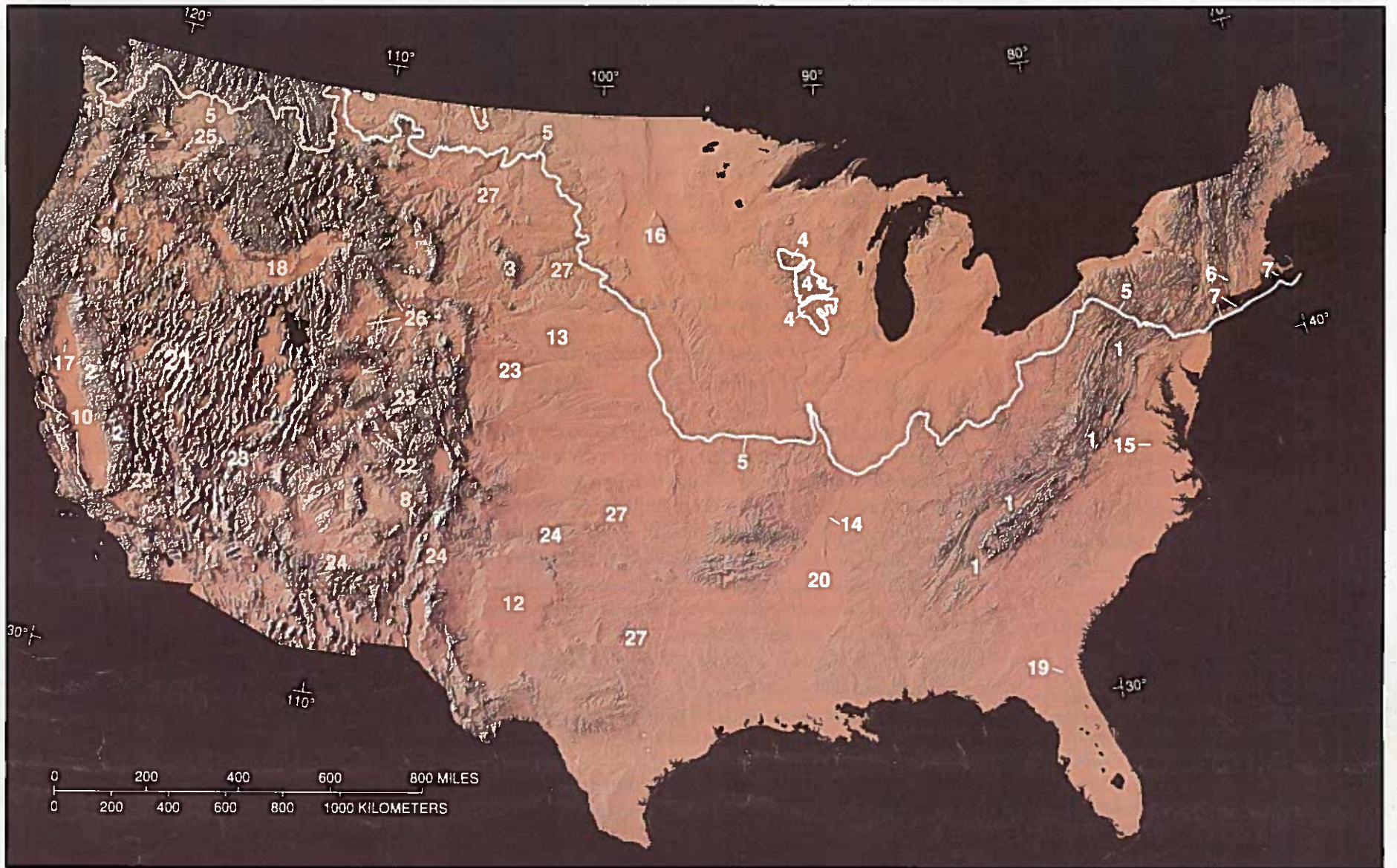


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Surface Features of Central North America: A Synoptic View From Computer Graphics

Richard J. Pike, U.S. Geological Survey, Menlo Park, California 94025

ABSTRACT

A digital shaded-relief image of the 48 contiguous United States shows the details of large- and small-scale landforms, including several linear trends. The features faithfully reflect tectonism, continental glaciation, fluvial activity, volcanism, and other surface-shaping events and processes. The new map not only depicts topography accurately and in its true complexity, but does so in one synoptic view that provides a regional context for geologic analysis unobscured by clouds, culture, vegetation, or artistic constraints.

MECHANIZED MAPPING OF RELIEF

The techniques of visualization provided by computer graphics offer a fresh look at Earth's landform patterns. Hill shading, which shows topographic form by intensity of the sun's shadows, was adapted for digital execution (Yoeli, 1967; Batson et al., 1975) because manual (artistic) methods can economically portray only small areas both accurately and in detail. Large areas have been mapped by mechanized shading, but spatial resolution has remained low (Moore and Simpson, 1982; Loughridge, 1986). This paper briefly reviews a sampling of land-

forms depicted in a digital relief map of the entire conterminous United States that shows features as small as 2.5 km across.

Machine-shaded maps resemble cloudless aerial photographs but are actually large arrays of minute gray squares. Each square represents a brightness value computed from a mathematical relation between ground slope and azimuth and position of the observer and a simulated sun (Yoeli, 1967; Batson et al., 1975). Light and dark tones show steep areas; intermediate tones are gentle terrain. The maps are created from dense square-grid matrices of terrain heights, or digital

elevation models, that sample topography normally observed in the field or viewed on photographs and satellite images.

A NEW MAP OF U.S. TOPOGRAPHY

The map (p. 252-253) is the most detailed and accurate synoptic view of U.S. relief forms yet made (for similar maps of some western states at 1:1 000 000 scale see Edwards and Batson, 1990). It resembles Harrison's (1969) vertical-perspective map in concept and execution but contains much more information than either that map or Raisz's (1940) near-vertical panorama of the same area. The new image was computed from 12 000 000 elevations (spaced 0.8 km apart) read from 1:250 000-scale topographic sheets. The 1:3 500 000-scale map (Thelin and Pike, 1991) gives specifics on the computer technique, digital dataset, and applications (see also Pike

Surface continued on p. 251

Figure 1 (above). The conterminous United States in computer-shaded relief (see large version on p. 252-253). Light source is 25° above the horizon at 300° azimuth. Numbers indicate topographic features cited in text (after Thelin and Pike, 1991): 1—folded Appalachian Mountains; 2—Sierra Nevada; 3—Black Hills; 4—driftless area; 5—southern limit of Pleistocene continental glacial deposits; 6—basalt ridges in the Connecticut River valley; 7—terminal moraines on Long Island and Cape Cod; 8—Valles caldera; 9—Crater Lake caldera; 10—San Andreas fault zone; 11—Mount St. Helens; 12—Llano Estacado; 13—Nebraska Sand Hills; 14—Crowleys Ridge; 15—Fall Line; 16—Coteau des Prairies; 17—Sutter Buttes; 18—low volcanic shields on Snake River plain; 19—Trail Ridge; 20—Mississippi alluvial plain; 21—Basin and Range province; 22—west-trending lineaments in Rocky Mountains; 23—extension of Garlock fault zone; 24—linear trend following Gila, Salt, and Canada rivers; 25—Olympic-Wallowa lineament; 26—northwest trends in Rocky Mountains; 27—north-northwest grain on High Plains.

