



GSA NEWS & INFORMATION

Monthly Newsletter of
The Geological Society of America

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Applications, Nominations Due Now

New *Bulletin* and Books Editors To Be Appointed

Terms of service for *Geological Society of America Bulletin* editors and the GSA books editor end this year, and the search is on for new editors.

Bulletin Editors Robert D. Hatcher, Jr. and William A. Thomas will finish seven years (two three-year terms and a one-year extension for GSA's Centennial) at the end of 1988. Books (Memoirs, Special Papers, and Reviews in Engineering Geology) Editor Campbell Craddock will finish his second three-year term.

Bulletin Editors

During their tenure as *Bulletin* editors, Hatcher and Thomas have reduced average acceptance-to-publication time to five months. When they began their stint as editors, the average time to publication was about one year. The 1988 *Bulletin* is 160 pages per month and contains 12-14 papers on a broad range of geologic subjects. GSA's Centennial Year volume of the *Bulletin* will contain additional papers on the history of and progress in specific geologic areas during the past 100 years. Hatcher and Thomas conceived the idea for these state-of-the-art reviews and solicited the papers to be published in 1988 in Volume 100 of the *Bulletin*.

The editors of the *Bulletin* are expected to be aware of developments and discoveries in geology and to make sure that the journal publishes papers on a wide range of topics in the geosciences. The editors are responsible for the acceptability of the scientific content of papers, determined with the assistance of the board of Associate Editors, who obtain at least two reviews of each paper submitted to the *Bulletin*. The *Bulletin* editors decide which papers are published in each issue. Receipt and tracking of submitted manuscripts as well as copy editing, typesetting, and other production processes are handled at GSA headquarters.

The editors' work involves periodic travel to GSA headquarters in Boulder, Colorado, to work with *Bulletin* Managing Editor Jean Thyfault and other staff members and to attend the GSA Committee on Publications meeting in the spring of each year. The editors also attend the other committee meeting, held during the GSA annual meeting. GSA pays expenses for the editors' office assistance, mail and telephone costs, and travel to headquarters. Hatcher has performed his *Bulletin* duties from the University of South Carolina in Columbia and, since July 1987, from the University of Tennessee. Thomas has worked from the University of Alabama in Tuscaloosa and from Cornell University during his sabbatical there last year.

Two new editors for the *Bulletin* will be appointed for three-year terms beginning in 1989; phase-in will begin in fall 1988. Applications

and nominations for *Bulletin* editors are due at GSA headquarters by February 22, 1988; see page 34 for details.

Books Editor

GSA Books Editor Campbell Craddock has had the satisfaction of joining the crowds at the GSA annual meeting bookstore to look at the 40 or so GSA Special Papers, 15 Memoirs, and two volumes of the Reviews in Engineering Geology series that have been published since he started his first term as GSA books editor in 1981. His efforts on behalf of the book series have generated many of the new books published; he is currently considering or has selected about 30 additional manuscripts for publication. Craddock, working from the University of Wisconsin in Madison, finds suitable reviewers for manuscripts submitted for the book series and decides, on the basis of the reviews, whether the manuscripts should be published and in which series. Copy editing, typesetting, and final production procedures for books are handled at GSA headquarters by Books Manager Lee Gladish and other headquarters staff members. The books editor travels to Boulder, Colorado, for the spring meeting of the Committee on Publications and to the GSA annual meeting for the fall committee meeting. Like that of the *Bulletin* editors, the position of books editor is honorary, but GSA pays costs of office assistance, mail and telephone expenses at the editor's place of primary appointment, and travel to GSA headquarters.

Craddock's two terms as books editor end this year. Applications and nominations for the next GSA books editor are due at GSA headquarters by March 15, 1988; see p. 45 for details.

Arvidson Named *Geology* Co-Editor

Raymond E. Arvidson, professor of earth and planetary sciences at Washington University in St. Louis, Missouri, has been named editor of *Geology*, to serve with M. E. Bickford, University of Kansas.

Arvidson's research specialties are planetary geology and remote sensing. His three-year term as *Geology* co-editor began in January this year. Arvidson and Bickford replace Eldridge M. Moores, professor of geology, University of California, Davis, whose second three-year term as *Geology* editor ended in December 1987.

Prospective authors of *Geology* articles should send manuscripts to *Geology*, Geological Society of America, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301, not to Bickford or Arvidson.

CALL FOR APPLICATIONS AND NOMINATIONS FOR BULLETIN EDITORS

GSA solicits applications and nominations of two persons to serve as Editors of the Bulletin. The terms of the current Editors will end December 31, 1988, and the new Editors will begin three-year terms at that time. A phased transition should begin in the fall of 1988.

These are not salaried positions, but GSA pays expenses for secretarial assistance, mail, telephone, and travel to GSA headquarters. GSA headquarters staff conducts copy editing and production activities.

Interested persons should submit a résumé and a brief letter describing relevant qualifications, experience, and objectives. Nominations should include a letter and the nominee's written permission and résumé. Applications and nominations should be sent
BEFORE FEBRUARY 22, 1988, to:

F. MICHAEL WAHL, EXECUTIVE DIRECTOR
GEOLOGICAL SOCIETY OF AMERICA
P.O. BOX 9140
BOULDER, COLORADO 80301

BULLETIN EDITOR DUTIES

1. Ensure that the Bulletin remains as one of the premier journals in the geological sciences.
2. Select and maintain an appropriate Board of Associate Editors.
3. Maintain expeditious manuscript flow.
4. Make decisions regarding acceptability of submitted manuscripts in concert with recommendations of reviewers and Associate Editors.
5. Advise authors about necessary revisions.
6. Organize the content and select cover design for each issue of the Bulletin.
7. Keep the Committee on Publications and the GSA headquarters staff informed about the flow of manuscripts and other Bulletin business.
8. Respond promptly to inquiries from authors and prospective authors.

EDITOR QUALITIES

1. Broad background and active research in the geological sciences with particular emphasis on regional geology (including geomorphology)/geophysics/geochemistry.
2. Good organizational skills.
3. Willingness to invest approximately one day per week.
4. Enthusiasm, tenacity, and imagination for future innovations and improvements in the Bulletin.
5. Broad knowledge of the geological research activities of scientists both nationally and internationally.
6. Good English language skills.
7. Objectivity.
8. Scientific maturity.
9. Patience, courtesy, tact, and firmness in dealing with authors.



DNAG NEWS

by Allison (Pete) Palmer

Publications under Control

The Atlantic Continental Margin: U.S. went to the printer on December 4. Because of slowdowns at the bindery, this will probably not be available until late February.

The long-promised last two chapters for the South-Central Section *Centennial Field Guide* arrived on December 7. Final pages for the first 72 chapters are already prepared. With luck we may have sent this to the printer before Christmas, but it will now barely be printed by the South-Central Section meeting in March.

Sedimentary Cover of the Craton, edited by Larry Sloss, is closer to being completed. The final missing chapter by Charlie Mankin was promised by December 15, by which time the four remaining chapter revisions were also expected. We can still make this an April book, if the color plate to be prepared from materials received at Thanksgiving can be ready for the printer in time.

The Gravity Anomaly Map of North America should be available by the time you receive this, and the *Seismicity Map of North America* should not be far behind.

Who's next?

I wish I knew. Eighty percent of all of the chapters needed to complete the 13 remaining U.S. volumes of *The*

Geology of North America have been written. However, there has been very little substantive change on the lagging 20% from last month's report up to the date of this writing (early December). Anyone who wishes to provide some useful leverage on those few of their colleagues who are holding up completion of any of 13 volumes will be most welcome to do so.

All authors who had not yet submitted revisions of their chapters following peer review were contacted in December and asked to complete their commitments. Meanwhile, we're working on the authors of chapters not yet seen. Some of these are hard nuts to crack, as indicated by the all-too-typical litany of "agreement" given below (from a volume editor, yet!) following telephone calls on progress status:

"By mid-April, 1985"; "by mid-September"; "by December 1"; (new deadline set for spring and mailed in February 1986); (call August 6, 1986): "working on it"; (call January 5, 1987): "will try for the end of January"; (call March 3, 1987): "trying for mid-March"; (call May 12, 1987): "by May 20"; "by end summer"; etc., etc.!! Manuscript not yet received for review, December 1987.

Permanent Museum Will House California State Mineral Exhibit

California's 107-year-old State Mineral Exhibit is scheduled to have its first truly permanent home this summer. The exhibit, owned by the California Department of Conservation, is one of the largest and most complete mineral collections in the world. It consists of an estimated 16,000 to 20,000 specimens. It has been the official collection of the State of California since 1880, although many of the specimens had been collected years before that. The collection contains California minerals, gems, crystals, rocks, mineral commodities, and relics of the Gold Rush. The more beautiful and exotic minerals are contained in the Dana Collection, or in smaller collections of mineral "families." One of the most interesting and valuable parts of the exhibit is a display of outstanding gold specimens.

The exhibit was housed in a variety of rented quarters in San Francisco from 1880 until 1983. At that time, due to State budgetary constraints, funding for rental payments ceased. The County of Mariposa applied to house the collection, and it was moved to that historic Mother Lode community in 1983. Part of the exhibit is now

on temporary display in rented quarters in Mariposa, and a permanent building is under construction at the Mariposa fairgrounds. The new building, expected to be completed in the summer of 1988, will have a rustic exterior, complete with mining head frame, ore carts, and other artifacts.

The nonprofit California State Mining and Mineral Exhibit Association (CSMMEA), which oversees the collection, has secured expert guidance in the design of the interpretive and display areas of the museum. The Interpretive Design Review Committee includes John Sampson White of the Smithsonian Institution, Anthony Kampf of the Los Angeles County Museum of Natural History, and Jean DeMouthe of the California Academy of Sciences in San Francisco. Funding for basic construction and interpretive design was raised during 1987 from public and private sources, including a grant of \$150,000 from ABM Mining Corporation of Canada. Fund raising for operations continues, and the CSMMEA board of directors is now actively recruiting for a curator.

Report from Washington

by James Evans
GSA Congressional Science Fellow



ARCTIC NATIONAL WILDLIFE REFUGE

One of the major environmental and scientific issues facing the 100th Congress is legislation concerning the fate of the coastal plain of the Arctic National Wildlife Refuge (ANWR). Although most of the public perceives the issue as a case of oil development vs. wildlife protection, there are many other relevant considerations, including energy policy and national security, the rights of Alaska Native people, and the long-term, cumulative effects of industrial development on arctic ecosystems.

Background

Initial protection of this part of the North Slope began in 1960, when the 8.9-million-acre Arctic Wildlife Range was established. In 1971, the Alaskan Native Claims Settlement Act (ANCSA) further defined the boundaries of the refuge. Under ANCSA, "aboriginal claims" on land throughout Alaska were surrendered in exchange for land patents and cash payments, both to be administered by village and regional Native corporations. Two of these Native corporations, the Kaktovik Inupiat Corporation (KIC) and the Arctic Slope Regional Corporation (ASRC), administer about 92,000 acres centered on the village of Kaktovik, in the coastal area of ANWR. Because this land represented an inholding to the refuge, initially the subsurface rights were retained by the U.S. government.

