bomber, a delight at many parties. He also has taken to athletics as he did early to red beds—with zeal! He and Barbara bike some 3000 miles per year, including century (100 mile) rides, and last Summer from Germany to Hungary along the Danube River, some 410 miles. In Winter they ski, and this year he has 20 days to his credit by early February. Now that he is of age (or maybe he has a false I.D.) his skiing is free! Finally, his groundwater days are not over, as recently he testified in San Francisco at one of the most expensive trials in history, having to do with the Rocky Mountain Arsenal. They put him and Barbara up at the Mandarin Oriental Hotel for a week. In the old days, Ted gave us

*Continued on page 2*



*Ted takes faculty and friends to Baja in 1970 (l to r, Pete Birkeland, Dave MacKenzie, Ted, and Bill Bradley; photo by John Harms).*



*Students on a trip to Baja in 1973. (l to r, rear, Dennis Bodenchuck, three unidentified people, Morgan Hocker, Tony Crone, Ralph Shroba, Mike Middleton, an unidentified person, and Ralph Lindberg; front, Mike Machette, Dave Sharpe, Tom Carroll, Dawn Kaback, Alison Conn, Dennis LaPoint, Lee Wilson, and an unidentified person.)*



University of Colorado at Boulder

Department of Geological Sciences  
Campus Box 250  
Boulder, Colorado 80309-0250

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# Message from the Chair

by Donald D. Runnells

As the new Chair, it is my privilege to have this opportunity to report to you on the "State of the Department." First, however, I want to recognize and thank my predecessor, John Andrews, for the excellent job that he did during his three-year term. John provided leadership during a period when we finally had to fully confront the immense problems posed by our antique building and greater competition for federal research grants. Of course, John Andrews was just the most recent in a long line of Chairs who have worked hard to maintain the strength and tradition of excellence of our Department. We have recently completed a framed collection of photographs of former Chairs, displayed in Room 206, beginning with Philip G. Worcester (1934-1949); I urge you to come in and view the collection the next time you are in Boulder (see photo).

As noted elsewhere in the Newsletter, during the year we added one new outstanding young faculty member in petroleum geology, Dr. Paul Weimer. Paul came to us after several years in the petroleum industry and is well known for his outstanding work in seismic stratigraphy. He will be teaching courses in petroleum geology, seismic stratigraphy, and historical geology. There is no doubt that our society will continue to rely on petroleum in the foreseeable future, and we want to be recognized as a source of outstanding students and graduates in petroleum exploration.

In 1990 we had 65 undergraduate majors, compared to 54 in 1989, for an increase of more than 20%. In addition, the number of student credit hours in undergraduate-level courses (the number of students enrolled in each class multiplied by the number of credit hours carried by each class) jumped from 3925 in 1988 to 4488 in 1989, to 5017 in 1990. We awarded 13 Bachelor's degrees in geology in 1990.

In 1990 our graduate student enrollment was 105. Student credit hours in graduate-level courses rose from 1261 in 1989 to 1420 in 1990. We awarded 27 graduate degrees in 1990, exactly equal to the average number for the past eight years.

I believe that the dramatic increase in our student credit hours is due to two factors. First, young people in general seem to be more aware and concerned about Mother Earth than in the past. And second, we have introduced a series of courses in interesting and relevant issues, including such courses as GEOL 1060 and 1070-Global Change, a Geologic Perspective (Professors Mark Meier, Giff Miller, Jim White); GEOL 3040-Geologic Record of Global Change (John Andrews); GEOL 3520-Environmental Issues in the Geosciences (Jim White); GEOL 3720-Evolution of Life, the Geologic Record (Erle Kauffman); GEOL 4950-Geologic Catastrophes and Hazards (Charles Stern). We believe that such courses address problems that should be of interest and concern to educated citizens. As a spin-off,

we anticipate that some of the best students in such courses will want to become professional earth scientists.

We are also working very hard to revise the curriculum for our undergraduate majors. The Departmental Advisory Board, under the Chairmanship of Gene Shearer, has contributed significantly to our debate on the best way to update the required curriculum for majors. We have not yet reached a consensus, but the general direction of our discussion is to provide more flexibility in the curriculum, without sacrificing rigor. We are proud of the quality of our past graduates and we will not compromise that quality in the future.

Last year the Department completed the Program Review which the University requires of every department on campus each seven years. The final report of the Program Review Panel mandated that our Department be more rigorous in its long-term planning. As a part of our response, the entire faculty took part in a day-long planning retreat early in January. The discussions have continued at a fairly intense level since that time and are on-going at this time. Our goal is to define where and what this Department wants to be in 1997, at the time of the next review. We are attempting to define areas in the earth sciences that will be of particular importance over the next seven years and to define our educational goals and priorities for faculty positions within those areas. Once again, the Departmental Advisory Board has offered invaluable guidance and assistance in this activity.

We also continue our efforts to offer better academic and career advising to our undergraduate majors. On an entirely voluntary basis, and with my approval, a group of geology graduate students has organized a peer-counseling service for the undergraduate majors.

We have now moved to Number 1 on the University's priority list for a new building on the Boulder campus. However, the chances that the State of Colorado will be able or willing to fully finance the construction of a new building are nil. We are therefore working very closely with the University of Colorado Foundation, through the Frontier 2000 Campaign, to raise 14 million dollars in private donations from alumni, foundations, corporations, and friends. I can tell you that great efforts are being exerted by many people to help us achieve that goal. The primary benefactors of a new Geology Building will be future generations of students, and it is this message which is being carried forth by Judy Walker of the C.U. Foundation, Dean Charles Middleton of the College of Arts and Sciences, John Masters and Eric Johnson of our Departmental Advisory Board, Bruce Benson, and others. I want to publicly thank all of these people for the enormous amounts of time and energy they are volunteering on our behalf.

While I am on the subject of fund-raising,

I want to thank each and every person, corporation, and foundation that contributed money to the Department last year. We are incredibly fortunate to have financial support from so many sources. We are very cautious to make certain that every such dollar is spent in a manner that directly enhances the educational mission of the Department. Without your financial support, we simply could not provide the same excellent education for our students. I think it is important to remind people that the State of Colorado provided only 16% of the total operating budget of the University of Colorado at Boulder in 1989-1990.

I have now been here for 22 years, and the pride that I feel in being a member of this Department increases each year. We have an excellent Department, and with your help, we

continue to work hard to make it better.

Please let me hear from you if anything about the Department troubles you, and I promise to respond to the best of my ability. I would even like to hear from you if you are pleased with what we are doing!

In closing, let me remind you that you are always welcome to drop in for a visit and a chance to renew old friendships. At the very least, please plan to join us at Homecoming on Saturday, October 12th. I think everyone had a good time at Homecoming last year, but we would like to have an even larger turnout and better time this year. Come and join with old friends and faculty in celebrating the certain victory of the Golden Buffaloes over the Missouri Tigers, even without the help of a fifth down!

## Life of an Alum in New Zealand

Warren Dickinson (Ph.D., 1984) has spent the past two years on a post-doctoral fellowship at Victoria University, Wellington, with wife Thera, and son Dane. Here are some of the highlights of their stay.

Wellington is a hilly city on a bay, rather like San Francisco. Temperatures are fairly mild until the southerlies blow in. There is a fair amount of rain, and when combined with the winds, you can bet it falls nearly horizontal. A few flakes of snow fell in town this year, and the mountain ski areas (volcanos about five hours drive away) had the best conditions in years. Warren has a fourth story office in the Department of Geology that overlooks the ocean, and reports that the faculty, staff and students are a very congenial group.

Next, the economics of living there. A three-bedroom house rents for \$650/month. In order to get around, they bought a car—or what they thought was a car. Turned out to be a Russian Lada with 46,000 miles on it that cost \$2700. After \$1000 in repairs they surrendered it for a Lada that works. With gas costing about \$3.50/gallon, one tries to use alternative modes of transportation. The one thing they really lack is tortillas, as the nearest ones that resemble ours are about ten hours away!

Language is a bit of a problem, because the locals (called Kiwis) have their own kiwi style of pronouncing words. In addition, there are many Maori (original inhabitants from Pacific Islands) names, many of which are unpronounceable. For example, there is a nearby hill named Taumatawhakatangihangakoauauotamateapokaiwhenuakitanatahu!

For holiday, the Dickinsons sometimes

head south by ferry to the northern part of the South Island, where the department has a cabin. Called "the Nelson area," there are expansive beaches for swimming and hiking, as well as abundant wine, fruit, and fish.

The academic system there differs quite a bit from ours. A university degree takes about three years, and one can continue on for the fourth (or honors) year. Honors requires a thesis and comprehensive examination, and is not quite comparable with the MS degree in the U.S.A. For those that continue for the MS and PhD degrees, it is based on original research and course work usually is not taken. Most university students receive bursary payments of about \$90-130/week from the government for going to school.

Ideal as the country is, New Zealand is not without its problems. The Maoris and Europeans have changed the original flora and fauna drastically. Because fur is out, the possum industry has hit bottom. Although there are racial problems between the Maoris and Europeans, these are not comparable to the racial problems in the U.S.A. Environmental policies are in their infancy, as is recycling.

The Dickinson family will be in New Zealand for several more years, as Warren was just awarded a lectureship. He will be teaching a variety of courses that range from introductory geology to those in his specialties, sedimentary geology and isotopes. Being that the main sports down there are lawn bowling, rugby, cricket, and horse racing, they still like to get a few Denver Bronco scores now and then (no matter how bad).

## ...Ted Walker Retires

vision and inspiration for the future. Now he leads us down, down a ski hill that is, with Bill Bradley his common companion. Welcome

to a well-deserved retirement, Ted, our Chairman of the Boards (see photo)!



Recognize some familiar faces in the above photo? In Room 206, a seminar room outside of the office, we have graced the walls with all of the more recent Departmental Chairs. We talked Don Runnells into posing with photos of Doc Thompson, Bruce Curtis, and Ernie Wahlstrom. Don has to finish two more years as chairman before we hang him on the walls. Stop in and view this interesting exhibit, our local Hall of Fame.



Ted in the lineup at Winter Park (l to r, Anson Mark, Anson's son, Ted, Louise and Bill Bradley, Warren Dickinson, and Wes LeMasurier).



# STUDENT NEWS

## Student Awards Spring 1991

**Marcella Hutchinson**, one of our top seniors, received the Neal J. Harr Memorial "RMAG Geologic Pick Award" from the Rocky Mountain Association of Geologists. Marcella also received one of the Departmental Johnston Scholarships.

**Thomas Gruber**, another of our top seniors, received the Departmental Brunton Compass along with one of the Departmental Johnston Scholarships.

**Gary Fager, Robyn Habegger, and Jeffrey Blake**, all outstanding Juniors, received engraved Estwing Picks.

**Terry Okumura**, graduate student, received a Johnston Scholarship.

**Barbara Mieras and Paul Manega**, graduate students, received the Keith Marks Scholarship.

**Alex Skewes, Claudia Johnson, Tomas Villamil, Eric Hiatt, and**

**Ursula Hammes**, graduate students, received the Longley-Wahlstrom-Warner Scholarships.

The following graduate students submitted proposals and received funding to assist them with their summer research. Fifty percent of this funding came from alumni gifts and 50% from the Shell Foundation.

