

GSA NEWS & INFORMATION

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Report from Washington

Science Funding and the Federal Budget

by Beth Robinson

1988-1989 GSA Congressional Science Fellow

In 1988, the government spent \$145 billion more than it took in revenues, and the national debt reached \$2.6 trillion. In 1989, the interest that we will pay on the debt is estimated at \$169 billion. Curbing this runaway debt will be a tough job. Congress is looking for every possible program to cut, and funding for the sciences may have to pay part of the price.

The Federal Budget Process

An important way for scientists to participate in decisions on science funding is to get involved in the budget process. An excellent article "Earth Sciences and the Federal Budget" was published in *GSA News & Information* in June 1988 by Jim Evans, the previous GSA Congressional Science Fellow.

Spring and early summer are the best times to contact legislators about the budget. (Table 1 lists the important dates in the Congressional appropriations process.) Even better than calling or writing the appropriate legislator is to appear at hearings on the budget to voice your support of specific changes to the budget. At too many of these hearings, there are almost no scientists to speak for continued funding of their discipline. Scientists can testify at the authorization and appropriations committee hearings on their research and development budgets. If you cannot testify, you can

write to the chairman of the appropriate committee and register your support for continued funding. There are scientists who are vocal in this process, but the more the better.

As the budget process moves forward, the Gramm-Rudman-Hollings (GRH) law lurks in the back of every legislator's mind. The attempts to comply with GRH law will drive much of the decision-making during this budget year. GRH curbs deficit spending and seeks to reduce it to zero by 1993. In particular, it orders mandatory deficit ceilings that are reduced each year (FY90 carries a \$100 billion limit with a \$10 billion cushion). The current budget is monitored for compliance with this deficit ceiling on a schedule spelled out in the Gramm-Rudman-Hollings law.

However, if that ceiling is exceeded by even one dollar, then a sequestration process is automatically put in motion, and money is taken back from the agencies in an across-the-board cut of their funds for the next year. This process is extremely disruptive and embarrassing for the Congress and the President, so it is avoided at all costs. The dates of the sequestration process are set out in Table 2.

Science R & D Spending in the 80s

The budget can be divided into four general categories: (1) Over 40% of the budget is for entitlement programs, whose funding levels are written into law. Social Security, Medicare, Medicaid, and veterans' benefits are some of the largest entitlement programs. (2) Nearly 30% of the budget goes to defense spending that is discretionary—i.e., it must be appropriated every year. However, much of defense spending is earmarked many years before the dollars are spent, so to all intents and purposes, much of the defense budget is similar to entitlement spending. (3) Almost 15% of the budget, close to \$150 billion, is payment on the debt. Since the federal debt will have risen from \$914 billion in 1980 to over \$2.8 trillion by the end of 1989, payments on the debt are the fastest growing portion of the federal budget. (4) The rest of the budget is nondefense discretionary spending, and because it is truly appropriated every year, it is the object of many of the proposed cuts. In addition to providing tempting morsels to eliminate, this category of spending has also not grown significantly since its peak in 1981.

All basic research that is not defense related is in this last category of spending. However, this budget category also includes

(continued on p. 130)

TABLE 1. Federal Budget Appropriations Process

Date	Action
First Monday after January 3	The President is required by law to submit a budget for the next year.
January 20	After an election year, the new President is sworn in. He/she may submit a new budget.
Mid-February	The Congressional Budget Office (CBO) reports the budget baseline, deficit reduction options, and an analysis of the President's budget.
April 15	Deadline for completion of a budget resolution by Congress, indicating how much can be spent by the various agencies. However, after May 15 appropriations bills may be considered even if there is no budget resolution.
June 15	Deadline for the House and Senate to come to a reconciliation on what will be spent.
June 30	Deadline for House to complete the appropriations bills.
October 1	Start of the fiscal year.

Science Funding (continued from p. 129)

programs such as aid for the homeless and aid for families with dependent children. With the GRH ceiling, a dollar added to basic research will be a dollar taken away from other good programs, and the decisions to cut will be difficult.

Science R&D funding is part of the budget of most departments and agencies. The departments with expenditures for R&D that are larger than \$1 billion in 1989 are the Department of Defense, Department of Health and Human Services, NASA, Department of Energy, NSF, and Department of Agriculture. From 1980 to 1988, nondefense R&D programs have seen a 16% growth. However, they did not keep pace with inflation, realizing a net loss of nearly 9% since 1980. Medical research funding has also declined in most disciplines except for notable exceptions such as research into the AIDS virus. Defense spending, on the other hand, has doubled since 1980, realizing a net growth of 82%.

Although the prognosis for continued level funding for non-defense and nonmedical science is not good, Congress has consistently supported R&D spending. The reasons are fourfold: (1) cultural—science is part of our national heritage and, like the arts, it should be funded by the federal government; (2) public policy—answers to some questions are essential for the creation of sound public policy; (3) national security—much of our superiority in defense comes from our technical achievements, and we need to

TABLE 2. Gramm-Rudman-Hollings Target Dates

Date	Action
Mid-July	The office of Management and Budget (OMB) issues a mid-session review along with the economic and technical assumptions to be used for the Gramm-Rudman-Hollings sequestration report.
August 15	Snapshot of government spending.
August 21	CBO issues the initial sequestration report.
August 25	OMB issues initial sequestration report for next year's budget and the President gives the initial order (to sequester), which is effective immediately.
October 10	CBO issues the revised sequestration report.
October 16	OMB issues the final sequestration report for the next year's budget and the President issues the final order, which is also effective immediately.
November 15	The General Accounting Office issues the report on compliance with sequestration.

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encourage the development of these innovations and of a technically trained populace to run them; (4) competitiveness—our economic competitiveness relies in part on technological innovation in the market place.

Competitiveness is the new kid on the block, and a few programs have taken advantage of the increased Congressional interest; the most notable of these is the Human Genome Project (HGP). The HGP will sequence human DNA base pair by base pair—all three billion of them. The program will cost \$3-9 billion over the next 10-15 years, and it is hoped that it will establish the American biotechnology industry at the forefront of this work.

Research into such priorities as global-warming, ground-water, and municipal solid waste issues are perceived as essential to the making of public policy in these areas. Global warming, in particular, has received quite a bit of attention. In fact, the enhanced scope of the research agenda into global warming was circulated in a separate booklet accompanying Reagan's budget.

Summary

Funding for basic science research may be cut in the next few years. Scientists who wish to influence the extent and manner in which these cuts are made can best do so by getting involved in the Congressional budget process. Appearances at authorization and appropriations hearings to provide testimony are particularly useful.

Furthermore, it is worthwhile to campaign for programs other than one's own. Even if a discipline is not coming under the axe this year, it may in the future. To promote a particular program, scientists may also score their programs on the criteria with which Congress has funded science in the past (cultural reasons, public policy needs, national security interests, and competitiveness needs) and present them accordingly.

Editor's note: Elizabeth Robinson, GSA Congressional Science Fellow for 1988-1989, is working in the office of Congressman Richard A. Gephardt, 1432 Longworth H.O.B., Washington, DC 20515; phone (202) 225-2671. The fellowship, which is for a one-year term, is jointly sponsored by funds from GSA and a grant from the USGS.

In Memoriam

Thomas P. Anderson
Golden, Colorado

Harold Jeffreys
Cambridge, England
March 1989

William M. Cogen
Oakland, California
April 4, 1988

Donald B. Gould
Aurora, Colorado
February 25, 1989

Frank Ebbutt
Ontario, Canada
October 15, 1988

Alfred Haak
Amsterdam, The Netherlands
November 17, 1988

Former GSA Editor Dies

Former GSA Managing Editor Josephine K. Fogelberg died on March 23, 1989, in Vista, California. Ms. Fogelberg was Managing Editor from October 1967 through March 1980, when she retired. She was instrumental in the initial development of *Geology*.



DNAG NEWS

by Allison (Pete) Palmer

There's Good News Tonight!

On April 6, Volume A went to the printer! Considering that the last text materials needed to typeset one of the chapters didn't arrive until March 22, that represents a lot of work by everybody here to get this out with a chance for making the IGC in July. The printing process normally requires 12 weeks, which gives a publication prediction, if

nothing goes wrong, of the end of June. Despite the problems in getting this wrapped up, this volume will set a new DNAG publication record. The authors were first solicited to write their chapters in June 1987. Thus this book took less than two years from start to finish. Maybe it helps to have a smaller cast of characters. Listed below are your 34 colleagues who created the new record:

Volume A

The Geology of North America—An Overview
A. W. Bally and A. R. Palmer, editors

Contributing authors

J. K. Arbenz	Z. de Cserna	P. F. Hoffman	N. Rast	J. G. Tanner
T. Atwater	R. W. Decker	P. J. Hood	M. I. Ross	H. P. Trettin
H. G. Avé Lallemant	T. W. Donnelly	W. P. Leeman	C. R. Scotese	B. E. Tucholke
A. W. Bally	R. H. Godson	R. G. McConnell	R. E. Sheridan	P. R. Vogt
K. J. Bird	W. F. Hanna	G. Meyer	B. J. Skinner	E. L. Winterer
L. W. Braile	T. G. Hildenbrand	W. D. Mooney	S. Snelson	D. M. Worrall
	W. J. Hinze	J. S. Oldow	R. E. Sweeney	H. E. Wright, Jr.

Other Good News

The editors for four more volumes of *The Geology of North America* are now committed to come to Boulder to go over the galleys for their books. This is the last step prior to preparing final pages, so these books should be on their way to the printer before the end of the summer.

- May 11-12—E. L. Winterer—*The Eastern Pacific Region*
- June 15-18—R. D. Hatcher, Jr., W. A. Thomas, and G. Viele—*The Appalachian-Ouachita Orogen in the United States*
- June 6-7—M. G. Wolman and H. C. Riggs—*Surface Water Hydrology*

Last week in July—J. E. Case and G. Dengo—*The Caribbean Region*

Art Grantz, Jack Sweeney, and Leonard Johnson will be here in late June to go over the galleys for the Arctic volume if Art can make his goal of having his chapter on the Alaska margin written before the end of April.

Chapters are regularly appearing from Norm Lasca, editor for the *Archaeological Geology* volume. This is now 25% in our hands, and more chapters arrive weekly.

The first chapters for *The Economic Geology of Mexico* have gone through translation and checking by the volume editor, G. P. Salas, and are now in copy editing.

It looks as if there will be a number of busy months ahead as this project winds down!

GSA Goes Kiwi



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emphasis on South Island

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1989 GSA ANNUAL MEETING

Frontiers in Geoscience

St. Louis, Missouri

November 6-9, 1989

Cervantes Convention Center



Abstracts Deadline Abstract forms available in geology departments, or contact GSA Abstracts Coordinator	July 19	Abstract Notices Mailed (First Class)	August 25
		Speaker Kits Mailed (First Class)	August 30
Preregistration and Housing Forms and Event Information <i>GSA News & Information</i>	August 1	Technical Program Schedule Available <i>GSA News & Information</i>	September 1
		Preregistration Deadline Information available from GSA Meetings Coordinator	October 6
Joint Technical Program Committee GSA division, associated society, and at-large representatives meet in Boulder	August 18-19	Abstracts Volume Mailed to Subscribers (First Class)	October 12

Call today for more information: GSA Meetings Coordinator (303) 447-2020, or write P.O. BOX 9140, BOULDER, CO 80301

1989 Annual Meeting Field Trips

St. Louis, the Gateway City, provides an ideal starting place for field trips to see many aspects of midcontinent geology. The trips summarized below are coordinated, where possible, with the technical program to offer an opportunity to visit areas that are subjects of discussion at symposia and in targeted sessions.

Several trips will be offered to areas far from the Midwest, where the meeting theme "Frontiers in Geoscience" presents compelling opportunities to see significant geologic terranes.

All trips begin and end in St. Louis unless otherwise noted.

Costs are preliminary estimates. Registration forms will appear in the August issue of *GSA News & Information*. Preregistration is suggested because attendance is limited and will be determined on a first-come, first-served basis. **Preregistration deadline is October 6.**

For further information, contact the 1989 Field Trip Chairman, Jerry D. Vineyard, Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65401-0250, (314) 364-1752, or the individual trip leaders.

Premeeting

1. Archaeological Geology and Geomorphology in the Central Mississippi-Lower Illinois Valley Region, Illinois and Missouri. Edwin R. Hajic, Dept. of Geology, University of Illinois, Urbana, IL 61801, (217) 333-4389; Russell W. Graham, Michael D. Wiant. November 5. Cost: \$40.

2. Late Pennsylvanian and Early Permian Cyclic Sedimentation, Paleogeography, Paleogeology, and Biostratigraphy in Kansas and Nebraska. Roger K. Pabian, Conservation and Survey Division, University of Nebraska, Lincoln, NE 68588-0517, (402) 472-3471; Robert F. Diffendal, Jr., Lynn Watney, Chris Maples, Philip H. Heckel, Ron West, Royal H. Mapes, Gene Mapes, Ted Huscher, Peter Holterhoff, R. M. Joeckel. November 3-5. Trip begins and ends in Kansas City, Missouri. Cost: \$350.

3. Depositional Environments and Geology of Coals of the Lower Pennsylvanian of the Western Part of the Appalachian Basin and the Eastern Part of the Illinois Basin in Kentucky, Indiana, and Illinois. James C. Cobb, Kentucky Geological Survey, Mining and Mineral Resources Building, University of Kentucky, Lexington, KY 40506-0107, (606) 257-5500; Donald R. Chesnut, Jr., Stephen F. Grob, Erik P. Kvale, Joe Devera. Sponsored by the Coal Geology Division. November 3-5. Trip begins in Lexington, Kentucky. Cost: \$300.

4. Geology of the Proposed Nuclear Waste Repository at Yucca Mountain, Nevada, and Surrounding Area. Steven R. Mattson, Science Applications International Corp., Suite 407, Valley Bank Center, 101 Convention Center Dr., Las Vegas, NV 89109, (702) 794-7615; Bruce M. Crowe, David E. Broxton, Tony Buono, Paul P. Orkild. November 3-5. Trip begins in Las Vegas, Nevada. Cost: \$300.

5. Regional Stratigraphy, Facies, and Paleoenvironments in the Cambrian of Southern Missouri. Vincent E. Kurtz, Southwest Missouri State University, Box 87, 901 S. National, Springfield, MO 65804-0089, (417) 836-5800; James R. Palmer. November 3-4. Cost: \$100.