In 1980, Congress passed the landmark Alaska National Interest Lands Conservation Act (ANILCA). Among provisions of the act, ANWR was officially designated and was increased to its present 19 million acres. All of ANWR was designated as wilderness except for the 1.5-million-acre coastal plain. The final bill recognized the potential of major oil and gas reserves under the coastal plain of ANWR and directed the Department of the Interior to assess its economic resources and the effect development would have on the area's natural values. Congress would then use this report, which Interior released in April 1987, to decide the fate of the coastal plain. The affected part of ANWR is often called the 1002 area because the study was directed by Section 1002 of ANILCA.

As part of the Department of the Interior study of the 1002 area, 1300 line miles of seismic data, gravity readings, and surface samples were collected. The 1002 study did not permit exploration wells, but one well has been drilled on the adjacent land owned by the Native corporations. This single exploration well was made possible by a land exchange, in which the Native corporations traded ownership of the 101,000-acre Chandler Lake property in Gates of the Arctic National Park for the subsurface rights of the 92,000-acre KIC land. This land was then leased to Chevron and British Petroleum, who drilled the 15,000-foot KIC well on one of the major structures that crosses ANWR. More recently, the oil companies and some Native corporations have proposed an even larger land exchange: the Native corporations would give the United States the surface rights of 891,000 acres of land that are inholdings to seven different National Wildlife Refuges in Alaska, in exchange for 166,000 acres of subsurface rights in ANWR, a trade of supposed equal value. The Department of the Interior has already held a "conditional auction," in which the Native corporations selected tracts in ANWR in consultation with the major oil companies. This proposed land exchange may become a major focus of the ANWR debate. Some argue in favor of the land exchange as a means for the United States to complete land acquisition in seven National Wildlife Refuges, and as a "fairness"

issue for the Native peoples. Others, including the State of Alaska, oppose it because it would effectively prevent competitive bidding and payment of royalties on that part of ANWR with the greatest oil potential. Congress passed a bill (H.R. 2629) this year preventing any further land exchanges prior to Congressional approval.

Issues

Some of the significant issues that have surfaced in the ANWR debate are accuracy of petroleum estimates and impact on U.S. energy security; availability of water and gravel resources; toxic-waste disposal; air pollution; and long-term, synergistic effects of industrial development in the arctic.

The Department of the Interior has used a two-step process to estimate reserves in ANWR: (1) an estimate of total in situ reserves, based on the size of traps, and (2) a probability analysis (called PRESTO II) of the chance of discoveries of a minimum economic field size of 440 million barrels. There are numerous assumptions involved in the PRESTO model, which has been criticized recently in a National Academy of Sciences report. Based upon anticipated oil prices in the 1990s (\$33 to \$40 per barrel), the mean probability is 3.2 billion barrels of economically recoverable oil. The amount produced per year and the lifetime of the fields depend on the available capacity of the Trans-Alaska Pipeline (TAP). As the Prudhoe Bay production declines, TAP would operate at less than capacity unless additional sources were found. The Department of the Interior estimates that ANWR production of 0.7 million barrels per day could be accommodated in TAP by the early 2000s. No one discounts the significance of this potential ANWR production to U.S. energy security, but opponents to leasing have pointed to alternative methods, such as conservation or increased fuel efficiency, of obtaining the equivalent to ANWR production.

Development of ANWR would require enormous quantities of gravel and water. Full development would require 50 million cubic yards of gravel to provide 5-foot-thick drilling pads, roads, airfields, and port facilities. Extraction of this quantity of gravel from stream beds and terraces would have a significant effect on the landscape. Since exploration wells would be drilled during winter, each well would require 15 million gallons of water to build ice pads, ice roads, and ice landing fields. Each production well would require 30,000 gallons of water per day; however, some or all of this could be replaced by treated seawater. The Department of the Interior report provides little or no data to support the assumption that adequate water supplies exist, and this aspect of the report has been criticized by the Environmental Protection Agency, the Fish and Wildlife Service, and the Congressional Research Service. Water availability

(continued on p. 37)

Report from Washington (continued from p. 36)

for wildlife is particularly critical during the winter, when many streams are dry or frozen solid.

Toxic-waste disposal is becoming a more significant issue as the environmental impact of earlier oil development becomes known. Technically, under the Resource Conservation and Recovery Act, drilling mud and related wastes are not toxic wastes, although they contain trace metals such as lead, cadmium, nickel, and zinc; liquid hydrocarbons; aromatic hydrocarbons such as benzene, naphthalene, and phenanthrene; biocides; degreasers; defoaming agents; salts; alkalis; and clay. Each well produces 0.8 million gallons of drilling wastes per year, and the long-term, cumulative effects of disposing of this material are poorly understood. More than 500 million gallons of drilling wastes have accumulated at Prudhoe Bay, according to the Alaskan Department of Environmental Conservation (ADEC). During 1986, 64 million gallons of drilling-waste fluids were directly discharged to tundra wetlands after reserve pits leaked or were overtopped and breached during spring snowmelt. In addition, 37 million gallons of drilling-waste fluids were directly applied to roads as part of dust-control efforts. ADEC studies have found elevated levels of trace metals, such as lead, up to one-half mile from roads at Prudhoe Bay. There have been other problems besides drilling wastes. North Slope Salvage, Inc. was convicted in 1983 of illegal disposal of toxic wastes at Prudhoe Bay. The Department of the Interior has estimated that there have been 17,000 oil spills on the North Slope since 1973 and that at least two of these exceeded 200,000 gallons each. Solid-waste disposal problems are significant also. ADEC has catalogued debris from a pipeline project that included hundreds of junked vehicles and buildings and thousands of batteries, tires, drums, pipes, and other debris. The Fish and Wildlife Service has complained that styrofoam litter complicates its annual census of tundra swans.

According to ADEC, in 1986 Prudhoe Bay released 74,000 tons of nitrogen oxides, which represents 2% of the total U.S. production of this pollutant. Sulfur dioxide is another pollutant emitted from Prudhoe Bay, and the Fish and Wildlife Service has expressed concern about the lack of knowledge concerning long-term, cumulative effects of acidification and ozone on lichens and other important food sources for caribou. Gas flaring and black smoke emissions release soot and particulates. ADEC reported over 150 black smoke emissions during 1985, including some that lasted one month or longer. Dust from roads has an effect on visibility and coats vegetation up to 35 feet from roadways. The effects of dust and soot on plant communities have not been studied.

An article in *Science* (11/6/87; Walker et al.) documented some of the synergistic effects of oil-field development in the Arctic. One example is the development of thermokarst features—sinkholes that form due to melting of the underlying permafrost. Thermokarst development is a naturally occurring process, but it can be accelerated by human activity. Indirect effects of human activities that enhance the development of thermokarst are flooding that results from building roadways and warming of the tundra surface due to gravel pads, dust, and black soot. In parts of the Prudhoe Bay field, flooding and resultant thermokarst covers twice the area

directly affected by human-made structures, according to Walker et al. (1987).

Legislation

In the Senate, the pro-development bill is S.1217, which has been referred to the Committee on Energy and Natural Resources. The wilderness bill is S.1804, which has recently been sent to the Committee on Environment and Public Works.

In the House, H.R. 39 would designate all of ANWR as a wilderness area, and it has been referred to the Committee on Interior and Insular Affairs. There are two pro-development bills: H.R. 1082 and H.R. 1960. A proposed compromise bill, H.R. 3601, contains provisions that differ from all the other bills. H.R. 3601 requires a further exploration program, in which a consortium of private oil companies would finance drilling of four additional wells in the most promising structures. Following a revised evaluation of ANWR's potential, full leasing could proceed without further Congressional mandate. State and Federal royalties would be split 50/50 (instead of the present 90/10), and the Federal portion would be directed toward enhancing or completing the National Wildlife Refuge system. The bill also allocates a new 23-million-acre National Wildlife Refuge in what is now the National Petroleum Reserve. Finally, this bill would allocate a 376,000-acre region in ANWR as a protective management zone for the main caribou calving grounds. Each of these bills has been jointly referred to two committees: Interior and Insular Affairs, and Merchant Marine and Fisheries. Further hearings on ANWR will be held throughout next year.

Editor's note: James Evans, GSA Congressional Science Fellow for 1987-1988, is working with Congressman Michael E. Lowry (D, Washington) and may be contacted through Lowry's office, House of Representatives, 2454 Rayburn House Bldg., Washington, DC 20515; phone (202) 225-3106.

PEOPLE

GSA Fellows **Wallace S. Broecker**, Lamont-Doherty Geological Observatory, and **Harmon Craig**, Scripps Institution of Oceanography, were awarded the 1987 Vetlesen Prize by Columbia University in November.

Fellow **William W. Hambleton**, director emeritus of the Kansas Geological Survey and professor emeritus of geology at the University of Kansas, received the KU geology department's outstanding alumnus award in October 1987.

Member **Paul H. Pause**, consultant, Midland, Texas, was elected president of the Society of Economic Paleontologists and Mineralogists Permian Basin Section for 1987-1988. Member **J. Frederick Sarg**, Exxon Production Research, Houston, Texas, was elected second vice-president.

Recently appointed Geraghty & Miller, Inc., vice-presidents are GSA Members **Bruce L. Cutright**, Milwaukee, Wisconsin; **Jerry E. Kubal**, Tampa, Florida; **Jeffrey P. Sgambat**, Annapolis, Maryland; and **Fred L. Troise**, Plainview, New York.

Fellow **David A. Stephenson** has joined Harding Lawson Associates as a principal hydrogeologist in the firm's corporate headquarters in Novato, California.

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*Advertising: Contact James R. Clark or Ann H. Crawford (303) 447-2020.

Geological Society of America



CONGRESSIONAL SCIENCE FELLOWSHIP 1988-1989

The Geological Society of America invites applications for the 1988-1989 Congressional Science Fellowship. The Fellow selected will spend a year (September 1988-August 1989) in the office of an individual member of Congress or a congressional committee advising on a wide range of scientific issues as they pertain to public questions. Guided by the American Association for the Advancement of Science, the Fellow selects a congressional staff position in which he or she can work on major legislative issues.

CRITERIA

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

AWARD

The GSA Congressional Science Fellowship carries with it a \$28,000 stipend and a limited relocation and travel allowance.

TO APPLY

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

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



Deadline for receipt of all application materials is March 15, 1988

FINAL ANNOUNCEMENT ROCKY MOUNTAIN SECTION, GSA, 41st Annual Meeting

May 16-18, 1988
Sun Valley, Idaho

The Rocky Mountain Section of the Geological Society of America will meet at the Sun Valley Inn, Sun Valley, Idaho, together with the Idaho Association of Professional Geologists and the Rocky Mountain Section of the Paleontological Society. The meeting is sponsored by the Department of Geology, Idaho State University. Local Committee Chairman is Paul Karl Link and Technical Program Chairman is David W. Rodgers, both at Department of Geology, Idaho State University, Pocatello, ID 83209-0009; (208) 236-3365.

Sun Valley is located near Ketchum and Hailey in the spectacular mountain country of central Idaho, and it is a premier all-season resort. The variety of restaurants and recreational activities is impressive. The beautiful setting, idyllic to America's affluent for 50 years, has not changed.