Mark Abbott	Daniel Levish
Lisa Barlow	David Lubinski
David Bowen	William Little
Ganglin Chen	Barbara Mieras
Randy Cherry	Raoul Miller
William Dupree	Jared Morrow
Bruce Geller	Peter Sauer
David Hanson	Peg Shippert
Eric Hiatt	Alex Skewes
Beverly Johnson	Bruce Vaughn
Claudia Johnson	Natasha Vidic
Michael Kozuch	Tomas Villamil
Debra Krumm	Scott Whitehead
Alan Lester	Kathryn Young

## 1990 Geology Graduates

### Bachelor of Arts:

Bush, Francois Andrew  
Glantz, Jeffrey Adam  
Kellam, Lusius James IV  
McCollom, Thomas M.  
Miller, Albert James IV  
Snow, David Earl  
Spaid, Albert Theodore III  
Thomas, William John (cum laude)  
Whitehead, Scott Michael  
Williams, Mark Dennis  
Young, James David (magna cum laude)

### Master of Sciences/ Thesis Title:

#### Aslan, Andres

Paleotopographic controls on hydromorphic paleosol development in the Willwood Formation, Bighorn Basin, Wyoming

#### Boylan, John A., Jr.

Zeolites: Using cation exchange to decrease permeability, with applications to waste management

#### Doi, Kentaro

Geology, and paleontology of two primate families of the Raven Ridge, northwestern Colorado and northeastern Utah

#### Doyle, Thomas A.

The environmental stability of copper smelter flue-dust treated by the Cashman Process

#### Garfield, Timothy R.

Reservoir geology of the upper Phosphoria Formation (Permian), Little Sand Draw Field, Big Horn Basin, Wyoming

#### Kirk, Lisa M. Bithell

Hydrogeochemical exploration for strata-bound CU-PB-ZN ore deposits Mt. Gunson area, Stuart Shelf, South Australia

#### McMillan, Mary Elizabeth

Soil development on a Pinedale moraine and erosion ten years after a burn, Rocky Mountain National Park, Colorado

#### Miller, Daniel C.

Soil Catena variation along an alpine climatic transect, northern Peruvian Andes

#### Santos, Hernan

The stratigraphy, paleoenvironments, and biofacies of the Cotui limestone: Cretaceous of southwestern Puerto Rico.

#### Smith, Henrietta Mercer

Deformation of synthetic olivine single crystal studies of flow law, dislocation development and recovery

#### Taranik, Dan Lee

Remote detection and mapping of supergene iron oxides in the Cripple Creek mining district, Colorado

### Wold, Christopher Ned

Fit and initial opening of the continents around the Atlantic Ocean from early Jurassic to early Cretaceous

### Doctor of Philosophy:

#### Berry, Margaret Elaine

Soil-geomorphic analysis of Late-Quaternary glaciation and faulting, eastern escarpment of the central Sierra Nevada, California

#### Deen, Jeffrey Alex

Hydrothermal ore deposition related to high-level igneous activity: A stable-isotopic study of the Julcani mining district, Peru

#### Evanoff, Emmett

Late Eocene and early Oligocene paleoclimates as indicated by the sedimentology and nonmarine gastropods of the White River Formation near Douglas, Wyoming

#### Fleming, Robert Farley

Palynology of the Cretaceous-Tertiary boundary interval and paleocene part of the Raton Formation, Colorado and New Mexico

#### Groul, Marilyn Ann

Fracture history of the southern Piceance Basin and tectonic development of intrabasin folds, northeastern Colorado plateau, Colorado

#### Kazi, Wallid M.

Velocity changes in the central Aleutian Island determined from the analysis of earthquake doublets using cross spectral analysis method

#### Kirkland, James Ian

The paleontology and paleoenvironments of the Middle Cretaceous (Late Cenomanian—Middle Turonian) Greenhorn Cyclothem at Black Mesa, northeastern Arizona

#### Patterson, Penny Ellen

Differentiation between the effects of diagenesis and pedogenesis in the origin of color banding in the Wind River Formation (lower Eocene), Wind River Basin, Wyoming

#### Tegtmeyer, Kathryn Jane

Origin of Tertiary peralkaline rhyolites in the Great Basin, western United States: A Nd and Sr isotopic study of the McDermitt, Black Mountain and Silent Canyon Volcanic Centers

#### Thornburg, Janet M. Bauder

Petrography and sedimentology of a Phosphatic shelf deposit: The Permian Sheddorn sandstone and associated rocks in southwest Montana and Northwest Yellowstone National Park

#### Waythomas, Christopher F.

Quaternary geology and Late-Quaternary environments of the Holitna Lowland, and Chuilnuk—Klokuk Mountains Region, interior southwestern Alaska

## Rodbell Wins GSA 10 K Race

A 10 km footrace along the streets of various cities is an early morning event at recent GSA meetings. Many present and former students and faculty have taken part in this event, including people such as Julie Brigham-Grette, Bill Locke, Warren Dickinson, John Chronic, and Pete Birkeland. We have had some good runners in the department, so it was only a matter of time before one of them won the race. At the Denver GSA in 1988, Chris Waythomas came away with 2nd place. However, at the



Ed, Don and Mark (l to r) running through the quad.

1990 GSA in Dallas Don Rodbell ran away from the field with a 35-minute winning time. Training under the eye of Ed Larson and being paced by Mark Bishop, office accountant, really paid off (see photo)!



## A Quick Trip to Pakistan

by Andres Aslan

At the beginning of this year I went to Pakistan for two weeks to participate in a paleontologic and sedimentologic study of the plate collision between Eurasia and the Indian subcontinent. This project is part of an ongoing collaborative effort between Howard University, Washington, D.C., and the Geological Survey of Pakistan to study the Cenozoic history of northern Pakistan.

I arrived in Islamabad, the nation's capital, on December 31, 1990 along with Hans Thewissen, a postdoctoral student from Duke University. From the airport, we drove through ancient Rawalpindi, the sister city of Islamabad. The scenes in Rawalpindi are typical of life in this Muslim nation: throngs of people creating a constant din, narrow streets, numerous mosques, and bazaars with vendors squatting beside their goods. It was amusing to see a tire in the middle of the street, which advertised the nearby presence of a local tire merchant.

Normally, visiting scientists have to drink gallons of chai (tea) with government officials before they can begin their research, but our project chief had miraculously arranged for us to venture into the field on a week-long reconnaissance the day after we arrived in Islamabad. We headed for the Kala Chitta Hills on the Potwar Plateau with a paleontologist, two Pakistani geologists, and myself. The rugged hills and broad flat plains of the Potwar Plateau are reminiscent of northern New Mexico and are indeed beautiful. At night, we stayed in Attock, three hours west of Rawalpindi. Each work day began with the call to Mecca. At approximately 5 a.m., the mullahs (religious leaders) of each mosque, which were fully equipped with outdoor loudspeakers, led their respective congregations in prayer. Each mosque, of course, attempts to be louder than its neighbor, which results in a sound that is far more effective than any alarm clock. Once awake, we were soon eating eggs and toast and drinking chai. After breakfast, we made haste for the outcrops but more often than not our Pakistani geologists, Arif and Raza, would inexplicably stop at a village or roadside hut. As soon as we

disembarked from the car we were surrounded by curious men who stood and stared at us. I guess we were quite a spectacle with our western-style clothes and backpacks. Although few Pakistanis spoke more than a word or two of English, they treated us royally and would always provide us with chai. Everyone we met was extraordinarily friendly but as the United Nations deadline of January 15th drew nearer, we were constantly asked why President Bush wanted to fight Iraq. Most of the Muslims we met in the hill country supported Saddam Hussein. On the other hand, I had an army officer tell me that the people would only support Hussein if the gasoline prices did not rise. The importance of this is seen in the average salary of a Pakistani man, which is about \$300 a year.

By the time we finally arrived at our destination, it would be near lunch time. Lunch was interesting. Arif had been to America several years ago and he told us that he had made some "burgers" for lunch. "Burgers" turned out to be eggs surrounded by greasy chapati bread which, in turn, was wrapped in newspaper. I could never quite get all the print off my "burger."

After several days of reconnaissance work, we returned to Islamabad to pick up another geologist at the airport. We never should have left the field. On January 7th, the American Embassy announced that all Americans should either leave Pakistan or confine themselves to Islamabad. We visited the embassy and everyone there seemed to be in a panic. We stayed in Islamabad for a week, hoping to get permission to resume our work, but eventually the Pakistani Geological Survey decided to suspend our work. We were left with no alternative but to return to the U.S. on January 14th.

In hindsight, I think our departure was for the best, but at the time, we had not experienced any problems nor had there been any protests. Needless to say, we were disappointed to leave, but assuming all goes well, I plan on returning to Pakistan next winter.



# Earthquakes, Fire and Ice in Southern South America

by Bill Manley

**A**t 3:15 p.m. on a Sunday afternoon, May 22, 1960, nearly 1000 km of coastline in south-central Chile experienced the largest earthquake of this century. Twenty meters of sudden slip across the interface between the subducting Nazca plate and the overriding South American plate created a shock of moment magnitude 9.5. During 4 minutes of severe groundshaking, humans and animals could not remain standing and many buildings collapsed. Within 30 minutes, the first wave of an earthquake-generated tsunami with a height of 5 to 10 m wreaked havoc on low-lying coastal towns. All-in-all, \$400 million in damages were incurred, thousands of people were injured, and at least 1500 people were killed. As a Master's student in the department, my objective during a field study at 39° S latitude in early 1989 was to determine if that earthquake, and previous great earthquakes in the region, left a record of their occurrence within the sediments and soils of tidal wetlands and coastal lowlands. If successful, the research could be used to help forecast similar great earthquakes in other subduction zones worldwide.

For Seattle and Portland, such forecasting is more than of academic interest. Studies within the last five years have suggested that the Cascadia subduction zone along the coasts of Washington and Oregon is storing strain, which could be released during a magnitude 8 or 9 earthquake. In an area not accustomed to moderate or large earthquakes and without building codes appropriate for seismic hazard, such a quake would be devastating. Previously, researchers noted the lack of historic seismicity and concluded that subduction had ended or

was occurring aseismically. Recently, however, some studies have suggested that a great earthquake struck the area in the 1690s, just before the arrival of white settlers and historical documentation.

In coastal Washington and Oregon, Brian Atwater and Alan Nelson of the U.S.G.S., David Yamaguchi of INSTAAR, and others have described the peaty soils of coastal salt marshes and lowland forests, buried beneath massive estuarine mud, that provide the first geologic evidence that great earthquakes have probably shaken the Pacific Northwest during the late Holocene. These dark brown organic layers, exposed at low tides and in cores, inspired a program for deciphering the earthquake history of active coasts. This recently expanded facet to paleoseismology relies primarily on two observations: 1) salt marsh peats develop (accumulate on the surface of a tidal wetland) within a very restricted portion of the intertidal range close to mean sea level, and 2) coastlines often subside during great mega-thrust earthquakes by as much as 1–2 m. Theoretically then, a large subduction zone quake might be recorded in protected estuaries where salt marsh peats and nearby lowland soils are down-dropped below mean sea-level and quickly buried by lower tidal or subtidal silt and clay. In association with a project led by the U.S. Geological Survey, I looked for such a record within the zone of coseismic subsidence of the great 1960 Chile earthquake.

Along the protected margins of two estuaries and a coastal lagoon north of Valdivia, Chile, the 1960 soil (the soil that apparently demarcates the 1960 lowland surface) is overlain by thin

intertidal sediments, and provides a modern analog for the processes theorized for "salt marsh paleoseismology." By poking holes in the salt marshes at low tide, ably assisted by a local geography student, I was able to follow the A horizons of river terraces and previously emergent estuarine benches that were abruptly buried beneath either tsunami-deposited sand or muds and muddy peats. Most of the surfaces that dropped below mean sea level during the 1960 event had been cultivated lowlands, but, in a few places, a buried peat deposit testifies to the drowning of a fringing salt marsh.

However, the salt marsh and lowland stratigraphy of these areas is clearly an incomplete record of past great earthquakes. Great earthquakes (magnitude 8 or larger) that probably produced significant coastal subsidence also struck south-central Chile in A.D. 1575, 1737, and 1837, and events as unusually large as the 1960 quake probably recur at least every 500 to 700 years. Yet, the only salt marsh or lowland soils that I could find buried beneath the 1960 soil are much older—with radiocarbon ages of 1,600 and 6,600 yr BP. Furthermore, these pre-1960 buried soils are spatially very limited, preserved in a few places where tidal wetlands originally formed fringing marshes and where river or estuarine processes did not later erode them. Within the cores, apparent unconformities suggest that the land surface, on average, has remained close to sea level during the late Holocene, and that uplift between great earthquakes has prevented the net submergence that would preserve a continuous record.

But wading through soft mud and pungent peat for three months was not the only thing I did while in South America. For just over two months, I traversed over seven degrees of longitude and 22 of latitude, soaking in as much as

possible of the local culture, language, and landscape. From the friendly, hard-working people of the Chilean lake district, to the big-city bustle of Santiago, to the vast expanses of Argentine pampa and towns folk strapped by 1000% inflation, to political discussions with young travellers from around the globe, my eyes were greatly opened.

