



## GSA NEWS & INFORMATION

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The Geological Society of America

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*Long Hours, No Pay, But Satisfaction*

## Be a GSA Campus Rep

Every college and university that has a geology program needs a GSA campus representative who can provide information about GSA services to students.

The Campus Representative Program began in 1979 in GSA's Southeastern Section. Active GSA members in the section were recruited to serve as campus representatives, establishing a communications link between GSA headquarters and present and prospective Student Associates.

Campus representatives, with the aid of a notebook of information provided by GSA's Membership Department, explain to interested students the benefits of being a GSA Student Associate:

- GSA *News & Information* every month
- Reduced subscription rates for *Bulletin* and *Geology*
- 20% discount on GSA books, maps, and charts
- \$30 discount for GSA's Employment Service (applicants)
- \$10 discount for registration fees for Penrose Conferences
- \$20 reduction in student registration fees for GSA's Annual Meeting
- Reduced registration fees for many GSA section meetings
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- Special discounts on Decade of North American Geology publications
- Group term life insurance plan at reduced member rates

- Opportunity to participate in GSA's specialized divisions and to receive their newsletters
- Opportunity to apply for student grants-in-aid in the Southeastern Section and the North-Central Section
- Discount for subscriptions to *Engineering Geology Abstracts* for Engineering Geology Division affiliates
- Discount for National car rentals
- 25% discount on many Geological Society of London publications
- Reduced subscription rate for publications of the American Institute of Physics
- Discount on subscriptions to *Geoarchaeology* or *Neotectonics* for GSA Division affiliates

All GSA sections participate in the program, and there are now 522 active campus representatives. We thank the current campus representatives now serving to keep the program growing. However, we need more volunteers. If you are a Member or Fellow (not Student Associate) and are interested in serving GSA as a campus representative for your college or university, please contact

T. Michael Moreland, Membership Services Manager  
Geological Society of America  
P.O. Box 9140  
Boulder, CO 80301  
(303) 447-2020

The following campuses need a GSA campus representative. If yours is on the list, won't you consider serving?

Campuses that **DO NOT** have GSA Campus Representatives:

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Central Arizona College  
Mesa Community College  
Phoenix College  
Prescott College  
Yavapai College

#### California

Antelope Valley College  
Bakersfield College  
California Polytechnic State University—  
San Luis Obispo  
California State University—  
Stanislaus  
Chapman College

Contra Costa Community College  
College of the Desert  
Diablo Valley College  
East Los Angeles College  
Fullerton College  
Gavilan College  
Glendale Community College  
Golden West College  
Los Angeles City College  
Los Angeles Harbor College  
Los Angeles Valley College  
Merced College  
Napa Valley College  
Naval Postgraduate School  
Ohlone College

Orange Coast College  
College of the Redwoods  
Riverside City College  
Sacramento City College  
Saddleback Community College  
San Joaquin Delta College  
San Jose City College  
Santa Ana College  
Santa Barbara City College  
Southwestern College  
Ventura College  
Yuba Community College

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**Campuses without GSA Reps** (continued from p. 69)

**Nevada**

Wassuk College

**Oregon**

Central Oregon Community College  
Clatsop Community College  
Willamette University

**Washington**

Green River Community College  
Lower Columbia College  
Olympic College  
Tacoma Community College  
Whitworth College  
Yakima Valley College

**British Columbia**

Capilano College  
Cariboo College

**Rocky Mountain Section**

**Colorado**

Colorado Mountain College  
Colorado Northwestern Community College  
University of Denver  
Metropolitan State College  
Pikes Peak Community College  
United States Air Force Academy

**Idaho**

Lewis-Clark State College  
College of Southern Idaho

**Montana**

Eastern Montana College  
Flathead Valley Community College  
Northern Montana College  
Rocky Mountain College

**New Mexico**

New Mexico Highlands University

**North Dakota**

Dickinson State College

**South Dakota**

Augustana College

**Wyoming**

Casper College

**Alberta**

University of Lethbridge  
Mount Royal College  
Northern Alberta Institute of Technology  
Southern Alberta Institute of Technology

**Saskatchewan**

University of Regina

**North-Central Section**

**Illinois**

University of Chicago  
Columbia University  
Concordia College  
Elgin Community College  
Field Museum of Natural History  
College of Lake County  
Lincoln Land Community College  
Principia College  
Wabash Valley College  
William Rainey Harper Community College

**Indiana**

Hanover College  
Holy Cross Junior College  
Indiana University/Purdue University—  
Fort Wayne  
Indiana University at Kokomo  
Vincennes University Junior College

**Iowa**

Drake University  
Grinnell College

**Michigan**

Adrian College  
Central Michigan University  
Charles Stewart Mott Community College  
Concordia College  
Gogebic Community College  
Henry Ford Community College  
Hope College  
Northern Michigan University  
Schoolcraft College  
St. Clair County Community College  
Washtenaw Community College  
Wayne State University

**Minnesota**

Anoka-Ramsey Community College  
Concordia College  
Itasca Community College  
Southwest State University  
St. Cloud State University  
College of St. Thomas  
Willmar Community College

**Missouri**

Central Methodist College  
Meramec Community College  
St. Louis Community College  
at Florissant Valley

St. Louis Community College at Forest Park

St. Louis University  
Stephens College  
William Jewell College

**Nebraska**

Doane College  
Kearney State College

**Ohio**

Ashland College  
Central State University  
Mount Union College  
Muskingum College  
Oberlin College  
Ohio University—Lancaster

**Wisconsin**

Milwaukee Area Technical College  
Mount Senario College  
Northland College  
University of Wisconsin—Extension—Madison  
University of Wisconsin—Marathon County  
University of Wisconsin—Platteville  
University of Wisconsin—Stevens Point

**South-Central Section**

**Arkansas**

University of Arkansas—Fayetteville  
University of Arkansas—Monticello  
University of Central Arkansas  
College of the Ozarks  
Southern Arkansas University

**Kansas**

Cowley County Community College

**Oklahoma**

Northeastern State University  
Phillips University  
Southwestern Oklahoma State University

**Texas**

Amarillo Junior College  
Angelo State University  
Brookhaven College  
Del Mar College  
Hardin-Simmons University  
Houston Community College System  
Kilgore College  
Lee College  
Odessa College  
Pan American University  
San Antonio College  
South Plains College  
Tarleton State University  
Tarrant County Junior College

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## Campuses without GSA Reps (continued from p. 70)

### Northeastern Section

#### Connecticut

Central Connecticut State University  
Southern Connecticut State College  
United States Coast Guard Academy

#### Delaware

University of Delaware—  
College of Marine Studies

#### District of Columbia

University of the District of Columbia—  
Van Ness Campus

#### Maine

Bowdoin College  
Colby College  
University of Maine—Orono at Walpole

#### Maryland

Catonsville Community College  
Montgomery College  
Towson State University

#### Massachusetts

Berkshire Community College  
Fitchburg State College  
Greenfield Community College  
University of Massachusetts at Boston/  
Harbor Campus  
Massachusetts Institute of Technology  
North Adams State College  
Woods Hole Oceanographic Institution  
Worcester State College

#### New Hampshire

New England College  
Plymouth State College

#### New Jersey

Fairleigh Dickinson University  
Glassboro State College  
Trenton State College  
Union County College  
Upsala College  
William Paterson College