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Letter from the President

Dear fellow member of GSA,

Greetings from your new president. I look forward to hearing from you and to working on specific projects with many of you. The purpose of this letter is to bring you up to date on the Society's outreach activities during the past year, including some initiated by our late president Doris Curtis, and to discuss their development.

As you are probably aware, GSA has, during the past several years, steadily expanded its efforts to promote and sustain a multifaceted outreach program to make geological information available in usable forms to the general public, decision makers, and those who formulate policy. Among our new and reaffirmed efforts are the following:

- The Committee on Minorities and Women in the Geosciences has expanded its efforts. One immediate project is to make sure that the school teachers involved in the field trips for minority students at the host cities for the GSA Annual Meeting become long-term members of the Partners for Excellence program. Other efforts of this committee include a plan to provide one-on-one mentoring for women and minority students from precollege to graduate school, and to provide role models and support systems for these students.
- The Institute for Environmental Education (IEE) is a new initiative of GSA that will provide an authoritative means for dealing with environmental issues, practice, and problems that involve the geological sciences. The institute offers a geoscience interface between the private and public sectors and the geological community on matters of the environment, and it will sponsor programs that are directed at the applied geological sciences. The mission of the IEE is to support and promote communication of geological and geotechnical information relevant to environmental issues, training relevant to environment practice, and research relevant to environmental problems. Fred Donath has agreed to develop the programs of the institute, and he serves as its executive director.
- The Committee on Geology and Public Policy, in addition to its regular programs and efforts, has been asked by Council to initiate and develop Society positions on issues of advocacy. The committee will also work closely with the director of the AGI advocacy program, a full-time person based in Washington, D.C., who will be responsible for providing two-way communication between the earth sciences community and the legislative and executive branches of government. Important legislative and/or executive policy decisions that affect Earth will be communicated to earth scientists so that relevant scientific information may be made available to support decision makers as they try to understand the technical issues involved. President Doris Curtis strongly promoted expanding GSA's efforts in this area, and the establishment of the AGI advocacy program.
- The SAGE (Science Awareness through Geoscience Education) program is focusing its efforts on precollege and undergraduate earth science education. SAGE promotes and coordinates educational activities within the Minorities and Women in the Geosciences Committee, the Geology and Public Policy Committee, and the Education Committee. The most recent initiative within SAGE is its Partners for Excellence program, which I will discuss in the remainder of this letter.

Partners for Excellence is a program designed to pair precollege science teachers with geoscientists who would like to serve as earth science resource persons for individual teachers or schools. The relationship could involve participation in classroom activities, design of laboratory experiments, leading field trips, or any other activity that the partners want to do. A partner could also serve as a mentor for an individual student outside of instruction hours.

Partners for Excellence opens up an opportunity for all of us in GSA (and I emphatically include the Student Associates) who have an interest in the improved learning of science in schools, to get directly involved in working with precollege science teachers and students. If you have not been involved in precollege science teaching before, then you may, like myself, find yourself a bit bewildered and hesitant to get involved. Let me relate to you my own recent partnering experience.

Initially, I found the contemplation of involvement in precollege science education to be daunting, if not positively scary, like the prospect of going on a long trip to a strange country without a guide. However, once I got into the classroom (it was a 9th grade earth science class in a suburban school of middle-class students), under the wing of a master teacher, I realized that it was not an impossible challenge, and it was a lot more fun and exciting than I had dared hope. I found it refreshing and humbling to deal with young minds not yet distorted by incorrect information, and I found it fun to deal with a broad and always surprising range of questions and concerns. I also found it rewarding that these students steadily grew more comfortable with asking me questions and with observing and discussing the rocks around us. Above all, I found it rewarding to learn about precollege education from the perspective of a teacher who has to deal with these educational challenges not as an avocation, but on a daily basis. From this experience my teacher partner and I developed trust, mutual respect, and friendship. It was an enriching experience that I look back on with pleasure and satisfaction. I am further convinced that a successful partner-for-excellence relation can be established by most of us if we realize from the start that we enter into the arrangement both to teach and to learn.

To make it easier for you to get involved in GSA's Partners for Excellence Program we have included in this issue of *GSA Today* parts of our new *Partnering for Excellence Guidebook for Educators and Geoscientists* (see p. 244). Although these materials may provide you with enough information to get started as a Partner, we realize that nothing quite takes the place of "hands-on" experience. Consequently, the Education Committee is asking each Section to organize Partners orientation and training workshops starting with next year's Section and annual meetings. If you are already involved in Partnering or are seriously interested in becoming a Partner, please fill out the application form on p. 244, return it to our Coordinator for Educational Programs, and consider spending a few hours at your next GSA meeting in a Partners for Excellence workshop.

Thank you for your attention.

With warm regards,



E-an Zen



Forum is a monthly feature of *GSA Today* in which many sides of an issue or question of interest to the geological community are explored. Each Forum presentation consists of an informative, neutral introduction to the month's topic followed by two or more opposing views concerning the Forum topic. Selection of future Forum topics and participants is the responsibility of the Forum Editor. Suggestions for future Forum topics are welcome and should be sent to: Bruce F. Molnia, Forum Editor, U.S. Geological Survey, 917 National Center, Reston, VA 22092; (703) 648-4120; fax 703-648-4227.

ISSUE: Radon—Science vs. Policy

Indoor radon is an environmental problem with a potential that can be predicted using many aspects of the geological sciences. Because it is also a controversial health and political issue, geology's role is complicated. Should geologists be influenced by the health and political issues of the indoor radon problem, and how should they respond?

PERSPECTIVE 1: Geologists need to respond to the health issue by defining areas of high radon potential

Naomi Harley, New York School of Medicine, New York

It is unusual for research in the geological sciences to lead to life-saving applications. Radon research is different in that it offers this potential. There is now abundant evidence that lung cancer in excess of that expected from smoking is observed in underground mining populations. The increased lung cancer risk is found to be directly related to total radon-decay-product exposure regardless of the types of mines involved, providing convincing evidence that radon is the major carcinogen involved.

The exposures received by persons in mines were usually much higher than those received through environmental exposure. The average exposures for the four largest mining populations (Colorado, Ontario, Czechoslovakia, and Sweden) were 800, 37, 220, and 100 WLM, respectively. In comparison, persons exposed to average indoor radon concentrations (1–2 pCi/L) accumulate 10–15 WLM, and persons living a lifetime in a home at the Environmental Protection Agency's (EPA) guideline of 4 pCi/L could accumulate 50 WLM.