Because this is the first major geological meeting in central Idaho, many of the field trips and symposia will cover previously little-known terrain. Plan to join us in Sun Valley for what we intend to be the most stimulating Rocky Mountain Section Meeting ever. Bring your family and enjoy spring in the Idaho mountains.

REGISTRATION

All persons participating in any events of the meeting must be registered.

Preregistration. You are urged to preregister to aid the local committee in making final plans. *Preregistration forms, with payment, must be postmarked no later than April 16, 1988.* Complete the registration form and return with a check or money order in U.S. currency, made payable to Rocky Mountain Section GSA, to GSA Meeting Registration, Department of Geology, Idaho State University, Pocatello, ID 83209. Those planning to attend the field trips or any of the spouse/guest activities must preregister by April 16, 1988. Refunds on canceled preregistration will be made in full until April 16, 1988. After that date, no refund will be made except for cancellation of a field trip.

On-Site Registration. Registration, and pick-up of meeting material by those who have preregistered, will be from noon to 9 p.m. on Sunday, May 15, and from 8 a.m. to 5 p.m. on May 16, 17, and 18. Registration will be held in the lobby of the Sun Valley Inn.

TRANSPORTATION

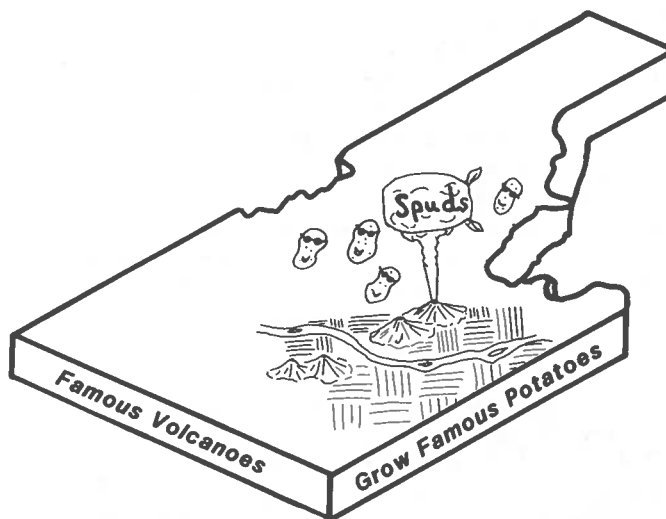
Air

The House of Travel [4155 Yellowstone Ave., Pocatello, ID 83202; (800) 426-5722 toll-free outside Idaho, or (208) 238-0600] is the official travel agency for this meeting. Reservations must be made no later than April 1, 1988, to insure sufficient airline seats and special fares. The House of Travel will have the best rates on flights to the meeting. Delta Airlines and Horizon Airlines are the official air carriers. Delta is offering discounts up to 40% off coach rates, and Horizon is offering special meeting rates.

Direct flights into Sun Valley are available via Horizon Airlines from Salt Lake City and Boise. If necessary, Horizon Airlines will add extra flights into Sun Valley for the meeting. Flights can also be arranged into Idaho Falls, Boise (a three-hour drive from Sun Valley), or Salt Lake City (six-hour drive).

Reservations procedures:

1. Book early. Understand restrictions, if applicable.
2. Call the House of Travel for reservations Monday-Friday, 9 a.m. to 8 p.m. or Saturday, 10 a.m. to 4 p.m. (Mountain time). Identify yourself as a GSA traveler.
3. Payment options: Check payable to The House of Travel, or



major credit card. Final payment must reach The House of Travel no later than 14 days prior to departure to allow time for mailing.

4. Tickets will be sent via certified mail upon receipt of final payment.
5. Airfares are subject to change at any time. Once your ticket has been issued, your fare is guaranteed.

Ground

Transportation from the Sun Valley airport is provided by the Sun Valley Company for those staying at the convention center. An airport limousine service is also available.

Public bus travel in the Sun Valley-Ketchum area is provided by KART (Ketchum Area Rapid Transit).

Car Rental

The House of Travel will be able to arrange car rental either in Sun Valley or from other cities. Call for rates (phone numbers above).

STUDENT TRAVEL GRANTS

The GSA Rocky Mountain Section has funds available for grants to GSA Student Associates who are contributing to the meeting. *Students are strongly encouraged to apply for these grants.* We anticipate that most students who qualify will be funded to some degree. Application letters must be sent by April 15, 1988, to Ken Kolm, Secretary, Rocky Mountain Section GSA, Department of Geology, Colorado School of Mines, Golden, CO 80401. Applications should include certification that the student is a GSA Student Associate and is presenting a paper or poster session.

WELCOMING PARTY

A no-host welcoming party will be held from 6:30 to 10 p.m. on Sunday, May 15, at the Sun Valley Inn.

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TECHNICAL PROGRAM

Technical sessions are scheduled as oral presentations and poster sessions on Monday, Tuesday, and Wednesday, May 16, 17, and 18. Oral presentations will be held in the convention center adjacent to the Sun Valley Inn. Poster sessions will be held in the Continental Room of the Sun Valley Inn. Poster booths will consist of three panels, each 4 feet high and 8 feet wide.

SYMPOSIA

1. **A Continent-Island-Arc Boundary: Eastern Oregon, Western Idaho.** Elaine Aliberti, Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA 02138, (617) 495-2351; Cathryn Allen Manduca, California Institute of Technology.

2. **Eocene Volcanism and Plutonism in the Northwest.** Falma Moye and Bill Hackett, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3365; Kathleen Johnson, USGS.

3. **Snake River Plain Volcanic Processes, Stratigraphy and Petrology.** Bill Hackett, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3960; Mel Kuntz, USGS.

4. **Hydrogeology of the Snake Plain Aquifer.** Paul Castelin, Idaho Department of Water Resources, 450 W. State, Boise, ID 83720, (208) 334-4487.

5. **Problems of Waste Disposal in the Greater Rocky Mountain Region.** Albert Ogden, Water Resources Center, P.O. Box 5082, Tennessee Tech, Cookeville, TN 38505, (615) 372-3353.

6. **New Interpretations of Sedimentary Basin Evolution in the Rocky Mountain Region.** Jim Schmitt, Department of Geology, Montana State University, Bozeman, MT 59715, (406) 586-3118; Jim Steidtmann, University of Wyoming.

7. **Mineralization of the Hailey 2° Sheet.** Dedicated to the memory of Wayne Hall. Ron Worl, USGS, Branch of Central Mineral Resources, MS 905, Box 25046, Denver, CO 80225, (303) 236-5603.

8. **Living with the Wasatch Fault—Geology, Politics, and Economics.** Doug Sprinkel and Genevieve Atwood, Utah Geological and Mineral Survey, 606 Black Hawk Way, Salt Lake City, UT 84112, (801) 581-6553.

9. **Late Quaternary History of the Great Salt Lake, Its Predecessors, and Other Intermountain Lakes.** Don Currey, Department of Geography, University of Utah, Salt Lake City, UT 84108, (801) 581-6831.

10. **Regional Geology of the Idaho-Wyoming Thrust Belt and Snake River Plain.** Dedicated to the memory of Steve Oriol. Paul Link, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3846; Lucian Platt, Bryn Mawr College; Mel Kuntz, USGS; Nick Woodward, University of Tennessee.

11. **Neogene Biostratigraphy of the Northern Rocky Mountain Region.** Michael E. Nelson, Fort Hays State University, (913) 628-5389; Dick Moyle, Weber State College; Bill Akersten, Idaho State University.

For general information on the symposia, contact Symposium Chairman William Hackett, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3960 or 3365.

SPECIAL GEOLOGY AND PUBLIC POLICY FORUM

There will be a special open forum on Ethics in Geology: Economic and Environmental Effects of Mining in Idaho. For further information contact William R. Hackett, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3365.

FIELD TRIPS

An extensive program of both premeeting and postmeeting field trips is planned. For details contact the first-listed trip leader or Field Trip Coordinator H. Thomas Ore, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3871 or 3365.

Premeeting

1. **Transect across a Continent-Island-Arc Boundary, West-Central Idaho.** In west-central Idaho the transition from accreted volcanic-arc terrane to the craton margin occurs across a zone about 20 miles wide. This trip will concentrate on the structural, petrological, and geochemical nature of this transition and provide a forum for discussing the abrupt nature of this continent-island-arc boundary. The first day will focus on the structure and petrology of the eastern margin of the Wallowa terrane and its relation to the Riggins Group and gneisses west of the 0.706 line. The second day will concentrate on the transition across the 0.706 line within the crystalline terrane along the western margin of the Idaho batholith.

Three days, May 13–15. Leave Sun Valley Inn at 11 a.m. or Boise airport at 3 p.m. May 13; return to Sun Valley at 7 p.m. May 15. Limit: 30; cost: \$140, including transportation, two nights lodging, two box lunches, beverages, and guidebook. Leaders: Elaine A. Aliberti, Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA 02138, (617) 495-2351; Cathryn Allen Manduca, California Institute of Technology.

2. **Structural and Stratigraphic Transect of South-Central Idaho: Lost River, White Knob, Pioneer, and Smoky Mountains.** The trip will illustrate a cross section of the Cordilleran orogen in scenic east-central Idaho, from Arco to Ketchum. Topics to be covered include the Antler orogeny in Idaho, upper Paleozoic carbonate bank facies, styles and effects of Mesozoic thrusting, intrusion of the Idaho batholith and associated mineralization, Paleogene extension faulting, rise of the Pioneer Mountain Core Complex, and interaction between Neogene Basin and Range faulting and formation of the Snake River Plain. A highlight of the second day, weather permitting, will be a drive to the top of Bald Mountain, the main Sun Valley ski area.

Two days, May 14–15. Leave Sun Valley Inn at 8 a.m. May 14; return to Sun Valley that night. Leave at 9 a.m. May 15; return to Sun Valley at 6 p.m. Limit: 35; cost: \$110, including transportation, one night lodging, two box lunches, refreshments, and guidebook. Leaders: Paul Karl Link, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3846; Betty Skipp, USGS, Denver; M.H. Hait, Jr., USGS (ret.); Susanne Janecke, University of Utah; Bradford R. Burton, Idaho State University.

3. **Southwest Montana Thrust Belt, Melrose to Bannack.** In the southwest Montana thrust belt, igneous activity and low-grade regional metamorphism overlapped thrusting and folding in time and space, and basement-cored uplifts interfered with thrusts. The first day is devoted to travel from Sun Valley to Dillon. On the second day we will study the increasing effects of regional metamorphism on strain in the thrust belt between Dillon and Melrose, with increasing proximity to the Pioneer batholith complex. Emphasis will be on changing structural styles and timing and intensity of strain with respect to thrust structures. On the third day we will examine the relation between volcanism, sedimentation, and thrusting in the Bannack area, where thrust faults impinged on basement-cored structures.

Three days, May 13–15. Leave Sun Valley Inn at noon May 13, return to Sun Valley at 10 p.m. May 15. Limit: 35; cost: \$140, including transportation, two nights lodging, two box lunches, beverages, and guidebook. An option without transportation and

(continued on p. 41)

Rocky Mountain Section (continued from p. 40)

with one night lodging, two box lunches, beverages, and guidebook is available for \$70: meet at Beaverhead County Courthouse, Dillon, Montana, at 8 a.m. May 14. Leaders: James W. Sears, Larry Johnson, Beth Geiger, Bill Brandon, Department of Geology, University of Montana, Missoula, MT 59812, (406) 243-2341.