#### New York

Adelphi University  
Adirondack Community College  
Broome Community College  
Hamilton College  
Hudson Valley Community College  
Jefferson Community College  
Lehman College (CUNY)  
Long Island University, Brooklyn Campus  
Long Island University, C. W. Post College  
Manhattan College  
Molloy College  
Nassau Community College  
Onondaga Community College  
Roberts Wesleyan College  
SUNY, College at Purchase  
SUNY, Maritime College  
SUNY at Albany  
SUNY at Binghamton  
United States Military Academy  
Utica College of Syracuse University

#### Pennsylvania

Drexel University  
Elizabethtown College  
Gannon University  
Lycoming College  
Montgomery County Community College

Pennsylvania State University—Erie  
Pennsylvania State University—McKeesport  
Pennsylvania State University—Monaca  
Susquehanna University  
Thiel College  
Waynesburg College  
Wilkes College  
York College of Pennsylvania

#### Rhode Island

Community College of Rhode Island  
Providence College  
Rhode Island College  
Roger Williams College

#### Vermont

Castleton State College  
Middlebury College  
Norwich University  
University of Vermont

#### New Brunswick

University of New Brunswick—Saint John

#### Newfoundland

Sir Wilfred Grenfell College

#### Nova Scotia

St. Mary's University  
University College of Cape Breton

#### Ontario

University of Guelph  
Laurentian University  
University of Ottawa  
Sir Sandford Fleming College  
University of Western Ontario

#### Quebec

Concordia University  
Université du Québec à Montréal  
Université du Québec à Rimouski  
Université du Québec—Ste-Foy  
Université du Québec à Trois Rivières

### Southeastern Section

#### Alabama

University of Alabama—Dauphin Island  
University of Montevallo

#### Florida

Broward Community College  
University of Central Florida  
Edison Community College  
Florida Atlantic University  
Florida Keys Community College  
Gulf Coast Community College  
Miami-Dade Community College (New World Center)  
Nova University  
Okaloosa-Walton Junior College  
Pensacola Junior College  
St. Petersburg Junior College  
St. Petersburg Junior College—Clearwater  
Stetson University  
Tallahassee Community College

#### Georgia

Emory University—Oxford College  
Gainesville Junior College  
Kennesaw College  
Mercer University  
Shorter College  
Valdosta State College

#### Kentucky

Berea College  
Henderson Community College  
Morehead State University  
Northern Kentucky University

#### Louisiana

Northwestern State University

#### North Carolina

Catawba College  
University of North Carolina—Greensboro  
North Carolina Agricultural & Tech  
State University

#### South Carolina

Benedict College  
Coker College  
Wofford College

#### Tennessee

Rhodes College

#### Virginia

Emory & Henry College  
Hampton Institute  
J. Sargeant Reynolds Community College  
Lynchburg College  
Northern Virginia Community College  
Virginia Commonwealth University  
Virginia State University  
Virginia Western Community College

#### West Virginia

Glenville State College  
Parkersburg Community College  
Potomac State College

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### In Memoriam

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John G. Dennis  
Long Beach, California

Martin F. Glaessner  
Adelaide, Australia  
November 22, 1989

Robert W. Johnson, Jr.  
Knoxville, Tennessee  
October 6, 1989

Virginia A. Langenheim  
Menlo Park, California  
June 1989

Emile Rod  
Turramurra, Australia  
1989

Walter M. Small  
Oil City, Pennsylvania

Walter H. Wheeler  
Chapel Hill, North Carolina  
November 21, 1989

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## Late Eocene–Oligocene climatic and biotic evolution

### Conveners

**Donald R. Prothero**, Department of Geology, Occidental College, Los Angeles, California 90041

**William A. Berggren**, Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543

**Philip R. Bjork**, Museum of Geology, South Dakota School of Mines and Technology, Rapid City, South Dakota 57701

With the current interest in mass extinctions, the dramatic climatic and faunal changes in the Eocene and Oligocene have garnered increased attention. New data have emerged from both the deep sea and from terrestrial sections, yet the geologists who work in these areas seldom attend the same meetings or read the same literature. To bring these people together, a Penrose Conference was held in Rapid City, South Dakota, August 1–5, 1989. More than 60 scientists participated, including three from Britain, three from France, two from Canada, and one each from Spain, West Germany, Australia, and New Zealand. On August 3, the group visited the classic Eocene and Oligocene exposures in Big Badlands National Park, where they examined the stratigraphic units, discussed the paleosols and newly completed magnetic correlations, and discovered land snails, turtles, and fossil mammals (including a titanotherium in situ).

Subsequent to the Penrose Conference, a theme session on "Late Eocene–Oligocene Climatic and Biotic Evolution" at the Geological Society of America 1989 Annual Meeting included many of the same participants; specific data are included in Geological Society of America *Abstracts with Programs*, v. 21, p. A87–A89.

The Penrose Conference sessions, which were chaired by Don Prothero, began with an update of the changes in the chronological framework of the late Paleogene. Bill Berggren reviewed the recent data from the Italian Apennines, the Gulf Coast, and Wyoming and Nebraska which push the Eocene/Oligocene boundary to around 34.0–34.5 Ma, contrary to earlier estimates of 36.5 Ma (Berggren et al., 1985) or 32 Ma (Odin, 1982). The most radical new dates came from single-crystal laser-fusion  $^{40}\text{Ar}/^{39}\text{Ar}$  dating done by Carl Swisher on volcanic ashes originally dated by K/Ar in 1964. The revised dates, magnetics, and biostratigraphy imply that the Uintan North American land mammal "age" is middle Eocene, the Duchesnean (40–37 Ma) and the Chadronian (34–37 Ma) are late Eocene (not early Oligocene, as the Chadronian was previously considered), and Orellan (32–34 Ma) and Whitneyan (29–32 Ma) are early Oligocene (not middle and late Oligocene).

The discussion then shifted to the global climatic evidence. Much of it has come from recent ODP drilling around Antarctica, as well as the CIROS I drilling project in the Ross Sea. The central issue was the timing and extent of glacial ice development during the late Paleogene, and the mechanisms for this cooling. Jim Kennett presented a model for warm saline deep waters during the Eocene, which were followed by surface-water cooling and development of cold bottom waters during the Oligocene. He was not convinced that significant ice sheets were developed until the middle Oligocene, although smaller glaciers may have been present before then. ODP Site 748 produced early Oligocene ice-rafted detritus as far north as 57°S, and Lou Bartek reviewed seismic and drilling data that

suggest a major ice sheet grounded over the Ross Sea region by the middle Oligocene. Ken Miller pointed out that the oxygen isotope record reveals several sharp increases through the middle and late Eocene which could be due to either deep-water cooling or ice-volume increases. However, the oxygen isotope increase in the early Oligocene is definitely associated with an ice-volume increase and a lowering of sea level of 50–100 m. Another big isotopic increase and a major drop in sea level were probably triggered by a major ice-growth event in the middle Oligocene. Lisa Cirbus Sloan presented results of climatic modeling which showed that decreasing oceanic heat transport, influenced by changing ocean-bottom topography and oceanic circulation patterns, produced steeper temperature gradients and cooler sea surface temperatures, whereas changing land-sea distributions could not account for the cooling.