The lifetime lung cancer risk for environmental exposure has been calculated from extrapolation of the underground miner studies by several organizations, such as the National Council on Radiation Protection and Measurements, a panel organized by the National Academy of Science, and the International Commission on Radiation Protection. The risk estimates range from 1% to 3% lung cancer mortality due to a lifetime exposure to 4 pCi/L; that is, 1 to 3 persons out of 100 exposed to this concentration for life will die of lung cancer induced by radon. The persons are considered a typical population of smokers and nonsmokers.

One important consideration in estimating lung cancer deaths in the environment is the effect of smoking and radon exposure combined. The miner studies suggest that the risk is more than additive; that is, the radon lung cancer estimate does not simply add to the existing risk from smoking, but is 2–3 times greater for smokers than for nonsmokers. Thus, the 1% to 3% figure for a population is a combination of the higher risk for smokers and the lower risk for nonsmokers.

A second important aspect of the epidemiology is the fact that after miners have left the high-radon underground environment, their increased lung cancer risk declines. This is somewhat similar to the decline in risk for a smoker who stops smoking. Therefore, identifying residences with high radon is emerging as one way to reduce the estimated deaths from radon in the United States.

Finally, and most important, is the task of evaluating exposure. It is actual radon exposure of individuals that confers the risk. While there are surrogates for exposure, such as housing construction, these fail to pass a rigorous test in identifying problem homes. The ability to identify large areas of the United States as potential high-radon locations is now an important area of research. Geology can go far in clarifying this identification process, and many lives may be saved as a result.

PERSPECTIVE 2: Geology cannot be used alone to predict radon potential, but it plays a critical role in the Environmental Protection Agency's efforts to assess the indoor radon problem and to establish protective public policies

Lisa Ratcliff, EPA, Washington, D.C.

Although some scientists dispute the precise number of deaths, virtually all scientists and major health authorities, like the Centers for Disease Control, the American Medical Association, and the American Lung Association, agree with the Environmental Protection Agency that radon causes thousands of preventable lung cancer deaths each year. The goal of EPA's radon action program is to reduce the public's exposure to elevated levels in homes, schools, and workplaces.

The challenge EPA faces is identifying which of the nation's buildings have a radon problem. Again, virtually all scientists agree that the best indicator of a radon problem is indoor measurements. The only way to know if a given building has elevated radon levels is to test. However, geology and other factors can be examined to determine the radon potential of an area. EPA and the U.S. Geological Survey (USGS) are working together to develop a methodology for mapping radon potential across the country.

Useful Definitions

Picocuries per liter (pCi/L): The radon concentration in air; one picocurie (10⁻¹² curies) is equal to 2.2 disintegrations of a radon atom/minute.

Working level: A measurement of decay product concentration in equilibrium with radon (equal to 200 pCi/L assuming 50% equilibrium); a working level month (WLM) is an exposure measurement equivalent to 173 hours at one working level.

Available data on surficial and bedrock geology, radiochemistry, aerial radioactivity, and soil permeability are being used with indoor radon measurements and structural characteristics of houses to predict radon potential at the county level.

The role of geologic data in the development of a national radon-potential map underscores its important contribution to the scientific assessment of the indoor radon problem. With respect to the establishment of radon-related policies, geology's role is also significant, but it is tempered by other considerations. For example, the radon-potential map will be used by EPA to determine areas where incorporation of specific radon-resistant construction techniques into state and local building codes may be appropriate. However, EPA will continue to recommend that all homeowners—regardless of their geographic location—test their homes for radon. EPA does not believe that the predicted radon potential of a given area should dictate whether a homeowner tests his or her house. Any home can have a radon problem, even if the uranium content of the underlying soils and rock is low.

PERSPECTIVE 3: Geologists have a responsibility to provide both information and education to the public regarding earth science issues

R. Randall Schumann, USGS, Denver, Colorado

Because radon is derived from the decay of naturally occurring radium in rocks and soils, few people would disagree that radon is a geologic hazard. Our approach as scientists, then, is to attempt to understand its properties and behavior and predict its occurrence in the natural environment. This is the case for other geologic hazards, such as volcanos, earthquakes, and landslides. Unlike these other examples, nearly all geologic environments are capable of generating potentially hazardous levels of radon, so a much larger segment of the population is potentially at risk.

In part because the science of radon detection is complex, public policy regarding radon is understandably complex. Standards for radon in indoor air cannot be enforced; levels at which remedial action is recommended can only be suggested, and it is up to individual homeowners to test and correct

any problems at their discretion. As scientists, it is our responsibility to provide the most complete and accurate information possible on which individual homeowners', as well as public policy makers', decisions may be based. In this we face a serious dilemma: to provide complete and objective information, it is necessary to make the incorrect assumption that all of the general public, or even all of our public policy makers, have the background knowledge necessary to evaluate the information provided and to reach a reasonable and objective conclusion. Otherwise, we must necessarily simplify our presentation of the geologic information while also trying to educate the general public so that individual decisions can be made. A primary difficulty in achieving this is in finding the balance point at which a practical level of information is combined with a practical amount of education.

It seems irresponsible for geologists to provide geologic information to the public without also providing the necessary tools to use it, i.e., interpretations by trained professionals. Because no one can be an expert on all subjects, it is logical and practical to entrust scientific experts with providing scientific information and making recommendations based on professional scientific judgements. As homeowners, parents, voters, and experts on earth science, geologists are perhaps in the best position to determine reasonable levels at which earth science information can be usefully presented to public policy makers and to the general public. However, when the multiple, interrelated geologic factors are interpreted by geologists to produce a radon risk map (referred to as a "geologic radon potential" map), it is likely to be presented in terms of someone's opinion of what constitutes risk, either through established public policy (for example, EPA's 4 pCi/L recommended action level), the geologist's personal opinion, his or her company's or agency's policy, or some combination of these. The geologist must try to serve multiple, sometimes conflicting purposes, in the best way possible, relying heavily on his or her professional judgement and ethics to do so. This constitutes a significant responsibility, which must be met with trust from the users of the information. There should be a point at which some types of scientific information are accepted by nonscientific policy makers and by the general public as scientific fact, subject only to the laws of nature but standing above and apart from the influence of public policy decisions. Only in this way can we remain true to our basic purpose as research scientists, which is to attempt to understand our natural environment and convey this understanding to others.

PERSPECTIVE 4: Ground water, an important but neglected contributor to indoor radon and other radionuclide problems.

Richard B. Wanty, USGS, Denver, Colorado, and Zoltan Szabo, USGS, Trenton, New Jersey.