In addition, I sought out some of the geologic wonders of Chile and southern Argentina. For example, during three days and four nights I travelled aboard a freight liner through the Straits of Magellan, where glaciers touch the sea and entire ranges remain unvisited. Draining a portion of the southern Patagonia ice cap on the other side of the Andes, 100 km to the east, the Moreno glacier calves into Lago Argentino; about once every four years, its glacial advance blocks an arm of the lake to the point where the ice dam, impounding a temporarily-raised lake, catastrophically fails, sending an outburst of bergs and rolling water into the other arm. From more than 17 km away, you can hear the pounding surge of eruption from Volcan Navidad, born on Christmas Day, 1988, where at night red-hot bombs could be seen hurtled into the air to land and roll down the sides of the near-perfectly shaped cone (see photo). And at Volcan Villarrica, culminating a hike and snow climb using ice axe and crampons, one can see frothing, red-hot magma churning within a vent inset into the summit crater, 40 m below.

I didn't feel an earthquake while in Chile and Argentina, but I did speak with people who survived the great earthquake and tsunami of 1960. I can only hope that besides the great personal experience I gained, I helped to better our understanding of when and where similarly destructive earthquakes might occur, in the future.



Volcan Navidad, four months after its explosive birth, emitting ash and lapilli, with small bombs in the foreground.

## Survival and Recovery in Germany

by Peter Harries

**I** was fortunate enough to receive a Fulbright Scholarship for the 1990–1991 academic year to come to Germany and continue my study over patterns of survival and recovery of marine macro-invertebrates following the Cenomanian-Turonian (lower Upper Cretaceous) mass extinction. In some ways Germany offers an interesting perspective from which to study this problem because as a nation they were almost extinct, but in the past 45 years they have managed to survive and undergo a pronounced economic and, in the last year, national recovery. I am based at the Institut für Paläontologie und historische Geologie in München, working with Prof. Dietrich Herm.

The initial struggle was to get myself adjusted to the German way of life and the language. Fortunately, the Fulbright commission arranges a language course for people coming to Germany, and, after six weeks of intensive German, the German that I had learned as a child while living here slowly came back to me. The course also was a chance to get to know other Fulbright students from a wide range of different fields and regions. The course was held in Kiel, in extreme northern Germany, and it was a chance to see how the Fish Heads (northern Germans, esp. those who live near the North and Baltic Seas) as opposed to the Weisswürste (southern Germans especially Bavarians who subsist on veal sausages that can only be eaten before noon) live—the rivalry is almost as big as CO vs. TX, but without the Tomato War. On arriving in Munich, the biggest hassle was to find a suitable place to live. After three weeks of frantically searching I found two rooms in

a house located about 40 miles outside Munich, but right on the commuter line and near a pretty monastery/brewery named Andechs.

My research up to now has been primarily focused on examining collections in Germany, utilizing the incredibly good paleontological library here (which contains many old and important works and where books and journals can be checked out indefinitely). If the weather improves, I hope to get out into the field. In the next few weeks, I plan to collect material from a few sections from Regensburg and in the Alps and hopefully make arrangements to go to the "ehemalige DDR," NW Germany, Switzerland, and England to look at some of their collections and sections as well. In addition, I will be giving a talk at a conference in Grenoble at the end of May, which could possibly be combined with a trip to Spain with the people from here.

In addition to my geologic work, the Fulbright people stressed that we should attempt to learn about the culture. In Bavaria, this is certainly often related to beer, where there is a law that one is allowed to, or practically should, drink a half liter of beer with lunch. To this end, beer is delivered weekly to the institute and it gives me a chance to sample the various products. My favorite, to this point, is Erding Stiftungs Weizen (a beer made from wheat). Munich also contains an incredible wealth of art galleries, science museums, and music.

All in all, my experience to this point has been scientifically inspiring and culturally exciting. I just hope that spring soon starts so that I can pull some rocks out of the ground.



# Research in Crustal Strain by Geological Science Graduate Students

by Michael Jackson

Numerous students pursuing graduate degrees through the Department of Geological Sciences are funded to work in solid earth geophysics through CIRES. One group of students, advised primarily by Roger Bilham and Max Wyss, concentrate on space geodetic techniques, predominantly the Global Positioning System (GPS), to measure crustal strain across major plate tectonic boundaries.

The GPS system is based on the transmission of radio frequency signals from a constellation of approximately 15 satellites, and the reception of these signals at portable receivers deployed across a plate boundary. Using the time delay of the signal between the satellite and receiver, and the simultaneous measurement of these signals at each station, the baseline distance between stations can be calculated to less than 1 cm in the horizontal and a few centimeters

in the vertical over baselines exceeding 500 km. Reoccupation of these stations after a few years, and calculation of the net change in the baselines provides a measure of the magnitude and direction of plate tectonic motion, and the partitioning of strain across the tectonic boundary.

The overall goal of the research is to apply surface geodetic techniques to model deformation at depth near a fault zone, to better understand the geodetic manifestations resulting from large earthquakes, and to eventually use geodetic techniques to help forecast impending earthquakes. The following is a brief description of the students and the work:

**Jeff Behr** (MS Geology) concentrates his efforts on the use of digital creep meters to determine pre-, postseismic and aseismic creep

on the San Andreas and subsidiary faults in California. In addition to processing and interpreting the creep data, Jeff maintains a network of over 15 California creep and strain meters. One of these is a tiltmeter located in Mammoth Lakes, California, that monitors the inflation of the resurgent magmatic dome in the Long Valley Caldera. In addition, Jeff has participated in an international GPS project in Tonga, Fiji, and Vanuatu in the South Pacific. Jeff was instrumental in the rapid response and installation of a creep meter only two days after the 1989 Loma Prieta earthquake in northern California.

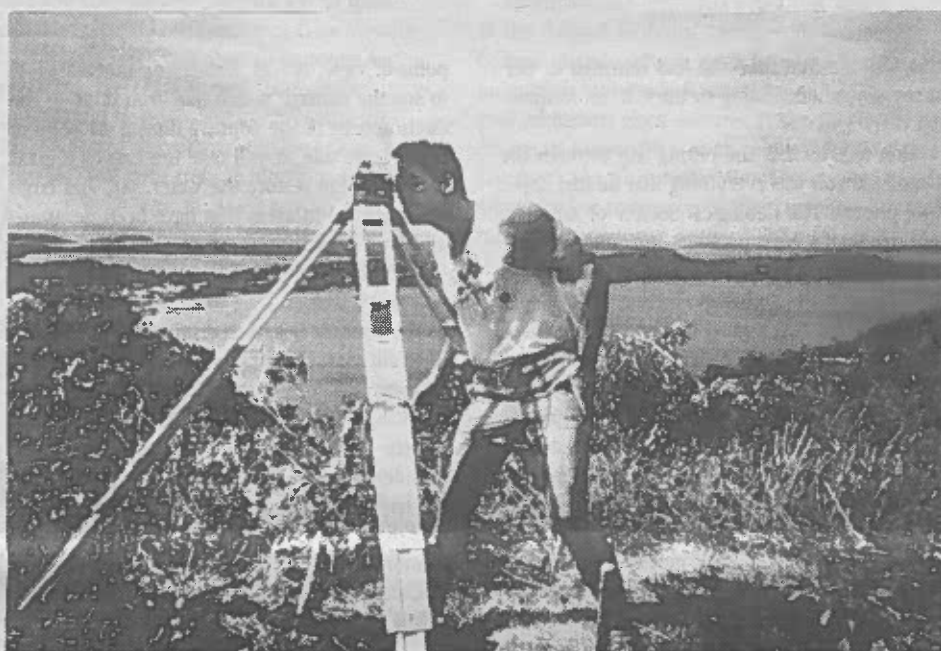
**Paul Bodin** (Ph.D. Geophysics) is working on earthquake prediction through an understanding of seismology and near-fault crustal strain. Paul has most recently become interested in space geodetic techniques as a means of monitoring crustal deformation and precisely locating seismic stations. Paul is co-author of an NSF proposal to monitor crustal deformation resulting from large subduction earthquakes off the western coast of Mexico. Along with Jeff Behr, Paul was featured in a University of Colorado Public Relations Video on the CU response to the Loma Prieta Earthquake.

**Christine Hackman** (Ph.D. Physics) studies crustal deformation in Iceland using boundary element modeling and GPS surveying, which are used to model how the geometry of tectonic structures relates to the current deformation in Iceland. The GPS measurements provide Christine with information on the magnitude and direction of deformation in Iceland.

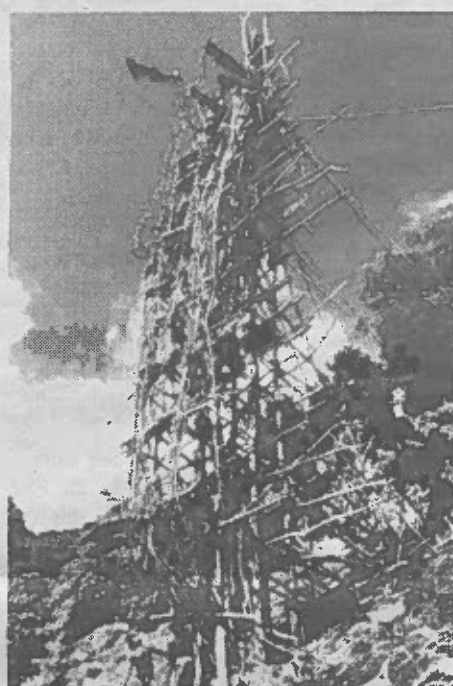
**Michael Jackson** (Ph.D. Geophysics) is interested in determining the variation in strain history over time at major plate tectonic boundaries using a combination of GPS data and offset and deformation of Quaternary landforms. Mike is the co-investigator on a recently submitted NSF proposal to install creep meters, study segmentation, and perform strain measurements using GPS on the Xianshuihe fault zone in China. Mike also has managed GPS projects in the South Pacific (see photo),

Indonesia, South America, and Ethiopia, and will be doing reconnaissance work for upcoming measurements in Nepal and northern India in the Spring of 1991. In addition, he is one of the first investigators to apply rapid kinematic GPS methods to crustal strain studies.

**Freysteinn Sigmundsson** (Ph.D. Geophysics) is originally from Iceland, so it is not unusual that his research concentrates on the initiation and propagation of oceanic and continental rift systems. He has been instrumental in the organization and deployment of two GPS field campaigns in Iceland. Freysteinn has also studied the rheology of rift zones and has estimated the asthenosphere viscosity in Iceland from post-glacial rebound. His current research focuses on the rifting process in Ethiopia.



Michael Jackson doing some GPS measurements in Vanuatu, South Pacific. Tough duty, Mike. As this newsletter is being written, Mike is trudging through Nepal with this instrument.



For excitement in Vanuatu, people try the original Bungie Cord. Send money to the newsletter so we can get a ride (drop?) for Mike!

## The Role of Geology in Development

by Michael Kozuch, Peace Corps Volunteer Geologist in Honduras, 1987-1990

When living in a country with as many economic and social problems as Honduras and when most Peace Corps volunteers (PCVs) are directly involved with addressing those needs at a grass roots level, the question often came to mind what Honduras was doing with a Peace Corps geology program? And I am sure that many PCVs wondered what a geologist was doing roving all over the country with a host agency vehicle at his disposal in a seemingly cushy job.

To understand why the Peace Corps is involved with such a specialized profession one needs to know how geology fits into the role of development and how it might address some of the immediate needs of the country. During the past year I have come up with some ideas that might help to resolve in my own mind what role a very specialized professional might play in the development picture.

There are several main tasks of a PCV geologist. For a number of years the Peace Corps has been involved in an ongoing geologic mapping program with two Honduran agencies that provide a valuable inventory of nonrenewable resources of the country—namely rocks and minerals. Oil and gas are not included because these projects are far in the future. Another purpose that the geology program serves is to train Honduran technicians and geologists both in and out of the field. This latter effort is perhaps the least effective aspect of the program due to the lack of educational background of the counterparts in this profession and the turnover of personnel after each election. The PCV geologist may also act as an intermediary

in setting up international contacts for local geologists that are searching for assistance in their respective fields of interest.