Catastrophists have argued that the presence of microtektites and iridium in some late Eocene sections suggests that the extinctions were caused by comets and/or asteroids. Joe Hazel did graphic correlations of sections with microtektite layers and argued that there were 6–9 of them in the late Eocene, spanning about 1.1 m.y. and not associated with mass extinctions. However, Gerta Keller and Norman MacLeod argued that the resolution of these correlated sections is insufficient to be able to distinguish that many layers, and only three are clearly distinct and well documented. All participants seemed to agree, however, that virtually none of the important extinction events are associated with microtektites, and that extraterrestrial factors played a relatively minor role, if any, compared to the massive climatic changes that were already taking place.

On the second day, conference participants reviewed the changes in marine floras and faunas. Gerta Keller pointed out that planktonic foraminifera undergo several steps of extinction and decreasing diversity, starting with the most important extinction at the end of the middle Eocene, and minor extinctions at the Eocene/Oligocene boundary. Marie-Pierre Aubry found a similar pattern in calcareous nannofossils: major extinction at the end of the middle Eocene, and then progressive decline of diversity and cooling through the late Eocene and Oligocene. Benthic organisms showed a similar pattern, punctuated by transgressions and regressions that affected the shelf on which they lived. This was true both of benthic foraminifera from Australia (McGowan) and the Gulf Coast (Thompson) and of benthic molluscs from the Pacific (Armentrout), Gulf Coast (Dockery), Atlantic (Ward), and Paris Basin (Dolin). Ewan Fordyce pointed out that diverse late Eocene archeocete whale faunas were replaced by toothed and baleen whales by the middle Oligocene, presumably in response to the oceanographic changes which created niches for filter-feeding in the early Oligocene.

After the mid-meeting field trip to the Badlands, the final two days focused on the terrestrial record. Gary Peterson and Charles Chapin both discussed the evidence of deep paleosols from the early and middle Eocene which indicate hot, humid conditions and protracted weathering; Chapin suggested that this might be due to slow spreading rates during Eocene plate reorganization, which decreased rates of uplift and topographic rejuvenation. Greg Retallack pointed out that paleosols in the High Plains show a trend from middle Eocene moist forests to middle Oligocene mixed

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grasslands. Margaret Collinson reviewed the floral evidence from both North America and Europe. As Jack Wolfe pointed out long ago, there are two major cooling events in land floras: one at the middle/late Eocene boundary, and one at the terminal Eocene event.

Several participants reviewed the climatic and faunal evidence from various parts of North America, including California and Oregon (Hanson), Canada (Storer), west Texas (Wilson, Runkel), Montana (Dawson, McKenna, Garcia, Tabrum, Hanneman), South Dakota (Bjork), and eastern Wyoming (Emry, Kron, Evanoff). The general consensus for North American land mammals was summarized by Lucas and Stucky: the greatest diversity was in the Uintan (middle Eocene), along with a great deal of endemism. Then, in the late Eocene (Duchesnean, about 40-41 Ma), diversity declined dramatically due to major extinctions and also to immigration of Asian forms. The Uintan/Duchesnean (middle/late Eocene) transition is truly the most fundamental one, and the extinctions in the late Eocene (Duchesnean/Chadronian) and at the Eocene/Oligocene boundary (Chadronian/Orellan) are much less important. The faunal elements present in the Duchesnean persist with only minor changes through the Chadronian, Orellan, and Arikareean. A similar story was given for mammals from Britain (Hooker), France (Hartenberger and Legendre), and central Europe (Heissig). Land snail faunas show similar changes in North America, although there is clearly a major drying event associated with the Chadronian/Orellan boundary, which dramatically affected the snails (Evanoff). Similarly, Howard Hutchinson showed that crocodilians and aquatic turtles declined throughout the late Eocene and virtually disappeared from the High Plains by the Orellan, leaving mostly land tortoises. Tortoise size changes indicate only slight declines in mean cold-month temperatures, but there was definitely an increase in aridity, resulting in loss of permanent streams and ponds by Orellan time.

Jim Swinehart and Richard Tedford reviewed the Whitneyan/Arikareean transition, which has been much confused in the past. New stratigraphic, magnetic, and Ar/Ar data show that the informally named "Brown Siltstone" which overlies the Whitney Member in Nebraska is temporally equivalent to the upper Poleslide Member and the Sharps Formation in South Dakota. Both are composed primarily of eolian volcanoclastics and are capped in Nebraska by the Gering Formation, which represents a period of fluvial valley-cutting in the late early Arikareean. However, the Whitneyan-Arikareean faunas are very low in diversity and consist mostly of inhabitants of interfluvial floodplains; they show no significant changes in response to the shift from eolian to fluvial deposition.

Two major themes emerged from the conference. Clearly, the Eocene/Oligocene extinctions were the product of a long-term (at

least 7 m.y.) decline in climate, and extraterrestrial events (if they occurred) had virtually no effect that can be detected. Second, the most dramatic event is the middle/late Eocene (Bartonian/Priabonian, Uintan/Duchesnean, about 40-41 Ma) transition, which resulted in a major drop in diversity and turnover in both marine and terrestrial faunas and floras. Other extinction events (mid-Priabonian, terminal Eocene event, mid-Oligocene) were much less important, even though the terminal Eocene event has received all the attention in the past. Indeed, as Spencer Lucas pointed out, the natural break in the Cenozoic is between the middle and late Eocene, which he whimsically and informally named the "Eotoadstoolian" and "Toadstoolian." Judging from the rapid adoption of his terms, the participants in this conference found this distinction more natural than Eocene/Oligocene, Paleogene/Neogene, or other attempts to subdivide the Cenozoic into fundamental parts.

#### Conference Participants

John Armentrout	Rob Lander
Marie-Pierre Aubry	John A. Larson
Louis Bartek	Serge Legendre
William A. Berggren	Spencer Lucas
Philip R. Bjork	Norman MacLeod
Harold N. Bryant	Paul Markwick
Charles Chapin	Brian McGowran
Janet Coleman	Bill McIntosh
Margaret E. Collinson	Malcolm C. McKenna
Mary Dawson	Ken Miller
David Dockery	Eustoquio Molina
Luc Dolin	Gary Peterson
Robert J. Emry	Donald R. Prothero
Emmet Evanoff	Jacques Renault
John J. Flynn	Greg Retallack
R. Ewan Fordyce	Tony Runkel
Dan Garcia	Rosalind Singer
Jonathan Goodmacher	Lisa Cirbus Sloan
Debra Hanneman	Margaret S. Stevens
Bruce Hanson	John Storer
Jan Hardenbol	Richard K. Stucky
Jean-Louis Hartenberger	Jim Swinehart
Joe Hazel	Carl Swisher
Tim Heaton	Alan Tabrum
Kurt Heissig	Richard H. Tedford
Jeremy J. Hooker	Dennis O. Terry, Jr.
J. Howard Hutchinson	Peter Thompson
Gerta Keller	Lauck Ward
James P. Kennett	John A. Wilson
Don Kron	James C. Zachos

#### Future Penrose Conferences

**Correlation of Nonmarine Cretaceous Strata**, May 9-14, 1990, Breckenridge, Colorado. Information: Niall J. Mateer, Nonmarine Cretaceous Correlations, 1467 N. 17th, Laramie, WY 82070; (307) 721-4946.