4. Rhyolitic and Explosive Basaltic Volcanism of the Eastern Snake River Plain and Margins. The eastern Snake River Plain is a bimodal basalt-rhyolite province, analogous to the Quaternary Yellowstone Plateau volcanic field, but older and further evolved. This trip examines three major 4.3–6.5-Ma ignimbrite sheets and associated rhyolitic deposits of the Heise volcanic field. Subsequent to early rhyolitic volcanism, Quaternary basaltic magma interacted with both ground water and surface water, producing diverse hydrovolcanic constructs and lithologies. Tuff cones, tuff rings, and pillow lavas will be examined at the Menan Volcanic Complex and along the South Fork of the Snake River.

Two days, May 13–15. For those wishing to fly to Sun Valley, a van will leave the Sun Valley airport at 4 p.m. on May 13. Those who wish to fly to Idaho Falls should take the airport limousine to the Westbank Motel on the evening of May 13. Leave the Westbank at 8 a.m. May 14; return to Sun Valley at 7 p.m. May 15. Limit: 35; cost: \$140, including transportation, two nights lodging (May 13 and 14), two box lunches, beverages, and guidebook. Leaders: William R. Hackett, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3960; Lisa Morgan, USGS and University of Colorado.

5. Glacial Geology of the Upper Big Wood River and Stanley Basin. This two-day loop around the Boulder-Pioneer Mountains will concentrate on the Pleistocene and Neogene history of this scenic area. Well-developed moraines and terraces along the Big Wood River and the Stanley basin will be discussed in terms of the Idaho glacial model. At Doublesprings Pass and near Arco, we will discuss surface faulting associated with the 1983 Borah Peak earthquake and previous movements along this major fault zone. Lunch stops at Craters of the Moon National Monument and the Yankee Fork-Custer gold mining areas will allow participants to visit, photograph, and discuss spectacular late Quaternary/Holocene volcanic features, dredge spoils, and the Yankee Fork dredge.

Two days, May 14–15. Leave Sun Valley Inn at 8 a.m. May 14; return to Sun Valley at 7 p.m. May 15. Limit: 20; cost: \$110, including transportation, one night lodging, two box lunches, dinner, breakfast, beverages, and guidebook. Leaders: Ed Evenson, Department of Geology, Lehigh University, Bethlehem, PA 18015, (215) 758-3659; Roy Breckenridge, Idaho Geological Survey; Ken Pierce and Anthony Crone, USGS, Denver; George C. Stephens, George Washington University; James Cotter, University of Minnesota—Morris.

6. Geologic History of the Camas Prairie Rift, South-Central Idaho. Emphasis will be on structural evolution, regional geomorphology, gravity modeling, stratigraphy, and selected hydrologic phenomena of the Camas Prairie, an anomalous late Cenozoic east-west structure. This trip will also be an excellent opportunity for wildlife and wildflower viewing.

One day, May 15. Leave Sun Valley Inn at 8 a.m. May 15; return at 7 p.m. Cost: \$40, including transportation, lunch, beverages, and guidebook. Leaders: Brian Cluer, Department of Geology, Northern Arizona University, Flagstaff, AZ 86011, (602) 523-5383; J. Kelly Cluer, University of Arizona.

Postmeeting

7. Cretaceous and Tertiary Intrusive Rocks of South-Central Idaho. Much of central Idaho is underlain by plutonic rocks of Late

Cretaceous and Tertiary age. Cretaceous rocks have considerable areal extent, while Tertiary plutons are generally small, numerous, and uniformly difficult to reach. This trip will examine the six phases of the Atlanta lobe of the Cretaceous Idaho batholith, Eocene granitic rocks of the Sawtooth Range and Boise basin, structures resulting from Eocene extension and younger Basin-and-Range faulting, and both Cretaceous and Tertiary stockwork molybdenum deposits. All exposures are close to the roads, so only limited walking is required.

Three days, May 19–21. Leave Sun Valley Inn at 7 a.m. May 19; return to Boise at 9 p.m. May 21. Limit: 35; cost: \$150, including one night lodging (May 20), three box lunches, beverages, and guidebook. Participants should keep their previous accommodations in Sun Valley for the nights of May 18 and 19. Leaders: Kathleen Johnson, USGS, MS 937, Box 25046, Denver, CO 80225, (303) 236-5704; Reed Lewis, Oregon State University and USGS, Corvallis; Earl Bennett, Idaho Geological Survey; Thor Kiilsgaard, USGS, Spokane.

8. Early Paleozoic Margin Development, Central Idaho. New information from early Paleozoic units of central Idaho demonstrates that there was extensive tectonic control of sedimentation. In a remarkably small area, near Challis, we can see deep-water rift(?) through shallow-water incipient foreland-basin carbonate-rock development of the Upper Ordovician Saturday Mountain Formation, Silurian Roberts Mountain Formation, and Upper Devonian Jefferson Formation. The Jefferson Formation contains a "reef" complex showing distinct autogenic and allogenic stromatoporoid and coral growth and replacement strategies.

Two days, May 18–20. Leave Sun Valley Inn at 5 p.m. May 18; return to Sun Valley at 9 p.m. May 20. Limit: 25; cost: \$140, including transportation, two nights lodging (May 18 and 19), two box lunches, beverages, and guidebook. An option for those who have their own transportation and wish to camp at Challis Hot Springs, and including two lunches, beverages, and guidebook, but without transportation or camping fee, is available for \$40. Leaders: Mark McFadden, Elizabeth A. Measures, and Peter E. Isaacson, Department of Geology, University of Idaho, Moscow, ID 83843.

9. Rhyolitic Volcanism in the Central and Western Snake River Plain. Numerous large-volume, high-temperature rhyolite units were erupted from the central and western Snake River Plain volcanic province in late Miocene and Pliocene time. Ash flows were generally erupted first and are well-exposed around the margins of the structurally depressed plain. These welded-tuff sheets were followed in time by large rhyolite lava flows and basalt flows that fill and cover the calderas and other sources of the ash-flow-tuff sheets. Participants will visit various places in the Magic Reservoir volcanic center on the north side of the plain, in the Bruneau-Jarbridge eruptive center on the south side, and in the Jacks Creek and Mountain Home areas in the western part. Field criteria to distinguish between rhyolite lava flows and densely welded, rheomorphically deformed ash-flow-tuff sheets will be emphasized.

Three days, May 19–21. Leave Sun Valley Inn at 8 a.m. May 19; end at Boise airport at 7 p.m. May 21. Limit: 50; cost: \$150, including transportation, two nights lodging, two box lunches, beverages, and guidebook. Leaders: Bill Bonnicksen, Idaho Geological Survey, University of Idaho, Moscow, ID 83843, (208) 885-7991; William P. Leeman, Rice University; Falma J. Moye, Idaho State University; Margaret Jenks, Idaho Geological Survey.

10. Neogene Paleontology of the Snake River Plain, South-Central Idaho. The first day will focus on lava tubes and blisters as sites of accumulation for late Pleistocene and Holocene biotic

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PREREGISTRATION FORM
Rocky Mountain Section, GSA, Annual Meeting, May 16-18, 1988, Sun Valley, Idaho

IMPORTANT

- | | |
|--|---|
| 1. Full payment must accompany registration.
2. Register one: professional, student, or spouse/guest. | 3. You will receive a receipt in the mail. Copy this form for your records.
4. Preregistration deadline: Must be postmarked no later than April 16, 1988. |
|--|---|

Name _____
last first middle

Registered as: Professional Student Spouse/Guest

Spouse/guest name for badge _____

Affiliation (abbreviate for badge) _____

Professional address _____
street

_____ city state ZIP

Phone: Business () _____ Residence () _____

GSA Member: yes no Speaker: yes no GSA Student Associate: yes no

Preregistration (postmarked by April 16, 1988)

GSA member	\$ 50	\$ _____
Nonmember	\$ 55	\$ _____
On-site registration		
GSA member	\$ 55	\$ _____
Nonmember	\$ 60	\$ _____
Student registration	\$ 10	\$ _____
Spouse/guest registration	\$ 10	\$ _____

Field Trips

Preregistration deadline for field trips is April 16, 1988. All field trip preregistrants must also preregister for the meeting.

Premeeting

1. Transect across a Continent Island-Arc Boundary, West-Central Idaho (May 13-15)	\$140	\$ _____
2. Structural and Stratigraphic Transect of South-Central Idaho (May 14-15)	\$110	\$ _____
3. Southwest Montana Thrust Belt, Melrose to Bannack (May 13-15)	\$140	\$ _____
3a. Alternative: own transportation	\$ 70	\$ _____
4. Rhyolitic and Explosive Basaltic Volcanism, Eastern Snake River Plain (May 13-15)	\$140	\$ _____
5. Glacial Geology, Upper Big Wood River and Stanley Basin (May 14-15)	\$110	\$ _____
6. Geologic History of the Camas Prairie Rift (May 15)	\$ 40	\$ _____

Postmeeting

7. Cretaceous and Tertiary Intrusive Rocks, South-Central Idaho (May 19-21)	\$150	\$ _____
8. Early Paleozoic Margin Development, Central Idaho (May 18-20)	\$140	\$ _____
8a. Alternative: own transportation and lodging	\$ 40	\$ _____
9. Rhyolitic Volcanism, Central and Western Snake River Plain (May 19-21)	\$150	\$ _____
10. Neogene Paleontology of the Snake River Plain (May 19-21)	\$150	\$ _____
11. Geothermal Systems of the Wood River Area (May 19)	\$ 40	\$ _____

Special Events

GSA Rocky Mountain Section Annual Banquet (May 16)	\$ 20	\$ _____
IAPG Banquet (May 18)	\$ 14	\$ _____
GSA Rocky Mountain Section Business Luncheon (May 18)	\$ 10	\$ _____

Spouse/Guest Activities

1. Sun Valley History Tour (May 16)	\$ 3	\$ _____
2. Artists at Work Tour (May 16)	\$ 10	\$ _____
3. Craters of the Moon Tour (May 17; lunch included)	\$ 15	\$ _____
4. Rocky Mountain Bird Walk (May 18)	\$ 10	\$ _____
5. Fashion Show Luncheon (May 18)	\$ 15	\$ _____
6. Ernest Hemingway Lecture (May 18)	\$ 3	\$ _____

TOTAL FEES

Enclose check or money order, U.S. funds only, payable to **Rocky Mountain Section GSA** \$ _____

PREREGISTRATION FORMS MUST BE POSTMARKED NO LATER THAN APRIL 16, 1988

Full refunds on canceled preregistrations will be made until April 16, 1988. After that date, no refunds will be made except for canceled field trips and spouse/guest activities.