The importance of high quality geologic mapping cannot be overemphasized and the role of mapping in development work can be crucial. The information contained on a geologic map is essential for many host country agencies when planning their own projects which may include: assessing groundwater source areas for wells, locating and designing roads and highways in potential landslide areas, assessing potential mineral or energy localities and locating adequate dam sites (of any scale) which can be used for hydroelectric

power or as irrigation reservoirs. Some recent examples where geologic information has had direct long term and short term impacts on human needs in Honduras include:

1) One community conceived a project to build a \$15,000 dam to store water in the reservoir for irrigation. Upon consulting the geologic maps and performing soils tests we found the site selection to be hazardous to the community downstream because of the presence of faults, evidence of past landslide activity and the high permeability of the rock type. Redesign of the dam to account for the poor site selection factors escalated the cost to

a prohibitive \$100,000 or more and the project was cancelled.

2) A small community of just three families had experienced high infant mortality rates and many birth defects for several decades. After studying the geology and performing soils tests, we found that toxic concentrations of mercury from a localized mineralization zone had permeated the surrounding water table thus contaminating well water, streams and corn crops.

3) Several landslide studies have been completed during the last year in the Tegucigalpa

*Continued on page 6*

## Paleobiology Graduates Win Awards

Graduate students in the Paleobiology Program won several prestigious awards and scholarships during 1990, reflecting both on the quality of the program and its student body.

Peter Harries was awarded a Fulbright Fellowship for one year to continue thesis research at the Universität München, Germany with Prof. Dietrich Herm. This is the third Fulbright awarded to paleobiology students during the last few years. Bradley B. Sageman spent 1988 at the Universität Tübingen in Germany on a Fulbright Fellowship, and Claudia C. Johnson was awarded a Fulbright Fellowship for work in Peru in 1984-1985, which she declined to become Professora de Geologia at the University of Puerto Rico.

Barbara Mieras and Claudia Johnson were awarded prestigious fellowships from the American Association of University Women in 1990 for their thesis research on the Depositional History of the Cretaceous Frontier Formation in Wyoming, and on The Evolution and Biogeographic History of Cretaceous Reef Ecosystems in the Caribbean Province, respectively. Claudia also received a research award from the Paleontological Society in 1989-1990.

Brad Sageman, whose thesis on "New Depositional and Biofacies Models for Mesozoic Black Shales" will be completed in the Spring of 1991, has been awarded a one-year postdoctoral fellowship at Pennsylvania State University to work with Professor Michael Arthur, one of

the world's foremost faculty of Northwestern University, as assistant professor.

William W. Little received the first SEPM fellowship for research in fluvial systems, as well as a graduate fellowship from the University of Colorado.

Graduate student research award from the Geological Society of America was granted to Claudia Johnson. University of Colorado Dean's Small Grant Awards for graduate research were presented to Tomas Villamil, Claudia Johnson, Debra Krumm, and Bill Little.

We are proud of these graduate students. Their achievements are the stuff that makes the paleobiology program at Colorado one of the strongest in the country.



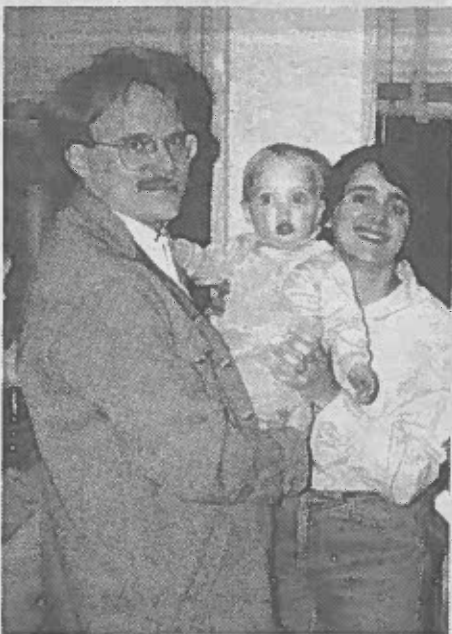
# FACULTY NEWS

## Paul Weimer

Paul Weimer has settled into an office, is teaching courses and continuing his research. Last fall he taught Petroleum Geology, and this spring he is teaching two sections of Historical Geology. Next fall he will be offering a course in his specialty, Seismic Stratigraphy and Basin Analysis.

His principal areas of research are in seismic and sequence stratigraphy, basin analysis, and their applications to petroleum exploration and development. Paul concentrates on detailed studies of the seismic facies and lithostratigraphy of various depositional settings within a sequence stratigraphic framework. Recently, his main interest has been in deep-water siliciclastic depositional systems in the Gulf of Mexico and other areas, although he has done work in generally all depositional settings in 30 basins worldwide. Roy Kliffeld and he are working feverishly to assemble an interpretation workstation for doing integrated sequence stratigraphic and structural studies. They hope to have the station up and working by this summer. Halliburton Geophysical has donated approximately \$1.2 million in multifold seismic data from the northern Gulf of Mexico that will be their initial study area. The area is the most active petroleum exploration area currently in the U.S. with production primarily in turbidite reservoirs deposited in intraslope basins in water depths of 200 to 1000 m. Eventually they hope to expand into other basins worldwide. In time, he plans to expand to include outcrop studies and aerial photography in regional basin studies, and studies involving shallow-penetration, high-resolution seismic data. He is also working on the relationship of tectonics and sedimentation in foldbelts (with Roy Kliffeld) and in studying the growth stratigraphy associated with such features.

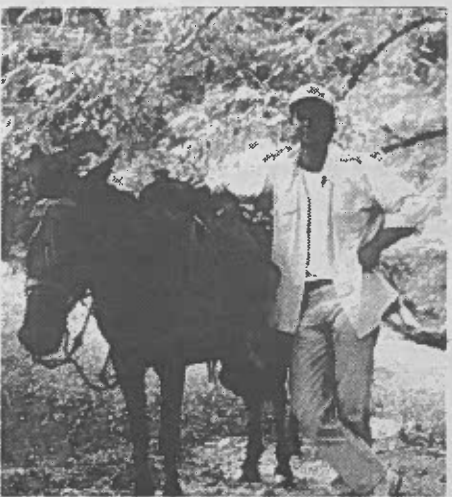
Paul is also busy on with committee work. He is Technical Program Chairman for the 1991 AAPG/SEPM national meeting in Dallas this



Paul Weimer, son Louis, and wife Laurie Lamar, at the Christmas party.

## ...The Role of Geology

area. The assessment of high risk areas has enabled cooperative developers to take the necessary steps to minimize the risk to the out-



M. Kozuch and his field vehicle during field work in the rainforests of eastern Honduras.

Spring. At the meeting he will co-chair a symposium entitled "Variations in depositional systems within a sequence stratigraphic framework; applications to exploration," and will be a co-editor of the resulting AAPG Memoir. He also is on the Technical Program Committee for the December, 1990, and June, 1991 meetings of the Gulf Coast Section SEPM Annual Research Conference. You can find him presenting posters at these meetings. Finally, he serves on the Editorial Board of Geo-Marine Letters.

He already has a good list of publications. One on the Mississippi fan is in a recent AAPG Bulletin (v. 74, p. 425-453). As co-editor, he has returned page proofs to Springer-Verlag for a 450-page volume entitled "Seismic Facies and Sedimentary Processes of Submarine Fans and Turbidite Systems." Look for four papers by Paul in this volume.

It is good to have Paul in the Department, and to see his program off and running (see photo).

## Don Runnells

The first part of Don's year was filled with worry about the possibility of becoming Chair, and the second part was filled with the task of learning how to be Chair. You can read a message from Don on the "State of the Department" elsewhere in the Newsletter.

In terms of teaching duties, Don continued to teach two courses and a seminar in low-temperature geochemistry, as well as serving as principal advisor for six graduate students. Don had research grants from the National Park Service to study the chemistry of ground water in Yellowstone Park (with graduate student Mary Siders), from the Electric Power Research Institute to study redox chemical reactions in ground water (graduate student Chuck Patterson) and electrochemical methods for removing contaminants from ground water (graduate student David Walker). A new research grant, in association with Dr. John Drexler, was obtained from the Environmental Protection Agency to study the forms of lead in solid wastes from mining and milling in Leadville, Colorado; this grant will support one graduate student, Maria Montour.

Don had four technical publications during the year, all dealing with some aspect of oxidation-reduction chemistry in ground water.

The high points of Don's year were a rafting trip through the Grand Canyon in late April, arranged by the Geological Society of America, and a trip to Germany and Czechoslovakia in late August to attend the international meeting of the Association of Exploration Geochemists. Don's companion on the float trip through the Grand Canyon was his son, Tim, who is a major in geology and hydrology at Utah State University. Don's wife, Erika, accompanied him on the trip to Europe. Erika was born and raised in Germany during World War II, and

lying marginal communities. One such study, however, was overlooked by political decision makers and this resulted in the evacuation of 300 homes of low income families after heavy rainfall triggered a massive landslide.

These are just a few examples of the many ways in which geologic information affects communities. Information obtained from good maps can expose risks, lead to small business development (e.g. quarrying), and provide resources for development.

In summary, it is clear that development work comes in many forms. It may be as individual as doing research and creating a "database" for other projects, it may be working with peasant farmers, or it may be addressing groups of people and sharing information which otherwise may not be available to them. In any case, after hiking or driving over most of the 500 square kilometers per quadrangle that I mapped, and trying to fit my atypical Peace Corps experience into the development picture, it all seemed worth it (see photo).

## John Andrews

1990 has been a full year for John Andrews, including his last semester as Chair of the Department. Much of the last year was spent on the seven year "Program Review." This was a very useful and critical exercise for the Department and it served to highlight many of the gains we have made in the last decade, as well as point out several areas where we need to develop better strategies. The latter include such important topics as: more flexibility in our undergraduate major curriculum, and a well thought out plan for replacement hires.

On the trips/research side he thoroughly enjoyed a visit to Tromso, Norway, in April, 1990 for the 20th Arctic Workshop. Tromso is a beautiful small city at about 70° N. latitude. The meeting was enjoyable and the scenery in and around Tromso is spectacular.

During the summer Martha and John were able to take advantage of two meetings at opposite ends of Europe. In June she attended the Polar Information Colloquy in northern Finland. After that he joined her; they both lectured at Oulu University, and then vacationed

through Finland, Poland, Hungary, France, England; then to Erice, Sicily, for work, where he was involved in a NATO Advanced Workshop on Glacial Isostasy and Earth Rheology.

John was excused from teaching in the Fall 1990 semester so that he could organize two new courses and get back into research. Although currently funded through NSF and ONR, much of this will end this next year. Future research will, hopefully, be involved in two major activities. The first is a two- to three-year joint effort with Woods Hole and the Bedford Institute of Oceanography on the sediment flux from the East Greenland ice margin to the deep sea. The second effort will be part of NSF's Arctic System Science paleoclimate program, one part of which is the Greenland Ice Sheet program and the other is Paleoclimate of Arctic Lakes and Estuaries. The latter project owes much of its development to activities of INSTAAR and Geological Sciences on this Campus, as well as leadership from other arctic research centers (such as U. Washington, etc.).

this was the first time she had returned to Germany since immigrating to the U.S. more than 30 years ago.

Don tells us that the rafting trip through the Grand Canyon was everything that he had hoped (see photo). The Geological Society of America put together a great package, including experienced guides in archeology, botany, biology, history, as well as geology. Having his geologist son with him was a great bonus. Unfortunately, seven days on the river simply went too fast.

The other major trip, to Germany and Czechoslovakia, was equally interesting. At the meeting in Prague, Don was installed as President of the Association of Exploration Geochemists for 1990-1991. A highlight of the meeting was a geologic field trip through Bohemia (western Czechoslovakia), guided by people from the Czech Geological Survey. From a geochemical

point of view, it was particularly interesting to see the damage which has been done to the environment of the country during 40 years of communist rule; it will take the Czechs a great many years to restore the water, air, and large areas of land in areas that have been devastated and polluted during the rush to industrialization. From the point of view of history and politics, it was exciting to be in Czechoslovakia as the country began to dismantle the structure of totalitarian communism. The Czechs are full of hope and enthusiasm, but they have a daunting task ahead of them to build a new society. Their hopes rest with their remarkable president, Vaclav Havel. Another highlight of the trip was to see a Russian tank dumped on its side in the central square of Prague to commemorate the 22nd anniversary of the invasion of Czechoslovakia by the Red Army (see photo).