6. Surface Effects of the 1811-1812 New Madrid Earthquake Sequence in Seismotectonics of the New Madrid Seismic Zone, Western Tennessee, Northeast Arkansas and Southeast Missouri. Eugene S. Schweig III, Center for Earthquake Research and Information, Memphis State University, Memphis, TN 38152, (901) 678-2007; Randall W. Jibson. November 3 (evening)-5. Cost: \$100.

7. Hydrogeology of Shallow Karst Ground-water Systems in Southeastern Missouri. James E. Vandike, Missouri Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65401-0250, (314) 364-1752; Paul Blanchard, Cynthia Endicott. November 4-5. Cost: \$120.

(continued on p. 133)

Field Trips (continued from p. 132)

Half-Day Mini-Trips (during the meeting)

8. Central Mississippi Valley Seismic Network, Data Base, Recording and Retrieval Systems of St. Louis University's Department of Earth and Atmospheric Sciences. Sean T. Morrissey, Dept. of Earth and Atmospheric Sciences, St. Louis University, St. Louis, MO 63156, (314) 658-3131. November 5 (afternoon). Cost: \$3.

9. The Geologic Story of the St. Louis Riverfront (A Walking Tour). Arthur W. Hebrank, Missouri Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65401-0250, (314) 364-1752. November 6 (morning). Cost: \$2.

10. Engineering Geology and Industrial Minerals Aspects of the Greater St. Louis-Illinois Area. Paul B. DuMontelle, Illinois State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820, (217) 333-5114; James W. Baxter, Alan G. Goodfield. November 7 (morning). Cost: \$25.

11. Digital Cartography, Map Library, and Data Base Management System of Washington University's Department of Earth and Planetary Sciences. Raymond E. Arvidson, Dept. of Earth and Planetary Sciences, Washington University, Campus Box 1169, St. Louis, MO 63130, (314) 889-5610; Clara McLeod. November 8 (morning). Cost: \$10.

12. Aerospace Center, U.S. Defense Mapping Agency. Ron Blouse, U.S. Defense Mapping Agency, Aerospace Center, DSGA, St. Louis AFS, MO 63118, (314) 263-8410; Capt. Dale Hotzaphel. November 9 (morning). Cost: \$8.

Postmeeting

13. Engineering and Environmental Geology of the St. Louis Area, Missouri. Mimi Garstang, Missouri Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65401-0250, (314) 364-1752; David Hoffman, Peter Price, Michael J. Navin. November 10. Cost: \$40.

14. Transition from Passive Margin to Foreland Basin Sedimentation: The Atoka Formation of the Arkoma Basin, Arkansas and Oklahoma. David W. Houseknecht, Dept. of Geology, University of Missouri—Columbia, Columbia, MO 65211, (314) 882-6285; Marvin O. Woods. November 10–12. Trip ends in Tulsa, Oklahoma. Cost: \$300.

15. Quaternary Loess and Glacial Record of Southwestern Illinois. Leon R. Follmer, Illinois State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820, (217) 244-6945; E. D. McKay III, Edwin R. Hajic. November 10. Cost: \$30.

16. Cyclic Strata of the Late Pennsylvanian Outlier, East-Central Illinois. C. Pius Weibel, Illinois State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820, (217) 244-2493; R. L. Langenheim, Jr. November 10–11. Cost: \$100.

17. Selected Economic Mineral Deposits of Central Arkansas. J. Michael Howard, Arkansas Geological Commission, 3815 W. Roosevelt Rd., Little Rock, AR 72204, (501) 371-1488; Benjamin F. Clardy, Charles G. Stone. November 10–11. Trip ends in Little Rock, Arkansas. Cost: \$90.

SEG-Sponsored Field Trips

Precambrian Ore Deposits and Geology of Volcanic and Plutonic Rocks in the Southern St. Francois Mountains, Missouri. Eva Kisvarsanyi, Missouri Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65401, (314) 364-1752; V. Max Brown, Richard D. Hagni. November 2–4. Cost: \$350.

Mississippi Valley-Type Mineralization of the Viburnum Trend, Missouri. Richard D. Hagni, Dept. of Geology, 125 McNutt Hall, University of Missouri—Rolla, Rolla, MO 65401, (314) 341-4616; Raymond M. Coveney, Jr. November 9 (evening)–11. Cost: \$150.

1989 Annual Meeting Symposia Highlights

This is the first in a series of articles highlighting symposia to be presented in St. Louis at the 1989 GSA Annual Meeting. Future articles highlighting additional symposia will appear in the July and September issues of *GSA News & Information*. The August registration issue of *GSA News & Information* will give a complete listing of symposia titles and authors.

S2. Cenozoic Deep-Sea Foraminifera: Distribution and Environments

Sponsored by the Cushman Foundation

Conveners: Kenneth G. Miller, Barun K. Sen Gupta

Speakers: Bruce H. Corliss, Duke University; Kenneth G. Miller, Rutgers University and Lamont-Doherty Geological Observatory; Barun K. Sen Gupta, Louisiana State University; Detmar Schnitker, University of Maine; Martin B. Lagoe, University of Texas at Austin; Paul Loubere, Northern Illinois University; Fay Woodruff, University of Southern California; Ellen Thomas, Wesleyan University; J. Otto R. Hermelin, University of Stockholm, Sweden; Michael Kaminski, Dalhousie University, Halifax, Nova Scotia.

General purpose: To delineate the distribution of deep-sea benthic foraminifera in space and time in relation to questions of ecology, stratigraphy, paleoceanography, and geological processes.

General pertinence: The distributions of modern deep-water (>200 m) benthic foraminifera are controlled by an interplay of physiochemical and biotic interactions that are still poorly understood. Although modern distributions are not fully understood, distributions of fossil deep-water benthic foraminifera are used to provide (1) an important constraint upon the changes in deep-water circulation, a critical component of the climate system; and (2) paleoenvironmental information (paleodepth, paleowater mass, etc.) used to decipher the geological histories of various regions. Two tactics can be employed to determine controls upon deep-water benthic foraminifera. The first is to conduct detailed studies of living forms using box cores and standard ecological techniques. The second is to study changes in the distribution of these creatures through space and time, and to compare these changes with other indicators of environmental conditions (paleodepth estimates obtained from "backtracking," stable isotopes, sediment composition, sediment distribution, etc.). Our symposium will address the controls upon deep-water benthic foraminifera using both tactics and evaluate the reliability with which they can be used to reconstruct past oceanographic conditions.

Importance to the general public: Deep-water circulation changes constitute an important, if not dominant, control upon Earth's climate system. Geological information on deep-water changes is derived predominantly from the distribution and chemistry of deep-water bottom-dwelling (benthic) shelled protozoans called foraminifera. The symposium will focus on deciphering the distributions in space and time of these tiny creatures whose shells may unlock the secrets of the ancient deep sea.

S4. Frontiers in Geoscience Information

Sponsored by Geoscience Information Society

Convenor: Mary Ansari, University of Nevada, Reno

Speakers: Jim O'Donnell, California Institute of Technology; Charlotte R. M. Derksen, Stanford University; E. J. "Jerry" McFaul, USGS, Reston; Julie Bichteler, University of Texas at Austin; Larry Carver, University of California, Santa Barbara; Gordon S. "Pete" Banholzer, Georgia Institute of Technology; Donald L. Light, USGS, Reston; Richard Walker, University of Wisconsin—Madison; Barbara DeFelice, Kresge Physical Sciences Library.

(continued on p. 134)

In 1989 GSA will be looking to the future with its theme "Frontiers in Geoscience." Consequently, because geoscience information is an integral part of the geosciences, it is appropriate that GIS should take this opportunity to look to the future in geoscience information. Considering that only a decade ago libraries and information centers had not yet been impacted by the microcomputer, one realizes that in the realm of geoscience information, looking ahead even ten years is extremely difficult, and anything beyond can border on sheer fantasy. Because of the rapid pace of technological developments in the information world, a focus on geoscience information in the 1990s is futuristic enough. The emphasis of the symposium will be on state-of-the-art information technology and anticipated developments in information management, retrieval, and dissemination over the coming decade. There will be eight invited papers by experts in geoscience information and technology covering CD-ROM technology; government publishing in electronic format; electronic geoscience research libraries; the Research Libraries Group's geographic information system; access to geoscience information in the online catalog; digital mapping; the future of the scientific journal; and cooperative collection development and preservation programs for the 1990s. Because of the geologist's heavy reliance upon the geoscience literature, the symposium topics will be of vital interest to research and field geologists as well as to earth science information specialists.

S7. Radiations and Recoveries from Mass Extinctions

Sponsored by the Paleontological Society

Conveners: Thor A. Hansen, Erle G. Kauffman

Speakers: Phil Signor, University of California, Davis; Erle G. Kauffman, University of Colorado, Boulder; P. Harries, University of Colorado, Boulder; Steven Stanley, Johns Hopkins University; J. John Sepkoski, University of Chicago; George McGhee, Rutgers University; George D. Stanley, University of Montana; Douglas H. Erwin, Michigan State University; Jennifer K. Schubert, University of Southern California; David J. Bottjer, Jr., University of Southern California; Kevin Padian, University of California, Berkeley; Thor A. Hansen, Western Washington University; Peter Sheehan, Western Washington University; Gerta Keller, Princeton University; Doug Nichols, USGS, Denver.

The advent of the asteroid impact hypothesis as a cause for mass extinctions has stimulated a tremendous amount of research into mass extinction events, but the recoveries from these events have been relatively neglected. While mass extinctions reduce or eliminate particular groups of organisms and thus open up ecological niches, it is during the recoveries from these extinctions that new groups of organisms appear (or change from a subordinate to dominant role) and the new course of evolution is determined. This symposium will present results from research on nine different radiations and recoveries (spanning nearly the entire Phanerozoic) and will cover a wide variety of organisms (vertebrates, plants, and marine invertebrates including brachiopods, molluscs, corals, and foraminifera). Questions that speakers will address will include: How do organisms survive mass extinctions? How long does it take for organisms and communities to recover from the effects of a mass extinction? How do different organisms respond during the recovery period? How does a recovery from an extinction, in which organisms are filling up a largely empty world, compare with an adaptive radiation, in which a biological innovation is competing in a crowded world? Do recoveries from mass extinctions that may be related to extraterrestrial impacts differ from recoveries from mass extinctions triggered by terrestrial events? Answers to these and

other questions will help us understand how the world's ecosystem has survived and responded to major mass extinctions in the past and may give us insight into how it will respond to a future ecological disaster.

S10. Becker and Van Hise's Challenges: Geology and Geophysics Since 1904

Sponsored by the History of Geology Division

Conveners: Clifford M. Nelson, Mary C. Rabbitt

Speakers: James R. Balsley; Daniel F. Merriam, Wichita State University; Clifford M. Nelson, USGS, Reston; G. Brent Dalrymple, USGS, Menlo Park; Robert H. Dott, Jr., University of Wisconsin—Madison; Carl Kisslinger, University of Colorado, Boulder; Mary C. Rabbitt, Washington, D.C.; Thomas L. Wright, USGS, Hawaiian Volcano Observatory; Ursula B. Marvin, Harvard-Smithsonian Center; Hatten S. Yoder, Carnegie Institution.

The History of Geology Division symposium for 1989 evaluates how our profession has (or has not) responded to some of the challenges proposed by George Becker and Charles Van Hise in papers they presented at the International Congress of Arts and Sciences in St. Louis in October 1904 and published later that year in *Science* (v. 20, p. 545–556) and *The Journal of Geology* (v. 12, p. 589–616). Becker and Van Hise assessed the state of research in 1904 and called for new and more rigorous quantitative and qualitative studies to solve more than a baker's dozen fundamental problems in geology and geophysics.

Following an introduction by co-conveners, eminent speakers will trace the development of ideas during the past eight decades about the origin of Earth and the solar system, Earth's age, tectonics, earthquakes, and Earth's interior, experimental petrology, volcanoes, remanent magnetism, and mathematical geology. The historical reviews and analyses of these topics of continuing importance and interest to scientists and the general public will be enhanced by the speakers' original contributions to knowledge in these fields.

Supplementing Becker and Van Hise's review and call to action, the speakers, as a panel, will pose challenges for the next generation of geologists and geophysicists.

(continued on p. 135)

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1989 GSA ANNUAL MEETING • ST. LOUIS

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WE WILL ALSO BE ATTENDING THE
INTERNATIONAL GEOLOGICAL CONGRESS (IGC) MEETING,
WASHINGTON, D.C. JULY 9-14, 1989.

Symposia (continued from p. 134)

S11. Geological Exploration of the Solar System: Past, Present, and Future

Sponsored by the Planetary Geology Division

Convener: Ronald Greeley, Arizona State University

Speakers: David Smith, Goddard Space Flight Center; Larry Soderblom, USGS, Flagstaff; Paul Spudis, USGS, Flagstaff; Harry McSween, University of Tennessee at Knoxville; James Head, Brown University; Raymond Arvidson, Washington University, St. Louis.

The year of 1989 marks the 20th anniversary of the *Apollo* landing on the Moon, as well as the flyby of Neptune by the *Voyager 2* spacecraft as it completes its journey through the outer Solar System. With the additional flyby of Mars by the Soviet *Phobos* spacecraft and successful launches of the U.S. *Magellan* mission to

Venus and the U.S. *Galileo* mission to Jupiter (anticipated in the fall), 1989 marks a banner year for Solar System exploration. This symposium is designed to provide a view of Solar System exploration and includes our own planet, Earth, both from the "dynamics" perspective and as an analog to extraterrestrial planetary surfaces. The program is structured through invited speakers who are leaders in their respective disciplines to address the past, present, and future missions to planets throughout the Solar System. The last two decades of exploration have shown that planets and satellites in the Solar System represent a wide spectrum of objects of which Earth is one member. During the symposium, the differences and similarities of various planetary objects will be compared with our planet to determine Earth's place in the evolution of the Solar System.

1989 Frontiers in Geoscience Theme Sessions

Theme titles and focus are described below. Up to three disciplines to which the abstract may be submitted follow each description. The discipline number is a reference to the abstract form. Authors will select ONE of the disciplines. This will be the review category. Theme abstracts must include:

1. the theme number (T1, T4, T20 . . .),
2. the first five key words of the theme title, and
3. ONE discipline.

Schedules for theme sessions will be provided after the JTPC meeting in August.