Mail completed registration forms and fee remissions to
 Carla Noonan Granquist
 Rocky Mountain GSA Registration
 Department of Geology, Idaho State University
 Pocatello, ID 83209-0009

For information,
 call (208) 236-3365

Rocky Mountain Section (continued from p. 41)

materials. Natural traps, human activities (including those of late Pleistocene Paleindians), packrats, mammalian carnivores, and avian predators have contributed to fossil deposits within the lava beds of the Upper Snake River Plain. On the second day we will consider late Pleistocene fossil vertebrates and events in the Pocatello area and a Miocene plant deposit in south-central Idaho. The third day will be devoted to the Pliocene (and Pleistocene?) Glens Ferry Formation and related units of the Snake River Plain in southwestern Idaho.

Three days, May 19-21. Leave Sun Valley Inn at 8 a.m. May 19; end at Boise airport at 6 p.m. May 21. Limit: 30; cost: \$150, including transportation, two nights lodging, three box lunches, beverages, and guidebook. Leaders: Bill Akersten, Sue Miller, and Dave Fortsch, Idaho Museum of Natural History, Idaho State University, Pocatello, ID 83209, (208) 236-3168; Ted Weasma, Bureau of Land Management, Boise.

11. **Geothermal Systems of the Wood River Area.** This field trip examines the geologic and geochemical characteristics of geothermal systems along the southeastern margin of the Idaho

batholith, in the Wood River area of south-central Idaho. The geothermal systems are of interest geologically for their occurrence in this complex area, geochemically for their relatively clean but high-fluoride waters, and economically for the current and potential applications. We will visit Guyer Hot Springs, Clarendon Hot Springs, Hailey Hot Springs, and Magic Hot Springs.

One day, May 19. Leave Sun Valley Inn at 8 a.m.; return at 5 p.m. Limit: 20; cost: \$40, including transportation, lunch, beverages, and guidebook. Leaders: Duncan Foley, Department of Earth Science, Pacific Lutheran University, Tacoma, WA 98447, (206) 535-7568; Leah Street, Idaho Department of Water Resources, Burley.

Field trip preregistrants must also preregister for the meeting. Field trip registration is on a first-come, first-served basis. If a trip is oversubscribed or canceled, the full trip fee will be refunded. **Preregistration for field trips must be received by April 16, 1988, accompanied by full payment. Trips may be canceled if registration is insufficient.** No trip refunds will be made after April 16, 1988.

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Housing Form
Rocky Mountain Section, GSA
May 16-18, 1988
Sun Valley Reservation Request



Housing will be on a run-of-the-house basis in the Sun Valley Lodge, Sun Valley Inn, and/or lock-off bedrooms in the Lodge Apartments or Wildflower Condominiums.

Single occupancy \$ 43
 Double occupancy 43

Suites: Lodge Apartments or Wildflower condominiums:
 Single or double occupancy 94
 Two bedroom for 2, 3, or 4 130
 Three bedroom for 4, 5, or 6 170

Condominiums: Atelier, Cottonwood, Dollar Meadows, Snowcreek, and Villager I or II
 Studio 59
 One bedroom 89
 Two bedroom 99
 Three bedroom 109
 Four bedroom 129

Each additional person 10
 Children, 17 and under, in same room as parents no charge
 Two children maximum per room

All rates subject to 9% tax (6% state; 3% municipal)

Reservation deadline: Group room blocks are held until 30 days prior to arrival, after which time reservations will be accepted on a space-available basis only.

Cancellations: No deposit refunds on cancellations received less than 7 days prior to arrival. There is a \$10 per person processing charge on all cancellations.

Please check here if reservation has been made previously by telephone.

Questions? (800) 635-8261. In Idaho call (800) 632-4104 or (208) 622-4111.

Name of convention Rocky Mountain Section—GSA

Your name _____ Number in party _____

Your address _____ Telephone (____) _____

City _____ State _____ ZIP _____

Accommodation requested _____ Rate _____

Arrival date _____ Departure date _____

Confirmed reservations require an advance deposit equal to one night's room rental. Please send deposit along with this entire form to: **SUN VALLEY RESERVATIONS OFFICE, SUN VALLEY, ID 83353**

Rocky Mountain Section (continued from p. 43)

PUBLICATIONS

Additional copies of the *Abstracts with Programs* volume and the Idaho Geological Survey Bulletin, *Guidebook to Central and Southern Idaho Geology* (field trip guidebook) may be purchased at the Registration Desk in the Lobby of the Sun Valley Inn. After the meeting, field trip guidebooks may be purchased from the Idaho Geological Survey, University of Idaho, Moscow, ID 83843. The Idaho Geological Survey will staff a booth in the Exhibit Hall, and all meeting registrants will receive a 15% discount on IGS publications.

PROJECTION EQUIPMENT

All slides must be 2" by 2" and fit a standard 35-mm carousel tray. Two projectors may be available for some symposia, but speakers should plan on using only one projector unless they hear otherwise from the Program Committee. Please bring your own loaded carousel tray, if possible.

EXHIBITS

Exhibits will be on display in the Continental Room of the Sun Valley Inn, adjacent to the technical sessions. Booths will be 8 x 10 feet and will include a draped table, chairs, and back and side walls to hang displays. Rental fees for commercial groups will be \$250. Fees for educational and nonprofit groups will be \$125; these groups may reduce expenses by sharing booths. For further information contact Exhibits Coordinator Falma Moye, Department of Geology, Idaho State University, Pocatello, ID 83209, (208) 236-3365.

SPECIAL EVENTS

Alumni receptions will be held on Monday, May 16, from 5:30 to 7:30 p.m. Universities wishing to have a banner should contact the registrar or general chairman.

The **Rocky Mountain Section Annual Banquet** will be held at 8 p.m. on Monday, May 16. The speaker will be J. David Love of the U.S. Geological Survey and Wyoming Geological Survey. Dinner will be broiled salmon steak or poached salmon filet. Cost: \$20.

The **Idaho Association of Professional Geologists Annual Banquet** will be held Tuesday, May 18, at 8 p.m. The speaker will be Robert Bartlett, newly appointed dean of the College of Mines at the University of Idaho. The annual IAPG business meeting will precede the banquet at 7 p.m. Cost: \$14.

The **GSA Rocky Mountain Section Business Meeting and Luncheon** will be on Tuesday, May 18. Cost: \$10.

The **Rocky Mountain Section Officers Breakfast**, (complimentary) for incoming and outgoing Rocky Mountain Section officers will be at 7 a.m. on Wednesday, May 18.

The **Rocky Mountain Section of the Paleontological Society Reception** will be held immediately after the symposium on Neogene Paleontology of the Snake River Plain, Tuesday, May 17.

GUEST AND SPOUSE ACTIVITIES

A full program of spouse and guest activities is planned. Sun Valley is an exquisite resort in beautiful mountain country. This is your chance to enjoy a family vacation in combination with a stimulating professional meeting. An information desk will be located in the registration area to provide details concerning the organized guest activities and brochures on additional attractions in the Sun Valley-Ketchum area.

Sun Valley History Tour. May 16, morning. A guided bus tour will focus on the history of the Sun Valley Resort and the town of Ketchum. Cost: \$3.

Artists at Work Tour. May 16, afternoon. Visit the studios of local artists and observe the creative process, guided by a knowledgeable member of the Ketchum Chamber of Commerce. Cost: \$10 (limited space available on this tour).

Craters of the Moon Tour. May 17. Experience the austere beauty of this volcanic landscape set aside as a National Monument. About 6 hours; cost: \$15, including a box lunch.

Rocky Mountain Bird Walk. May 18, morning. Discover the joys of bird watching on a hike led by an experienced member of the Audubon Society. About 2 hours; cost: \$10.

Fashion Show Luncheon. May 18, noon. A local store will present the latest in resort wear. Cost: \$15, including lunch.

Ernest Hemingway Lecture. May 18, afternoon. A brief lecture, focusing on Hemingway's years in Ketchum, will be followed by a short walk to the Hemingway Memorial. Cost: \$3.

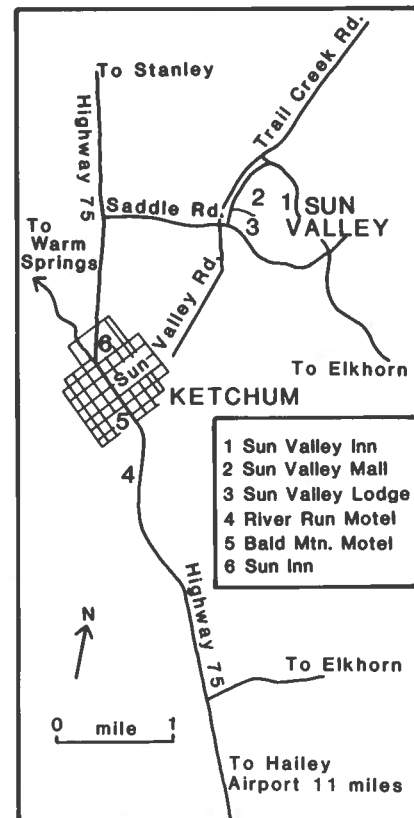
SHOPPING

The Sun Valley-Ketchum area has a wide variety of clothing and specialty stores. **KART** (Ketchum Area Rapid Transit) provides regular bus service between Ketchum and Sun Valley.

HOUSING

Sun Valley. Registrants are encouraged to stay at Sun Valley because other hotels are several miles distant and will require private transportation. Room reservations should be made directly with the Sun Valley Company, (800) 635-8261 (toll-free).

Other Motels. Motels in Ketchum will be the least expensive option for student groups, but they are several miles from the convention center and require private transportation. The following motels have offered convention rates of \$32 for a double: River Run Motel, (208) 726-3611, and Sun Inn, (208) 726-5183. Bald Mountain Hot Springs Motel, (208) 726-9963, has double rooms for \$35 and kitchen apartments for \$40; there is a \$3 charge per person over two people. Tax will be added to all rates.



Memorial Preprints

The following memorial preprints are now available, free of charge, by writing to GSA, P.O. Box 9140, Boulder, CO 80301.

Charles H. Behre Jr., by G. F. Brown

Martin Julian Buerger, by Leonid V. Azároff

Conrad Gravenor, by David T.A. Symons

Bruce A. Liberty, by Wayne T. Jolly

John T. McGill, by Edwin B. Eckel, David J. Varnes, Robert L.

Schuster, and Donald R. Nichols

Robert B. Newcombe, by Rick Nelson

Alexander Voldemar Peive, by Nikita A. Bogdanov

Paul Ramdohr, by Gerhard Frenzel

Francis Parker Shepard, by Joseph R. Curry, Edward L.

Winterer, and Douglas L. Inman

Orville Frank Tuttle, by William C. Luth

Kenneth DePencier Watson, by W. G. Ernst

1988-1989 Fulbright Grants in Geology Still Available

The Council for International Exchange of Scholars (CIES) has announced that some 1988-1989 Fulbright Grants remain available to U.S. faculty in the field of geology. There are specific openings in Czechoslovakia, Hungary, Mauritius, the USSR, and Yugoslavia. In addition, other countries are open to applications in any discipline, and geology is among their preferred fields.

Scholars in all academic ranks, including emeritus, are eligible to apply. It is expected that applicants will have a Ph.D. degree, college or university teaching experience, and evidence of scholarly productivity. U.S. citizenship is required. In a few countries (of Central and South America and Francophone Africa), knowledge of the host-country language is required.