**Transpressional Tectonics of Convergent Plate Margins**, August 25-30, 1990, Bellingham, Washington. Information: Vicki L. Hansen, Dept. of Geological Sciences, Southern Methodist University, Dallas, TX 75275-0395; (214) 692-4179.

**Large Lakes and Their Stratigraphic Record**, September 9-13, 1990, Lake Tahoe, California. Information: Andrew S. Cohen, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721; (602) 621-4691 (direct), (602) 621-6024 (dept.).

**New Methods for Dating of Geomorphic Surfaces**, October 12-17, 1990, Mammoth Lakes, California. Information: Fred M. Phillips, Dept. of Geoscience, New Mexico Tech, Socorro, NM 87801; (505) 835-5540 (direct), (505) 835-5634 (dept.).

Geological Society of America



# CONGRESSIONAL SCIENCE FELLOWSHIP 1990-1991

The Geological Society of America invites applications for the 1990-1991 Congressional Science Fellowship. The Fellow selected will spend a year (September 1990-August 1991) in the office of an individual member of Congress or a congressional committee advising on a wide range of scientific issues as they pertain to public questions. Guided by the American Association for the Advancement of Science, the Fellow selects a congressional staff position in which he or she can work on major legislative issues.

## CRITERIA

The program is aimed at highly qualified earth scientists in early or mid-career. Candidates should have exceptional competence in some area of the earth sciences, cognizance of a broad range of matters outside the Fellow's particular area, and a strong interest in working on a range of public policy problems.

## AWARD

The GSA Congressional Science Fellowship carries with it a \$35,000 stipend and a limited relocation and travel allowance. The fellowship is funded by GSA and by a grant from the U.S. Geological Survey. (Employees of the USGS are ineligible to apply for this fellowship.)

## TO APPLY

Procedures for application and detailed requirements are available in the geology departments of most colleges and universities in the United States or upon request from

Executive Director  
Geological Society of America  
P.O. Box 9140  
Boulder, Colorado 80301



**Deadline for receipt of all application materials is March 15, 1990**



# GSA Bulletin and Geology Contents

## March 1990

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The Geological Society of America

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## GSA in Education

by Allison R. (Pete) Palmer

Several months ago, I asked for some input on geological misperceptions that are abroad in our schools and public information systems. I have received a number of responses, some of which are excerpted below. We have our work cut out for us.

1. Two of my high school teacher contacts in the east, one suburban and one more rural, ran a survey on geo-conceptions that produced the following from a total of about 95 responses:

- 62% thought that "volcanoes and earthquakes were active everywhere and a constant threat to living things" millions of years before humans existed on Earth.
- 54% agreed that all major rivers "flow from north to south"
- Nearly 20% thought we might have to move south for only 10 years if we had another ice age, and only 42% recognized that it would be 10,000 years or more.
- Almost 1/3 thought that ground water "exists in large underground lakes and fast-flowing underground rivers."

2. Some sources of confusion in our use of language:

- polar wandering
- the sun rises and sets
- glaciers retreat

3. An advanced high-school chemistry student in a suburban California school: "... don't boulders in rivers grow to be mountains—like in Yosemite?"

4. From Missouri: Much of the public thinks all ground water is purified after it has traveled 50 to a few hundred feet under ground, and water from springs, even in karstic terrane, is "invariably clean and good to drink." One famous northern Arkansas spring is said to be so clean and cold because it is glacial meltwater that originated during the ice age in Minnesota and emerges today far to the south.

5. From Wisconsin: During hearings for permission to develop a mine on a major sulfide ore body in an area of lakes and tourism, a public ombudsman wanted to know why the mine couldn't be located in another county.

6. From Virginia: A wildcatter told a Virginia Oil and Gas Conservation Board hearing that oil flows in underground rivers, which is why some wells are successful and some aren't. Faults are big open cracks into which you can fall. California will fall into the Pacific someday (also noted in a letter from Ohio). Deserts are just great big seas of sand. Tidal waves can flip large vessels in the open ocean. Dinosaurs and people lived together (also from Ohio). A high school chemistry teacher said we knew Earth's core was metallic because we had drilled into it.

7. A major oil company provided a kit for 4th graders to learn about minerals, which included beautiful cleavage rhombs of calcite. The accompanying questions referred to these as crystals.

8. From an early version (fortunately; but not the earliest!) of a major state science framework that drives much of the content of precollege science texts, supposedly monitored by a reputable professor from a major university in that state:

"Earthquakes occur along fault lines. . . . [Earthquakes] often occur along a line; this line helps us to recognize the edges of crustal plates."

"Also, some plates straddle continental and marine areas; for example, the Atlantic plate runs from the Appalachian Mountains east to the middle of the Atlantic Ocean."

"The Coriolis force is one manifestation of the constantly shifting surface pressure on the Earth."

"During World Wars I and II, when sonar was developed to chart underwater distances of objects, the mid-Atlantic ridge and the hot spots of seismic activity within its trench. . . ."

"Rocks are combinations of lots of different minerals. . . ."

Discussing paleomagnetism, "When these rocks were laid down, their iron minerals assumed the magnetic declination of their latitude. . . ."

"Different features of the Earth have different ages. . . . The Pacific Ocean seafloor is older than the Atlantic seafloor."

"Toxic wastes buried in landfills adversely affect the water table. . . ."

"The angle of repose of beds is important to consider."

"Tectonic processes in the Earth create a force field that holds the atmosphere on Earth, which in turn allows the water cycle to occur."

". . . and tides also cause ocean waters to circulate."

And this is only a sample! Do you want your kids to learn stuff like this? It's time to get involved in public education at all levels and undo the consequences of decades of "let George do it."

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# FOUNDATION NEWS

by Robert L. Fuchs

## Foundation Receives Bequest from W. Storrs Cole Estate

W. Storrs Cole, a leading benefactor of GSA, died on June 14, 1989, at the age of 86. A gift of \$140,000 has been received by the GSA Foundation from his estate. Part of this gift, \$100,000, will establish the W. Storrs Cole Memorial Research Fund, which will provide annual support for research in invertebrate micropaleontology. Contributions that have been received from GSA members and other individuals in memory of Storrs Cole will be transferred from the Foundation's Memorial Fund to this new fund.

The balance of the bequest, \$40,000, will be added to the Gladys W. Cole Memorial Research Award Fund, which Storrs Cole had established in 1980 in memory of his wife. The addition will increase the principal of this fund to \$100,000. The Gladys Cole Fund provides research support for investigation of geomorphology of semi-arid and arid terrains in the United States and Mexico.

Foundation Chairman Phil LaMoreaux, in acknowledging the bequest, commented that this gift provides a significant increase in the financial base from which the Foundation is able to support geological research. Executive Director Mike Wahl, a long-time friend of Storrs Cole, extended appreciation on behalf of GSA to Pat and John Vickery, with whom Storrs Cole lived in his later years, particularly for their efforts in estate matters that resulted in the completion of this gift.