T1. Geological Mapping in the Next Several Decades. New technologies are becoming available to facilitate geological mapping efforts, including advanced remote sensing and positional systems, as well as digital methods of data compilation and publication. Contributions are solicited from geoscientists having a broad overview of the importance of geological maps and mapping, and from individuals who are cognizant of new technologies that are being—or will be—brought to bear on facilitating geological mapping, together with archive and distribution processes. Geoscience Information (11), Planetary Geology (25), Remote Sensing (28).

T2. The Effects of Man on the Mississippi River and Its Delta. From headwaters to delta, the ecosystem of the Mississippi has been modified extensively. Man has caused channel and floodplain changes and influenced sediment regimes, hydrology, chemistry, biota, and water quality. A system-wide model of the river is needed that incorporates information from diverse disciplines such as geography, civil engineering, geochemistry, biology, and statistics. Contributors are asked to address the dynamics of this system and its adjustments to the hand of man. They are encouraged to include predictions of future impacts and ways of dealing with them. Engineering Geology (4), Environmental Geology (5), Geomorphology (9).

T3. Correlation and Basin Analysis of Nonfossiliferous Sedimentary Rocks. Many Precambrian orogenic belts and intracratonic and marginal basins contain thick sequences of nonfossiliferous sedimentary rocks. Correlation of strata both within and between individual orogenic belts and basins is problematic, especially in areas subjected to metamorphism, but essential for understanding the evolution of Precambrian shields. Contributions are solicited that discuss new methods of correlation in such terranes, including examples from physical stratigraphy and sedimentology, as well as applications of petrological, geochemical, and

isotopic techniques. Geochemistry (7), Precambrian Geology (26), Stratigraphy (30).

T4. Magma Currents, Melt Migration, and Geochemical Transport in Mafic Igneous Complexes. Our understanding of how mineralogical and compositional variations develop in mafic igneous complexes is undergoing rapid change. The traditional view of simple crystal accumulation is no longer adequate, and the importance of thermochemical diffusion processes in magma chambers is being emphasized. Contributions are solicited that present new results of field and laboratory studies, and theoretical treatments that might guide directions of future research, including the significance of hydrothermal processes in platinum-group element mineralization. Economic Geology (3), Geochemistry (7), Petrology, Igneous (22).

T5. The Effects of Greenhouse Warming on North American Deserts: Holocene Analogues. At present rates of increase, the concentration of atmospheric CO₂ will double within the next century. Computer models have been used to predict the climatic effects of increased CO₂, but an alternative—and possibly preferable—way to predict the effects of greenhouse warming on natural systems is through study of past intervals when temperatures were higher than today. Contributions are solicited that explore the potential effects of increased temperature on biotic, fluvial, and aeolian systems, using warm periods of the Holocene as analogues. Environmental Geology (5), Quaternary Geology (27).

T6. Trace Element and Isotopic Studies with the Ion Microprobe. Trace element and isotopic analyses that take advantage of the sensitivity and spatial resolution of secondary ion mass spectrometry (SIMS) are having an increasingly greater impact in a wide range of geoscience subdisciplines. Contributions are solicited that present applications of SIMS techniques to terrestrial and extraterrestrial materials. Geochemistry (7).

T7. Sub-Mediterranean "Giant Salt" as a Deep-Water Brine Precipitate: An Alternative to the Evaporite Hypothesis. Although the model for the "giant salt" as an *evaporite* (created by complete evaporation) has achieved considerable scientific currency, this deposit might actually be a *precipitate* that accumulated beneath a deep-water, semi-isolated brine basin. The Dead Sea, where a 4-cm-thick halite precipitate settled out between 1973 and 1975, may be a useful actualistic model. Contributions are solicited

(continued on p. 136)

that address this alternative hypothesis, including those that establish criteria which distinguish between true evaporites and deposits representing precipitates. Geochemistry (7), Petrology, Sedimentary (24), Sedimentology (29).

T8. Quantitative Structural Geology: The Nature, Mechanism, and Implications of Natural Deformation. Interpretations of finite strains, incremental strains, and kinematic indicators are reaching a stage where rigorous quantitative constraints can be placed on the nature of mountain building, faulting, and the evolution of shear zones. Contributions are solicited that consider quantification of strain measurements; microstructural and model studies of deformation mechanisms and mineral microstructures; interpretation and model studies of kinematic indicators; analogue studies of deformation; and application of these studies to orogenic belts and fault zones. Mineralogy/Crystallography (17), Structural Geology (31), Tectonics/Geophysics (33).

T9. The First Half of Earth History. Studies of ancient rocks reveal the presence of highly evolved continental crust from the oldest times preserved in the geologic record. It appears that the processes leading to continent formation have changed little in the past 3.8 billion years, although rates and scales may have, due to the declining thermal budget of Earth. Contributions are solicited that provide geological, petrological, geochemical, and isotopic tests of current models contending that major differences in composition, areal extent, and tectonic style distinguish Archean from post-Archean crustal terranes. Precambrian Geology (26).

T10. Seismic Tomography and Mantle Dynamics. Recent advances in our ability to image velocity variations deep within the Earth have implications for several areas outside of seismology, including petrology and geochemistry, mineral physics, tectonophysics, gravity, geomagnetism, and geodesy. Perhaps the most important immediate contribution of seismic imaging techniques is the determination of the scale of mantle convection. In addition to contributions of a purely seismological nature, papers are solicited that discuss mantle convection and physical and chemical properties in the vicinity of the core-mantle boundary. Geochemistry (7), Geophysics (10), Tectonics/Geophysics (33).

T11. Global Sedimentary Geology. There is an increasing interest in global-scale aspects of sedimentary geology, from both societal and scientific viewpoints. Among these are the Global Change Program, the greenhouse condition, paleoclimatology, paleoceanography, sequence stratigraphy, global distribution of resources, and paleogeography/biogeography. Contributions are solicited from researchers involved in studying sediments and sedimentary rocks utilizing a global-scale point of view. Oceanography (18), Petrology, Sedimentary (24), Sedimentology (29).

T12. A Growing Crisis in (Geo)Science Education. The substantial nationwide decline in geoscience students—especially undergraduate majors—over the past several years has reached crisis proportions. Contributing factors include the state of pre-college science education, the neglect of science-teacher training in our institutions, the negative public image of science and particularly earth science in the United States, and an overemphasis on research relative to teaching in our degree-granting institutions. Contributions are solicited from individuals who wish to propose realistic improvements in this system. Geology Education (8).

T13. The Lunar Science Frontier: Implications for Earth's Past and Future. Studies of the Moon allow us to better understand important aspects of Earth's earliest history (possible formation of the Moon from debris excavated from proto-Earth; differences in igneous rocks that bear on whether either planet produced magma oceans; the formation of lunar impact basins as an anomaly and not the last manifestation of a continuous flux, etc.). Topics affecting Earth's future include the potential use of lunar resources in space (e.g., construction materials) or on Earth (e.g., ³He in fusion reactors). Contributions are solicited in these areas of lunar science. Geochemistry (7), Petrology, Igneous (22), Planetary Geology (25).

T14. Tectonometamorphism. The study of metamorphic rocks in the context of overall tectonic framework is a key element in deducing how continental crust forms. Contributions are solicited that relate the timing of metamorphism to that of crustal thickening; the mechanism of exhumation of terranes that record high metamorphic pressures at relatively low temperatures; the mechanisms for heat generation and transfer in tectonically thickened crust, including the role of fluids and melts in deformation processes; and distinctions among uplift, exhumation, and erosion. Petrology, Metamorphic (23), Tectonics (32), Tectonics/Geophysics (33).

T15. Continental Dynamics. Continents are affected by processes that are not well accommodated by classic plate-tectonic concepts. Examples include mid-continent rifting, shortening, and vertical displacements; anorogenic magmatism; broadly distributed zones of shear; and vigorous continent collision. These involve a balance between stress and strength, and leave a distinctive accounting of their activity. Contributions are solicited that consider tectonics, magmatism, and possibly fluid transport in the continental crust and subcontinental lithosphere pertinent to the above issues. Petrology, Igneous (22), Tectonics (32), Tectonics/Geophysics (33).

T16. Volcanism and Climate. Improved techniques for monitoring volcanological and climatological phenomena have renewed interest in long-suspected links between the two. Contributions are solicited from atmospheric, earth, and ocean scientists which address the following: influence of magmatic volatile content, style of eruption, latitude of volcano, and season of eruption on climatic perturbation; stratospheric reactions and rates by which volcanic H₂S and SO₂ are converted into stable sulfuric acid; mechanisms relating stratospheric volcanic aerosols to El Niño–Southern Oscillation behavior. Volcanology (34).

T17. Mantle Plumes and Mass Extinctions. Popular hypotheses that meteoritic/cometary impact caused the Cretaceous-Tertiary (K-T) extinctions remain problematic. Alternative hypotheses have been advanced in which events in Earth's core and lower mantle are linked to increased mantle plume activity and changes in the frequency of geomagnetic reversals, leading ultimately to extinctions. Contributions are solicited that provide a multidisciplinary evaluation of this endogenous model for biological extinctions. Paleontology/Paleobotany (19), Tectonics/Geophysics (33).

T18. Geoscience and the Arts. The arts have historically been influenced by the geosciences, which have provided materials, settings, and inspiration for painting, sculpture, music, and literature. Understanding the relation between art and geology potentially can contribute toward improved methods of geoscience education as well as furthering communication of geoscience to the public. Contributions are therefore solicited that explore past, present, and

(continued on p. 137)

Annual Meeting Theme Sessions (continued from p. 136)

future interactions of the geosciences and the arts. *Geology Education* (8).

T19. New Concepts in Understanding Fluid-Rock Interactions at High Temperatures: Problems and Solutions.

Significant advances are being made in understanding the interactions of high-temperature fluids with crystalline rocks. Remaining problem areas include diverse approaches to calculating fluid/rock ratios, mechanistic aspects of fluid flow through crystalline rocks, the role of fluids in heat transfer in the crust, and the chemical effects of fluid-rock interaction. Contributions are solicited that address these issues, with the expectation that additional problem areas will be identified and new approaches considered. *Geochemistry* (7), *Petrology, Igneous* (22), *Petrology, Metamorphic* (23).

T20. Physical Properties of the Lower Continental Crust.

Information from high-resolution seismic surveys and detailed geochemical analyses reveal the complexity of processes that have taken place in the lower crust, whereas recent advances in instrumentation permit high-quality laboratory measurements of the physical properties of lower crustal rocks. Contributions are solicited that will integrate observations from diverse disciplines as a guide to our current understanding of the lower crust and that will evaluate new interdisciplinary approaches to mapping local and regional variations in lower crustal properties. *Geophysics* (10), *Tectonics/Geophysics* (33).

T21. Frontiers of Fluid-Inclusion Research.

Fluid inclusions correspond to trapped samples of the fluid phase present at some stage during igneous crystallization, metamorphism, ore formation, diagenesis, etc. As such, studies of fluid inclusions have wide applications to several important problems in petrogenesis. Contributions are solicited from researchers investigating natural occurrences of fluid inclusions. Presentations that consider new techniques in fluid-inclusion analysis, experimental phase equilibria of fluids, and nontraditional applications of fluid inclusions are especially encouraged. *Geochemistry* (7), *Petrology, Experimental* (21).

T22. Application of Artificial Intelligence, Expert System, or Knowledge-Based System Methods in Geological Sciences.

Geological research has taken advantage of new advances in computer science and computing technology. Artificial intelligence (AI) research is one such technology that has gained maturity in recent years. AI techniques aid in both quantitative and qualitative situations where data are insufficient, evidence conflicts, or only partial information is available. These systems are capable of capturing the knowledge of experts and delivering it to nonexperts. Contributions are solicited that convey the usefulness of AI and related methods to solving geological problems. *Mathematical and Computer Geoscience* (35).

T23. Determining the Relative Timing of Pluton Emplacement and Regional Deformation.

Many orogenic belts evolve through series of regional events of deformation, metamorphism, and pluton emplacement, so pre-tectonic, syntectonic, and post-tectonic plutons may be juxtaposed. In order to decipher the relative timing of such complex events, it is necessary to distinguish fabrics within plutons that are primary (developed during igneous crystallization) from those that are secondary (imposed by later deformation). Contributions are solicited that will evaluate criteria used to establish timing

of pluton emplacement, address the behavior of plutons during subsequent deformation, and generally examine the use of plutons in establishing the ages of regional deformation and metamorphism in their wall rocks. *Petrology, Igneous* (22), *Structural Geology* (31), *Tectonics/Geophysics* (33).

T24. Geomorphic Processes and Landform Evolution.

Significant progress has been made in field, flume, and theoretical studies of surficial processes, which relate these processes to landscape development. Such processes are complex, and modern processes are not necessarily responsible for current landforms. In addition, climatic change can affect our ability to extrapolate to the past from recent measurements. Contributions are solicited that formulate the study of processes within the larger framework of landform evolution and consider how to extend small-scale process studies to larger scales by using digital data bases. *Geomorphology* (9), *Hydrogeology* (14), *Remote Sensing* (28).

T25. Late Eocene-Oligocene Climatic and Biotic Evolution.

The late Eocene and Oligocene were periods of dramatic climatic and biotic change; the tropical world of the Mesozoic was replaced by the modern, cool-temperate glacial world. New data about Antarctic glaciation, oceanic changes, and faunal/floral changes in both marine and terrestrial environments are now emerging. Contributions are solicited from the disciplines of paleontology, climatology, stratigraphy, and geochemistry that document the nature of change during the late Eocene-Oligocene, which will lead to a better understanding of this time interval. *Marine Geology* (15), *Paleontology/Paleobotany* (19), *Stratigraphy* (30).

T26. Hydrothermal Organic Geochemistry.

Organic compounds are known to occur in Earth's crust at much higher temperatures than previously thought possible. Studies involving minerals and fluids can no longer be considered complete if the organic compounds are ignored. Contributions are solicited on organic compounds in sedimentary basin brines and basinal sources of petroleum, geothermal and submarine hydrothermal systems, and hydrothermal ore deposits, as well as experimental and theoretical methods establishing thermodynamic/kinetic properties of aqueous organic species at high temperatures and pressures. *Geochemistry* (7).

T27. Cretaceous Record of the Eastern Margin of the Western Interior Seaway.

Cretaceous rocks along the eastern margin of the Western Interior Seaway (WIS) record global eustatic cycles; early "Vail curves" were calibrated in this area. In Minnesota, Iowa, Nebraska, and North and South Dakota, the Cretaceous thins and onlaps older rocks. Thickness and facies changes document marginal marine environments not commonly found in other parts of the WIS which also have an expression in geochemical and paleontological data. Contributions are solicited that document the extensive record of Cretaceous transgression, progradation, and paleotectonics in this region. *Paleontology/Paleobotany* (19), *Sedimentology* (29), *Stratigraphy* (30).