For information, call or write CIES, Eleven Dupont Circle NW, Suite 300, Washington, DC 20036; telephone (202) 939-5401. When inquiring, indicate countries of interest.

CALL FOR APPLICATIONS AND NOMINATIONS FOR GSA BOOKS SCIENCE EDITOR

GSA solicits applications and nominations of persons qualified to serve as GSA Books Science Editor. The term of the current Editor will end December 31, 1988, and the new Editor will begin a three-year term at that time. A phased transition should begin by September 1988.

This is not a salaried position, but GSA pays expenses for secretarial assistance, mail, telephone, and copying and for travel to meetings of the GSA Publications Committee twice each year. The GSA headquarters staff handles copyediting and production of books from accepted manuscripts.

Interested persons should submit a vita, a list of publications, and a letter describing relevant qualifications, experience, and objectives. Nominations should include a letter and the nominee's written permission, vita, and publications list. Applications and nominations should be sent **BEFORE MARCH 15, 1988**, to:

F. Michael Wahl, Executive Director
Geological Society of America
P.O. Box 9140
Boulder, CO 80301

Duties

- Encourage submission of appropriate manuscripts or collections of manuscripts to GSA.
- Respond to inquiries, oral or written, about possible manuscripts.
- Inform prospective authors and volume editors about GSA policies and procedures.
- Appoint volume editor(s) and supervise selection of reviewers for multi-paper volumes.
- Select and recruit reviewers for single-paper volumes; send out manuscripts for review. Advise author(s) about necessary revisions.
- Inform volume editors on procedures for review and revision of papers.
- Review each proposed volume upon receipt of final draft from author(s) or volume editor(s). If volume is up to standard, forward it to GSA headquarters with a recommendation for publication.

- Keep the GSA Committee on Publications and the headquarters staff informed about the flow of manuscripts and other GSA book business.

The GSA Books Science Editor should have

- Strong, broad background in geological sciences.
- Good organizational skills.
- Willingness to invest the necessary time (sometimes 15-20 hours/week).
- Familiarity with many earth scientists and their work.
- Good English language skills.
- Objectivity regarding subject matter and author(s) and affiliation(s).
- Scientific maturity (but eyesight intact).
- Patience, courtesy, and tact in dealing with agitated authors.
- Persistence in finding and persuading suitable reviewers.

FOUNDATION NEWS

by Robert L. Fuchs

Coal Scholarship Fund Established

The Antoinette Lierman Medlin Scholarship Award and Fund has been established under the auspices of the Coal Geology Division. The scholarship will be awarded on a continuing basis to students in coal geology.

Initial funding has been provided by Jack Medlin and the Medlin and Lierman families and friends, in memory of Jack's wife, Toni. Contributions to the fund currently exceed \$8000, and the objective is to build a fund that will ultimately be in the significant five figures.

Contributions to the Antoinette Lierman Medlin Fund are being accepted by the Foundation. Awards are being administered by the Coal Geology Division's Scholarship Committee. For further information about contributing to the fund, please call the Foundation office (303) 447-2020, at GSA headquarters in Boulder. Specifics of the scholarship may be obtained from Robert Finkelman at the USGS in Reston, Virginia, (703) 648-6412. A flyer with more information is in preparation by the Coal Geology Division for distribution.

Century Challenge Advances

At the end of November there were 283 gifts to the Century Challenge, totaling \$41,345. Challenge Partners, those giving \$250 or more, now number 22, or 7.78% of the total contributors.

HAVE YOU SENT IN YOUR BIRTHDAY CARD AND GIFT?

Tragedy of the Month Department

A birthday gift and a much-mangled birthday card were received from Charles Sclar of Lehigh University, with the following explanation: "Sorry about the condition of this card. My dog tried to get a share of the birthday cake!" Charles, we suggest you increase the Alpo portions.

GSA Foundation
3300 Penrose Place, P.O. Box 9140
Boulder, CO 80301

To help me in my financial planning, please send the booklets about charitable giving that I have checked below.

- Planning Bequests
- Tax Planning after Tax Reform
- The Remarkable Unitrust
- Magic of Gifts of Appreciated Property
- Charitable Gift Annuity
- Life Insurance Tax Shelter



Please print:

Name _____
Address _____
City/State _____
Phone _____

Foundation Donors, November 1987

Century Challenge

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(continued on p. 47)



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

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

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

- *Bulletin*, *Geology*, and *GSA News & Information* every month
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- \$20 reduction in student registration fees for GSA's Annual Meeting
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- Reduced dues for spouse member
- 25% discount on Member Standing Order Plan
- Special discounts on Decade of North American Geology publications
- Group term life insurance plan at reduced member rates
- Opportunity to participate in GSA's specialized divisions and to receive their newsletters

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

All GSA sections participate in the program, and there are now 455 active campus representatives. We thank the current campus representatives now serving to keep the program growing. However, we need more volunteers. If you are a Member or Fellow (not Student Associate) and are interested in serving GSA as a campus representative for your college or university, please contact

Clara Hodgson, Membership Coordinator
Geological Society of America
P.O. Box 9140
Boulder, CO 80301
(303) 447-2020

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

Campuses that *do not* have GSA Campus Representatives:

Cordilleran Section

Arizona

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

California

Antelope Valley College
Bakersfield College
University of California—Berkeley
University of California—Davis
University of California—Riverside
California Polytechnic State University—
San Luis Obispo
California State Polytechnic University—
Pomona
California State University—Stanislaus
Cerritos College
Chabot College
Chaffey College
Chapman College
Contra Costa Community College
College of the Desert
Diablo Valley College
East Los Angeles College
Fresno City College
Fullerton College
Gavilan College
Glendale Community College
Golden West College
Long Beach City College
Los Angeles City College
Los Angeles Harbor College
Los Angeles Pierce College
Los Angeles Valley College
Marin Community College

Merced College
Mount San Antonio Community College
District
Napa Valley College
Naval Postgraduate School
Ohlone College
Orange Coast College
College of the Redwoods
Rio Hondo College
Riverside City College
Sacramento City College
Saddleback Community College
San Joaquin Delta College
San Jose City College
Santa Ana College
Santa Barbara City College
Shasta Community College
Southwestern College
Stanford University
Ventura College
West Valley College
Yuba Community College

Nevada
Wassuk College

Oregon
Central Oregon Community College
Clatsop Community College
Willamette University

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

British Columbia
Capilano College
Cariboo College
Douglas College

Rocky Mountain Section

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

Idaho
Lewis-Clark State College
Ricks College
College of Southern Idaho

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

New Mexico
New Mexico Highlands University

North Dakota
Dickinson State College

South Dakota
Augustana College

Utah
Snow College
Southern Utah State College

(continued on p. 49)

Your Campus Needs a GSA Rep (continued from p. 48)

Wyoming

Casper College

Alberta

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

Saskatchewan

University of Regina

North-Central Section

Illinois

Argonne National Laboratory—
University of Chicago
Bradley University
University of Chicago
Columbia University
Concordia College
Elgin Community College
Field Museum of Natural History
University of Illinois—Chicago
College of Lake County
Lincoln Land Community College
Monmouth College
Northwestern University
Oakton Community College
Principia College
Wabash Valley College
Wheaton College
William Rainey Harper Community College

Indiana

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

Iowa

Cornell College
Drake University
Grinnell College

Michigan

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

Minnesota

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

Missouri

Central Methodist College
Meramec Community College
Missouri Western State College
Northeast Missouri State University
St. Louis Community College
at Florissant Valley
St. Louis Community College at Forest Park
St. Louis University
Stephens College
William Jewell College

Nebraska

Doane College
Kearney State College

Ohio

Ashland College
Central State University
Cleveland State University
University of Dayton
Kent State University—Stark Campus
Marietta College
Mount Union College
Muskingum College
Oberlin College
Ohio State University—Mansfield
Ohio University—Lancaster

Wisconsin

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

Manitoba

Brandon University

South-Central Section

Arkansas

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

Kansas

Cowley County Community College
University of Kansas—Lawrence

Oklahoma

Northeastern State University
Phillips University
Southwestern Oklahoma State University

Texas

Amarillo Junior College
Angelo State University
Brookhaven College
Del Mar College
Hardin-Simmons University
Houston Community College System
University of Houston Downtown
Kilgore College
Lee College
Midwestern State University
North Texas State University

Odessa College

Pan American University
San Antonio College
South Plains College
Tarleton State University
Tarrant County Junior College

Northeastern Section

Connecticut

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

Delaware

University of Delaware—College of Marine
Studies

District of Columbia

University of the District of Columbia—
Van Ness Campus

Maine

Bowdoin College
Colby College
University of Maine—Orono at Walpole

Maryland

Catonsville Community College
Montgomery College
Towson State University
United States Naval Academy

Massachusetts

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

New Hampshire

Keene State College
New England College
Plymouth State College

New Jersey

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

New York

Adelphi University
Adirondack Community College
Brooklyn College (CUNY)
Broome Community College
City College (CUNY)
Columbia University, Teachers College
Graduate School of the City University
of New York
Hamilton College
Hudson Valley Community College
Hunter College (CUNY)
Jefferson Community College
Lehman College (CUNY)

(continued on p. 50)

Your Campus Needs a GSA Rep (continued from p. 49)

Long Island University, Brooklyn Campus
Long Island University, C. W. Post College
Manhattan College
Molloy College
Nassau Community College
Onondaga Community College
Pace University—New York Campus
Roberts Wesleyan College
SUNY, College at Purchase
SUNY, Maritime College
SUNY at Albany
SUNY at Binghamton
United States Military Academy
Utica College of Syracuse University

Pennsylvania

Drexel University
Elizabethtown College
Gannon University
Juniata College
Kutztown University of Pennsylvania
Lycoming College
Montgomery County Community College
Moravian College
Pennsylvania State University—Erie
Pennsylvania State University—McKeesport
Pennsylvania State University—Monaca
Susquehanna University
Thiel College
Waynesburg College
Wilkes College
York College of Pennsylvania

Rhode Island

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

Vermont

Castleton State College
Middlebury College
Norwich University
University of Vermont

New Brunswick

University of New Brunswick—Saint John

Newfoundland

Sir Wilfred Grenfell College

Nova Scotia

St. Mary's University
University College of Cape Breton

Ontario

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

Quebec

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

Southeastern Section

Alabama

University of Alabama—Dauphin Island
Livingston University
University of Montevallo

Florida

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

Georgia

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

Kentucky

Berea College
Henderson Community College
Morehead State University
Northern Kentucky University

Louisiana

Northwestern State University

North Carolina

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

South Carolina

Benedict College
Coker College
Winthrop College
Wofford College

Tennessee

Rhodes College

Virginia

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

West Virginia

Glenville State College
Parkersburg Community College
Potomac State College

Beard Competition to Highlight Centennial Welcoming Party

What is a centennial celebration without a beard contest? In conjunction with the 100th anniversary of the Geological Society of America, prizes will be awarded for the best field beard, the most unusual beard, the beard that most looks like that of a nineteenth-century geologist, and the most "unnatural" beard. Judging will take place during the evening welcoming party of the GSA Annual Meeting in Denver on October 30, 1988.