## Former Chairman's Library Is Well Received

A geological library of more than 2000 items, including U.S. Geological Survey publications dating back to the 1880s, has been donated by Betty Silver, widow of former Foundation Chairman Caswell Silver, to the Navajo Community College—Shiprock, located in northwestern New Mexico. In addition to this unique and extensive collection of USGS publications, the library includes textbooks, atlases, numerous field trip guide books, and continuous sequences of geological journals dating back to the 1920s. NCC professor and GSA member Steve Semken originally contacted GSA requesting assistance in obtaining educational materials, and this gift was the direct result of his request.

The Navajo Community College was the first tribal college controlled by Native Americans and was established on the Navajo's Arizona-New Mexico reservation in 1968. An article in November in the *Denver Post* pointed out that while there are now 24 such small colleges operating in 11 states, these colleges have meager resources and their facilities are often distressingly inadequate.



The Silver collection arrives at Navajo Community College—Shiprock.

A recent comprehensive study of the tribal colleges concluded that Congress should increase appropriations under the Tribally Controlled Community College Assistance Act of 1968, in order to improve the educational conditions at these schools.

The establishment of the Caswell and Betty Silver Geoscience Collection at Navajo Community College—Shiprock is a continuation of the philanthropy that Caswell Silver and the Silver family have long practiced in the New Mexico area. Previously, Caswell and Betty had formed the Caswell Silver Foundation to support geological education and research at the University of New Mexico. In addition to his eight-year service as the first Chairman of the GSA Foundation, Caswell Silver was an early contributor to the Foundation and the Decade of North American Geology project.

## The Lucky Ones

Winners for prizes being awarded to Foundation contributors were drawn on Wednesday, November 8, at the close of the exhibits at GSA's 1989 Annual Meeting, in St. Louis. Those who joined the winners' circle are:

Gerald T. Sweeney—the large amethyst crystal  
Roland W. Tabor—*The Art of Geology* book  
Richard A. Hoppin—"The Earth Has a History" tape  
Bruce R. Johnson—a polished ammonite specimen  
Stephen A. Kirsch—a polished ammonite specimen  
Gordon Winder—a polished ammonite specimen

If you were among the few who didn't win, don't despair. Contributors to the Foundation in 1990 will have another chance to "go for the gold" at the 1990 Annual Meeting, in Dallas.

## Donors to the Foundation, December 1989

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(continued on p. 81)



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### 1990

**GSA Annual Meeting • Dallas, Texas**  
**October 29–November 1, 1990**



*Call for papers*  
 April 1

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 July 11

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 August 10

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*Joint Technical Program Committee*  
 August 10-11

*Preregistration due*  
 September 28

### 1991

**GSA Annual Meeting • San Diego, California**  
**October 21–24, 1991**

*Call for field trip proposals*

The deadline for submitting a field trip proposal is *June 15, 1990*. Selection of trips will be made shortly thereafter, leaving 16 months for preparing guidebooks and making arrange-

ments. To submit your proposal or for further information, contact the 1991 Field Trip Chairman:

Michael J. Walawender  
 Dept. of Geological Sciences  
 San Diego State University  
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 (619) 594-5586

### FUTURE

Dallas	October 29–November 1 .....	1990
San Diego	October 21–24 .....	1991
Cincinnati	October 26–29 .....	1992
Boston	October 25–28 .....	1993
Seattle	October 24–27 .....	1994

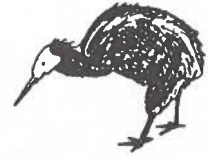
## GSA Section Meetings

### 1990

<u>Section, Location, Dates</u>	<u>Contact</u>	<u>Section, Location, Dates</u>	<u>Contact</u>
Cordilleran Tucson, Arizona March 14–16	William Dickinson Department of Geosciences University of Arizona Tucson, AZ 85721 (602) 621-6024 or -4051	Rocky Mountain Jackson, Wyoming May 21–23	Ronald W. Marrs University of Wyoming Dept. of Geology & Geophysics P. O. Box 3006 Univ. Station Laramie, WY 82071 (307) 766-3386
North-Central Macomb, Illinois April 26–27	John S. Klasner Department of Geology Western Illinois University Macomb, IL 61455 (309) 298-1151	South-Central Stillwater, Oklahoma March 5–6	Scott M. Ritter Oklahoma State University School of Geology 105 Noble Research Center Stillwater, OK 74078-0451 (405) 744-6358
Northeastern Syracuse, New York March 4–7	Henry T. Mullins Heroy Geology Laboratory Syracuse University Syracuse, NY 13244-1070 (315) 443-2672 (dept.) 4706 (direct) Donald I. Siegel Heroy Geology Laboratory (315) 443-3607 (direct)	Southeastern Tuscaloosa, Alabama April 5–6	William A. Thomas Department of Geology University of Alabama P. O. Box 1945 Tuscaloosa, AL 35487-1945 (205) 348-5095

## GSA Goes Kiwi

# New Zealand: North and South Islands



**Dates (tentative):** February 15 to March 8, 1991; 21 days

**Itinerary:** Our trip starts on February 15 in Auckland, from which we will travel south, through Rotorua toward Wellington. The primary geological focus will be volcanological and geothermal features, including the Wairakei geothermal area, Lake Taupo, and the mighty volcanic trio of Mounts Tongariro, Ngauruhoe, and Ruapehu. The insight of interpretive specialists will help us to explore the unique cultural and biological story of New Zealand.

We will cross to South Island to visit the spectacular Banks Peninsula volcanics, Fiordland National Park, Milford Sound, Fox Glacier, Te Anau, Mount Cook, and the "Scottish" city of Dunedin. In addition to glacial areas, the trip focuses on metamorphic facies, gold mineralization, alpine faulting, and the features of the mountain high country. This fascinating trip will end in Christchurch on March 8 for the return trip home.

**Leader:** Douglas S. Coombs, University of Otago, Dunedin, South Island, will coordinate the scientific leaders. He is a GSA Honorary Fellow and was elected Foreign and Commonwealth Member of the Geological Society of London "in recognition of . . . outstanding contributions in the fields of mineralogy, and igneous and metamorphic petrology." He has led an impressive number of field trips in New Zealand, and has been known to play a mean game of cricket.

**Lodging:** A range of accommodations, including hotels, inns, bed and breakfast establishments, and occasionally field stations.

**Transportation:** Bus and van; ferry between North and South Islands.

**Land cost:** \$2525 for 21 days; \$125 special discount for GSA members. There is also an advance registration discount. Airfare to and from New Zealand is additional.

**Included:** Island transportation by bus, van, and ferry; lodging (double occupancy); most meals (except those enjoyed during free time); entrance fees and applicable taxes; transfers and tours; luggage handling; and educational materials. There will be a small additional charge for those wanting single accommodations. If they wish, solo travelers may be paired to share accommodations.

**Not included:** Airfare to and from New Zealand; meals during free time; optional activities such as overflights of glaciers or to White Island, raft trips, or visits to sheep farms (to name a few of the possibilities); personal items such as laundry, liquor, gifts, excess baggage fees, or other items not specifically listed in the final brochure; side trips to places such as Tahiti, Samoa, or Australia.

**Limit:** 36 persons plus leaders. The trip will fill quickly, so register as soon as you can. Your \$200 deposit will be refunded through November 14, 1990 (less \$25), so you can secure a place on the trip early with almost no risk.