T28. Hydrogeologic Challenges for the Next Decade.

Contributions are solicited that will describe likely scenarios for the thrust of hydrogeologic research endeavors for the next 10 years. In addition to policy statements and administrative outlooks, topics for consideration include problem areas such as radioactive-waste mismanagement, integrity of the domestic water supply, and the

(continued on p. 138)

Annual Meeting Theme Sessions (continued from p. 137)
overall role of subsurface water (e.g., petroleum migration, ore deposition, crustal failure). Hydrogeology (14).

T29. Thermal and Hydrologic Evolution of Accretionary Prisms: Modern and Ancient Examples. Accretionary prisms provide a "natural experiment" illustrating how fluids affect the mechanical behavior of the sediment and rock during deformation. Contributions are solicited that address sea-floor manifestations of fluid flow; models for the dynamics and geometries of the flow regime; thermal structure; fluid chemistry and chemical evolution; diagenesis and metamorphism of inorganic phases; relations between fluids and the physical properties of rock and sediment bodies; and effects of fluids on geologic structures and the processes of deformation. Geochemistry (7), Marine Geology (15), Tectonics (32).

T30. Origin of Brines in Earth's Crust. The origin and chemistry of brines in Earth's crust have broad implications for sedimentary diagenesis, evaporite deposition and chemistry, ore and metamorphic petrology, and crust-sediment chemical exchange. Contributions are solicited that will address the origin of saline crustal fluids using recent advances in hydrodynamic modeling, integrated chemical and isotopic studies of brine compositions, chemical and isotopic studies of diagenetic mineral phases, fluid inclusions as examples of trapped brines, and the chemistry and mineralogy of associated evaporites. Geochemistry (7), Hydrogeology (14), Petrology, Sedimentary (24).

T31. Geologic Causes of Natural Radionuclide Anomalies. As a result of increased environmental concerns, including heightened public awareness of the hazards of radon, more research is being carried out on the causes and distribution of natural radionuclide anomalies. A knowledge of geologic factors affecting the distribution of natural radionuclides is the first step in risk assessment in any particular geographical region. Radionuclide distribution also has implications for mineral exploration. Contributions are solicited that relate to evaluation of radionuclide distribution within the present context. Environmental Geology (5), Geochemistry (7).

T32. Rock-Water Interactions in Carbonate Rocks and Sediments. The main purpose of this session, which has the formal endorsement of GSA's Sedimentary Geology Division, is to bring together researchers engaged in active study of rock-water interactions in carbonates. Contributions are solicited that include investigations of modern or ancient, marine or meteoric, and shelf or pelagic sediments and sedimentary rocks. Petrology, Sedimentary (24), Sedimentology (29), Geochemistry (7).



For Meeting Information (303) 447-2020

Geo-Videos

1989 GSA Science Theater

St. Louis Annual Meeting • November 6-9, 1989
Cervantes Convention Center

In keeping with the 1989 GSA Annual Meeting theme, **Frontiers in Geoscience**, the organizing committee for the Science Theater encourages the submission of innovative audiovisual presentations for our review. Two media of particular interest are new professional-quality video and slide presentations, like those now available from numerous geology groups around the country. As always, we hope to obtain and show a variety of materials that will interest and educate professional geologists, geology students, and the populace.

If you have presentation-quality audiovisual materials that could be shown in the 1989 GSA Science Theater, please send your name, address, telephone number, and a description of the material (AV type and format, running time, age of suggested audience, program content) by June 30 to

Guy M. Smith
Dept. of Earth & Atmospheric Sciences
St. Louis University
3507 Laclede
St. Louis, MO 63156
(314) 658-3128.

Air Transportation to 1989 Annual Meeting

GSA has again designated Cain Travel Group of Boulder, Colorado, as the official airline reservation agent for the GSA Annual Meeting. Meeting participants are encouraged to call Cain's toll-free number to take advantage of discounted fares on selected airlines.

TWA, Delta, and United Airlines have been named the official carriers. Reduced rates are 5% off any available discount fare, generally having restrictions. If you do not meet the requirements for the discount fare, you will be offered 40% to 45% off the unrestricted coach fare.

To make a reservation:

- Call 1-800-346-4747 (toll-free outside Colorado) or 303-443-2246 (inside Colorado or collect from Canada).
- Hours: Monday through Friday 8 a.m. to 5:30 p.m., Mountain Standard Time.
- Call early for best availability and identify yourself as a GSA traveler.
- Be sure that you understand the restrictions on the type of ticket you purchase.
- Tickets can be paid for by check (payable to Cain Travel) or major credit card, or be invoiced to your company. The final payment must reach Cain Travel no later than seven days prior to departure to allow for mailing time.
- All tickets will be mailed via certified mail upon receipt of payment unless requested otherwise.
- After tickets are issued, you are protected from fare increases; if a fare decreases, call Cain Travel for an adjustment.
- Cain Travel will have an on-site Customer Service Desk at Cervantes Convention Center in St. Louis.

Committee on Geology and Public Policy Reports on Activities

The Committee on Geology and Public Policy was established in 1971 to develop and disseminate information from the geological sciences to the GSA membership, the general public, and public representatives to help in the discussion and formulation of relevant public policies.

The committee currently has ten members, two of which are the past GSA Congressional Science Fellows. The members are Clement F. Shearer, Chairperson, Reston, Virginia
Diana C. Dale, Houston, Texas
Robert C. Milici, Charlottesville, Virginia
Marcus E. Milling, Austin, Texas
Samuel J. Tuthill, Amana, Iowa
Patricia A. Jacobberger, Washington, D.C.
Thomas E. O'Connor, Washington, D.C.
Steven Schamel, Columbia, South Carolina
Jennifer Hess, 1986 GSA Congressional Science Fellow,
Herndon, Virginia

James Evans, 1987 GSA Congressional Science Fellow,
Bowling Green, Ohio

The committee also helps select and support the Congressional Science Fellow. The GSA Congressional Science Fellows participate in a much broader program involving about 20 scientific and

engineering societies and coordinated by the American Association for the Advancement of Science. The Science Fellows select positions in which to work on varied legislative, oversight, and investigative activities in the U.S. Congress. The GSA Science Fellows regularly contribute comments and progress reports to *GSA News & Information*.

The committee also sponsors an annual public policy forum. The forums are of broad interest to geologists and of national significance. This year, the committee hopes to reinstitute the series of white papers on geology and public policy. Last year a *Guide to USA Legislative Information and Contacts* prepared by the committee was mailed to each GSA member. Current plans include liaison with the American Geophysical Union and other professional societies interested in public policy; formation of similar committees within the six sections of the GSA; and a policy on legislative testimony.

The committee wants to hear from the GSA membership about current and potential activities and topics. In 1988 it began sponsorship of a booth at the GSA Annual Meeting to advertise the committee and solicit comment. But don't wait until November; forward your ideas and comments to Clement F. Shearer, U.S. Geological Survey, 106 National Center, Reston, VA 22092.

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ABOUT THE BOOK...

In his sparkling introduction to this Centennial volume, editor Eldridge M. Moores outlines the history of the geological sciences and of the Geological Society of America, and relates the timing of the development of both to events and personalities in world history.

The volume includes a colorful geologic time scale made especially for nonscientists. Then follow more than 250 color photographs, in 69 essays, depicting geology from around the world. Included are the familiar and the unusual, from Yellowstone to the moons of Jupiter, from Brazil to Alaska, from New York to China ... from mountains to canyons, from glaciers to hot springs, from volcanoes to caverns, from mudflats to diamonds. All photos were contributed by working earth scientists.

The *Art of Geology*, edited by Eldridge M. Moores and F. Michael Wahi, 1988. Deluxe hardbound edition, 140 p., full color throughout, 9"x12", with dust jacket, ISBN 0-8137-2225-X. List price \$37.50.



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GSA Divisions and Sections 1989

DIVISIONS

GSA's ten specialty divisions provide a focus for members interested in a particular discipline. The divisions hold annual business meetings in conjunction with the Society's annual meeting, and each division publishes a newsletter periodically. Division membership totals are as of December 31, 1988.

Archaeological Geology Members: 524
Officers: Fekri A. Hassan, chairman; Robert M. Thorson, first vice-chairman; Julie K. Stein, second vice-chairman; Vance T. Holliday, secretary-treasurer; John A. Gifford, past chairman.
Newsletter editor: David L. Weide.

Coal Geology Division Members: 354
Officers: Peter J. McCabe, chairman; James C. Cobb, first vice-chairman; Robert B. Finkelman, second vice-chairman; Susan M. Rimmer, secretary; Frederick J. Kuellmer, past chairman.
Newsletter editors: James C. Cobb, Russell A. Brant.

Engineering Geology Members: 1,190
Officers: Thomas L. Holzer, chairman; Jeffrey R. Keaton, chairman-elect; Perry H. Rahn, secretary; Ellis L. Krinitzky, past chairman.
Newsletter editor: Robert J. Larson

Geophysics Members: 670
Officers: Walter D. Mooney, chairman; Clement G. Chase, first vice-chairman; Laurie L. Brown, second vice-chairman; Francis S. Birch, secretary-treasurer; Mary Lou Zoback, past chairman.
Newsletter editor: Henry Spall.

History of Geology Members: 413
Officers: Clifford M. Nelson, chairman; Robert H. Dott, Jr., first vice-chairman; Alan E. Leviton, second vice-chairman; Michele L. Aldrich, secretary-treasurer; Léo F. LaPorte, past chairman.
Newsletter editor: Michele L. Aldrich.

Hydrogeology Members: 1,858
Officers: Robert N. Farvolden, chairman; Joseph S. Rosenshein, first vice-chairman; Paul R. Seaber, second vice-chairman; Darryll T. Pederson, secretary-treasurer; John M. Sharp, Jr., past chairman.
Newsletter editor: William E. Wilson.

Planetary Geology Members: 462
Officers: Raymond E. Arvidson, chairman; Ronald Greeley, first vice-chairman; Theodore A. Maxwell, second vice-chairman; Baerbel K. Lucchitta, secretary-treasurer; James W. Head III, past chairman.
Newsletter editor: Baerbel K. Lucchitta.

Quaternary Geology and Geomorphology Members: 1,505
Officers: Dale F. Ritter, chairman; Kenneth L. Pierce, first vice-chairman; Richard F. Madole, second vice-chairman; John E. Costa, secretary; James C. Knox, past chairman.
Newsletter editor: William E. Scott.

Sedimentary Geology Members: 1,044
Officers: James R. Steidtmann, chairman; Julia M.G. Miller, first vice-chairman; Paul L. Heller, second vice-chairman; Donald H. Zenger, secretary-treasurer; Juergen Reinhardt, past chairman.
Newsletter editor: Larry T. Middleton.

Structural Geology and Tectonics Members: 2,276
Officers: Arthur W. Snoke, chairman; Peter J. Hudleston, first vice-chairman; Mark P. Cloos, second vice-chairman; Donald T. Secor, Jr., secretary-treasurer; Gregory A. Davis, past chairman.
Newsletter editors: Roy Kligfield, Gary Couples.

SECTIONS

GSA has six regional North American sections, generally including GSA members who live within the geographical limits of each section. (Members who live in one section but have a professional interest in another section can become members of the section of interest.) Each section holds annual technical and business meetings. The number of voting members shown for each section is as of December 31, 1988.

Cordilleran Voting members: 3,628
Geographic area: Alaska, Arizona south of lat 35°N, California, Hawaii, Nevada, Oregon, Washington, British Columbia, Yukon, Northwest Territories
Officers: Mary Lou Zoback, chairman; to be elected at 1989 section meeting, vice-chairman; to be elected at 1989 section meeting, secretary; Robert S. Yeats, past chairman.

Rocky Mountain Voting members: 1,929
Geographic area: Arizona north of lat 35°N, Colorado, Idaho, Montana, New Mexico, North Dakota, South Dakota, Utah, Wyoming, Alberta, Saskatchewan
Officers: Ronald W. Marrs, chairman; James E. McClurg, vice-chairman; Kenneth E. Kolm, secretary; John H. Bush, Jr., past chairman; Peter E. Isaacson, past vice-chairman.

North-Central Voting members: 1,183
Geographic area: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, Wisconsin, Manitoba, Ontario west of 89th meridian
Officers: John S. Klasner, chairman; Richard C. Anderson, vice-chairman; George A. Hallberg, secretary; Michael J. Murphy, past chairman; James A. Rigert, past vice-chairman.

South-Central Voting members: 1,394
Geographic area: Arkansas, Kansas, Oklahoma, Texas
Officers: Charles I. Smith, chairman; Scott M. Ritter, vice-chairman; Rena Mae Bonem, secretary-treasurer; Anthony W. Walton, past chairman.

Northeastern Voting members: 2,233
Geographic area: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, New Brunswick, Newfoundland, Nova Scotia, Prince Edward Island, Quebec, Ontario east of 89th meridian
Officers: Nicholas M. Ratcliffe, chairman; Gary M. Boone, vice-chairman; Kenneth N. Weaver, secretary; Donald B. Potter, past chairman.

Southeastern Voting members: 1,593
Geographic area: Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia
Officers: Harry Y. McSween, Jr., chairman; William A. Thomas, vice-chairman; Michael J. Neilson, secretary-treasurer; James F. Tull, past chairman; Earl A. Shapiro, past vice-chairman.

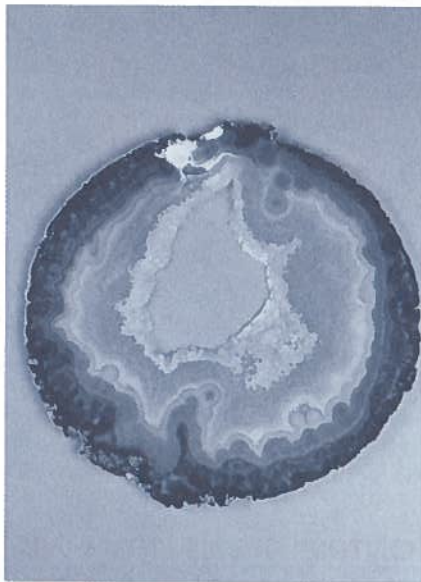


GSA

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Annual Report



Chairman's Message

The Geological Society of America Foundation has completed its eighth successful year in behalf of the Geological Society of America. The Trustees of the Foundation have been responsive and industrious, with nearly perfect attendance at meetings of the Foundation as well as the annual meetings of GSA.