Given the inability of a significant part of our membership to grow a beard, Centennial awards will be given to the best dressed and most unusually dressed field geologist also. These costumed geologists will represent the field explorer of 1888 and the modern, fully equipped field geologist of 1988. Here is an opportunity for creativity! Potential contestants should begin growing beards now and assembling their collection of modern and ancient field gear in time for the 1988 Centennial Celebration. Watch *GSA News & Information* for contest updates.

GSA CENTENNIAL CELEBRATION

Denver, Colorado • October 31–November 3, 1988
Denver Convention Complex

First announcement and call for papers April 1
Short course announcements/registration May 1
Group event requests May 1
Abstracts deadline June 10
Program information/registration & housing August 1
Preregistration deadline October 7

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CALL FOR FIELD TRIP PROPOSALS

1989 GSA Annual Meeting
November 6-9 St. Louis, Missouri

The theme for the 1989 meeting will be "Frontiers in Geoscience." The emphasis of the field trips and the technical program will be on the future and on leading-edge technology. This is in keeping with St. Louis as the "Gateway City" site and with the beginning of GSA's second century.

The committee would like to structure field trips to complement the Frontiers in Geoscience theme and to coincide with topics of major symposia or theme sessions. Field trips that have this focus will be particularly welcomed.

Selection of trips will be made during July 1988, leaving 15 months for preparing guidebooks and making arrangements.

To submit your proposal or for further information, contact the 1989 Field Trip Chairman

Jerry D. Vineyard
Dept. of Natural Resources
Div. of Geology and Land Survey
P.O. Box 250
Rolla, MO 65401

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Committee on Minorities Field Trip Attracts 150 8th Graders in Phoenix

The GSA Ad Hoc Committee on Minorities in the Geosciences conducted its 11th annual field trip for junior/senior high school students from high-minority-enrollment schools during the 1987 Annual Meeting, in Phoenix. Temperatures in the 90s in Phoenix on October 28 did not discourage 150 8th-grade students along with 30 teachers and other school officials, who joined 30 scientists attending the GSA Annual Meeting on a hike up Squaw Peak. The group observed different rock types and discussed careers in earth science. A. Wesley Ward, Jr., U.S. Geological Survey, Flagstaff, Arizona, was the coordinator for the trip.

Other activities of the committee at the GSA Annual Meeting are sponsoring booths in the exhibits area for local students to present their earth science projects and free passes for local earth science teachers to attend technical talks and poster sessions.

The committee welcomes suggestions about other activities it might pursue to encourage interested and able minority students to consider earth science as a career. Chairman of the GSA Ad Hoc Committee on Minorities in the Geosciences is Penelope M. Hanshaw, USGS, 911 National Center, Reston, VA 22092.

Alternates Receive GSA Grants

Each year the GSA Committee on Research Grants selects recipients for grants up to the maximum amount of funding available for that year. An alternate group of recipients is also selected in the event that some of the grantees receive funding from other sources and return part or all of their funds. The Research Grants administrator awards the returned funds as they become available to alternates named by the committee.

In 1987 eight alternates received funding following the initial awarding of grants:

James Jeff Allred, Boise State University
Theodore G. Apotria, Texas A&M University
Barbara J. Ellis, Oregon State University
Ralph M. Feather, Jr., University of Pittsburgh
Nicholas P. Schneider, Southern Illinois University
Donna L. Whitney, University of Washington
Arthur S. Whittemore III, University of Vermont
Stacey Elizabeth Zeck, University of California, Santa Barbara

In Memoriam

John A. Dorr, Jr.
Ann Arbor, Michigan
March 1986

James M. Gromer
Las Vegas, Nevada
June 18, 1987

Arthur C. McFarlan
Lexington, Kentucky

Walter S. Newman
Flushing, New York
May 19, 1987

Vernon E. Scheid
Reno, Nevada

Quentin Singewald
Silver Spring, Maryland
August 1, 1987

Carl R. Swartzlow
Dillon, Montana
October 27, 1987

Charles V. Theis
Albuquerque, New Mexico
August 6, 1987

Frederick S. Turneure
Ann Arbor, Michigan
August 9, 1986

MEETINGS

(Asterisk indicates new or changed information)

1988

Australian Association of Exploration Geophysicists- Society of Exploration Geophysicists International Geophysical Conference and Exhibition, February 14-21, 1988, Adelaide, Australia. Information: ASEG/SEG Adelaide '88 Conference, c/o Ellisservice Convention Management, P.O. Box 753, Norwood 5067, SA, Australia; phone (08) 332-4068; Telex AA87129.

American Association of Petroleum Geologists Southwest Section, February 21-23, 1988, El Paso, Texas. Information: Robin Hoffer, Dept. of Geology, University of Texas, El Paso, TX 79968; (915) 747-5501.

Central Canada Geological Conference, February 22-23, 1988, London, Ontario. Information: Brett Norris, Dept. Geology, University of Western Ontario, London, Ontario N6A 5B7, Canada; (519) 661-3187.

Fourth Annual V. E. McKelvey Forum on Mineral and Energy Resources: Roles of Geological Research in Assessment of Energy Resources, March 1-2, 1988, Denver, Colorado. Information: Buhler and Abraham, Inc., 8700 First Ave., Silver Spring, MD 20910; (301) 588-4177.

Prospectors and Developers Association of Canada 56th Annual Convention, March 6-9, 1988, Toronto, Ontario. Information: Susan Sikala, Suite 1002, 74 Victoria St., Toronto, Ontario M5C 2A5, Canada; (416) 362-1969.

Second International Symposium on Geotechnical Applications of Ground-Penetrating Radar, March 6-10, 1988, Gainesville, Florida. Information: Gregg Schellengrager, U.S.D.A.-SCS, 701 SE First Ave. Gainesville, FL 32601; (904) 377-1092.

***Environment '88 seminar and exhibition**, March 8-9, 1988, Milwaukee, Wisconsin. Information: Federation of Environmental Technologists, P.O. Box 185, Milwaukee, WI 53201; (414) 251-8163.

American Association of Petroleum Geologists Annual Meeting, March 20-23, 1988, Houston, Texas. Information: AAPG Convention Dept., P.O. Box 979, Tulsa, OK 74101; (918) 584-2555.

European Geophysical Society XIII General Assembly, March 21-25, 1988, Bologna, Italy. Information: A. K. Richter, MPI für Aeronomie, D-3411 Katlenburg-Lindau, Federal Republic of Germany, or A. Speranza, Dipartimento di Fisica, Via Irnerio 46, I-40126 Bologna, Italia.

***Symposium on Application of Geophysics to Engineering and Environmental Problems**, March 28-31, 1988, Golden and Lakewood, Colorado. Information: Jack Corbett, 4045 Niagara Way, Denver, CO 80237; (303) 759-9747.

Anadarko Basin Symposium, April 5-6, 1988, Norman, Oklahoma. Information: Kenneth S. Johnson, Oklahoma Geological Survey, University of Oklahoma, Norman, OK 73019; (405) 325-3031.

American Association of Petroleum Geologists Pacific Section, April 17-19, 1988, Santa Barbara, California. Information: Jack Cunningham, Celeron Oil & Gas, 111 West Micheltorena, Santa Barbara, CA 93101-3018; (805) 966-0831.

First Catamarca International Mining Exposition and Fair, May 7-15, 1988, Catamarca, Argentina. Information: FEMICA, Uruguay 435, 3° piso, Of. E, Buenos Aires (1015), Argentina; Telex 17808 ANCYA-AR.

V. M. Goldschmidt Conference for geochemistry, May 11-13, 1988, Baltimore, Maryland. Information: Goldschmidt Conference Coordinator, Pennsylvania State University, 410 Keller Bldg., University Park, PA 16802.

***Evolutionary Innovations: Patterns and Processes**, Spring Systematics Symposium, May 14, 1988, Chicago, Illinois. Information: Matthew H. Nitecki, Field Museum of Natural History, Roosevelt Rd. at Lake Shore Dr., Chicago, IL 60605-2496; (312) 922-9410.

***International Conference on Fluid Flow in Fractured Rocks**, May 15-18, 1988, Atlanta, Georgia. Information: Ram Arora, Dept. of Geology, Georgia State University, University Plaza, Atlanta, GA 30303; (404) 651-2272.

Sixth Thematic Conference on Remote Sensing for Exploration Geology, May 16-19, 1988, Houston, Texas. Information: Thematic Conference, Environmental Research Institute of Michigan, P.O. Box 8618, Ann Arbor, MI 48107; (313) 994-1200, ext. 3382; Telex 4940991 ERIMARB.

American Geophysical Union Spring Meeting, May 16-20, 1988, Baltimore, Maryland. Information: Ann E. Singer, American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 20009; (202) 462-6903.

Bicentennial Gold 88, May 16-20, 1988, Melbourne, Australia. Information: R. R. Keays, Dept. of Geology, University of Melbourne, Parkville, Victoria 3052, Australia; phone (03) 345 1844; Telex AA35185.

Geological Association of Canada-Mineralogical Association of Canada-Canadian Society of Petroleum Geologists Joint Annual Meeting, May 23-25, 1988, St. John's, Newfoundland. Information: John Fleming, St. John's '88, P.O. Box 13577, Postal Station A, St. John's, Newfoundland A1B 4B8, Canada; (709) 576-2768.

Society for the Preservation of Natural History Collections Annual Meeting, May 30-June 3, 1988, Pittsburgh, Pennsylvania. Information: Duane A. Schlitter or Stephen L. Williams, Carnegie Museum of Natural History, 5800 Baum Blvd., Pittsburgh, PA 15206; (412) 665-2611.

***Radon in the Northeast: Perspectives and Geologic Research**, May 31-June 2, 1988, Troy and Albany, New York. Information: Gerald M. Friedman, Northeastern Science Foundation, 15 Third St., P.O. Box 746, Troy, NY 12180-0746; (518) 273-3247.

Case Histories in Geotechnical Engineering 2nd International Conference, June 1-5, 1988, St. Louis, Missouri. Information: Shamsher Prakash, Room 308, Dept. of Civil Engineering, University of Missouri, Rolla, MO 65401; (314) 341-4461.

WaterTech China '88, International exposition and congress of water technologies, June 3-8, 1988, Beijing, China. Information: Management Committee, WaterTech China '88, c/o MartLink Communications Group, GPO Box 13477, Hong Kong; phone 5-225705; Telex 72091 HX.

Second International Symposium on Rockbursts and Seismicity in Mines, June 8-10, 1988, Minneapolis, Minnesota. Infor-

(continued on p. 53)

MEETINGS (continued from p. 52)

mation: Charles Fairhurst, Dept. Civil and Mineral Engineering, University of Minnesota, 500 Pillsbury Dr. S.E., Minneapolis, MN 55455-0220.

29th U.S. Symposium on Rock Mechanics, June 13-16, 1988, Minneapolis, Minnesota. Information: Jan Becker, Dept. Professional Development, University of Minnesota, 315 Pillsbury Dr. S.E., Minneapolis, MN 55455; (612) 626-1358.

Fourth Symposium on the Geology of the Bahamas, June 17-22, 1988, San Salvador Island, Bahamas. Information: Donald T. Gerace, CCFL Bahamian Field Station, 270 Southwest 34th St., Fort Lauderdale, FL 33315.