The occurrence of high concentrations of ²²²Rn in ground-water supplies is well documented in a variety of geo-

Forum continued on p. 246

Partners for Excellence— A Project of the SAGE Program

We live in a continuously changing universe with awesome time as well as space dimensions—a universe in which the rates of change are often barely perceptible to the individual, but have major consequences for humanity. Too few recognize that water is a limited resource, that some key mineral and energy resources are non-renewable and geographically restricted, that we can only mitigate the inevitable consequences of many natural hazards, or that some basic geological knowledge can help avoid costly problems on many construction projects. Too few appreciate the history of the fragile landscape in which they live and travel. If we are to solve the environmental problems that confront us, we must have an informed citizenry. The key to heightened environmental awareness is improved education in earth science.

Partnering for Excellence

Partnering is a cooperative educational interaction between a professional educator and a professional geoscientist. The Partners for Excellence project encourages continuity in the partnering relationship. The educator should consider the geoscientist as a reliable resource for a range of activities, from classroom visits and presentations, one-on-one mentoring, or field trips, through clarification of issues or ideas to be presented. The goal is to enhance awareness of the key issues or areas of knowledge in the geosciences that should be understood by all Americans.

On becoming a Partner

To register in the Partners for Excellence program and receive a packet containing tips for partnering, complete the coupon below and return it to GSA.

A sampling of what's in the Partnering Guidebook

For the geoscientist

- Identify a school, teacher, museum, or grade level where you feel you can be an effective Partner.
- Offer to serve as a resource for your chosen Partner, and discuss possible ways that you might be most effective.

Prior to your visit

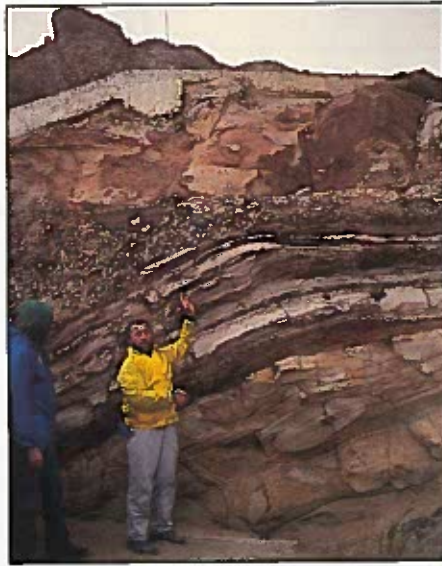
- Arrange to see copies of the classroom text and of any district or school curriculum materials that are relevant.
- Let your partner know of any special equipment needed for your presentation.
- If you are unable to keep your commitment for a presentation, arrange for a suitable substitute or let your Partner know of the problem as soon as possible.

When you visit

- Stop by the school or museum office and identify yourself, your reasons for being there, and your Partner.
- Remember you are there to assist your Partner.
- Bring enough materials (handouts, pamphlets, etc.) for your audience.
- With your Partner, plan your presentation to focus on scientific concepts that are useful and relevant to the students' lives.

In the classroom

- Constantly be sensitive to your audience. Tailor your language and examples to the level of your audience. Your Partner can help you determine the appropriate level. Speak slowly and clearly.
- Remember that the need for hands-on activity is indirectly proportional to the grade level, and that learning styles of children vary.



Chevron geologist William Schweller discusses Pt. Reyes, California, geology with a group of teachers from the Bay Area Earth Science Institute.

Some learn through oral presentations, some through visual, and some only through tactile. Thus, variety in your approach may increase your effectiveness.

- Relate career discussions to your own experiences and communicate the natural joys and enthusiasm that you feel about your chosen field. See your world through the eyes of a child.

For the educator

Talk with your Partner

- Arrange for a pre-visit contact.
- Provide clear directions to your school and classroom, or museum facility. Include parking information and your home and work telephone numbers.
- Learn about your Partner's special fields of interest.
- Find out about any special needs for a presentation: projectors, colored chalk, etc.
- For a class or museum presentation, describe the audience and the setting: group size, grade level, previous geoscience knowledge, layout of the lecture or discussion area; discuss the format for presentation and the time allotted.
- For mentoring a student, describe the student's special interests and abilities.
- For field trips, describe the group size, any medical limitations, and logistical arrangements including parental release forms.
- For discussion of issues or concepts, describe what clarification is needed for the intended audience.
- When appropriate, invite your colleagues and their classes to participate.

When your Partner arrives

- Introduce your Partner to the class, and help her/him feel welcome.
- Be present in the classroom. You are responsible for class discipline, and you can help to guide the discussion and keep it focused.

Follow-up

- Most speakers appreciate a thank-you note from you or your students.
- Provide your Partner with feedback about the effectiveness of the visit.
- When appropriate, let others in your school or museum know about your Partner and the possibilities for further interactions. ■

Get more information on Partners for Excellence by checking the appropriate line and mailing the coupon at left.

Parts of this article were reprinted from the Partners for Excellence brochure and the Partnering for Excellence Guidebook for Educators and Geoscientists.

NSF Offers Minority Graduate Fellowships

The National Science Foundation offers three-year graduate fellowships for minorities in science and engineering. Applicants must be United States citizens or nationals, or permanent resident aliens of the United States, who are members of one of the following ethnic minority groups: American Indian, Black/African American, Hispanic, Native Alaskan (Eskimo or Aleut), or Native Pacific Islander (Polynesian or Micronesian).

Fellowships are awarded for study and research leading to master's or doctoral degrees in the mathematical, physical, biological, engineering, and behavioral and social sciences, including the history and philosophy of science, and to research-based Ph.D.s in science education. Those eligible to apply in the fall of 1991 are college seniors, first- and second-year graduate students, and others who have completed a limited amount of graduate study in science and engineering. The fellowships include a \$14,000 stipend, for a 12-month tenure, and tuition waiver at U.S. institutions (or up to \$7500 at foreign institutions). A \$1000 Special International Research Travel Allowance is also available under the conditions specified in the Program Announcement. Mentoring Assistantships for new Minority Graduate Fellows entering their fellowship institutions for the first time as graduate students provide one, two, or three months of additional stipend support for Fellows to participate in research during the summer before they begin their fall fellowship tenures.

The application deadline is *November 8, 1991*. For information and application materials, write to The Fellowship Office National Research Council 2101 Constitution Avenue Washington, DC 20418, or telephone (202) 334-2872.

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Bruce F. Molnia

Washington Report provides GSA membership with a monthly window on the activities of the federal agencies, Congress and the legislative process, and international interactions that could impact the geoscience community. In future issues, Washington Report will present summaries of agency and interagency programs, track legislation, and present insights into Washington, D.C., geopolitics as they pertain to the geosciences.

Antarctic Legislation and Earth Science Research

Although earth science research has been conducted in Antarctica for more than five decades and more than two dozen nations are currently conducting scientific research there, surprisingly little is known about the onshore and offshore mineral resource potential of Antarctica. Antarctica's remoteness, immense size, severe climate, and unique logistic problems have resulted in only a minimal understanding of its natural history and natural resources. More than 97% of the continent is permanently covered by ice and snow, and much of its perimeter is armored with permanent ice shelves or annual sea ice.