During the recent GSA meeting at Denver, the Foundation Trustees tended the Foundation booth, welcoming hundreds of members and encouraging their support for GEOSTAR, Century Challenge, and special Foundation gifts. A substantial number of support projects have been described, and are being used to solicit pledges from private individuals, foundations, and industry.

During 1988 the Trustees developed a selective list of key individuals with major companies having close association with the geological sciences. Individual Trustees are selecting from the list their preferred contacts to be used systematically to contact these individuals on a personal basis to gain support for GSA programs.

Tangible results are being accomplished toward the completion of the DNAG books, maps, and transects. DNAG sales at the GSA bookstore during the recent Denver meeting exceeded expectations. As we move toward completion of the DNAG project, and with the conclusion of the Centennial year's Century Challenge campaign, emphasis is being shifted to GEOSTAR and to special endowment projects in order to develop long-term funding for geological research, student scholarships, and expanded communication within and about the geological sciences.

Evidence of the success of the Foundation's programs and growing support from GSA members can be observed by reviewing the attached graph. While total contributions increased 2% over 1987 to \$495,000, payments on industry pledges to DNAG declined from \$361,000 to \$299,000. The result was that membership giving increased 53%, from \$128,000 to \$196,000. I am confident that this trend will continue during 1989.

During 1988 membership of the Board of Trustees changed. Harrison C. Jamison and Lawrence W. Funkhouser retired, and we were both pleased and honored to welcome Fred A. Donath and Roy M. Huffington as new Trustees. The Board and GSA sustained great losses in the deaths of honorary Trustees Hollis D. Hedberg and Caswell Silver. Hollis was always in attendance at meetings and provided sound guidance to the Board over the years. Caswell was the Foundation's initial Chairman and served in this capacity until his retirement in 1986. His leadership and generosity are missed.

During the Denver meeting, the Trustees continued the tradition of an annual reception for our Senior Fellows and officers. The gathering was a great success, with over 230 in attendance.

At the end of my first year as Chairman of the Board, I would like to take this opportunity to recognize once again the fine

contributions over the years by Hollis D. Hedberg and Caswell Silver, the outstanding work of Harry Jamison, our immediate Past Chairman, and the exemplary service to GSA by Larry Funkhouser. I wish also to acknowledge the persistent leadership and work of Robert L. Fuchs, President of the Foundation, and F. Michael Wahl, Executive Director of GSA, without which the Trustees' efforts would not be effective. Finally, Donna L. Russell, Corporate Secretary/Treasurer, pro-

vided the necessary continuity, communication, and effort that made it all happen.

The Trustees are optimistic, enthusiastic, and delighted to contribute their energies and support to the success of GSA. Success is not possible, however, without the involvement of all members of our organization. GSA is strong, healthy, and important to science and society. Let's all of us keep up the good work.

Philip E. LaMoreaux
Chairman

President's Message

In 1988 GSA celebrated its 100th birthday, and the Foundation was proud to be part of this historic event. The Century Challenge Fund, which was created to honor GSA in its Centennial, raised slightly over \$100,000 in contributions and pledges. The Trustees of the Foundation contributed \$20,000 to this total, responding to the challenge from the membership. I extend my personal thanks to members and trustees for making this a successful program.

Contributions from members reached a new high during 1988, and there were several other important milestones. Dr. and Mrs. Fred A. Donath established an endowment that will grow to \$250,000, the purpose of which is to fund GSA's Young Scientist Award and the accompanying Donath medal. Also created during the year were the John T. Dillon Alaska Research Award Fund and the Allan V. Cox Student Research Award Fund. There was further growth in the endowment comprising the Antoinette Lierman Medlin Scholarship Fund, which has now reached a balance of \$18,000. All of these very positive developments augur well for the Foundation's ability to provide future research and student support.

The total fund balance of the Foundation decreased from \$387,417 to \$354,317, a drop of 8.5%. This can be attributed to the continued heavy demands of publishing the Decade of North American Geology. DNAG revenues during the year were \$217,728, as compared to expenditures of \$625,891. A significant portion of this gap was offset by industry and government contributions to

DNAG totaling \$299,496. Exclusive of DNAG, the Foundation's fund balance is expected to increase in 1989.

Disbursements of cash to fund geologic activities other than DNAG in 1988 totaled \$33,396. This money was spent for research support, scholarships, and student travel grants. Disbursements of this sort are anticipated to increase to \$56,000 in 1989.

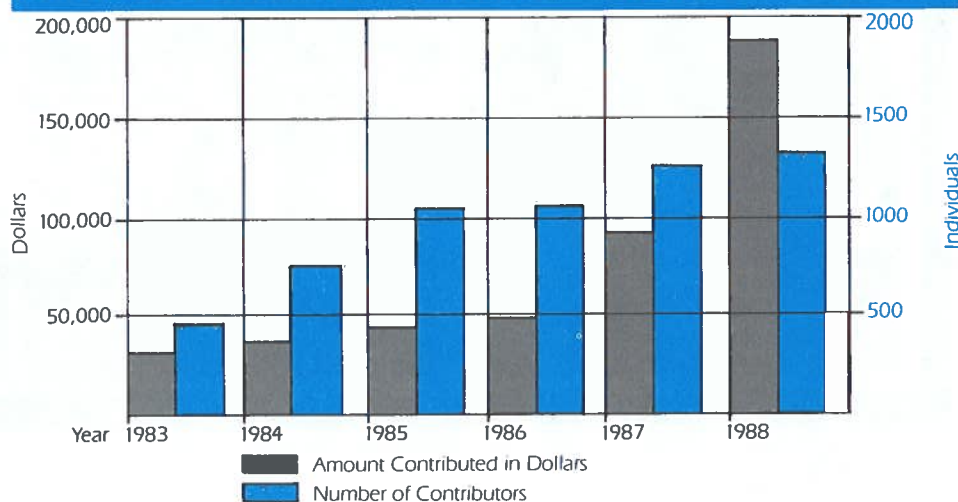
The first year of the second century will be a time for planning and the implementation of those plans. Nineteen-hundred and eighty-nine represents the culmination of a changing direction for the Foundation, from the almost total dedication to DNAG that occupied the 80's until the Centennial to the broader support of a diversity of GSA research and education programs. A noticeable trend is the growing importance of GSA activities that relate to the understanding of global geologic systems and socio-geologic interrelationships. GEOSTAR, the Foundation's program to expand the endowment is responsive to these second century directions. The efforts of the Foundation continue to be in support of GSA's purpose to promote the science of geology.

Fuchs is managing director of First Fairfield Investment Company in Denver, Colorado. He is a Fellow of the Geological Society of America and has been Treasurer since 1982. Fuchs is a member of AAPG and a director of several mining, oil, and gas companies. He received his B.A. from Cornell University and his M.S. from the University of Illinois.

Robert L. Fuchs
President



CONTRIBUTIONS FROM INDIVIDUALS - 1983-88



Trustees



Philip E. LaMoreaux is chairman of the board of P.E. LaMoreaux & Associates, Inc. He is a Fellow and former councilor of the Geological Society of America and has membership in a number of professional and scientific societies including the American Geological Institute, the International Association of Hydrogeologists, both of which he served as president, and the Board of Minerals and Energy. LaMoreaux is a member of the National Academy of Engineering. He received his B.A. from Denison University and his M.A. from the University of Alabama, both in geology. He is the author of many professional publications.



F. Beach Leighton is currently Chairman Emeritus of Leighton & Associates, an engineering geology consulting firm located in southern California. Before retirement in 1988, Dr. Leighton was the chairman of the board and chief executive officer and devoted his attention to the rapidly expanding application of geology to urban environment. He is widely recognized for his work in the analysis and treatment of landslides and other aspects of hillside development. He has published extensively on urban geology, earthquakes, and landslides. He has been a Fellow of GSA since 1953.



Fred A. Donath is a consultant located in Long Beach, California. Until recently, he had been Corporate Vice-President for R&D in The Earth Technology Corporation, a geotechnical consulting firm. Previously, he served eleven years as Head of Geology at the University of Illinois. Before that, he had been Professor of Geology at Columbia University in New York, and well known for his contributions to experimental rock deformation and structural geology. Since 1976 Donath has largely devoted his professional career to the problem of high-level radioactive waste disposal. He is a Fellow of the Geological Society of America, and served as Acting Editor for the society during 1964.



McLain J. Forman is president and chief executive officer of Forman Petroleum Corporation located in New Orleans, Louisiana. He received his bachelor of science degree in geology at Tulane University, and his M.A. and Ph.D. at Harvard University. A Fellow of the Geological Society of America and a member of the American Association of Petroleum Geologists, Forman has authored several publications dealing with sub-surface geology of southern Louisiana.



Michel T. Halbouty is the chief executive officer and chairman of the board of the Michel T. Halbouty Energy Co. in Houston. A Fellow of the Geological Society of America, Halbouty served as chairman of President Reagan's Energy Policy Advisory Task Force and leader of the Transition Team on Energy. He is an active member of the National Academy of Engineering and past president of the American Association of Petroleum Geologists.



Roy M. Huffington is chairman of Roy M. Huffington, Inc., an independent international oil and gas company based in Houston, Texas. He received his bachelor of science degree in geology from Southern Methodist University and his M.A. and Ph.D. degrees from Harvard University. He is a director of the American Petroleum Institute, a Fellow of the Geological Society of America, a member and trustee associate of the American Association of Petroleum Geologists, the Independent Petroleum Association of America, the National Petroleum Council, the Texas Independent Producers and Royalty Owners Association, and the Texas Mid-Continent Oil & Gas Association. He is the author of several articles on petroleum geology.



Charles J. Mankin is director of the Oklahoma Geological Survey, a research and public service agency located on the Norman Campus of the University of Oklahoma. He is a Fellow of the Geological Society of America and has served on the GSA Council and Executive Committee. He also has served as President of the American Institute of Professional Geologists, the American Geological Institute, the Association of American State Geologists, and the Mid-Continent Section of the Society of Economic Paleontologists and Mineralogists. Mankin is former chairman of the Board of Mineral and Energy Resources of the National Academy of Sciences and has chaired or worked on a number of other committees for NAS. He received his B.S., M.A., and Ph.D. in geology from the University of Texas.



John C. Maxwell retired in 1984 from the University of Texas in Austin, where he was the William Stamps Farrish Professor of Geological Sciences. A Fellow of the Geological Society of America, he has been active in the Society as a councilor and president. He was also a member and chairman of the U.S. Geodynamics Committee, and a member and vice-chairman of the Board of the UNESCO-IUGS-sponsored International Geological Correlation Programme. Maxwell is a former president of the American Geological Institute.



Brian J. Skinner has been professor of geology and geophysics at Yale University since 1966, serving as chairman of the department for six years during that period. He is a well-known expert in economic geology and the geochemistry of ore deposits. Dr. Skinner has been editor of *Economic Geology* for eighteen years. Currently he is chairman of the U.S. National Committee on Geology, the Board of Earth Sciences and Resources, the board of overseers of the *American Journal of Science*, and the Board of Editors *American Scientist*. Skinner, a Fellow of the Geological Society of America, has held numerous important posts in the Society, including President and Chairman of the Special Publications Study Committee and its Committee on Path to 2000.

Foundation Mission Statement

The GSA Foundation operates under the following mission statement:

The GSA Foundation exists to fund those research, student support, and publication programs of the Geological Society of America that the Society deems necessary to accomplish its purpose of promotion of the science of geology.

To accomplish this mission, the Foundation's long-term policy is to raise money from members, individuals, companies, and institutions. Funds received are invested for income, preservation of capital, and growth of principal. GSA program funding requirements are met out of income and such principal as is necessary. The Foundation's financial goal is to build a fund balance in the \$5-10 million range.

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INDEPENDENT AUDITOR'S REPORT

Board of Trustees
The Geological Society of America
Foundation, Inc.
Boulder, Colorado

We have audited the accompanying combined balance sheets of The Geological Society of America Foundation, Inc. as of December 31, 1988 and the related combined statements of operation and fund balances and cash flows for the year then ended. These financial statements are the responsibility of the Foundation's management. Our responsibility is to express an opinion on these financial statements, based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the combined financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provided a reasonable basis for our opinion.

In our opinion the combined financial statements referred to above present fairly, in all material respects, the financial position of The Geological Society of America Foundation, Inc. as of December 31, 1988, and the results of its operations and its cash flows for the year then ended in conformity with generally accepted accounting principles.

We have previously examined the financial statements of the Foundation for the year ended December 31, 1987, and comparative financial information from which is presented herein. In our opinion, such comparative financial information has been properly extracted from the prior year's financial statements

Touche Ross & Co.