**Registration:** Registration is open to everyone, but GSA members will be given preference during the advance registration period up to June 30, 1990. Registrants should be in good health. Although there will be no mountaineering or first ascents, this trip will include moderate activity, especially because tramping (hiking) is a national pastime in New Zealand.

**Airfares:** The current 1990 roundtrip airfare on United Airlines from Los Angeles is \$1101 (plus tax). Air reservations are *not* included in the GSA trip price. We are making arrangements for a group fare, and we will keep Kiwi-trippers posted. A GSA travel agent will be designated to help with questions and concerns about travel to New Zealand and to other areas of the South Pacific.

**Interested?** Call today: 1-800-472-1988 for the complete 1991 New Zealand brochure, or send the coupon below.

If you would like to discuss the trip, call Sue Beggs, GSA Meetings Manager, or Delores Jones, Registration Coordinator.

## FUTURE GSA SECTION MEETINGS

### 1991

- Northeastern/Southeastern . . . . . Baltimore, Maryland
- South-Central/Rocky Mountain . . . . . Santa Fe, New Mexico
- North-Central . . . . . Toledo, Ohio
- Cordilleran . . . . . San Francisco, California

### 1992

- North-Central . . . . . Iowa City, Iowa
- South-Central . . . . . Houston, Texas
- Southeastern . . . . . Winston-Salem, North Carolina
- Northeastern . . . . . Bethlehem, Pennsylvania
- Cordilleran . . . . . Eugene, Oregon
- Rocky Mountain . . . . . Ogden, Utah

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# MEETINGS

(Asterisk indicates new or changed information)

## 1990

**GSA South-Central Section**, March 5-6, 1990, Stillwater, Oklahoma. Information: Scott M. Ritter, School of Geology, Oklahoma State University, 105 Noble Research Center, Stillwater, OK 74078-0451; (405) 744-6358.

**GSA Northeastern Section**, March 5-7, 1990, Syracuse, New York. Information: Henry T. Mullins or Donald I. Siegel, Dept. of Geology, Heroy Geology Lab., Syracuse University, Syracuse, NY 13244; (315) 443-4706 or 2672.

**SIAM Conference on Applied Probability in Science and Engineering**, March 5-7, 1990, New Orleans, Louisiana. Information: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; (215) 382-9800; fax 215-386-7999.

**Subsurface Science Program Annual Meeting**, March 5-7, 1990, Germantown, Maryland. Information: Judith Wright, P.O. Box 999, MS K6-84, Richland, WA 99352; (509) 376-7915, fax 509-376-7915.

**AAPG Southwest Section Convention**, March 11-13, 1990, Wichita Falls, Texas. Information: Will Tucker, Technical Program Co-Chairman, 825 MBank Building, Wichita Falls, TX 76301.

**Prospectors and Developers Association of Canada 58th Annual Convention**, March 11-14, 1990, Toronto, Ontario. Information: Cary McLeod, Prospectors and Developers Association of Canada, Suite 1002, 74 Victoria St., Toronto, Ontario M5C 2A5, Canada; (416) 362-1969; fax 416-362-0101.

**Symposium on the Application of Geophysics to Engineering and Environmental Problems**, March 12-15, 1990, Golden, Colorado. Information: SAGEEP '90, 133 S. Van Gordon, Suite 200, Lakewood, CO 80228; (303) 980-1648.

**American Institute of Hydrology: Minimizing Risk to the Hydrologic Environment**, March 12-16, 1990, Las Vegas, Nevada. Information: AIH, 3416 University Ave. S.E., Minneapolis, MN 55414; (612) 379-1030.

**21st Annual Lunar and Planetary Science Conference**, March 12-16, 1990, Houston, Texas. Information: Pamela Jones, Lunar and Planetary Institute, 3303 NASA Road 1, Houston, TX 77058; (713) 486-2150.

**GSA Cordilleran Section**, March 14-16, 1990, Tucson, Arizona. Information: William R. Dickinson, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721; (602) 621-4051.

**Second Asia/Pacific Mining Conference**, March 14-17, 1990, Jakarta, Indonesia. Information: Irene Low, Cahners Exposition Group (S) Pte Ltd, 1 Maritime Square, #12-01 World Trade Centre, Singapore 0409; phone 65-2711013; fax 65-274 4666; Telex RS 39200 CEG SP.

**9th Industrial Minerals International Congress**, March 24-28, 1990, Sydney, Australia. Information: Diana Little, Industrial Minerals, Park House, Park Terrace, Worcester Park, Surrey KT4 7HY, England; phone (01) 330-4311; fax 01-337-8943.

**Colorado School of Mines SEG Student Chapter Symposium on Megastructures and Associated Ore Deposits**, March 28, 1990, Golden, Colorado. Information: Craig Ford, Dept. of Geology, Colorado School of Mines, Golden, CO 80401; (303) 273-3800.

**Symposium on Geology and Ore Deposits of the Great Basin**, April 1-5, 1990, Reno, Nevada. Information: Geological Society of Nevada, P.O. Box 12021, Reno, Nevada 89510.

**Engineering Geology and Geotechnical Engineering 26th Symposium**, April 4-6, 1990, Pocatello, Idaho. Information: Lee Robinson, Engineering Geology Symposium, Box 8371, Idaho State University, Pocatello, ID 83209; (208) 236-3273.

**GSA Southeastern Section**, April 5-6, Tuscaloosa, Alabama. Information: William A. Thomas or C. Michael Leshner, SE-GSA, Dept. of Geology, University of Alabama, Tuscaloosa, AL 35487.

**Ninth Symposium on Coastal Sedimentology**, April 5-6, 1990, Tuscaloosa, Alabama. Information: Richard Hummell, Energy and Coastal Geology Division, P.O. Box 0, Tuscaloosa, AL 35486.

**International Conference on High-Level Radioactive Waste Management**, April 8-12, 1990, Las Vegas, Nevada. Information: American Society of Civil Engineers, 345 East 47th St., New York, NY 10017; (212) 705-7543; fax 212-421-1826; telex 422847 ASCE UI.

**8th Petroleum Congress of Turkey**, April 16-20, 1990, Ankara, Turkey. Information: Aytac Eren, Mudafaa Cad. 22, 06420 Bakanliklar, Ankara, Turkey; phone 90-4-117-91-60/288-285; telex 42-426 TPAO-TR.

**Conference on Subsurface Contamination by Immiscible Fluids**, April 18-20, 1990, Calgary, Alberta. Information: K. Udo Weyer, Weyer Corp., Inc., 4827 Vienna Dr. N.W., Calgary, Alberta T3A 0W7, Canada; (403) 286-3777; fax 403-247-6074.

**International Conference on Mechanics of Jointed and Faulted Rock**, April 18-20, 1990, Vienna University of Technology, Vienna, Austria. Information: H. P. Rossmannith, Wiedner, Jaupstrasse 8—10/325, A-1040 Wien, Austria; phone 0222-588-01.

**Orogenesis in Action: Tectonics and Processes in the West Equatorial Pacific Margin**, April 18-20, 1990, London, England. Information: Robert Hall, Department of Geological Sciences, University College, Gower St., London, WC1E 6BT, England.