During the past three years, much of the attention of the world environmental and political community has been focused on the debate about the regulation of these little-known mineral resources. In response to domestic and international negotiations concerning the future of the Convention for the Regulation of Antarctic Mineral Resources Activities (CRAMRA), a proposed addition to the Antarctic Treaty System, a substantial U.S. and international pro-environmental backlash has resulted. One manifestation of the domestic backlash was the large number of pro-environmental, Antarctic-oriented bills introduced in last year's 101st Congress. The same trend seems to be continuing in the 102nd Congress. Antarctic scientific research, especially earth science research, may become a casualty of this backlash.

For the past 30 years, the Antarctic Treaty has been the governing document responsible for peaceful, international cooperation, including scientific cooperation in Antarctica. A fundamental tenant of Article II of the Antarctic Treaty is: "Freedom of scientific investigation in Antarctica ... shall continue...." The language contained in the enacted Antarctic Protection Act of 1990 (APA90) and proposed legislation such as the 102nd Congress's H.R. 2826, the Antarctic World Park and Protection Act, may put the future of Antarctic earth science research in jeopardy.

Internationally, CRAMRA (the subject of the January 1991 *GSA Today* FORUM) has not been, nor is it likely to be, ratified. Whereas CRAMRA did not attempt to exercise control over scientific research activities, much of the enacted or proposed Antarctic legislation of the 101st and 102nd Congress does. APA90, the primary piece of Antarctic legislation produced by the 101st Congress, was signed into law by President Bush on November 16, 1990. Most significantly, APA90 establishes a formal prohibition on all Antarctic mineral resource activities by U.S. nationals and companies. Employees of the federal government are included within this prohibition.

Antarctic mineral resource activities prohibited by APA90 are prospect-

ing, exploration, and development. Section 3.(5) defines *mineral resources* as "all nonliving natural nonrenewable resources, including fossil fuels, minerals, whether metallic or nonmetallic, but does not include ice water, or snow." Section 3.(7) defines *prospecting* as "any activity, including logistic support, the purpose of which is the identification of mineral resource potential for possible exploration and development." Section 3.(4) defines *exploration* as "any activity, including logistic support, the purpose of which is the identification or evaluation of specific mineral resource deposits. The term includes exploratory drilling, dredging, and other surface or subsurface excavations required to determine the nature and size of mineral resource deposits and the feasibility of their development." Section 4.(3) defines *development* as "any activity, including logistic support, which takes place following exploration, the purpose of which is the exploitation or evaluation of specific mineral resource deposits, including processing, storage, and transport activities."

The repeated use of the term "any activity," coupled with the statement in Section 2 that "the level of scientific study, including necessary support facilities, has increased to the point that some scientific programs may be degrading the Antarctic environment," should raise flags in the earth science research community.

Section 3.(2) of APA90 states that "the term 'Antarctic mineral resource activity'... does not include scientific research within the meaning of Article III of the Antarctic Treaty...." Unfortunately, Article III of the Antarctic Treaty, which deals with promotion of international cooperation in scientific activities in Antarctica, *does not characterize or define types of permissible scientific research*; rather, it deals only with exchanges of information regarding scientific programs in Antarctica, scientific personnel, and scientific observations and results.

Many other sections of APA90 contain statements that could have a negative bearing on the conduct of future scientific research. Specifically, Section 4 states that "it is unlawful for any person to engage in, finance, or otherwise knowingly provide assistance to any Antarctic mineral resource activity."

Section 5 instructs the Secretary of State to enter into international negotiations leading to agreements that "grant Antarctica special protective status as a land of science dedicated to wilderness protection, international cooperation, and scientific research; and ensure that the results of all scientific investigations relating to geological processes and structures be made openly available to the international scientific community, as required by the Antarctic Treaty...."

Although APA90 focuses on the Antarctic continent, its prohibitions pertain to the entire area south of the Antarctic Convergence. This includes much of the Southern Ocean, including certain regions that extend as far north as 45° south latitude, or half-way to the equator from the South Pole. APA90 uses the same definition of Antarctica as does the Antarctic Marine Living Resources Convention Act (AMLR). AMLR's focus is krill and fishery resources of the Southern Ocean.

APA90 states that its fourfold purpose is to "1) strengthen substantially overall environmental protection of Antarctica; 2) prohibit prospecting, exploration, and development of Antarctic mineral resources by United States citizens and other persons subject to the jurisdiction of the United States; 3) urge other nations to join the United States in immediately negotiating one or more new agreements to provide an indefinite ban on all Antarctic mineral resource activities and comprehensive protection for Antarctica and its associated and dependent ecosystems; and 4) urge all nations to consider a permanent ban on Antarctic mineral resource activities."

H.R. 2826. The proposed Antarctic World Park and Protection Act, H.R. 2826 appears to be a well-meaning piece of legislation designed to establish a world park dedicated to scientific research and to help protect the Antarctic environment. However, some provisions, such as Section 3(b)(5), make it clear that certain types of scientific research may not be permitted and that all permissible scientific research will be conducted under pre-specified conditions and restrictions. Like APA90, Section 6 of H.R. 2826 specifically includes a prohibition on (1) prospecting or other mineral exploration or development, and (2) activities intended to obtain seismic or other data concerning mineral resources.

Past and present U.S. Antarctic earth science research has not focused on exploration, prospecting, or development of Antarctic minerals. Reconnaissance and regional geologic studies conducted in Antarctica, like those conducted anywhere else, provide information on the geologic history and age, tectonic evolution, and mineralogical composition and petrology of the rocks that make up Antarctica. Most marine geohazards, continental margin structure, tectonic evolution, and sediment thickness studies are dependent on seismic data. Similarly, much of the data needed for ice-sheet and glacier geophysics investigations are the result of seismic data collection.

We in the earth science community must be concerned that the U.S. Congress, in its enthusiasm to protect Antarctica, will inadvertently and, from our perspective, incorrectly eliminate all earth science activities. We must prevent the earth science research baby from being thrown out with the Antarctic minerals activities bathwater. We must educate Congress that not all geological and earth science studies are mineral exploration or exploitation activities. ■

Some of the comments presented in this Washington Report appeared in a commentary describing APA90 published in the February 1990 *Geotimes*.

About People

U.S. Geological Survey Meritorious Service Awards for 1991 have been given to GSA Member **Mary Jo Baedecker**, Reston, Virginia; Fellow **Owen P. Bricker**, Reston; Fellow **Edwin A. Noble**, Reston; Fellow **Eugene A. Shinn**, St. Petersburg, Florida; and Fellow **Warren W. Wood**, Reston.

Fellow **Michel T. Halbouty**, Houston, Texas, received the USGS John Wesley Powell Award for citizen achievement.

Fellow **S. J. Mazzullo**, Wichita State University, has been awarded Honorary Life Membership in the Permian Basin Section of SEPM.