Certified Public Accountants

March 24, 1989

Financial Statements (continued)

Financial Statements

COMBINED BALANCE SHEETS

(with comparative totals for 1987)

ASSETS	OPERATING	UNRESTRICTED	RESTRICTED	TOTALS	
				DECEMBER 31, 1988	1987
Cash	\$ 39,951	\$ 3,989	\$108,623	\$152,563	\$182,741
Contributions receivable	--	4,639	18,306	22,945	8,521
Due from other funds	185	5	35,000	35,190	191
Investments, at market (Note B)	1,613	186,794	477,488	665,895	569,814
Furniture and equipment, net of accumulated depreciation of \$20,543 and \$15,423	15,685	--	--	15,685	12,899
	<u>\$ 57,434</u>	<u>\$195,427</u>	<u>\$639,417</u>	<u>\$892,278</u>	<u>\$774,166</u>
LIABILITIES AND FUND BALANCES					
Accounts payable	\$ 5,564	\$ --	\$ 1,290	\$ 6,854	\$ 3,387
Due to Geological Society of America (Note C)	200,000	--	295,917	495,917	383,171
Due to other funds	35,000	--	190	35,190	191
Fund balances (deficit):					
Unrestricted	(183,130)	195,427	--	12,297	(1,501)
Restricted	--	--	323,706	323,706	369,958
Held in trust for others (Note D)	--	--	18,314	18,314	18,960
	<u>(183,130)</u>	<u>195,427</u>	<u>342,020</u>	<u>354,317</u>	<u>387,417</u>
	<u>\$ 57,434</u>	<u>\$195,427</u>	<u>\$639,417</u>	<u>\$892,278</u>	<u>\$774,166</u>

COMBINED STATEMENTS OF OPERATIONS AND FUND BALANCES

(with comparative totals for 1987)

	OPERATING	UNRESTRICTED	RESTRICTED	TOTALS	
				YEARS ENDED DECEMBER 31, 1988	1987
REVENUES:					
Contributions	\$ --	\$ 10,606	\$ 489,108	\$499,714	\$491,225
Decade of North American Geology Program	--	--	217,728	217,728	248,627
Interest and dividends	522	10,969	27,053	38,544	49,791
Other	185	--	10,262	10,447	7,290
	<u>707</u>	<u>21,575</u>	<u>744,151</u>	<u>766,433</u>	<u>796,933</u>
EXPENDITURES:					
Operating expenses	137,823	678	1,713	140,214	128,560
Decade of North American Geology Program	--	--	625,891	625,891	598,033
Distribution of assets held in trust	--	--	1,518	1,518	692
Other	--	2,800	28,327	31,127	38,407
	<u>137,823</u>	<u>3,478</u>	<u>657,449</u>	<u>798,750</u>	<u>765,692</u>
EXCESS (DEFICIENCY) OF REVENUES OVER EXPENDITURES	(137,116)	18,097	86,702	(32,317)	31,241
INVESTMENT ACTIVITY:					
Realized loss on investments	--	--	(783)	(783)	(61,072)
Unrealized loss on investments	--	--	--	--	(1,515)
	--	--	(783)	(783)	(62,587)
TRANSFERS IN (OUT)	<u>132,817</u>	<u>--</u>	<u>(132,817)</u>	<u>--</u>	<u>--</u>
EXCESS (DEFICIENCY) OF REVENUES OVER EXPENDITURES, including investment activity	(4,299)	18,097	(46,898)	(33,100)	(31,346)
FUND BALANCE (DEFICIT), beginning of year	<u>(178,831)</u>	<u>177,330</u>	<u>388,918</u>	<u>387,417</u>	<u>418,763</u>
FUND BALANCE (DEFICIT), end of year	<u>\$ (183,130)</u>	<u>\$195,427</u>	<u>\$ 342,020</u>	<u>\$354,317</u>	<u>\$387,417</u>

See next page for notes to combined Financial Statements.

Financial Statements *(continued)*

COMBINED STATEMENT OF CASH FLOWS
YEAR ENDED DECEMBER 31, 1988

CASH FLOWS FROM OPERATING ACTIVITIES:	
Deficiency of revenue over expenses	\$ (33,100)
Adjustments to reconcile deficiency of revenues over expenses to net cash provided by operating activities:	
Depreciation	5,120
Increase in:	
Contributions receivable	(14,424)
Due from other funds	(34,999)
Due to Geological Society of America	112,746
Accounts payable	3,467
Due to other funds	34,999
Net cash provided by operating activities	<u>73,809</u>
CASH FLOWS FROM INVESTING ACTIVITIES:	
Additions to furniture and equipment	(7,906)
Purchase of investments	(1,635,787)
Proceeds from maturity of investments	1,539,706
Net cash used in investing activities	<u>(103,987)</u>
NET DECREASE IN CASH	(30,178)
CASH, beginning of year	<u>182,741</u>
CASH, end of year	<u>\$ 152,563</u>

In-kind contributions are recorded at fair value at date of gift.

In 1988, the Foundation adopted the provisions of Statement of Financial Accounting Standards (SFAS) No. 95, "Statement of Cash Flows," which requires companies to include a statement of cash flows rather than a statement of changes in financial position. SFAS No. 95 requires that a statement of cash flows classify cash receipts and payments according to operating, investing or financing activities. The Foundation defines cash and cash equivalents as immediately accessible funds held in bank checking and savings accounts.

B. Investments:

Investments held are summarized as follow.

	DECEMBER 31, 1988		DECEMBER 31, 1987	
	COST	MARKET	COST	MARKET
Mutual fund	\$ —	\$ —	\$ 10,770	\$ 10,253
U.S. Treasury bills	382,367	382,367	191,923	191,923
Demand notes	280,000	280,000	359,000	191,923
Stocks	170,000	2,813	175,795	7,688
Other	715	715	950	950
	<u>\$833,082</u>	<u>\$665,895</u>	<u>\$738,438</u>	<u>\$569,814</u>

C. Due to Geological Society of America:

The amount due to the Society includes a non-interest-bearing advance to the Foundation to enable it to begin operations. The advance is to be repaid from unrestricted funds of the Foundation as they become available.

Also due to the Society at December 31, 1988 is \$295,917 for reimbursement of expenses incurred by the Centennial Program in excess of designated 1988 contributions received from the Foundation.

D. Assets Held in Trust:

The Foundation has an agreement with the Symposium of the Geology of Rocky Mountain Coal (the Symposium) whereby the Foundation will manage the assets of the Symposium. The Foundation receives a management fee equal to 1% per year of the market value of the funds. The agreement can be terminated by either party upon 90-day written notice.

E. Pension Plan:

Employees of the Foundation participate in a discretionary pension plan covering substantially all employees. Contributions to the plan are made at the discretion of the Foundation's Board of Directors, and totaled \$2,671 and \$2,520 in the years ended December 31, 1988 and 1987, respectively.

F. Related Party Transaction:

The Foundation leases its office space from the Geological Society of America under a month to month agreement. Total rent expense paid in 1988 was \$4,800.

NOTES TO FINANCIAL STATEMENTS

YEAR ENDED DECEMBER 31, 1988
(with comparative totals for 1987)

A. Summary of Significant Accounting Policies:

The Geological Society of America Foundation, Inc. (the Foundation) was established in December, 1980 to promote the science of geology.

A primary objective of the Foundation is to provide funds for the Decade Program, which was established to publish a series of geological references in celebration of the 100-year anniversary of the Geological Society of America (the Society) in 1988. Revenues are recorded by the Decade Program when its qualified expenses are incurred.

The financial statements of the Foundation have been prepared on the accrual basis of accounting. The accounts of the Foundation are maintained in accordance with the principles of fund accounting which classify funds, for accounting and reporting purposes, according to the Foundation's activities or objectives.

Donor-restricted funds may be used only in accordance with purposes established by the donor, in contrast to use of unrestricted and operating funds. The Foundation board has full authority to use donated unrestricted funds for operational purposes.

The Foundation records investments at fair market value. The difference between cost and fair market value is reflected in the combined statements of operations and fund balances as unrealized appreciation or depreciation on investments.

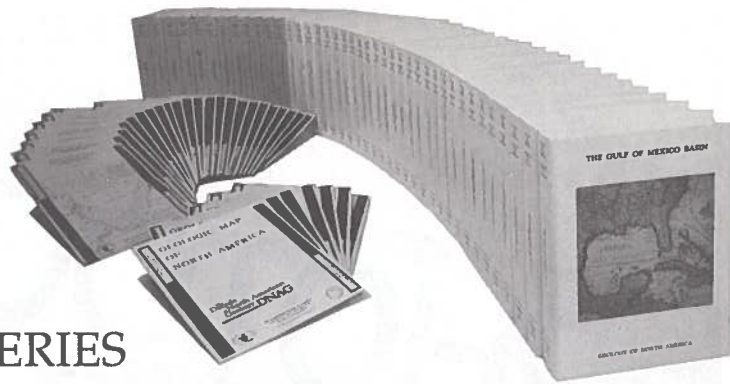
The Foundation is exempt from federal income taxes pursuant to Section 501(a) (3) of the Internal Revenue Code of 1954, as amended.

Furniture and equipment are stated at cost. Depreciation is provided by the straight-line method over the estimated useful lives of various classes of assets.



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Volume D2 SEDIMENTARY COVER — NORTH AMERICAN CRATON: U.S.

edited by L.L. Sloss, 1988

The "sedimentary cover" refers to the stratified rocks of youngest Proterozoic and Phanerozoic age that rest upon the largely crystalline basement rocks of the continental interior. The early chapters of the volume present data and interpretations of the geophysics of the craton and summarize, with sequential maps, the tectonic evolution of the craton. The main body of the text and accompanying plates and figures present the stratigraphy, structural history, and economic geology of specific sedimentary basins (e.g., Appalachian basin) and regions (e.g. Rocky Mountains). The volume concludes with a summary chapter in which the currently popular theories of cratonal tectonics are discussed and the unresolved questions are identified.

GNA-D2, 520 p., 8 plates in slipcase, indexed, ISBN 0-8137-5205-1, hardbound, \$49.50

Volume I2 THE ATLANTIC CONTINENTAL MARGIN: U.S.

edited by R.E. Sheridan and J.A. Crow, 1988

This synthesis covers stratigraphy, depositional processes, and geophysical interpretation of the major onshore and offshore marginal basins from Maine to the Bahamas, and includes an up-to-date review of thinking on regional tectonic history. Additional chapters discuss the theoretical aspects of thermal evolution, subsidence, and seismic stratigraphy as applied to this region. Geological resources including petroleum, water, sand and gravel, hard minerals, and heat flow are reviewed, and environmental hazards such as seismicity, coastal erosion, waste disposal and submarine instability as it relates to site of drilling platforms and mining are evaluated. A summary chapter reviews areas of controversy and suggests key topics for research.

GNA-I2, 620 p., 16 plates on 8 sheets in slipcase, indexed, ISBN 0-8137-5204-3, hardbound, \$49.50

Volume K3 NORTH AMERICA AND ADJACENT OCEANS DURING THE LAST DEGLACIATION

edited by W.F. Ruddiman and H.E. Wright, Jr., 1987

Most Quaternary sediments in North America north of 45°N post-date the last deglaciation. This volume looks at those extensive deposits from the standpoints of timing, cause, and mechanism of the wastage of North American ice during the last deglaciation and the accompanying environmental changes in the nonglaciated and deglaciated areas. It particularly examines the mechanisms by which a mass of ice equivalent to 100 m of global sea-level was returned to the ocean within about 8,000 years. A truly comprehensive synthesis of marine and terrestrial information in 22 chapters grouped into five sections: Chronology of Disintegration of the North American Ice Sheets, Ice Core and Other Glaciological Data, the Nonglacial Physical Record on the Continent, Biological Record on the Continent, and Analysis and Summary. Includes two oversized pocket plates in color showing time-series maps of pollen densities and vegetation changes since 18 ka.

GNA-K3, 509 p., 2 pocket plates, indexed, ISBN 0-8137-5203-5, hardbound, \$43.50

Volume M THE WESTERN NORTH ATLANTIC REGION

edited by P.R. Vogt and B.E. Tucholke, 1986

The award-winning first volume in this 28-volume series. Complete coverage of the geology and geophysics of the western North Atlantic Ocean basin in 41 chapters, organized into 8 sections: Introduction; Present Accretion Axis; Regional Geology and Geophysics; Plate Tectonic Evolution; Surficial Sedimentation; Biofacies; Paleoceanography; and Resources and Law of the Sea. The editors received the 1986 Alan Burman Research Publication Award for this volume. Includes 11 plates, several in color, in slipcase.

GNA-M, 720 p., 11 plates in slipcase, indexed, ISBN 0-8137-5202-7, hardbound, \$47.50

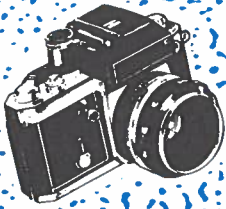
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- Description of print on front lower edge of mat board.
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Entries will be screened for suitability. Photos will be displayed on the second level of Cervantes Convention Center. Judging, by GSA's editors, will take place on Sunday, November 5. First, second, and third place prizes will be awarded. First place color winner will appear on the cover of *Geology*. (Photos that have already appeared on the cover of *Geology* are not eligible.)

All entries will be returned by November 30, 1989.

To enter, fill out the entry form and send it, along with your photo, before **OCTOBER 1** to

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Washington University
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International Effort Targets Cretaceous Sedimentary Geology

by Robert N. Ginsburg

Global Sedimentary Geology Program Chairman

A new international research effort on Cretaceous sedimentary geology is well underway, organized by the International Union of Geological Sciences Commission on Global Sedimentary Geology. Entitled *Cretaceous Resources, Events and Rhythms*, the project will address global aspects of the Cretaceous. The Cretaceous was selected for this pilot research project because Cretaceous sea levels and climates can provide a vision of Earth in its "greenhouse state"; because there is an established geochronology for these widespread deposits; and because there are extensive resources in Cretaceous rocks—hydrocarbons, coals, bauxites, etc.

To plan the research on global aspects of Cretaceous sedimentary deposits, an international workshop was held in Digne, France, during September 1988. Approximately 100 scientists from 22 countries attended this NATO Advanced Research Workshop. Additional financial support came from international petroleum companies, the French and Italian governments, the IUGS, and the International Association of Sedimentologists. The National Science Foundation Earth Sciences Division made it possible for 35 scientists from the United States to attend.

For the workshop, five working groups and two coordinating committees were established to plan and execute the needed research, both short-term (3–5 years) and longer term (10 years). The long-term goal of WG-1, *Sequence Stratigraphy and Sea-level Change*, is to evaluate the role of eustasy in Cretaceous sedimentary cycles in the range of 1–10 m.y. The short-term strategy is to place time constraints on unconformity-bounded sequences from widely separated basins during a restricted time interval in the mid-Cretaceous in order to test their global synchronicity. WG-2, *Stratigraphy, Geochemistry, and Paleocyanography of Organic-rich Mid-Cretaceous Sequences*, is directed toward understanding the oceanic anoxic events that produced the widespread black shales some of which are major source rocks for hydrocarbons. Initially this group will establish a data base of uniform information on age, lithologic sequence, stable isotopes, and composition of organic matter that can be used to test the global synchronicity of specific black shale events and to estimate rate of accumulation of sediment, carbonate, and organic carbon.

The long-term goals of WG-3, *Cyclostratigraphy*, are to increase time resolution beyond the approximate 1 m.y. level of biostratigraphy and to search for the records of Earth's orbital cycles, the Milankovitch Rhythms. To begin, this group will standardize methods of describing and analyzing cyclic sequences, explore for proxy indicators both chemical and magnetic, and begin the cooperative study of additional occurrences of cyclic sequences between some of the well-established localities. For WG-4, *Carbonate Platforms*, the long-term goal is to decipher the sensitive records of variations in productivity of skeletal sediments, sea-level change, and variations in climate. First it is necessary to standardize terminology and methods of description of carbonate facies and then begin the characterization of platform growth and drowning during specific time intervals. WG-5, *Paleogeography, Paleoclimatology, Sediment Flux*, aims to characterize the record of extreme, end-member conditions during the Cretaceous: the ultra-warm period with high sea levels, and the cooler times when sea level was low. The existing maps and data of paleogeography and models of paleoclimates will provide the starting points, but much additional new data are needed.