View of the Colorado River in the bottom of the Grand Canyon. A raft is visible on the sand bar. (Photo by Al Fagerstrom.)



Don Runnells and children enjoying a graffiti-covered Russian tank in Wenceslaus Square in Prague.



## Erle G. Kauffman

Erle will be awarded the R. C. Moore Medal from the Society for Sedimentary Geology (SEPM) at the annual Awards Dinner of SEPM and AAPG on April 8, 1991, in Dallas, Texas. The R. C. Moore Medal is awarded annually by the SEPM for "Excellence in Paleontology." This medal is traditionally presented to scientists whose research has been characterized by the application of paleobiological research to geological problem solving, the development of relevant new concepts, and whose work is strongly interdisciplinary. Kauffman's most notable contributions in these fields have been in the development of new concepts and methods of biostratigraphy, high-resolution event stratigraphy and graphic correlation, the application of stratigraphy and graphic correlation, and the application of these powerful correlation tools to basin analysis and the evolution of global ecosystems. Erle's work has been centered in the Western Interior Cretaceous Basin of North America, the Caribbean Province, Central and South America, and Europe. His published work also encompasses molluscan paleobiology, functional morphology, evolutionary rates and patterns and their regulating mechanisms, and theories and tests for global mass extinctions. Dr. Steven Stanley of Case Western Reserve University will be the Citationist for this award; the citation, and Kauffman's response will be published by the SEPM in 1991. Kauffman also shared the Best Paper Award in 1982 with J. R. Steidtmann, University of Wyoming, for their article "Are These the Oldest Metazoan Trace Fossils" in the Journal of Paleontology.

## Former Faculty

John Chronic writes from Houston, Texas, that in his copious free time he managed to get to China twice and to help with the article whose title is: "Late Carboniferous to Permian Sedimentation in Inner Mongolia, China, and Tectonic Relationships Between North China and Siberia." He is a zoo and museum docent in Houston, and Chairman of the Academic Liaison Committee of the Houston Geological Society. His househusbanding duties help to keep him out of mischief, as he and Carol have both a local zoo and botanical garden in and

This is Erle's second major award in four years. In 1987 he was awarded an honorary Doctoral Degree (Doktor der Naturwissenschaften ehrenhalber) from the George-August-Universität Göttingen in Germany, one of Europe's oldest Universities, for his work in paleobiology, biostratigraphy, event stratigraphy, and extinction theory.

Erle is on the road again as a distinguished lecturer. He has been selected as the 1991 Distinguished Lecturer of the American Association of Petroleum Geologists (AAPG). This is his fifth distinguished lecture tour, and second for the AAPG. Kauffman toured twice for the American Geological Institute between 1962-1964, did his first AAPG tour in 1984-1985, and was a Fulbright Fellow and touring lecturer in Australia during 1986. This two-week tour will begin in late March in northwestern and western North America, and will involve two additional weeks in the Fall. He will offer two featured lectures: (1) 250 Million Years of Mass Extinction, from Dinosaurs to Man; and (2) The Biological Evolution of Cretaceous Reef Porosity in the Caribbean Province; Implications for Exploration.

Kauffman was further selected this year as the Osgood Memorial Lecturer at Wooster College in Ohio, where he delivered a lecture on ancient and modern mass extinctions. He gave additional guest lectures at several North American Universities, at the Universität Tübingen and Universität München in Germany, and at numerous energy company research laboratories during 1990.

around their house. He says to tell his former colleagues that the new emphasis on field work in the Department is to be highly commended, and thanks to the former students for financing it. He is trying to sell geology there in an environment in which geology is thought of as the lowest form of science in the local schools, to be taken by the throwbacks and misfits rather than the best students. Little do the local students realize that, in the words of Ralph Langenheim, former student at CU, it is "the highest calling."

of The Valley Museum of Northwest Art, while Dede is full time in his art studio. He invites all of us to stop by for a visit (and buy some art?). See photos for examples.



Dede's rendition of a 'Geologist's Boot' (after several seasons).



This one is 'Tethys', a photolithograph that combines mythology (Tethys), geology (field trip crew and maps), and Seuss himself!

# An Earthquake Prediction Test

by Max Wyss and co-workers

During the last year some interesting developments occurred near Parkfield on the San Andreas fault. Changes of four parameters can be interpreted as precursors to a moderate magnitude earthquake. These changes are: (1) A reduction by about 50 % in the rate of earthquakes occurring, (2) a decrease of the crustal deformation rate as measured by a two-color laser, (3) an increase of the mean hypocentral depth of the background seismicity, and (4) a pattern of decrease followed by a return to normal of the mean magnitude of earthquakes.

All of these patterns have been documented to have occurred before some other mainshocks and each has been proposed as a precursor, an anomaly usually followed by a mainshock. However, we have little experience with predicting earthquakes based on these patterns. This is why the opportunity at Parkfield to test some of our hypothesis is very welcome. Before earthquake predictions can be made more frequently than just occasionally we must test our hypotheses about precursors. However, large earthquakes happen seldom and almost never where we are ready with equipment to measure the physical changes that may precede them. Now at Parkfield we have measured four different changes, defined what we suppose to be the background value for these parameters and quantitatively estimated the amount and statistical significance of the departures from normal. Then we stated what pattern we expect for these parameters, based on other case histories, and we predicted that the next  $M = 6 \pm 0.5$  Parkfield earthquake should

occur within one year of March 1991. So the test is on. We hope that the events in the next few months will support our hypotheses.

We are not the first to suggest that the Parkfield segment of the San Andreas fault is likely to re-rupture. Based on the relatively regular recurrence of these events (every  $22 \pm 6.4$  years), other workers have expected the next Parkfield earthquake in 1988. The contribution we made with our work is that we reported the first, and up to now only, precursory changes and that we narrowed the uncertainty of the occurrence time to  $\pm 1$  year.

A physical model that would explain all the observed changes, and their connection to the expected mainshock is still lacking. Part of the reason for this is that we are still working at establishing firmly what kind of precursors really exist. Before we know the answer to this question we do not really know what phenomena must be explained by a physical model. Up to now we have most confidence in the pattern of seismic quiescence as a precursor, because we have predicted successfully two mainshocks by this method. The reduction of crustal deformation rate was also noted before several other mainshocks, but the precursory nature of the other two changes (increase of mean depth and fluctuations of mean magnitude) are still relatively unexplored. If nothing else, the timely occurrence of the Parkfield earthquake might help us and others to get a little better funded to make some progress in the identification of precursors and their application to earthquake prediction.

## Rocky Mountain National Park Geologic Map Is Published

For many years we have been watching as Bill Braddock and a large group of students have mapped a huge portion of the Front Range. In 1991, the USGS published part of this work, a beautiful colored geologic map of Rocky Mountain National Park and vicinity at a scale of 1:50,000, authored by Bill (see photo) and former student, Jim Cole. The map has something for everyone, and includes rock glaciers for the Quaternary types, Tertiary sediments for the sedimentary geologists, volcanic rocks for

the petrologists, and the ever abundant metamorphic and intrusive rocks for all of us. Former students who supplied information via theses or other work include Jeff Abbott, Bob Bucknam, Jim Cole, Bruce Gamble, John Gephart, Les LaFountain, Tom Meierding, Bill Nesse, Mike O'Neill, and D.E. Ward. It is a departmental effort we all can be proud of. Get your copy now before they are all sold out! It is USGS Miscellaneous Investigations Series Map I-1973, and costs \$6.20 (see back page).



Bill Braddock and his new Rocky Mountain National Park geologic map.



## New Course in the Introductory Series

The University is working hard at making itself available to a wider group of students. One way to do this is to admit a certain number of students who, for one of several reasons, would not have been admissible under the normal admission rules. Reasons could be poor scores in a national test, poor GPA, etc., but all show promise at achieving a college degree. For their first year here, students are in the Fall Institute, and take courses only through the Institute program. After that they take the courses everyone also takes at the university.

We are offering a course, The Earth, for the Institute. It is a basic earth science course taught by Pete Birkeland in the Fall, and Mary Kraus in the Spring. Students also take recitations and labs. So far, we all agree the course has been a success.

The students are what makes the course so much fun (see photo). Asians, Blacks, Hispanics, and Whites are represented in the student population. The top students in the class includes one White and one Black student discharged from the U.S. Army just before the Gulf Crisis began (they joined the Army to save money for college, and both were yanked back in for duty), a native Hawaiian, an Hispanic student whose parents are migrant farmers, and another Hispanic student who came across the border from Tijuana, spent some time avoiding U.S. officials, eventually got a green card, and now is in Boulder. Many of these students are the first generation in those families to go to college. The students worked as hard or harder than the usual CU students, and the best are as good as the campus-wide best. We will continue our participation in the program.



The Geology 1410 class, fall, 1990. Instructor Pete Birkeland and projectionist Missy are on the left (front), and TA's Dan Levish and Dave Bowen on the right (front).

## What's New in the Earth Sciences Library?

by Suzanne T. Larsen, Librarian

The Earth Sciences Library has completed another banner year. Thanks in large part to funding from the Crail-Johnson Foundation, we have been able to add over 3,000 books to the collection over the last two years. Escalating journal prices, especially from foreign scientific publishers, have caused many Universities to cut their journal holdings drastically. So far, the University of Colorado Libraries have avoided this unhappy situation. Over the last two years we have been able to add the following titles to our collection: Cretaceous Research, Global Biogeochemical Cycles, Facies, Biogeochemistry, Historical Biology, Geomorphology, Marine and Petroleum Geology, Powder Diffraction, and Carbonates and Evaporites.

While on-line searching done through the librarian will continue, we now have four computer databases in the Earth Sciences Library that are end-user searchable. Three of them are in CD-ROM format and one is on the hard disk of the PC workstation. These databases are accessible whenever the Library is open and are free of charge, even to alumni!

### GeoRef—CD-ROM (3 disks)

This database, which dates back to 1785, is produced by the American Geological Institute and mirrors the on-line database, GeoRef and the paper index, the Bibliography and Index of Geology. It was first issued in CD-ROM format in the Fall of 1990 and contains over 1.5 million records. It indexes all types of material including journal articles, conference proceedings, chapters in books, and government publications and will be updated quarterly. The subject matter is geology, in the broadest sense.

### Selected Water Resources Abstracts (SWRA)—CD-ROM (2 disks)

The Selected Water Resources Abstracts database is produced by the Water Resources Scientific Information Center of the U.S. Geological Survey. The database dates back to 1967 and

includes abstracts of pertinent journal articles, books, reports and other publication formats. These documents cover water resources as treated in the life, physical and social sciences, as well as legal and engineering aspects of water resources. The database is available on-line and in paper format as well.

### Earth Sciences—CD-ROM (1 disk)—OCLC Software

This disk consists of three separate files, all created by the U.S. Geological Survey.

### 1. Earth Science Data Directory (ESDD)

This is a compilation of information about databases in the earth and natural sciences. The directory provides researchers with rapid

*Continued on page 11*



Suzanne Larsen, librarian, relaxing at a picnic. Stop in and see what a fantastic job she has done for the Earth Sciences Library, and while you are there see if her high-tech search capabilities can find some obscure reference for you!

## Departmental Colloquium

Every Wednesday at 4 p.m. we meet in Room 121 for our colloquium. Here are some of the recent talks:

Dr. Andy Davis, PTI Environmental Services—Fate and Transport of Organic Compounds in the Subsurface.

Dr. Ron Greeley, Dept. of Geology, Arizona State University—Mars: Aeolian and Volcanic Processes.

Dr. David Lawrence, Shell Development Co., Houston and AAPG Distinguished Lecturer—Stratigraphic Modeling of Sedimentary Basins.

Dr. Phil Tonkin, Lincoln College, New Zealand—Soil-geomorphic Relations in the Mountains of New Zealand.