Student Associate **Kenneth Ridgway**, University of Rochester, has been awarded a 1991 dissertation fellowship by the Ford Foundation Doctoral Fellowship Program for Minorities.

Fellow **Robert J. Weimer**, professor emeritus at the Colorado School of Mines, Golden, has been elected president of the American Association of Petroleum Geologists (AAPG).

The American Institute of Professional Geologists (AIPG) awarded the Ben H. Parker Memorial Medal to Member **Wayne A. Pettyjohn**, Oklahoma State University; the Public Service Award to Fellow **Meredith E. Ostrom**, Middleton, Wisconsin; Honorary Membership to Fellow **Konrad B. Krauskopf**, Stanford University; and a Presidential Certificate of Merit to Member **Ernest K. Lehmann**.

Fellow **Charles E. Chapin** has been appointed director of the New Mexico Bureau of Mines and Mineral Resources and State Geologist, on the retirement of Fellow **Frank E. Kottowski**, now emeritus director/state geologist.

Fellow **Charles G. Groat** has been appointed executive director of a newly reorganized coastal, energy, and environmental resources research center at Louisiana State University.

Midland Library Group Offers Technical Publications for Sale

The Friends of the Midland County Library, Midland, Texas, keep donated collections of several technical and scientific journals, including those published by GSA, AAPG, and JPT. These publications are available for resale to those interested in this reference material. The cost is very reasonable, and all proceeds benefit the Petroleum-Technical Section, which is open to the public at no charge. The Friends of Midland County Library was established in 1935 by the West Texas Geological Society and receives no funding from the public sector, relying on donations and proceeds from the sale of these journals. ■

CALL FOR NOMINATIONS

Officers and Councilors

The GSA Committee on Nominations requests your help in compiling a list of GSA members qualified for service as officers and councilors of the Society. The committee requests that each nomination be accompanied by basic data and a description of the qualifications of the individual for the position recommended (vice-president, treasurer, councilor).

Nominations for 1993 officers and councilors must be received at GSA headquarters no later than **FEBRUARY 15, 1992**. Please send nominations and backup material to the Administrative Department, Geological Society of America, P.O. Box 9140, Boulder, CO 80301.

Penrose and Day Medals, and Honorary Fellowship

Nominations for GSA's Penrose and Day Medals and for Honorary Fellowship in the Society are due at headquarters by **FEBRUARY 1, 1992**.

For procedures and additional information, please refer to the October 1991 issue of *GSA Today*, or call headquarters at (303) 447-2020.

Send your nominations and required backup material to the Administrative Department, Geological Society of America, P.O. Box 9140, Boulder, CO 80301.

Young Scientist Award (Donath Medal)

The Young Scientist Award was established in 1988 to be awarded to a young scientist (35 or younger during the year in which the award is to be presented) for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences. The award, consisting of a gold medal called the Donath Medal and a cash prize of \$10,000, was endowed by Dr. and Mrs. Fred A. Donath.

For the year 1992, only those candidates born on or after January 1, 1957, are eligible for consideration. In choosing candidates for the Young Scientist Award, scientific achievement and age will be the sole criteria. Nominations for the 1992 award must include

- biographical information,
- a summary of the candidate's scientific contributions to geology (200 words or less),
- a selected bibliography (no more than 10 titles),
- supporting letters from five scientists.

Nominations for the 1992 Young Scientist Award must be received at GSA headquarters by **FEBRUARY 1, 1992**. For procedures and additional information, please refer to the October 1991 issue of *GSA Today*, or call headquarters at (303) 447-2020.

Distinguished Service Award

The GSA Distinguished Service Award was established by Council in 1988 to recognize individuals for their exceptional service to the Society. GSA Members, Fellows, Student Associates, or, in exceptional circumstances, GSA employees may be nominated for consideration. Any GSA member or employee may make a nomination for the award. Awardees will be selected by the Executive Committee, and all selections must be ratified by the Council. Awards may be made annually, or less frequently, at the discretion of Council. This award will be presented during the Annual Meeting of the Society. Nominations and any supporting information may be addressed to Executive Director, Geological Society of America, P.O. Box 9140, Boulder, CO 80301.

Deadline for nominations for 1992 is **MARCH 1, 1992**.

AGI Offers Low Member Rates for *Geotimes* Subscriptions

Geotimes, the American Geological Institute's monthly magazine of geoscience news and trends, is now available at a special price for members of AGI's member societies (GSA is one). Previously, all subscribers paid the same price. Now, members will pay \$14.95 for an annual subscription. Although geoscience students will qualify for the reduced rate, other individuals, libraries, and institutions will pay the full subscription price, currently \$24.95.

Upcoming issues of *Geotimes* will focus on environmental geology; science, stewardship, and water resources; what geoscience educators are doing about the crisis in science education; international efforts in the earth sciences; applications of computer technology in the earth sciences; and what's happening in the oil, gas, and mining industries.

The "members-only" price will be offered only in member-society publications, through the mail, or at meetings of some societies. To order, or renew, at the new price, members should contact Johanna Wertz, *Geotimes* Circulation, AGI, 4220 King St., Alexandria, VA 22302.

Forum continued from p. 243

logic settings. The short half-life of ^{222}Rn precludes it from migrating far from its source, so if high concentrations of ^{222}Rn occur in ground water, the presence of high concentrations of the parent radionuclides uranium and radium in the aquifer is also required. Further, these parent elements may be present in the water supply in concentrations sufficiently high to cause concern in their own right. Despite the widespread nature of anomalous radon concentrations and the high cancer risk it poses relative to other hazardous constituents in ground water, research activity on radon in ground water has been less than robust.

Limited data suggest direct ingestion of dissolved ^{222}Rn to be a minimal health risk. The main concern over ^{222}Rn in water supplies is its contribution to indoor air upon degassing. This contribution is difficult to quantify, owing to the large number of variables involved and the wide range of possible values for each. Due to this variability, the rule of thumb that 10,000 picocuries per liter of ^{222}Rn in water contributes 1 picocurie per liter of ^{222}Rn to indoor air is grossly oversimplified, yet it is the basis for most population-exposure estimates and regulatory decisions. Clearly, more research is needed to develop quantitative models of the contribution of ^{222}Rn from water supplies to indoor air.

Geoscientific researchers could provide the data needed by policy makers to responsibly evaluate the extent of public risk. Natural processes that mobilize ^{222}Rn and its parent radionuclides in various environments need to be determined. To accomplish this, different scales of observation are necessary. On a microscopic scale, the abundance and physical-chemical residences of uranium and radium must be characterized, because they have a direct impact on the proportion of ^{222}Rn generated in the aquifer that is transferred to ground water. On a macroscopic scale, our understanding of natural occurrences of radionuclides in geologic material must be improved to the point where specific problem areas can be more clearly delineated.