Two coordinating committees were also established. One, CC-1, *Geochronology*, will combine and correlate all the existing

time scales with the goal of providing a practical, linear time scale for dating events and calculating rates, frequencies, and durations of earth-surface processes. A second coordinating committee on Data Management will provide advice on systems of data storage and retrieval.

Working Group 3 assembled in Perugia, Italy, for its four days of meetings and field trips hosted by Isabella Primoli Silva of the University of Milan, with support from the Consiglio Nazionale delle Ricerche. The other four working groups met in France, then all five joined together for two days of plenary sessions and field trips in the city of Digne. All organization of the workshop and the extensive arrangements in France were made by Bernard Beaudoin and his staff and students of the Ecole des Mines in Paris.

For additional information on the project, write to GSGP Secretariat, University of Miami, Fisher Island, Miami Beach, FL 33139.

Solid-Earth Sciences Committee To Assess Science Knowledge

The National Research Council has established a committee under the Board on Earth Sciences and Resources to undertake a critical assessment of the state of knowledge of the basic and applied solid-earth sciences.

The committee has been charged with a number of tasks, including the following: (1) to identify emerging lines of research promise; (2) to identify and address key scientific and societal issues; (3) to identify and assess directions, changes, and contributing factors; (4) to recommend long- and short-range research priorities. A report will be issued which will review these topics as well as research policy options; opportunities for increased effectiveness; and roles for government, academia, and industry.

The report is intended to serve as a blueprint for the solid-earth sciences in the next decade and beyond. In recommending priorities, it will provide guidance for cooperative efforts in addressing the most promising lines of research with the funds available in changing budgetary climates.

The committee shares these charges with the solid-earth sciences community and would like to receive concise statements about the above items from as many individuals as possible, as soon as possible. Please forward your comments to Peter J. Wyllie, Committee on the Solid-Earth Sciences, National Research Council (HA 460), 2101 Constitution Ave. NW, Washington, DC 20418.

People

GSA Member **Doyle E. Cottrell** has been named manager of the Hunter Architectural, Engineering, Planning, and Environmental Services office in Orlando, Florida. Fellow **Gerald M. Friedman**, Troy, New York, has been named Distinguished Professor by Brooklyn College. The American Association of Petroleum Geologists will give its Distinguished Service Award to Fellow **Lee C. Gerhard**. Member **Paul H. Pausé** has been elected chairman of the Midland Chapter of the Society of Independent Professional Earth Scientists. The national board of the Association for Women Geoscientists has elected Member **Virginia Murphy Sand** as editor.

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Geology of the Henry Mountains, Utah, As Recorded in the Notebooks of G.K. Gilbert, 1875-76.

edited by Charles B. Hunt, 1988

Go back in time with this volume and experience the thrill of discovering brand new geologic concepts! Accompany one of America's greatest geologists, Grove Karl Gilbert, through these field notes of his trip into Utah's Henry Mountains in 1875-1876. Here is an exciting, first-hand record of this historic field trip during which Gilbert introduced the concept of laccoliths and demonstrated clearly that intrusive igneous masses can deform the rocks into which they intrude. Gilbert's notes became the guide for Charles Hunt's many seasons of work in the same area 60 years later. Now Hunt shares Gilbert's notes and maps with us, adding asides and clarifications of his own to create a fascinating combination of geologic history and frontier Americana. For young geologists, Gilbert's precise and elegant field sketches and descriptions provide a virtual course-book in field operations, techniques, and geologic sketching. An enjoyable book for all, and an essential companion for those exploring this scenic section of the great American West on their own.

MWR167, 234 p., ISBN 0-8137-1167-3, hardbound, \$52.50, **SALE \$36.00**

The Cretaceous System of Southern South America

by A. C. Riccardi, 1988

This synthesis of the existing knowledge of the Cretaceous System of southern South America gives a general account of the stratigraphy, magmatism, tectonism, paleontology, and paleogeography of Argentina, Bolivia, southern Brazil, Chile, Paraguay, and Uruguay. In the first part is a description of the Cretaceous rocks on the basis of generalized sections of the most important areas or basins; in the second part is a summary of patterns of plutonism, volcanism, tectonism, paleontology, transgressive-regressive history, and paleogeographic evolution. Includes more than 1,100 bibliographic references, a general correlation chart for the entire area, and 16 tables listing the stratigraphic and geographic distribution of all described and figured fossils. Tithonian to Maastrichtian ammonites are figured in 18 plates.

MWR168, 168 p., 1 pocket-plate, indexed, ISBN 0-8137-1168-1, hardbound, **\$32.00**

Geology and Paleontology of Seymour Island, Antarctic Peninsula

edited by R. M. Feldmann and M. O. Woodburne, 1988

This small, desolate island, located off the northeast tip of the Antarctic Peninsula, contains one of the most important records of Late Cretaceous and early Tertiary life in the Southern Hemisphere. The prophetic words of early explorer/scientist Otto Nordenskjöld about the importance of the deposits here have been borne out by spectacular paleontologic discoveries during the past ten years — discoveries that have provided new insights into the geologic history of Antarctica and answers to old questions about life in the Southern Hemisphere that have puzzled naturalists since Darwin's voyage on HMS *Beagle*. The authors provide an enormous amount of information in 22 chapters. A complete table of contents may be requested from GSA's Marketing Department.

MWR169, 574 p., indexed, ISBN 0-8137-1169-X, hardbound, **\$85.00**

Interaction of the Rocky Mountain Foreland and the Cordilleran Thrust Belt

edited by Christopher J. Schmidt and William J. Perry, Jr., 1988

Are the nature and degree of interaction of the thrust belt and foreland fairly well defined? The editors assumed so when they began this project, but soon found, from reviewer comments and from authors who described the same areas but arrived at completely different conclusions, that the style and degree of interaction in some areas (the Teton-Gros Ventre region, for example) were in considerable dispute. This new and massive work by leading scientists attempts to clarify some of the disputes and to focus new attention on the many problems yet to be resolved in the region where the Cordilleran thrust belt and the Rocky Mountain foreland merge or overlap. Here are thirty-two chapters presented in four sections, titled: Styles of Deformation in the Foreland; General or Comparative Structural Studies of Interaction and Overlap; Regional Structural and Geophysical Studies of Interaction and Overlap; and Sedimentologic and Stratigraphic Studies Related to Foreland/Thrust Belt Interaction. Included are three pocket-plates and a microfiche card.

MWR171, 596 p., 3 pocket plates, 1- 24X 98-frame microfiche, indexed, ISBN 0-8137-1171-1, hardbound, **\$78.00**

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1990 GSA Annual Meeting—Dallas, Texas

October 29–November 1
Dallas Convention Center

**General Chairman: David E. Dunn,
University of Texas at Dallas**

Field Trips Deadline August 15, 1989

If you would like to lead a trip or have an idea for a trip, please contact one of the chairmen immediately.

By working with a division or associated society, you may be able to focus in depth on a topic by coordinating a technical session or short course and a field trip. Plans must be made early because theme session, symposia, and short course deadlines occur by the end of this year.

Field Trip Chairmen

Robert T. Clarke (Chairman), Mobil Research & Development Corp., DRD—P.O. Box 819047, Dallas, TX 75381, (214) 851-8481

Kent C. Nielsen (Co-Chairman), Program in Geosciences, University of Texas at Dallas, P.O. Box 830688, Richardson, TX 75083-6088, (214) 690-2401 (dept.), (214) 690-2448 (direct)

Theme Session and Symposia Deadline . . . January 2, 1990

For 1990 program specifics contact:

Technical Program Chairman

Richard M. Mitterer, Program in Geosciences, University of Texas at Dallas, P.O. Box 830688, Richardson, TX 75083-6088, (214) 690-2401 (dept.), (214) 690-2462 (direct)

For general information on program participation (1990 and future years) contact:

GSA Meetings Manager

Sue Beggs, GSA, P.O. Box 9140, Boulder, CO 80301, (303) 447-2020

1990 ANNUAL MEETING

October 29–November 1 Dallas, Texas

Call for Short Course Proposals

Have you thought about giving a short course? The GSA Committee on Short Courses invites those interested in proposing a GSA-sponsored or co-sponsored short course to contact GSA headquarters for proposal guidelines.

Short courses may be conducted in conjunction with all GSA annual or section meetings, but we are particularly interested in identifying short courses to be offered during the 1990 Annual Meeting in Dallas.

Proposals for the Dallas meeting must be received by December 15, 1989. Selection of courses will be made by February 1, 1990, leaving eight months for preparing course manuals and making arrangements.

For proposal guidelines or further information contact

Edna A. Collis

Short Course Coordinator

GSA Headquarters

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GSA Grand Canyon 1990

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MEETINGS

(Asterisk indicates new or changed information)

1989

Engineering Geology in Tropical Terrains, June 26-29, 1989, Selangor Darul Ehsan, Malaysia. Information: Organising Secretary, Conference on Engineering Geology in Tropical Terrains, Dept. of Geology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan, Malaysia.

IGCP Project 257, Mafic Dyke Swarms, Annual Meeting, July 1, 1989, Santa Fe, New Mexico. Information: John W. Geissman, Dept. of Geology, University of New Mexico, Albuquerque, NM 87131; (505) 277-2644 or (505) 277-0887 (lab).

28th International Geological Congress, July 9-19, 1989, Washington, D.C. Information: 28th International Geological Congress, P.O. Box 1001, Herndon, VA 22070-1001; (703) 648-6053; Telex 248418.

SIAM 1989 Annual Meeting, July 17-21, 1989, San Diego, California. Information: SIAM Conference Coordinator, 117 S. 17th St., 14th Floor, Philadelphia, PA 19103-5052; (215) 564-2929.

Society for the Preservation of Natural History Collections 4th Annual Meeting, July 23-28, 1989, Drumheller, Alberta. Information: SPNHC Conference Secretary, Tyrrell Museum of Palaeontology, P.O. Box 7500, Drumheller, Alberta T0J 0Y0, Canada; (403) 823-7707.

6th International Symposium on Water-Rock Interaction, August 3-8, 1989, Malvern, England. Information: W. M. Edmunds, Hydrogeology Research Group, British Geological Survey, Walling-

ford, Oxon OX10 8BB, England; phone (0) 491-38800, ext. 2293; Telex 849365 HYDROL G; Fax (0) 491-32256.

12th Caribbean Geological Conference, August 7-11, 1989, Christiansted, St. Croix, Virgin Islands. Information: Frederick Nagle, 12th Caribbean Geological Conference, c/o Dept. of Geological Sciences, P.O. Box 249176, University of Miami, Coral Gables, FL 33124.

Dunes '89: Geomorphology and Ecology of Desert and Coastal Sand Dunes, August 14-17, 1989, Swakopmund, Namibia. Information: Dunes '89, c/o J. D. Ward, P.O. Box 2168, Windhoek 9000, Namibia.

14th International Cartographic Conference, August 17-24, 1989, Budapest, Hungary. Information: Conference Secretary, Institute of Geodesy, Cartography and Remote Sensing, POB 546, H-1373 Budapest, Hungary.

Second International Research Symposium on Clastic Tidal Deposits, August 22-25, 1989, Calgary, Alberta. Information: Ray Rahmani, Canadian Hunter Exploration Ltd., 435-4th Ave., S.W., Calgary, Alberta T2P 3A8, Canada; (403) 260-1818.

9th International Clay Conference, August 28-September 2, 1989, Strasbourg, France. Information: H  l  ne Paquet, Inst. de G  ologie, 1, rue Blessig, 67084 Strasbourg, France.

(continued on p. 155)

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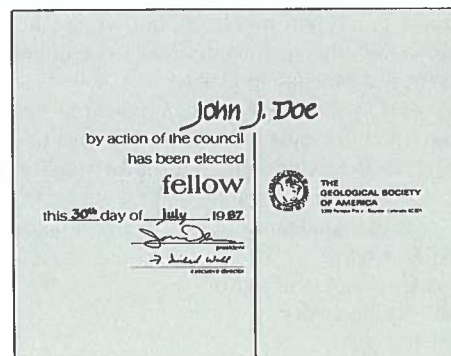
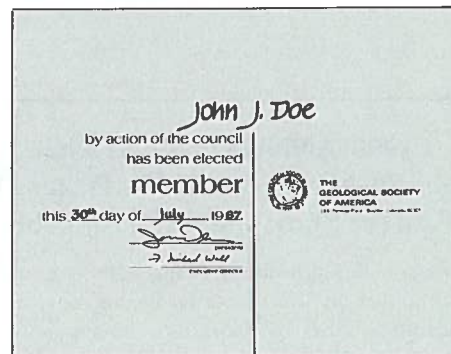
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Meetings (continued from p. 154)

Montana Geological Society Centennial Field Conference: Geologic Resources of Montana, August 31-September 3, 1989, Bozeman, Montana. Information: MGS Field Symposium, P.O. Box 844, Billings, MT 59103; (406) 256-3034.

New Frontiers for Hazardous Waste Management Third International Conference, September 10-13, 1989, Pittsburgh, Pennsylvania. Information: NUS Corporation, Park West Two, Pittsburgh, PA 15275.

Crustal Geochemical Cycles Symposium, during American Chemical Society National Meeting, September 10-15, 1989, Miami Beach, Florida. Information: James R. Herring, U.S. Geological Survey, M.S. 939, Box 25046, Federal Center, Denver, CO 80225; (303) 236-5559.

3rd International Conference on Palaeoceanography, September 10-16, 1989, Cambridge, England. Information: I. N. McCave or N. J. Shackleton, Dept. of Earth Sciences, University of Cambridge, Downing St., Cambridge CB2 3EQ, England; phone 223-333422/334876.

23rd International Conference of Safety in Mines Research Institutes, September 11-15, 1989, Washington, D.C. Information: John N. Murphy, U.S. Bureau of Mines, Pittsburgh Research Center, P.O. Box 18070, Pittsburgh, PA 15236; (412) 892-6601.

Focus '89, Nuclear Waste Isolation in the Unsaturated Zone, September 18-21, 1989, Las Vegas, Nevada. Information: D. Burton Slemmons, School of Mines, Center for Neotectonic Studies, University of Nevada, LME 400, Reno, NV 89557-0047.

SIAM Conference on Mathematics of Geophysical Sciences, September 18-21, 1989, Houston, Texas. Information: SIAM Conference Coordinator, 1400 Architects Bldg., 117 S. 17th St., Philadelphia, PA 19103-5052; (215) 564-2929.