Dr. Kathryn Newton, Dept. of Geology, Syracuse University—Paleobiogeography of Pacific Accreted Terranes.

Dr. Pieter Tans, NOAA, Boulder—Contradictions in our Understanding of the Global Carbon Cycle.

Dr. Steven Stanley, Case Western Reserve University, Cleveland—Brain Size, Bipedalism and Climate Forcing in the Evolution of the Human Genus, *Homo*.

Dr. Peter Rona, NOAA, Univ. of Miami, Florida—Hot Topics Concerning Submarine Springs and Seeps.

Dr. Paul Crevello, Marathon Oil Co., Denver—Stacking Patterns and Sequence Stratigraphy of Rifted Carbonate Platforms, Lower Jurassic of Morocco

Dr. Sergio Barrientos, University of Chile—Crustal Movements During and Following Great Earthquakes in Chile.

Dr. Eric Barron, Pennsylvania State University—Cretaceous Climate Modeling and the Tropical Enigma.

Dr. Leslie D. McFadden, Department of Geology, University of New Mexico—Soil Geomorphic Evidence for Polycyclic Cinder Cone Eruptions Near the Proposed High-level Waste Repository, Yucca Mountain, Nevada.

Dr. Michelle Tuttle, USGS—Disastrous Gas Release from Lake Nyos, Cameroon: Geological Interpretations.

Dr. Malcolm McCallum, Dept. Earth Resources, Colorado State University—Colorado-Wyoming Kimberlites.

## EMARC Director Search

The abrupt departure of the EMARC Director, Phil Oxley, during the Fall semester 1990 created a vacancy in the EMARC Directorship. After extensive discussions amongst EMARC, the Department of Geological Sciences faculty, the Dean, alumni, and the Advisory Board members, it was enthusiastically decided to begin a search for a new Director.

Roy Kligfield, Chair of the EMARC Director Search Committee, reports that the search to fill the EMARC Directorship is already underway. Advertisements have been placed in *Geotimes* and in the *AAPG Explorer* and all interested alumni and friends of the department are asked to participate in bringing to the Search Committee's attention suitable candidates. It is hoped that the search can be successfully concluded with the hiring of a candidate this summer, but it was agreed that the search will continue until a suitable candidate is identified.

Applications and letters of reference should be submitted promptly to:

Chair, EMARC Director Search Committee  
Department of Geological Sciences  
University of Colorado  
Boulder, Colorado 80309-0250



## Advisory Board

The Advisory Board, listed on the front page of the newsletter, continues to meet on the campus twice a year and help us out with a wide range of problems. The next meeting is scheduled for May 9-10 in Boulder. Members who have recently completed terms on the board include Dave Egger, Gary Graubeger, Tim Grove, John Harms, and John Rold. Many thanks to all board members for taking the time to help us with some fairly complex matters.

The newest members of the board will serve through 1993, and include Fred Baker, Barbara Tewksbury, and Charles Ross. Here we provide information on Fred Baker.

**Fred Baker** (see photo) is a consulting engineer/hydrogeologist and leader of the Hydrogeology Program for the Rocky Mountain Region of Ebasco Environmental in Lakewood, Colorado. Fred has more than 17 years of experience in consulting, academic research, and government, including project management and laboratory and field investigation. He has managed and conducted investigations in the areas of hydrogeology, engineering geology, and geotechnical engineering, including evaluation of hydrogeologic conditions at sites having complex geology, groundwater resources development, aquifer testing, and groundwater flow and contaminant transport modeling. His research interests and contributions include: modeling transport of dissolved solutes in the vadose zone and in groundwater; modeling of surface water and groundwater interactions; the development of *in situ* and laboratory



Fred Baker

methods for the measurement of saturated and unsaturated hydraulic conductivity and aquifer transport properties; and the variability of aquifer, soil, and chemical properties. He received his B.S. in Geology and M.S. in Soil Science at the University of Wisconsin, Madison, and his M.S. in Civil Engineering (1981) and Ph.D. in Geology (1985) from the University of Colorado at Boulder.



Above: the office staff gathers under the Christmas tree. From left to right they are: Kris White, in charge of student affairs after we lost Betty Taylor to the Dept. of Kinesiology; Mark Bishop, accountant; Edith Ellis, who still runs the show and was more than happy to pass the accounting tasks on to Mark; Kay Fox, working hard on graduate admissions, and Don Runnells, our leader and Chair.



Left: we had the traditional Christmas potluck party on the third floor, and it included a visit by Santa Claus. Here he took time out from his busy schedule to dance with his wife, Erika Runnells.

## Field Trips

In mid-September the department sponsored a weekend field trip and picnic in Rocky Mountain National Park. About 100 attended, including faculty, staff, students, and some families. One highlight was the free picnic style dinner in a campground. Many overnighted in the campground—some slept, and some talked through the night.

For those that wanted a field trip on the way to the park, a group left Friday afternoon with professors Bill Atkinson, Lang Farmer, Hartmut Spetzler, and Joe Smyth. For the

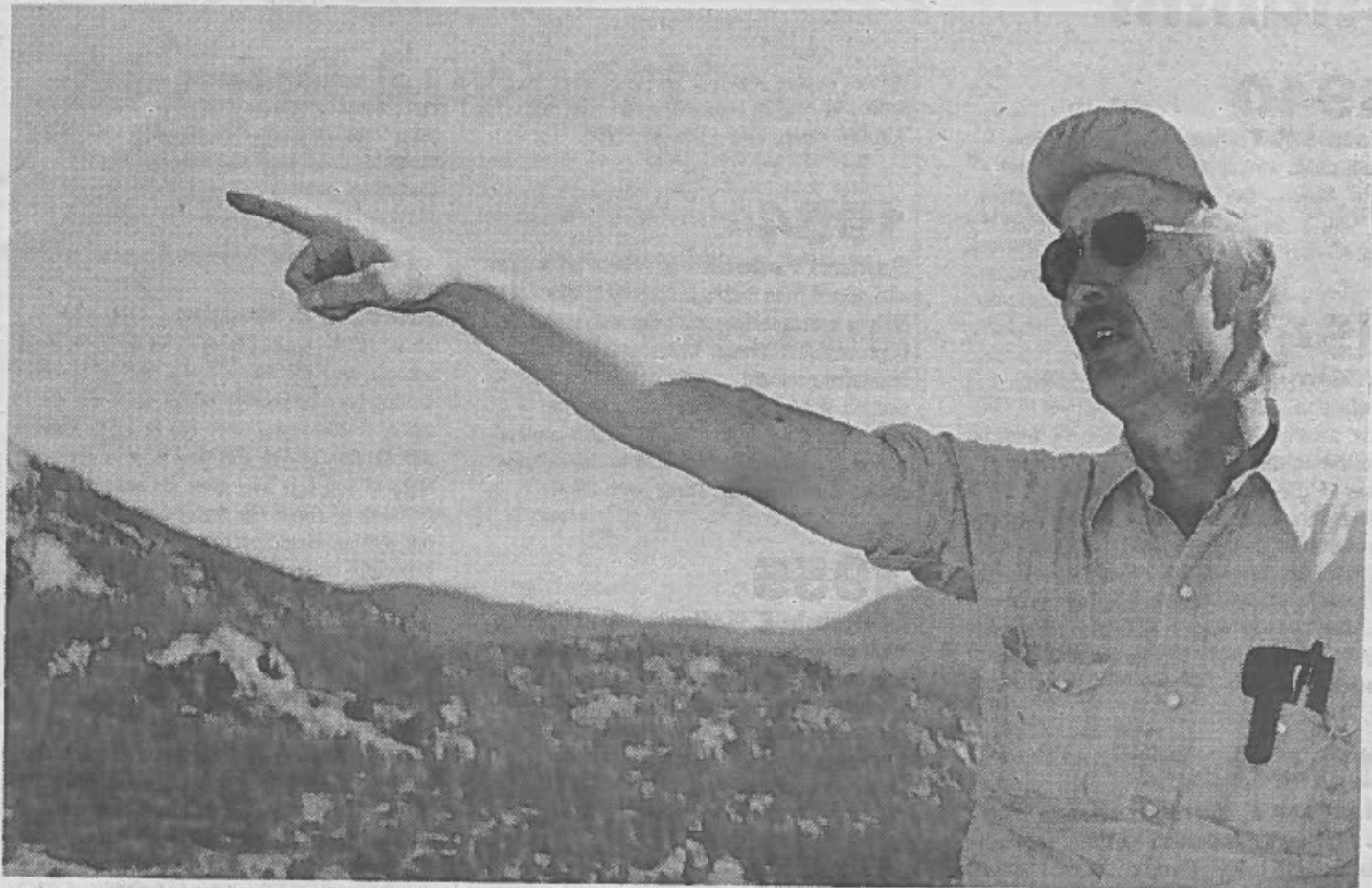
weekend trip in the Park, Bill Braddock (see photo) took the group through numerous stops over Trail Ridge Road. On Sunday, Bill was joined by Bill Hay and students Alan Lester and Scott Lundstrom, who added their expertise at various stops.

The weekend was a wonderful icebreaker enabling new students to meet the faculty and returning students in a glorious geological setting. Hopefully, it will become an annual affair. Alumni are encouraged to participate.

The Spring field trip to Utah was lead by Bill

Atkinson. About a dozen students and faculty participated in a fascinating whirlwind tour of Dinosaur National Monument, the tectonic setting and potential demise of Salt Lake City, and the open-pit copper mine of Anaconda.

Many field trips are conducted in conjunction with courses. Bruce Jakosky hopes to return to Meteor Crater in Arizona, and Bill Atkinson will take his class to operating mines in Mexico.



Bill Braddock points to a fine-grained, granoblastic, microcline-biotite-quartz-plagioclase granofels on the Fall Rocky Mountain National Park field trip.

## Isotope Researcher



Jim White is a fairly new addition to the faculty, having come on board in 1988. He teaches courses in global change and environmental issues in geosciences, and conducts research on the isotopic record of climatic change in ice cores.



## Memorial Fund Established for William J. (Bill) Gardiner II

**Bill** Gardiner (see photo), a 1941 graduate of this department, passed away on Nov. 23, 1990. Because of his long-term interest in the department, a memorial fund has been set up in his honor. Those who wish to honor Bill's memory with a contribution to his favorite philanthropy may do so by writing a check payable to the University of Colorado Foundation with the notation "Geological Sciences, In memory of W.J. Gardiner."

Bill was born in Long Beach, California. His early years were spent in Hollywood. After high school he attended the University of Colorado at Boulder, graduated in 1941 with a BA in Geology, at which time he accepted a job as mining geologist with the Tennessee Schuylkill Mine in Chloride, Arizona, where his grandfather had been underground superintendent in earlier days. This mine produced gold, silver, lead and zinc. As the second world war progressed, lead and zinc were on the critical mineral list and workers at the mine were frozen to their jobs and deferments were sent directly from Washington. He was not able to enlist in the services until 1944, when lead and zinc were finally removed from the critical mineral list. It was at this time that he met his future wife, Martha J. Chavness.

Bill enlisted in the "Eddy Program" of the U.S. Navy and after boot camp studied in Chicago, University of Houston, Corpus Christi, and San Diego. At the completion of the course, he earned a rank of Aviation Radio Technician 2nd class.

After his discharge in 1946, he went to work as a Geologist for the U.S. Bureau of Reclamation and worked on the preliminary investigation of many proposed dam sites, mostly on the Colorado River. When work quieted down in the bureau, he moved with his family to Long Beach, where he checked out the oil business. His first love, the mining business, was in a decline, so he went to work for the Shell Oil Co. in 1953. Shell had all the geologists they needed, so they decided Bill would make a good geophysicist. During his years with Shell he lived with his family in California, Colorado, New Mexico, Texas, Wyoming, and Holland. While in Holland he spent time as well in Nigeria and Gabon.

In April, 1971, Bill was sent to Houston and assigned to International Ventures as Staff Geophysicist. He worked in the Cameroons, Syria, Tunisia and many other parts of the Middle East, until April 1981, when he returned to Houston as Manager of Exploration Recruitment. He continued at this post until his retirement in 1985, having spent 32 happy and productive years with Shell.