PERSPECTIVE 5: Some practical problems encountered when using geology to assess radon potential within a public policy framework

Linda C. S. Gundersen, USGS, Denver, Colorado

The methodology used in a geologic radon-potential assessment is determined by (1) the scale of the proposed assessment and (2) the scale needed to understand the geologic processes responsible for the radon concentrations. To understand an indoor radon problem at the neighborhood scale, one must look at geology on the outcrop scale and possibly on the microscopic scale. To make a general radon-potential assessment of the United States, remote sensing data, broad geochemical models, and national-scale geologic maps can be used. Many government agencies at the town, county, state, and national level are inhibited by the political boundaries from which they must view a problem. As a result, geologists are generally forced to work at artificial scales rather than the natural scales of terrane or rock type.

Consider a county assessment for indoor radon. County size is variable, so that a geologic map at one scale may produce different (or no) correlations with indoor radon than may a geologic map at another scale. For instance, in relatively broad, homogeneous radon source rocks, such as a marine shale, the radon source potential can be accurately delineated with a small-scale map.

Conversely, carbonate terrains are very heterogeneous with respect to radon but are the source for many of the high, localized indoor high-radon areas in the United States. The occurrence of radium in soils derived from carbonate rocks is controlled by soil weathering processes, and larger scale, more detailed maps related to soil depth, chemistry, and maturity must be consulted or created.

These problems of scale commonly lead to confusion in both the scientific and cultural press and to dismayingly contrasting headlines: "Geology predicts indoor radon!" "Geologic maps not useful for radon prediction!" Part of this problem can be attributed to the nongeologist view of what geology is. It is not simply maps. A geologic assessment for radon must incorporate the science behind the maps, including igneous and metamorphic petrology, sedimentology, surficial geology, geomorphology, geochemistry, geophysics, and hydrology. Educating policy makers, other scientists, and the public in all aspects of geology and the environment is not practical in the short time frame in which an environmental problem is popular, but it should be included in the long-range goals of the earth sciences. The geologist must present the data in a form that policy makers and other scientists involved with the radon problem can use, and they must work with them to ensure that the data are used and presented to the public logically. To do this, the geologist must be educated in the other scientific aspects of the problem (such as the physics of gas movement into a home) as well as the political and health issues of the radon problem. In turn, those who are involved with other aspects of the radon problem need to be equally responsive to the geologists by using and presenting the geologic science available to them in the truest way possible. A further complication to the role of the geologist in assessment of radon is the health aspect of the problem. Because the health effects of radon are still controversial and the architecture of the home is an important controlling factor in the concentration of indoor radon, reporting an area as a "health threat" solely on the basis of geology is inaccurate. A real prediction of a person's annual exposure must take into consideration that individual's every activity and exposure to radon at the time. Geologists can only define the potential of the rocks and soils to produce radon, and they must accept this limitation. However, defining and understanding radon potential is an important task that in the future may yield information vital to other environmental radioactivity problems. ■

Special thanks go to Linda Gundersen for her help in coordinating this forum. Similar thanks are due to Marilyn Suiter for her help in putting together the September and October Forum columns.

Tectonics of the Coast Mountains Orogen, British Columbia, Yukon, and Alaska

A GSA Penrose Conference, Tectonics of the Coast Mountains Orogen, British Columbia, Yukon, and Alaska, will be held May 17-22, 1992, in Whistler, British Columbia. Conveners are Maria Luisa Crawford, Dept. of Geology, Bryn Mawr College, Bryn Mawr, PA 19010, (215) 526-5111; George E. Gehrels, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721, (602) 621-6026; James W.H. Monger, Geological Survey of Canada, 100 W. Pender St., Vancouver, BC V6B 1R8, (604) 666-6743 or 666-0529.

The conference is dedicated to Richard Lee Armstrong, who died on August 9, 1991. Armstrong had planned to attend the conference, and would have been an active participant. His efforts in the fields of isotope geochemistry and geochronology, and his regional syntheses have profoundly influenced our understanding of Coast Mountains and Cordilleran geology.

The Coast Mountains orogen provides an excellent natural laboratory for studies of continental crustal genesis. Pre-Jurassic rocks within and adjacent to the Coast Mountains formed largely in oceanic arc-type terranes that were located outboard of, and perhaps far from, the Cordilleran margin. These rocks became part of the North American continent during mid-Mesozoic to early Tertiary time by a variety of processes, including development of a thrust belt more than 1800 km long; burial of supracrustal rocks to lower crustal levels; emplacement of one of the world's largest batholiths; and rapid uplift and erosion. Some workers view this orogenic activity as the result of closure of a suture in the Coast Mountains that separates the Alexander and Wrangellia terranes on the west from the Stikine and Yukon-Tanana terranes to the east. Others see the orogen as an intra-terrane feature driven mainly by magmatic processes related to subduction of Pacific Ocean crust.

One of the primary objectives of the conference will be to elucidate along- and across-strike variations in the orogen. Such comparisons have been difficult to make in the past because of incomplete mapping,

insufficient control on ages of units and structures, and lack of an appropriate forum involving both Canadian and U.S. geologists. However, the state of knowledge has now advanced to the point that temporal and spatial patterns of magmatism, metamorphism, deformation, sedimentation, and uplift can be reconstructed. With these patterns as a framework, we plan to address more controversial topics such as (1) processes of melt-enhanced deformation, tectonic surge, and magmatic loading, (2) petrogenesis of plutons in the batholith, (3) regional tilt vs. large-scale translation alternatives to explain anomalous paleomagnetic data, (4) relations between plate motions and orogenesis, (5) distribution and significance of continental margin strata in the Coast Mountains, (6) roles of transtension, transpression, and crustal extension in formation and uplift of the orogen, and (7) proposed pre-Cretaceous structural, stratigraphic, and plutonic links across the Coast Mountains. Such discussions will shed light on possible genetic links between the formative tectonic processes and will perhaps resolve the role of terrane displacement and accretion in the evolution of the orogen.

We encourage participation from earth scientists with a wide variety of backgrounds and interests. Such diverse techniques and talents have been important in unraveling the history of the Coast Mountains, and will play an ever-increasing role in the future. We also plan to incorporate information from critical regions adjacent to the Coast Mountains, as well as from along-strike areas of southern Alaska and northwestern Washington.

Prospective participants should send a letter of application stating the relevance of their research to the conference to George E. Gehrels. The deadline for applications is *February 1, 1992*. The conference fee will be approximately \$650, including registration, food (except dinners), and lodging at the Whistler Resort, and a one-day field trip through the southern Coast Mountains. Limited support is available for qualified graduate students. ■

Memorial Preprints

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

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Another Year—Another Tax Dilemma

Less than two months remain until the end of 1991, which means that less than two months remain for 1991 tax planning. There is little that can be done to reduce 1991 taxes once New Year's Day 1992 arrives, so if you feel that you have not optimized your personal and family income tax situation, November–December is the time in which this must be done.