**\*9th Annual Princeton-Conoco Symposium in Geoscience: Computation and Data Analysis in the Earth Sciences**, April 20-21, 1990, Princeton, New Jersey. Information: Tracey McGrath, Dept. Geological and Geophysical Sciences, Guyot Hall, Princeton, NJ 08544; (609) 258-4128; internet e-mail tracey@weasel.princeton.edu.

**European Geophysical Society XV General Assembly**, April 23-27, 1990, Copenhagen, Denmark. Information: EGS Office, Postfach 49, D-3411 Katlenburg-Lindau, Federal Republic of Germany; phone 49-5556-1140; fax 49-5556-4709; telex 965564 zil d.

**GSA North-Central Section**, April 26-27, 1990, Macomb, Illinois. Information: John Klasner, Dept. of Geology, Western Illinois University, Macomb, IL 61455.

**V. M. Goldschmidt Conference** (international conference for the advancement of geochemistry), May 2-4, 1990, Baltimore, Maryland. Information: Donna Ricketts, 409 Keller Conference Center, Pennsylvania State University, University Park, PA 16802.

**Pacific Rim Congress**, May 6-12, 1990, Gold Coast, Queensland, Australia. Information: AusIMM PACRIM 90, P.O. Box 731, Toowong, Queensland 4066, Australia; 61-7-371-7900.

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**MEETINGS** (continued from p. 84)

**SIAM Conference on Applications of Dynamical Systems**, May 7-10, 1990, Orlando, Florida. Information: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; (215) 382-9800; fax 215-386-7999.

**West Texas Geological Society and Permian Basin Section of SEPM Field Seminar to the Marathon Area, Brewster County, Texas**, May 10-12, 1990. Information: WTGS/PBS-SEPM, P.O. Box 1595, Midland, TX 79702; (915) 683-1573.

**Midwest Friends of the Pleistocene Field Trip**, May 11-13, 1990, Council Bluffs, Iowa. Information: Art Bettis, Iowa Dept. of Natural Resources-Geological Survey Bureau, 123 N. Capitol St., Iowa City, IA 52242; (319) 335-1578.

**13th Annual Spring Systematics Symposium: Evolutionary Ethics**, May 12, 1990, Chicago, Illinois. Information: Symposium Coordinator, Dept. of Geology, Field Museum of Natural History, Roosevelt Rd. at Lakeshore Dr., Chicago, IL 60605-2496; (312) 922-9410, ext. 298.

**Andean Geodynamics Symposium**, May 15-17, 1990, Grenoble, France. Information: R. A. Oliver, Inst. Laue-Langevin, 156X, Centre de Tri, 38042 Grenoble Cedex, France.

**Geological Association of Canada-Mineralogical Association of Canada Joint Annual Meeting**, May 16-18, 1990, Vancouver, British Columbia. Information: R. I. Thompson, c/o GAC-MAC '90 Secretariat, 801 - 750 Jervis St., Vancouver, B.C. V6E 2A9, Canada; (604) 681-5226; fax 604-681-2503; telex 04-352848 VCR.

**GSA Rocky Mountain Section**, May 21-23, 1990, Jackson, Wyoming. Information: Ronald W. Marrs, Dept. of Geology & Geophysics, University of Wyoming, Laramie, WY 82071; (307) 766-3386.

**Geological Association of Canada Nuna-SEG Field Research Conference on Greenstone Gold and Crustal Evolution**, May 24-27, 1990, Val d'Or, Quebec. Information: Francois Robert, Geological Survey of Canada, 601 Booth St., Ottawa, Ontario K1A 0E8, Canada; fax 613-996-9990.

**Symposium on Naturally Occurring Radionuclides in Agricultural Products**, May 29-June 1, 1990, Orlando, Florida. Information: IFAS Office of Conferences, University of Florida, 551 IFAS, Gainesville, FL 32611; (904) 392-5930.

**American Association of Petroleum Geologists Annual Convention**, June 3-6, 1990, San Francisco, California. Information: Jim Baroffio, Chevron Canada Resources Ltd., 500 5th Ave., SW, Calgary, Alberta T2P 0L7, Canada.

**1st Joint Meeting of the Canadian Quaternary Association and American Quaternary Association**, June 4-6, 1990, Waterloo, Ontario, Canada. Information: Alan V. Morgan, Quaternary Sciences Institute, Dept. of Earth Sciences, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada.

**5th Symposium on the Geology of the Bahamas**, June 15-19, 1990. Information: R. J. Bain, Dept. of Geology, University of Akron, Akron, OH 44325-4101; (216) 375-7659.

**USA/USSR Joint Conference on Global Environmental Hydrology and Hydrogeology**, June 18-21, 1990, Leningrad, USSR. Information: Helen Klose, American Institute of Hydrology, 3416 University Ave., S.E., Minneapolis, MN 55414; (612) 379-1030.

**4th International Conference on Geoscience Information (GeoInfo IV)**, June 24-29, 1990, Ottawa, Ontario. Information: David Reade, Conference Secretary-Treasurer, GEOSCAN Centre,

Geological Survey of Canada, 601 Booth St., Ottawa, Ontario K1A 0E8, Canada; (613) 992-9550; fax 613-996-9990; telex 0533117 EMAR-OTT.

**9th International Conference on Basement Tectonics**, July 2-6, 1990, Canberra, Australia. Information: IBT9 ACTS, GPO Box 2200, Canberra, A.C.T. 2601, Australia; phone 062-49-8015; fax 062-573256.

**1990 Watershed Management Symposium**, July 9-11, 1990, Durango, Colorado. Information: Robert Riggins, USACERL, P.O. Box 4005, Champaign, IL 61824-4005.

**International Association on the Genesis of Ore Deposits 8th Symposium**, August 12-18, 1990, Ottawa, Ontario. Information: L. M. Cumming, 8th IAGOD Symposium, Geological Survey of Canada, 601 Booth St., Ottawa, Ontario K1A 0E8, Canada.

**\*Wyoming Geological Association 41st Annual Field Conference**, August 17-23, 1990, Casper, Sheridan, Cody, Jackson, and Riverton, Wyoming. Information: Kent A. Sundell, P.O. Box 1543, Casper, WY 82602; (307) 266-4760.

**\*Cretaceous Resources, Events and Rhythms**, SEPM Research Conference, August 20-24, 1990, Denver, Colorado. Information: Michael A. Arthur, Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882-1197; fax 401-792-6160.

**International Sedimentological Congress**, August 26-31, 1990, Nottingham, England. Information: C. P. Summerhayes, Institute of Oceanographic Sciences Deacon Lab., Brook Rd., Wormley, Godalming, Surrey GU8 5UB, England.

**International Conference on Water Resources in Mountainous Regions**, August 27-September 1, 1990, Lausanne, Switzerland. Information: Aurèle Parriaux, Laboratory of Geology EPFL, 1015 Lausanne, Switzerland; phone 021-47-23-55; telex 454478 EPFV CH.

**AEG General Meeting and 14th International Geochemical Exploration Symposium**, August 29-31, 1990, Prague, Czechoslovakia. Information: Frantisek Mrna, Geological Survey of Prague, 118 21 Praha 1, Malostranske nam. 19, Czechoslovakia.

**Conference on Evolution of Upwelling Systems since the Early Miocene**, September 3-4, 1990, London, England. Information: C. P. Summerhayes, IOS Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England; 042-879-4141; fax 042-879-3066.