After his retirement he, his wife and her two sisters made a memorable six weeks visit in Sao Paulo, Brazil, where his son, John, worked. They travelled the country with John and wife, Celeste, and visited mining areas in the state of Minas Gerais, his dream from college days.

The special pleasure of his retirement years was the building of a family home in the mountains near Durango. He spent many happy hours there in the company of family and friends.



W. J. Gardiner II

## Profile of an Alumnus: A. Reynolds Morse (Geology '38)

Although he now divides his time between Cleveland, Ohio and St. Petersburg, Florida, Ren Morse's "heart is in Colorado."

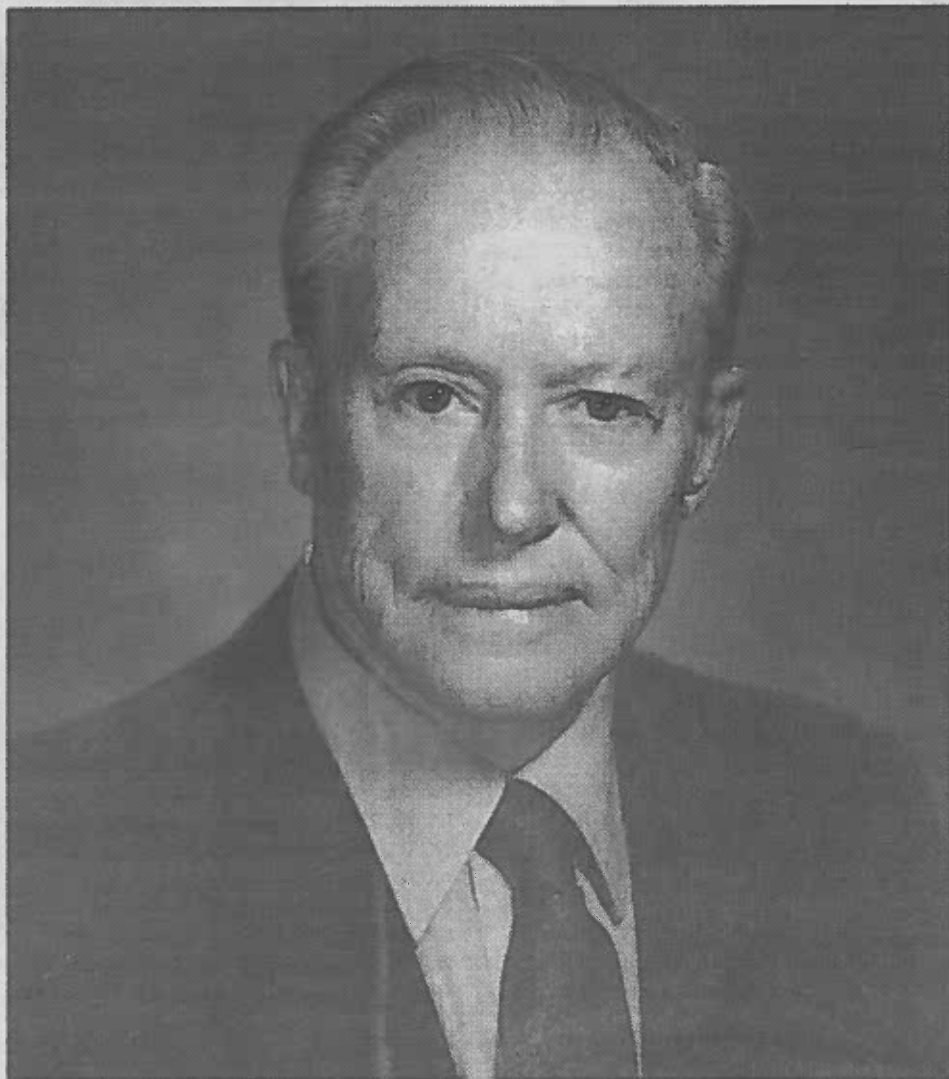
Ren grew up in Denver and attended St. Paul's School in Concord, New Hampshire. He then spent one year at the University of Denver and wisely transferred to the University of Colorado graduating Phi Beta Kappa in 1938 with a degree in Geology. He then received a Masters degree in Business Administration from Harvard Business School.

Ren's grandfather was a miner, Indian trader and founder of the Denver Museum of Natural History. The Morse family still owns Colorado mining properties such as the Revenue Mine in Ouray, the Fold Cup Mine in Tin Cup, the Gold Links Mine in Ohio City and the Summitville Mine near Del Norte. His father came to Colorado in the late 1800's and ran a successful machinery business across from Union Station in Denver.

Although mining was in his blood, Ren decided to enter the machinery business himself. He is founder and President of IMS Company of Cleveland, Ohio. IMS sells specially designed equipment to the plastic injection molding industry.

Ren and his wife, Eleanor, are renowned for their dedication to the collection and study of the works of the great 20th century Spanish artist, Salvador Dali. Eleanor and Ren first saw Dali's work in 1941 at a traveling exhibition. "We were impressed by his super draftsmanship. The nostalgia of his deep perspectives beguiled us. His unusual subject matter intrigued us," Eleanor recalls. In 1943 the couple met Dali in New York and began a long and fascinating personal relationship with the artist and his wife, Gala.

The Morses' collection of the artist's work is showcased at the Salvador Dali Museum in St. Petersburg, Florida. Ren has written many articles and books on Dali. In 1989 Eleanor and Ren were honored both locally and internationally for their scholarship and generosity; they received the highest award Spain can bestow, The Order of Isabella Catolica. Ren Morse also has been awarded an honorary doctorate from Rollins College in Winter Park, Florida, from which Eleanor graduated, for his scholarship and collection of works of the Edwardian novelist, M. P. Shiel. Eleanor Morse



A. Reynolds Morse

was also awarded an honorary doctorate for her contribution to French culture.

Many of Ren Morse's other interests are rooted in his Colorado upbringing. Following in his grandfather's footsteps, he is a lifetime trustee of the Denver Museum of Natural History and, after helping to start the University of Colorado Foundation in 1954, he served eighteen years on its board.

In 1975 the Board of Directors of the CU Foundation adopted a resolution commending Ren for his "infectious enthusiasm and support (both moral and financial) of the University of

Colorado" and stating that the entire University wished to express "profound gratitude for his continuous services over the past years and wish him well in his personal endeavors over the coming years, reserving, however, the right to recall him to 'active duty' when his own affairs allow it and after a sabbatical from University business."

A long-time close friend of Doc Thompson, Ren has been a generous supporter of our Department for many years. We are proud to say that he is one of our most distinguished alumni (see photo).

## Alumni

### 1940

**Harold F. Thompson**—BA—Upon graduation, worked for American Zinc Company, Mascot, TN. From 1950 until retirement in 1981, he was Safety Director for ASARCO. Passed away, Sept. 4, 1990.

### 1941

**William J. Gardiner**—BA—After graduation, Bill was a mining engineer in Chloride, Arizona. After serving in the US Navy, he worked on the geology of the Glen Canyon Dam for the Bureau of Reclamation. In 1953, he began a long career with Shell Oil Company, first as a geophysicist and later as manager of recruitment. His work took him to many interesting places overseas. Following retirement in 1985 he spent much time building a family home in the mountains near Durango. Passed away, Nov. 23, 1990.

### 1949

**Harrison F. Murray**—BA, with MS in 1950—After graduation Harrison was an instructor in the department. He did a stint as a consultant in 1957, then joined Lion Oil Division of Monsanto Chemical Company in Denver. He actively sought oil in the Gulf of

Mexico, Central America, and the North Sea. Retired in 1985 in southern Spain with wife, Dorothy. Passed away, Dec. 17, 1989.

### 1954

**Samuel Pollock**—BA—Went on to earn a BS degree from Brown University in 1956. Presently a hydrogeologist with the Massachusetts Dept. of Public Works, Wellesley Hills. Is a registered geologist in Arkansas, a Certified Ground Water Professional, and currently works and publishes on ground water contamination and remediation related to the highway salt de-icing program. Three boys, 25-31.

### 1955

**Benjamin F. Ballar**—BA—Benjamin went on to earn an MBA from Harvard in 1959. Presently is Dean and Professor, Jesse H. Jones Graduate School of Administration, Rice University, Houston. He is on the board of directors of Transco Energy Co., Houston, as well as several other companies.

### 1956

**William G. Woist, Jr.**—MS—Presently is Senior Project Manager, Office of Surface

Mining, Reclamation and Enforcement, Colorado. Recently was one member of a 5-person team from his group that attended a workshop in central India on reclaiming coal mines. Three daughters.

### 1957

**Bradford B. VanDiver**—BA, with MS in 1958—Retired from SUNY in 1989, Built a house near the Adirondacks, and he is still writing popular geology books. *Roadside Geology of Pennsylvania* came out in 1990, *Roadside Geology of New England* is in progress. Many of you may have seen his beautiful book, *Imprints of Time: The Art of Geology*. When not writing, Brad and wife, Bev, are climbing, canoeing, cross-country skiing and travelling the world.

### 1962

**John M. Cys**—BA, with MS in 1965—Presently in Ft. Worth, TX, where he is a consultant and secondary school science teacher. Has written about 50 papers on the Permian-Pennsylvanian geology of TX-NM. Reports he would have liked to have joined up with the departmental Guadalupe Mountains field trip last year. You are on our list for next time, John!

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## ... Alumni

### 1965

**Paul Goldberg**—*BA*—After earning both the MS and PhD degrees from the University of Michigan, Paul has been at the Institute of Archaeology, The Hebrew University, Jerusalem, where he is an Associate Professor. Look for his 1990 book: Courty, M.A., Goldberg, P., and MacPhail, R.I., *Soils and Micromorphology in Archaeology*, Cambridge University Press.

### 1967

**R.W. Tillman**—*PbD*—Rod just took over duties as President of SEPM, the Society of Sedimentary Geology. Congratulations! From 1969-1985, he was a Senior Research Associate with Cities Service Oil and Gas Company, Tulsa. Presently, he is a consulting sedimentary geologist.

### 1968

**Dick Smith**—*MS, with PbD in 1975*—Presently directing geoscience activities for natural hazards assessment for E.G. and G., Idaho Falls. Still working on dikes, and presented a poster on some at the recent Rocky Mountain GSA in Jackson Hole. The Governor has appointed Dick to the Idaho Board of Registration for Professional Geologists. Wife teaches at a local Junior H.S., rides horses, and together they searched Hawaii for rifts and beaches.

### 1969

**Patricia J. King** (now MacMillan)—*BA, with MS in 1972*—Pat went on for yet another MS in 1990 from rival, CSU. Previously she was a geophysicist and environmental geologist for Chevron Corp., but now is a geologist with the BLM, Denver. The family has a real CU connection with husband Andy, CU geology—1969, and son Tim, CU-Denver—1990. We await son Sean!

### 1970

**W.W. (Bill) Boberg**—*MS*—A few years ago Bill took a position with Western Mining (Australia) to manage a project in Liberia, West Africa. Alas, a civil war got in the way, and when he wrote us he was working out of a home in Bremerton, WA. The project is quite exciting, involves the mineral exploration of a 8,000 square mile area, and concentrates on diamonds and gold.

### 1971

**Stephen J. Kridelbaugh**—*PbD*—After being a student of Jim Munoz all those years, Steve has risen above us all, as President of Southwestern Community College, Coos Bay, OR. He loves it out there, but has only been on the job since September!

### 1972

**Lawrence D. (Larry) Williams**—*MS*—Worked in the real world for a while, and earned a PhD from the University of East Anglia (UK). Larry is presently a Research Scientist at the University of Edinburgh (UK) working on a model for the evolution of Laurentide Ice Sheet and its interaction with atmospheric circulation.

### 1973

**Jim Gullinger**—*BA*—After a stint in Montana, Jim has returned to Colorado as Projects Manager, Addwest Minerals, Arvada. Currently he directs the development of mineable sulphur deposits in west Texas. Recently presented a paper on disseminated gold deposits in the Madison Limestone in Montana at the annual meeting of the Colorado Mining Association.