Shelf Sedimentation: Events and Rhythms (SEPM research conference), June 26-July 1, 1988, Santa Cruz, California. Information: M. Field or E. Clifton, USGS, 345 Middlefield Rd., Menlo Park, CA 94025; (415) 354-3088 or 3112.

Seismic Probing of the Continents and Their Margins International Symposium, July 6-8, 1988, Canberra, Australia. Information: Jim Leven, Bureau of Mineral Resources, P.O. Box 378, Canberra, ACT 2601, Australia; phone (062) 499 111; Telex AA62109.

International Working Meeting on Soil Micromorphology (meeting of Subcommission B of the International Society of Soil Science), July 10-15, 1988, San Antonio, Texas. Information: L. P. Wilding, Dept. of Soil and Crop Sciences, Texas A&M University, College Station, TX 77843-2474; (409) 845-3604.

First International Conference on Radiolaria, July 18-20, 1988, Marburg, Federal Republic of Germany. Information: Joyce R. Blueford, U.S. Geological Survey, MS 144, 345 Middlefield Rd., Menlo Park, CA 94025; (415) 329-4004, or R. Schmidt-Effing, Interrad Conference, Dept. of Geosciences, Philipps-Universität, Lahnerge, D-3550 Marburg, Federal Republic of Germany.

5th International Symposium on Fossil Cnidaria, including Archaeocyatha and spongiomorphs, July 25-29, 1987, Brisbane, Australia. Information: John Jell, Uniquist Ltd., University of Queensland, St. Lucia, QLD 4067, Australia; phone (07) 344 2733.

Permafrost 5th International Conference, August 2-5, 1988, Trondheim, Norway. Information: V International Conference on Permafrost, Norwegian Institute of Technology, Studies Administration, N-7034 Trondheim-NTH, Norway.

Fifth International Symposium on the Ordovician System, August 9-12, 1988, St. John's, Newfoundland. Information: Chris R. Barnes, ISOS, Dept. of Earth Sciences, Memorial University, St. John's, Newfoundland A1B 3X5, Canada; (709) 737-8143.

Paleozoic Biogeography and Paleogeography, August 14-19, 1988, Oxford, England. Information: C. R. Scotese, Shell Development Co., P.O. Box 481, Houston, TX 77001, (713) 663-2688, or W. S. McKerrow, Dept. Earth Sciences, Parks Rd., Oxford OX1 3PR, England.

39th Annual Highway Geology Symposium, August 15-17, 1988, Park City, Utah. Information: Highway Geology Symposium, T. Leslie Youd, 368 Clyde Bldg., Dept. Civil Engineering, Brigham Young University, Provo UT 84602; (801) 378-6327.

American Association of Petroleum Geologists Rocky Mountain Section, August 21-24, 1988, Bismarck, North Dakota. Information: Roger N. Borchert, Box 5006, Bismarck, ND 58501; (701) 223-3588.

Society of Economic Paleontologists and Mineralogists Fifth Midyear Meeting, August 21-24, 1988, Columbus, Ohio. Information: SEPM, P.O. Box 4756, Tulsa, OK 74159-0756; (918) 743-9765.

6th International Fission Track Dating Workshop, September 5-9, 1988, Besançon, France. Information: J.-L. Janier-Dubry, Lab. de Microanalyses Nucléaires, U.F.R. des Sciences et Techniques, 16 Route de Gray, 25030 Besançon cedex, France; phone 81-53-81-22.

International Symposium on Geochemistry and Mineralization of Proterozoic Mobile Belts, September 6-10, 1988, Beijing, China. Information: Proterozoic Geochemistry Symposium, c/o Prof. Sun Dazhong, Tianjin Inst. Geology and Mineral Resources, CAGS No. 4, 8th Rd., Dazhigu, Tianjin 300170, People's Republic of China.

International Symposium on Rock Mechanics and Power Plants, September 12-16, 1988, Madrid, Spain. Information: ISRM Symposium, Sociedad Española de Mecánica de las Rocas, Paseo Bajo de la Virgen del Puerto, 3, 28005 Madrid, Spain.

***ECORS Program: International Meeting on a Deep Seismic Line with Field Trip across the Pyrenees**, September 19-22, 1988, Toulouse, France, to Balaguer, Spain. Information: Société Géologique de France, 77 rue Claude Bernard, 75005 Paris, France; phone 331-43-31-77-35.

International Symposium on Engineering Geology: Study, Preservation and Protection of Ancient Works, Monuments and Historical Sites, September 19-23, 1988, Athens, Greece. Information: Paul G. Marinos, Greek Committee of Engineering Geology, 1988 Symposium Secretariat, P.O. Box 19140, GR-117 10 Athens, Greece; Telex 45 4312 POLX.

Fourth International Tectonostratigraphic Terrane Conference, September 23-October 7, 1988, Nanjing University, Nanjing, People's Republic of China. Information: Tom Wiley, U.S. Geological Survey, MS 999, 345 Middlefield Road, Menlo Park, CA 94025; (415) 354-3067.

Mediterranean Basins Conference, September 25-28, 1988, Nice, France. Information: AAPG Convention Dept., P.O. Box 979, Tulsa, OK 74101-0979; (918) 584-2555.

***Geological Association of New Jersey Annual Meeting**, October 7-9, 1988, Lawrenceville, New Jersey. Information: Jonathan Husch, Dept. of Geosciences, Rider College, 2083 Lawrenceville Rd., Lawrenceville, NJ 08648; (609) 896-5330.

New York State Geological Association Annual Field Trip Meeting, October 7-9, 1988, Plattsburgh, New York. Information: Tom Wolosz, Center for Earth and Environmental Science, SUNY College, Plattsburgh, NY 12901; (518) 564-4031.

***Symposium on Hot Spots in the South Pacific**, November 21, 1988, Paris, France. Information: Société Géologique de France, 77 rue Claude Bernard, 75005 Paris, France; phone 331-43-31-77-35.

American Geophysical Union Fall Meeting, December 5-9, 1988, San Francisco, California. Information: Ann E. Singer, American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 20009; (202) 462-6903.

***ECORS Program: Deep Seismic Line across the Western Alps**, joint meeting of French, Swiss, and Italian geological societies,

(continued on p. 54)

MEETINGS

(continued from p. 53)

December 12-13, 1988, Paris, France. Information: François Roure, Inst. Français du Pétrole, 1-4 ave. du Bois Préau, 92506 Rueil-Malmaison, France.

GSA 1988

Northeastern Section, March 10-12, Portland, Maine
South-Central Section, March 14-15, Lawrence, Kansas
Cordilleran Section, March 29-31, Las Vegas, Nevada
Southeastern Section, April 6-8, Columbia, South Carolina
North-Central Section, April 21-22, Akron, Ohio
Rocky Mountain Section, May 16-18, Sun Valley, Idaho
Annual Meeting, October 31-November 3, Denver, Colorado

Penrose Conferences

Paleozoic and Early Mesozoic Paleogeographic Relations Between the Klamath Mountains, the Northern Sierra Nevada, and North America, June 5-10, 1988, Redding, California. Information: David S. Harwood, U.S. Geological Survey, MS 975, 345 Middlefield Rd., Menlo Park, CA 94025; (415) 329-4932.

Origin of Massif Anorthosites and Related Rocks, August 14-19, 1988, Chugwater, Wyoming. Information: B. Ronald Frost, Dept. of Geology and Geophysics, University of Wyoming, Laramie, WY 82071; (307) 766-4290.

Volcanic Influences on Terrestrial Sedimentation, August 28-September 3, 1988, Crystal Mountain, Washington. Information: Gary A. Smith, Dept. of Geology, University of New Mexico, Albuquerque, NM 87131; (505) 277-4204.

Criteria for Establishing the Relative Timing of Pluton Emplacement and Regional Deformations, September 10-15, 1988, California. Information: Scott R. Paterson, Earth Science Board, University of California, Santa Cruz, CA 95064; (408) 429-3251.

1989

Society of Mining Engineers Annual Meeting, February 27-March 2, 1989, Las Vegas, Nevada. Information: Society of Mining Engineers, Meetings Dept., P.O. Box 625002, Littleton, CO 80162.

European Geophysical Society XIV General Assembly, March 13-17, 1989, Barcelona, Spain. Information: EGS Office, c/o MPI für Aeronomie, D-3411 Katlenburg-Lindau, Federal Republic of Germany. (Abstracts due December 15, 1988.)

***International Symposium on the Silurian System** (Murchison Symposium), March 28-April 9, 1988, Keele, England. Information: M. G. Bassett, Dept. of Geology, National Museum of Wales, Cardiff CF1 3NP, Wales; phone 02222-397951.

***American Association of Petroleum Geologists Annual Meeting**, April 23-26, 1989, San Antonio, Texas. Information: AAPG, P.O. Box 979, Tulsa, OK 74101; (918) 584-2555.

***American Geophysical Union Spring Meeting**, May 8-12, 1989, Baltimore, Maryland. Information: AGU, Convention Director, 2000 Florida Ave., N.W., Washington, DC 20009; (202) 462-6903.

***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.

FUTURE GSA ANNUAL MEETINGS

1988	October 31-November 3	Denver, Colorado
1989	November 6-9	St. Louis, Missouri
1990	October 29-November 1	Dallas, Texas
1991	October 21-24	San Diego, California
1992	October 26-29	Cincinnati, Ohio
1993	October 25-28	Boston, Massachusetts

REVIEWS IN ENGINEERING GEOLOGY VII

DEBRIS FLOWS/AVALANCHES

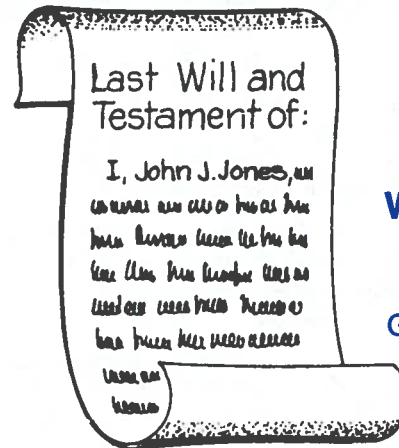
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edited by John E. Costa and Gerald F. Wieczorek

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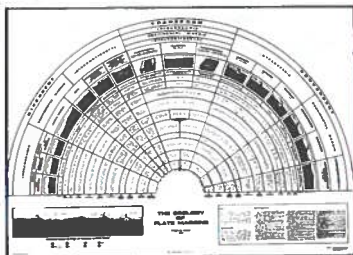
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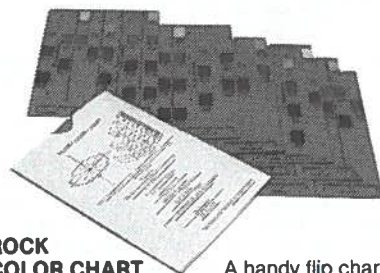
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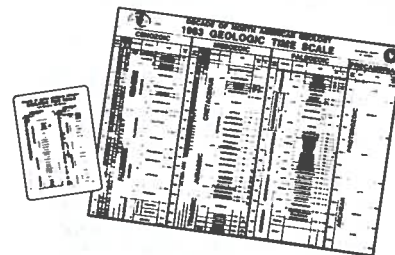
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