14th International Conference of Organic Geochemistry, September 18-22, 1989, Paris, France. Information: Yolande Rondot, Institut Français du Pétrole, BP 311, 92506 Rueil-Malmaison cedex, France; phone 33(1) 47.49.02.14; Telex A 203050 F.

7th Annual Denver GeoTech, September 23-26, 1989, Denver, Colorado. Information: Denver GeoTech 1989, c/o C. B. & Associates, 13 S. Van Gordon, #200, Lakewood, CO 80228. (Abstracts deadline: June 9, 1989.)

Clay Minerals Society, September 23-28, 1989, Sacramento, California. Information: J. L. Past, Dept. of Civil Engineering, California State University, Sacramento, CA 95819; (916) 278-6081.

SIAM Conference on Mathematical and Computational Issues in Geophysical Fluid and Solid Mechanics, September 25-28, 1989, Houston, Texas. Information: SIAM Conference Coordinator, 117 S. 17th St., 14th Floor, Philadelphia, PA 19103-5052; (215) 564-2929.

3rd Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst, October 1-4, 1989, St. Petersburg, Florida. Information: 3rd Multidisciplinary Conference, Florida Sinkhole Research Institute, University of Central Florida, Orlando, FL 32816.

***Special Sessions on Future of Marine Mining to Highlight 20th Underwater Mining Institute**, October 1-4, 1989, Madison, Wisconsin. Information: Allen H. Miller, UW Sea Grant Advisory Services, 1800 University Ave., Madison, WI 53705; (608) 262-0644.

Association of Engineering Geologists 32nd Annual Meeting, October 1-6, 1989, Vail, Colorado. Information: Michael W. West,

Michael W. West & Associates, Inc., 290 Bank Western Bldg., 8906 West Bowles Ave., Littleton, CO 80123; (303) 972-1537.

XIII International Geochemical Exploration Symposium and II Brazilian Geochemical Congress, October 1-6, 1989, Rio de Janeiro, Brazil. Information: RIO '89 (XIII IGES-II CBGq), A/C CPRM-LAMIN, Av. Pasteur, 404 - Urca, CEP 22292 - Rio de Janeiro, RJ, Brazil; phone (55-21) 295-5297; Telex (55-21) 22685.

7th Thematic Conference on Remote Sensing for Exploration Geology, October 2-6, 1989, Calgary, Alberta, Canada. Information: Robert H. Rogers, ERIM, P.O. Box 8618, Ann Arbor, MI 48107-8618; (313) 994-1200, ext. 3382.

American Institute of Professional Geologists 26th Annual Meeting, October 4-7, 1989, Hyatt Crystal City, Virginia. Information: Stan Johnson, 1016 Holmes Ave., Charlottesville, VA 22901; (804) 293-5121.

18th Geochautauqua: Mineral-Resource Assessment, October 13-14, 1989, Newark, Delaware. Information: J. H. Schuenemeyer, Dept. of Mathematical Sciences, University of Delaware, Newark, DE 19716; (302) 451-1883.

Institute for Tertiary-Quaternary Studies Annual Meeting, October 13-15, 1989, Fort Collins, Colorado. Information: Frank G. Ethridge, Dept. of Earth Resources, Colorado State University, Fort Collins, CO 80523; (303) 491-6195.

New York State Geological Association 61st Annual Meeting and Field Trips, October 13-15, 1989, Middletown, New York. Information: Lawrence E. O'Brien, Orange County Community College, Middletown, NY 10940; (914) 343-6222, ext. 2570.

(continued on p. 156)

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Meetings (continued from p. 155)

Structural and Tectonic Modelling and Its Application to Petroleum Geology, October 18-20, 1989, Stavanger, Norway. Information: Norwegian Petroleum Society, P.O. Box 1897 - Vika, 0124 Oslo 1, Norway; phone 47-2-207025; Telex 77 322 nopen n.

Late Cambrian-Ordovician Geology of the Southern Mid-continent Symposium, October 18-19, 1989, Norman, Oklahoma. Information: Kenneth S. Johnson, Oklahoma Geological Survey, University of Oklahoma, Norman, OK 73019; (405) 325-3031.

Supercomputing World Conference and Exposition, October 18-20, 1989, San Francisco, California. Information: Carol Y. Hurley, Meeting Brokers International, Inc., 5 Science Park, New Haven, CT 06511; (203) 786-5132.

20th Annual Geomorphology Symposium: Geomorphic Evolution of the Appalachians, October 20-22, 1989, Dickinson College, Carlisle, Pennsylvania. Information: W. D. Sevon, Pennsylvania Geological Survey, P.O. Box 2357, Harrisburg, PA 17120; (717) 787-6029.

1989 Joint International Waste Management Conference, October 22-28, 1989, Kyoto, Japan. Information: Leslie Friedman, ASME Meetings Dept., 345 E. 47th St., New York, NY 10017; (212) 705-7795.

MAPFRE International Meeting on Catastrophes and Society, October 24-26, 1989, Madrid, Spain. Information: Ignacio G. Peso, Paseo de Recoletos, 25. 28004, Madrid, Spain; phone (1) 581 11 00; Telex 48902 MAPFRE; Fax (1) 419 91 95.

Society for Organic Petrology Annual Meeting, October 29-31, 1989, Urbana, Illinois; and **Workshop on Fluorescence Microscopy**, November 1-2, 1989, Carbondale, Illinois. Information: Richard Harvey, Illinois State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820; (217) 244-0836.

***Annual Meeting of the Association of Ground Water Scientists and Engineers**, October 31-November 1, 1989, Houston, Texas. Information: Susan Crites, National Program, AGWSE/NWWA, 6375 Riverside Dr., Dublin, OH 43017; (614) 761-1711; Telex 241302. (*Abstracts deadline: June 1, 1989.*)

Sociedad Española de Paleontología 5th Annual Meeting, November 2-3, 1989, Valencia, Spain. Information: Ana Márquez-Aliaga, Depto. Geología. Facultad de Ciencias Biológicas, 46100 Burjassot, Valencia, Spain.

World Gold '89, November 5-8, 1989, Reno, Nevada. Information: Meetings Dept., World Gold '89, Society of Mining Engineers, P.O. Box 625002, Littleton, CO 80162; (303) 973-9550; Telex 881988.

Geological Society of America Annual Meeting, November 6-9, 1989, St. Louis, Missouri. Information: Meetings Department, GSA, P.O. Box 9140, Boulder, CO 80301; (303) 447-2020.

1989 Eastern Oil Shale Symposium, November 15-17, 1989, Lexington, Kentucky. Information: Geaunita H. Caylor, 201 Porter Building, Lexington, KY 40506-0205; (606) 257-2847.

***1989 Petroleum Hydrocarbons Conference**, co-sponsored by the Association of Ground Water Scientists and Engineers and the
(continued on p. 157)

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Meetings (continued from p. 156)

American Petroleum Institute, November 15-17, 1989, Houston, Texas. Information: National Water Well Association, P.O. Box 182039, Dept. #017, Columbus, OH 43218; (614) 761-1171; Telex 241302.

American Society of Mechanical Engineers Winter Annual Meeting, December 10-15, 1989, San Francisco, California. Information: ASME Meetings Dept., 345 E. 47th St., New York, NY 10017; (212) 705-7795.

Penrose Conferences 1989

Late Eocene-Oligocene Climatic and Biotic Evolution, July 31-August 6, 1989, Rapid City, South Dakota. Information: Donald R. Prothero, Dept. of Geology, Occidental College, Los Angeles, CA 90041; (213) 259-2823; Philip R. Bjork, Museum of Geology, South Dakota School of Mines, Rapid City, SD 57701; (605) 394-2461.

The Eocene Tectonic Transition: Oregon to Alaska, September 4-10, 1989, Penticton, British Columbia. Information: Ralph A. Haugerud, U.S. Geological Survey, MS 975, 345 Middlefield Rd., Menlo Park, CA 94025; (415) 329-4910.

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

1990

***Workshop on Tertiary Stratigraphy of Highly Extended Terranes, Southern Basin and Range Province**, February 9-12, 1990, Zzyzux Springs, California. Information: Rick Hazlett, Dept. of Geology, Pomona College, 609 N. College Ave., Claremont, CA 91711-6339; (714) 621-8000 ext. 2952.

First PNG Petroleum Convention, February 12-14, 1990, Port Moresby, Papua New Guinea. Information: Mick McWalter, First PNG Petroleum Convention, c/o PNG Chamber of Mines and Petroleum, P.O. Box 7059, Boroko, Port Moresby, Papua New Guinea; phone 675-25-2836; Fax 675-21-7107; Telex NE 23482.

Society of Mining Engineers Annual Meeting, February 26-March 1, 1990, Salt Lake City, Utah. Information: Meetings Department, Society of Mining Engineers, P.O. Box 625002, Littleton, CO 80162; (303) 973-9550; Fax 303-973-3845; Telex 881988.

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, NV 89510.

International Conference on Mechanics of Jointed and Faulted Rock, April 18-20, 1990, Vienna University of Technology, Vienna, Austria. Information: H. P. Rossmannith, Wiedner, Jauptstrasse 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.

(continued on p. 158)

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Meetings (continued from p. 157)

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. (Abstracts deadline: January 31, 1990.)

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.

***4th International Conference on Geoscience Information (GeoInfo IV)**, June 24-29, 1990, Ottawa, Canada. 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.

***1990 Watershed Management Symposium**, July 9-11, 1990, Durango, Colorado. Information: Robert Riggins, USACERL, P.O. Box 4005, Champaign, IL 61824-4005. (Abstracts deadline: August 1, 1989.)

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.

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.

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.

3rd International Archaeological Symposium, September 17-21, 1990, Perth, Western Australia. Information: Susan E. Ho, P.O. Box 435, Nedlands, Western Australia 6009, Australia. (Abstracts deadline: December 31, 1989.)

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 062-47-4639; Telex 62693.

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 619-4814029; Telex AA 95380.

NEW!

SPECIAL PAPERS

Terranes in the Circum-Atlantic Paleozoic Orogens

edited by R. D. Dallmeyer, 1989

Not just another "late-tectonic" reconstruction volume, this is a comprehensive geologic summary which enables regional syntheses. The authors describe initial efforts to apply terrane-tectonic concepts to the Paleozoic orogens of the circum-Atlantic region. Although similar studies are well advanced in the younger orogens of the Western American Cordillera, application of these concepts in the older, more deeply eroded Paleozoic orogens is much more complicated and requires consideration of some basic modifications of the terrane concepts as derived in the Cordillera. These modifications are detailed, making this a valuable reference guide for those attempting to carry out tectonic, stratigraphic, structural, and/or paleontologic correlations in the circum-Atlantic region. Indeed, this is the first truly comprehensive collection of papers treating the entire circum-Atlantic realm, including such previously untreated areas as West Africa, central Europe, and Svalbard. Each paper provides an in-depth summary of pertinent stratigraphic, paleontologic, and/or structural characteristics of each of the terranes described.

SPE230, 281 p., indexed, paperback, ISBN 0-8137-2230-6, \$45.00

Proterozoic Geology of the Southern Rocky Mountains

edited by Jeffrey A. Crambling and Barbara J. Tewksbury, 1989

This volume considers the ca. 1,500-km-wide Proterozoic orogenic belt that lies south of North America's Archean craton. In Wyoming, Colorado, Utah, New Mexico, and Arizona, the belt exposes metaigneous and metasedimentary rocks that formed between 1800 and 1600 Ma and were intruded by plutons dated at 1500-1300 Ma. The authors provide an overview of the lithology, geochemistry, geochronology, deformation, and petrology of rocks in the belt. Individual papers treat the transition from Archean to Proterozoic

rocks in Wyoming; the U-Pb zircon geochronology of parts of Wyoming and Colorado; rock types and deformation in the Needle Mountains, Colorado; Middle Proterozoic plutonic rocks of the Needle Mountains, Colorado, and the Sandia Mountains, New Mexico; Proterozoic metamorphism and tectonism in New Mexico; the geology of Cimarron Canyon, New Mexico; geochemistry of the Pecos greenstone belt, New Mexico; and the deformation of Proterozoic rocks in Arizona.

SPE235, 176 p., indexed, paperback, ISBN 0-8137-2235-7, \$27.50

Landslide Processes of the Eastern United States and Puerto Rico

edited by A. Schultz and Randall W. Jibson, 1989

Presents the results of recent, detailed field investigations of landslide processes in the eastern United States and Puerto Rico. These studies document the interdependence of topography, climate, and geology and include descriptions of catastrophic slope failures associated with large storms, large prehistoric landslides on dip slopes, and frost-induced rock creep and topple. How bedrock lithology and geologic structure control debris flow distribution and intensity is shown in a variety of geomorphic and climatic settings. Studies of large, ancient landslides in sedimentary rocks are presented, and problems of their recognition, genesis, and distribution are discussed. Quantitative measurements of the effects of cyclic frost wedging on quartzite bedrocks in New England complete the volume. Here is a basis for much continued work on slope evolution and landslide process and the foundation for predictive models of slope failures.

SPE236, 108 p., paperback, ISBN 0-8137-2236-5, \$18.75

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The \$2500 prize will be presented during the AAAS Annual Meeting in New Orleans, Louisiana, February 15-20, 1990.

For further information, contact Patricia S. Curlin, AAAS Committee on Public Understanding of Science and Technology, 1333 H St. NW, Washington, DC 20005, (202) 326-6600.

GSA Legislative Guide Published

The GSA Geology and Public Policy Committee has prepared a "Guide to USA Legislative Information and Contacts." The purpose of this eight-page guide is to assist individuals in communicating with legislators and government officials in the United States on matters relating the geosciences to issues of public policy.

Copies of the guide are available on request from the Geological Society of America, Membership Department, P.O. Box 9140, Boulder, CO 80301; (303) 447-2020.

Future GSA Annual Meeting Sites

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

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Abstracts must be typed on 1989 abstract forms, available from Abstracts Coordinator, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, or call (303) 447-8850. Abstracts must be mailed to the same address in time to arrive on or before July 19, 1989. NOTE: Abstract forms will not be sent to anyone after July 14, 1989. The absolute deadline for receipt of abstracts is JULY 19. NO ABSTRACTS WILL BE ACCEPTED FOR PROCESSING AFTER THAT DATE.

INSIDE _ _ _

1989 Annual Meeting Previews	p. 132
GSA Divisions and Sections	p. 140
Foundation Annual Report	p. 141



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