### 1975

**Gerald R. (Jerry) Grocock**—*MS*—Presently Vice President of exploration, General Atlantic Resources, Denver, Jerry would be more than happy to offer career advice for new graduating students that are interested in the oil and gas industry.

### 1977

**James C. (Jim) Cole**—*PbD*—Still with the USGS, Denver, with half time spent as team leader for structural geology/geochronology research at the Nevada Test Site, and the other half time spent on Precambrian shield studies, Saudi Arabia. We have a promise he will write up his experiences in Saudi Arabia for the newsletter soon, where he was Chief Geologist, 1981-1984. Wife Estella recently earned a Master's degree in architecture at CU-Denver, and they both have continued singing (he Barbershop and she Sweet Adelines).

### 1978

**Hassan Amini**—*MS, with PbD in 1983*—Director of Regulatory Programs and Site Assessments for IT Corporation, Irvine,

California. Also teaches courses at California State Universities at Long Beach and Fullerton. Passed yet another exam, so is a registered geologist in the state. He and Tara have a budding soccer star in son Ali, and dancer in daughter Yassi. Look up Hassan at the San Diego GSA meeting!

### 1980

**Scott Burns**—*PbD*—After teaching 8 years at Louisiana Tech University, Scott has accepted a position in the Department of Geology at Portland State University, his "home" turf. He also has been awarded a prestigious Kellogg National Fellowship (49 awarded, 800 applicants), so part of his task for the next 3 years will be some aspect of leadership development. Glenda is organizing the new home 12 miles south of Portland, helping the 3 children get used to the area and school, and may someday return to the University.

**Julie Brigham-Grette**—*MS, with PbD in 1985*—Associate Professor in Geology at the University of Massachusetts, Amherst. Julie continues her research in western Alaska and the Bering Straits areas, recently was Visiting Professor at the Alaska Quaternary Center, University of Alaska in Fairbanks, and more recently had a nordic son, Karl Olaf! (See Roger, 1982, for the other half of this story.)

### 1981

**Jennifer Smith Askey**—*BA*—Project manager for FMC Gold, Denver. Happily married and they are starting out with an attack rabbit instead of kids.

**Janet Elleen Bronken-**

**Jakobsson**—*BA*—In October, resigned a position as geophysicist with GECO in Oslo, and is now setting up her own consulting firm there (moving to Trondheim in August). Has written manuals and taught courses on seismic processing. Married a Norwegian, has a daughter, Ingrid, who has already been to 10 countries at age 1.5 yr. Needless to say, they enjoy travelling!

**Dana Geary**—*MS*—After leaving here, Dana earned her PhD from the Colorado of the east, Harvard, in 1986. Now Dana is an Assistant Professor at the University of Wisconsin, Madison, and studies the Neogene evolution of gastropods in the Caribbean. In 1985 she married Robert Bleiweiss, an evolutionary biologist whose thing is hummingbirds.

**Ann Rosen**—*BA*—Ann went on to earn an MBS in international business in 1982.

Presently is international sales manager for specialized office equipment for Asia and Latin America. Now sees all her geomorphology from the air, during frequent trips.

### 1982

**Scott C. Balke**—*BA*—Went on to earn an MS at Oklahoma State University. Presently a geologist with Phillips Petroleum in Odessa, TX, in charge of exploration and development in SE New Mexico. He and wife, Paula, have a son.

**Roger Grette**—*BA*—Now a Master's degree candidate in geography at the University of Massachusetts, Amherst, working on wilderness management issues of the Alaska Arctic Wildlife Refuge. Recent papa of Karl Olaf (see Brigham, 1980). No mention of skiing, so he must be hitting the books!

**Thomas A. McClurg**—*BA*—In 1990 Tom completed his MS at the University of Wyoming. Now he is an Associate Geologist with Conoco, stationed in New Orleans, and working the eastern Gulf of Mexico. (Brother John lives in Chicago, but seems to be spending a lot of time in Boulder, biking and skiing).

**Kim T. Norstog**—*MS*—Now a district geologist for Enserch Exploration. Lives in Dallas with Nona Knight (History, '80) and they have 3 children.

### 1983

**Lyons Witten**—*BA*—Presently completing an MS in hydrogeology at the University of Massachusetts, Amherst; he reports Julie Brigham-Grette is doing great there. He also works for ECS, Inc., an environmental consulting firm, and works on hazardous waste site remediation and groundwater modelling. Married to Laura Fitch (Environmental Design, 1982), and they care for 1 dog, 2 cats, but no kids yet.

### 1984

**James A. Short**—*BA*—Jim Walters informs us that James is Project Manager/Hydrologist for ENECOTECH, Denver.

### 1985

**James E. Walters**—*BA, with an MS in 1988*—Jim is a Project Manager/Hydrogeologist for Engineering-Science Inc., Denver.

## Alumni Support

The Department of Geological Sciences has several specific accounts to which contributions may be made. Checks should be made payable to the University of Colorado Foundation with a notation to which of the following funds you would like your contribution to be used for.

**SCHOLARSHIP ACCOUNTS:** (funds donated to these accounts are put in an interest-bearing account and the Department uses the yearly interest to provide scholarships to students).

Keith Marks Memorial Scholarship  
Warren Longley Scholarship  
Ernest Wahlstrom Scholarship  
Larry Warner Scholarship  
General Geology Scholarships

Contributions may also be made to the following accounts:

**GEOLOGY GENERAL GIFTS:**  
(unrestricted funds for use at the discretion of the Chairman).

**WARREN O. THOMPSON GRADUATE RESEARCH:**  
(funds are used to assist graduate students with their research).

**GEOLOGY EQUIPMENT:**  
(funds specifically designated for the purchase of equipment).

**ALUMNI RELATIONS:**  
(funds specifically designated for travel, etc. to promote alumni relations).

**GEOLOGICAL SCIENCES BUILDING FUND:**  
(funds specifically designated for the new Geological Sciences Building).

## ... Library

access to available data resources in their fields. Databases cited in ESDD are produced and maintained by governmental agencies, academic institutions, and private-sector entities. Both automated and nonautomated databases are covered. Each record briefly describes a database, and who to contact concerning it.

#### 2. GEOINDEX

Geoindex is a guide to published geologic maps of the United States and its territories. The database consists of more than 19,000 citations to maps of counties, states or regions, published by state surveys, professional societies, universities, commercial entities, and federal agencies. To be included in the database, the map must have been published, it must be an original compilation, and it must have scale.

#### 3. USGS Library

The United States Geological Survey Library database consists of bibliographic records representing the acquisitions of the USGS Library System (Reston, VA; Denver, CO; Flagstaff, AZ; Menlo Park, CA) since 1975. Monographs and serials, including maps, are indexed, but separate chapters or articles are not.

#### Deep Sea Drilling Project (DSDP)

Marine Geological and Geophysical Data—CD-ROM (2 Disks). The DSDP was an international study of the global oceans which spanned three decades and 96 cruises of the Glomar Challenger. Data resulting from intensive study of the 624 sites drilled and cored are largely contained in the Initial Reports of the Deep Sea Drilling Project. The database is produced and distributed by the National Oceanic and Atmospheric Administration.

#### Mineral—Hard disk

The Mineral database is a compilation of information on mineral species. The following information is indexed and retrievable through the system: Species name (name fragment or synonym), elemental and/or polyatomic constituents, mineral group name, related species name, and JCPDS number. The ES Library has this database courtesy of John Drexler of the Department's Analytical Lab.



## Attention Alumni

**By completing and mailing in this form, you can help us do a better job of keeping up with you and your whereabouts and career or family news. We all enjoy reading about classmates**

and not-so-close mates who survived Boulder in whatever era! So send us some news, or just some recollections—we promise to use it, well, most of it!

Name \_\_\_\_\_ Date \_\_\_\_\_

Address \_\_\_\_\_

Degree(s) \_\_\_\_\_

before, during, and after CU-Boulder

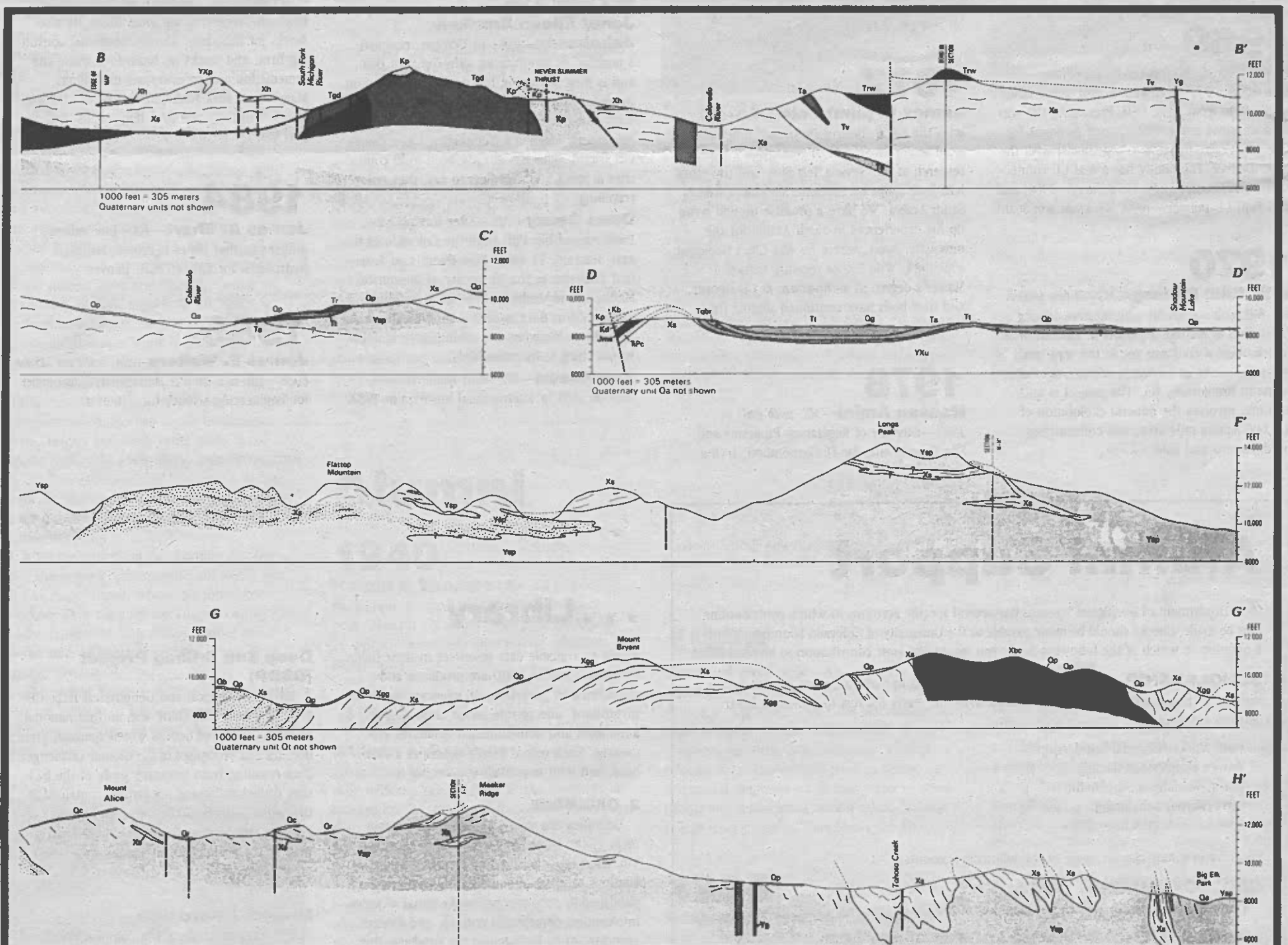
**Current Activity/Position/Employer/Location, etc.**

Publications/Awards/Accomplishments

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Name/Address of Potential CU Geology Student We Should Contact: \_\_\_\_\_

Comments, Critiques, Accolades, as Appropriate, About Newsletter: \_\_\_\_\_



# GEOLOGIC MAP OF ROCKY MOUNTAIN NATIONAL PARK AND VICINITY, COLORADO

By

William A. Braddock and James C. Cole

1990

*Cross-sections from the recently published geologic map of Rocky Mountain National Park. (See story on page 7.)*