**Geological Association of Canada Nuna Research Conference**, Late Proterozoic Rifting, Glaciation and Eustasy, as Illustrated by the Windermere Supergroup, September 8-14, 1990, Windermere and Valemount, British Columbia. Information: J. D. Aitken, Geological Survey of Canada, 3303 33rd St. NW, Calgary, Alberta T2L 2A7, Canada.

**GOLDTech 4**, September 10-12, 1990, Reno, Nevada. Information: Meetings Department, Society for Mining, Metallurgy, and Exploration, P.O. Box 625002, Littleton, CO 80162-5002; (303) 973-9550; fax 303-973-3845; telex 881988.

**AAPG-SEPM-EMD Rocky Mountain Section Meeting**, September 16-19, 1990, Denver, Colorado. Information: Matt Silverman, Gustavson Associates, Inc., 5757 Central Ave., Suite D, Boulder, CO 80301.

**3rd International Archaean Symposium**, September 17-21, 1990, Perth, Western Australia. Information: Susan E. Ho, P.O. Box 435, Nedlands, Western Australia 6009, Australia.

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**MEETINGS** (continued from p. 85)

**7th International Conference on Geochronology, Cosmochronology and Isotope Geology**, September 24-29, 1990, Canberra, Australia. Information: Organizing Committee, ICOG 7, Research School of Earth Sciences, Australian National University, G.P.O. Box 4, Canberra, A.C.T. 2601, Australia; phone 062-49-3406; fax 61-62-490 738; telex 62693.

**European Geological Societies**, September 29-October 7, 1990, Lisbon, Portugal. Information: MEGS 6, Sociedade Geológica de Portugal, Apto. 2361, P1109 Lisboa Codex, Portugal. (Abstracts deadline: March 31, 1990.)

**\*Association of Engineering Geologists 33rd Annual Meeting**, October 1-5, 1990, Pittsburgh, Pennsylvania. Information: 33rd AEG Meeting, MEMS, One Northgate Sq., Suite 211, P.O. Box 270, Greensburg, PA 15601; (412) 836-6813; fax 412-836-6817.

**International Earth Sciences Congress on Aegean Regions**, October 1-7, 1990, Izmir, Turkey. Information: IESCA-1990, D.E. University Dept. of Geology, P.K.74 (E.U.-PTT) Bornova, Izmir, Turkey; phone 51-182919 or 180680 or 181088; telex 52407 dbte tr; fax 51-220978.

**Clay Minerals Society 27th Annual Meeting**, October 6-11, 1990, Columbia, Missouri. Information: W. D. Johns, Dept. of Geology, University of Missouri, Columbia, MO 65211; (314) 882-3785.

**Federation of Analytical Chemistry and Spectroscopy Societies 17th Annual Meeting**, October 7-12, 1990, Cleveland, Ohio. Information: Charles J. Belle, Lucas Aerospace, PEC, 4259 W. 192 St., Fairview Park, OH 44126.

**5th Australasian Remote Sensing Conference**, October 8-12, 1990, Perth, Western Australia. Information: Golden West Conventions, P.O. Box 411, West Perth, W.A. 6005, Australia; phone 619-3227922; telex AA 95380; fax 619-4814029.

**American Institute of Professional Geologists Annual Meeting**, October 9-12, 1990, Long Beach, California. Information: Stephen M. Testa, 6695 E. Pacific Coast Highway, Long Beach, CA 90803; (213) 430-6500.

**Geodynamics of the Arabian Plate**, October 20-25, 1990, Kuwait. Information: Waris E.K. Warsi, Dept. of Geology, University of Kuwait, P.O. Box 5969, Safat 13060, Kuwait; or Muawia Barazangi, INSTOC, Snee Hall, Cornell University, Ithaca, NY 14853-1504. (Abstracts deadline: April 1, 1990.)

**\*Geological Society of America Annual Meeting**, October 29-November 1, 1990, Dallas, Texas. Information: GSA, Meetings Department, P.O. Box 9140, Boulder, CO 80301; (303) 447-2020. (Abstracts deadline: July 11, 1990.)

**Supercomputing '90**, November 12-16, 1990, New York, New York. Information: Joanne L. Martin, IBM T. J. Watson Research Center, P.O. Box 218, Rte. 134, Yorktown Heights, NY 10598; (914) 945-3285.

**Penrose Conferences 1990**

**Correlation of Nonmarine Cretaceous Strata**, May 9-14, 1990, Breckenridge, Colorado. Information: Niall J. Mateer, Nonmarine Cretaceous Correlations, 1467 N. 17th, Laramie, WY 82070; (307) 721-4946.

**Transpressional Tectonics of Convergent Plate Margins**, August 25-30, 1990, Bellingham, Washington. Information: Vicki L.

Hansen, Dept. of Geological Sciences, Southern Methodist University, Dallas, TX 75275-0395; (214) 692-4179.

**Large Lakes and Their Stratigraphic Record**, September 9-13, 1990, Lake Tahoe, California. Information: Andrew S. Cohen, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721; (602) 621-4691 (direct), (602) 621-6024 (dept.).

**New Methods for Dating of Geomorphic Surfaces**, October 12-17, 1990, Mammoth Lakes, California. Information: Fred M. Phillips, Dept. of Geoscience, New Mexico Tech, Socorro, NM 87801; (505) 835-5540 (direct), (505) 835-5634 (dept.).

**1991**

**European Geophysical Society XVI General Assembly**, April 22-26, 1991, Wiesbaden, Federal Republic of Germany. Information: EGS Office, Postfach 49, 3411 Katlenburg-Lindau, Federal Republic of Germany; phone 49-5556-1440; fax 49-5556-4709; Telex 965564 zil d.

**SEPM Midyear Meeting—Continental Margins, Tectonics, Eustasy and Climate Change**, August 15-18, 1991, Portland, Oregon. Information: Susan Green, SEPM, P.O. Box 4756, Tulsa, OK 74159-0756; (918) 743-9765.

**\*Third U.S. Conference on Lifeline Earthquake Engineering**, August 22-23, 1991, Los Angeles, California. Information: American Society of Civil Engineers, Specialty Conference Dept., 345 East 47th St., New York, NY 10017; (212) 705-7139.

**International Symposium on Fossil Cnidaria including Archaeocyatha and Porifera**, September 9-14, 1991, Münster, Federal Republic of Germany. Information: Fossil VI. Cnidaria, Pferdegasse 3, D-4400 Münster, Federal Republic of Germany.

**\*American Institute of Professional Geologists Annual Meeting**, October 16-19, 1991, Gatlinburg, Tennessee. Information: Lawrence I. Benson, ERC/EDGE, P.O. Box 22879, Knoxville, TN 37933-0879; (615) 966-9761; fax 615-966-4155.

**\*Geological Society of America Annual Meeting**, October 21-24, 1991, San Diego, California. Information: GSA, Meetings Department, P.O. Box 9140, Boulder, CO 80301; (303) 447-2020.

**Mining Indonesia '91**, December 4-7, 1991, Jakarta, Indonesia. Information: Eileen M. Lavine, Information Services, Inc., 4733 Bethesda Ave., #735, Bethesda, MD 20814; (301) 656-2942; fax 301-656-3179.

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