Our elected representatives in Congress have made numerous changes to federal income tax laws over the past several years, and if you are like most taxpayers, you are probably confused about how these changes have affected you and your tax deductions. One aspect of this whole tax regulatory melange that has remained relatively clear and effective is the charitable deduction. Fortunately for you, the taxpayer, and for us, the GSA Foundation, contributions remain deductible against income, resulting in a lower taxable amount and correspondingly lower taxes on April 15th.

Charitable contributions fall into four categories: cash, securities, life insurance, and property—real or personal. First, the easiest and simplest—cash gifts. The vast majority of gifts received by the Foundation (last year there were 1209) come to us in the form of cash. Whether the cash gift is in the form of a check, an allocation on a member's annual dues statement, or a credit card charge at the Foundation booth at the GSA Annual Meeting, the cash contribution is both convenient and easily recorded through canceled checks and receipts. As you might expect, the Foundation receives very few \$5 and \$10 bills.

Gifts of securities require a little more effort on the part of the donor, but they may have more financial impact on the tax return. Securities

such as stocks, bonds, and mutual funds are generally quite liquid and can be given directly to the GSA Foundation. The result is a charitable income tax deduction for the full market value of these securities at the time of the donation.

An important aspect of a gift of securities enters into the picture if the particular holding has appreciated in value since originally purchased by the donor. This market value concept means that the donor may deduct the current full value of the security in the same manner that cash contributions are deducted. The tax authorities do not consider this a sale of these securities, so no capital gains tax is due on the increase in value from original cost. As you can imagine, this provides the contributor with terrific leverage, because she or he is able to reduce the tax bill without tapping into cash.

A gift of securities can be handled by your broker, or shares may be given directly to the Foundation. Call or write the Foundation office for detailed information on how to do this.

One further consideration with regard to securities gifts. If the present value of a security is below your cost, the better course of action is to sell it, take a loss for tax purposes, and make a cash gift with the resulting proceeds. Thus, a security in a loss position can be converted into two deductions on your tax return.

Life insurance is an excellent and popular charitable gift device. A substantial gift can be given by making a series of modest payments over a period of years. An important consideration is that in the event of a donor's death, a gift of life insurance does not become tied up in estate administration. The contribution of a life insurance policy to the GSA Foundation

provides an immediate tax deduction in the amount of the present cash value of the policy. In the case of a paid-up policy, this is the extent of the deduction. However, should premium payments be ongoing, the amount of these payments is considered as a charitable contribution in the year that a payment is made. Thus, life insurance gifts can have both an immediate and long-term tax impact.

Gifts of real and personal property are a topic unto themselves, to be discussed in the December Foundation Update. Please call the Foundation office at (303) 447-2020 if you have any questions about year-end giving. You may use the accompanying coupon in making your gift. ■

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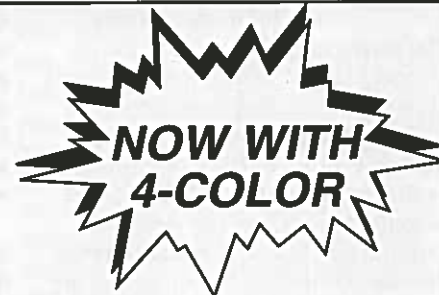
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June Forstrom, Research Grants Administrator

General Grants

The purpose of the general research grants program is to provide partial support of master's and doctoral thesis research for graduate students at universities in the United States, Canada, Mexico, and Central America. Applicants need not be members of GSA.

To apply for one of these grants, you must fill out an application form, which is available from GSA Campus Representatives at geology departments in the United States and Canada, or from GSA headquarters (Research Grants Administrator, Geological Society of America, P.O. Box 9140, Boulder, CO 80301). Evaluations from two faculty members are required on GSA appraisal forms. The deadline for applications for the 1992 research grants program is *February 15, 1992*. Applications must be submitted on 1992 forms. The GSA Committee on Research Grants evaluates all applications and chooses those to be funded at its early spring meeting at GSA headquarters. Grants are awarded in April. In 1991 a total of 493 proposals were received; 240 of them were funded. A total of \$278,526 was awarded, the grants ranging from \$200 to \$2000; the average amount awarded was \$1161.

Specialized Grants

Recipients of special awards are selected by the Committee on Research Grants from applicants to the general research grants program; the same application forms are used, and they must also be postmarked by *February 15*. It is not necessary for applicants to indicate that they wish to be considered for a specialized grant. The committee considers all qualified applicants when selecting recipients for special awards.

The Gretchen L. Blechschmidt Award was established to support research by women interested in achieving a Ph.D. in the geological sciences and a career in academic research. Special consideration may be given to women (1) whose proposals are in the fields of biostratigraphy and/or paleoceanography and (2) who have an interest in sequence stratigraphy analysis, particularly in conjunction with research into deep-sea sedimentology.

The aim of the John T. Dillon Alaska Research Award is to support scientific research that addresses earth science problems particular to Alaska. Special consideration may be given to students whose proposals are (1) field-based studies dealing with the structural and tectonic development of Alaska, and (2) studies that include some aspect of geochronology (either paleontologic or radiometric) to provide new age control for significant rock units in Alaska. Candidates with other objectives in Alaskan earth science research will also be considered.

The Robert K. Fahnestock Memorial Award is made annually to the applicant with the best application in the field of sediment transport or related aspects of fluvial geomorphology.

The Harold T. Stearns Fellowship Award is awarded annually in support of research on one or more aspects of the geology of Pacific islands and of the circum-Pacific region.

Division Grants

Seven of the 12 GSA divisions award grants for outstanding student research within the respective division's field of interest. The Committee on Research Grants will select candidates from the general research grant applicants for awards by the Engineering Geology, Geophysics (Allan V. Cox Award), Hydrogeology, Sedimentary Geology, and Structural Geology and Tectonics Divisions.

The Coal Geology Division awards the Antoinette Lierman Medlin Scholarship Award annually to the full-time graduate or undergraduate student who submits the best proposal of a research project in the field of coal geology. Detailed guidelines are available from the chairman of the Coal Geology Division Scholarship Committee, C. Blaine Cecil, U.S. Geological Survey, Branch of Coal Geology, M.S. 956, Reston, VA 22092. The recipient of the award is announced in the fall.

The Coal Geology Division of GSA and the Symposium on the Geology of Rocky Mountain Coal jointly sponsor scholarships for research on coal in the Rocky Mountain and northern Great Plains coal provinces. Applicants must be masters or doctoral candidates doing research on coal in Arizona, Alberta, British Columbia, Colorado, Idaho, Montana, New Mexico, North Dakota, Saskatchewan, South Dakota, Utah or Wyoming. However, the college or university where applicants are enrolled need not be in those states or provinces. Applications for Rocky Mountain Coal Scholarships can be obtained from GSA (address under General Grants) or from Gary B. Glass, Geological Survey of Wyoming, Box 3008, University Station, Laramie, WY 82071. The deadline for 1992 applications is *March 1, 1992*.

GSA's Quaternary Geology and Geomorphology Division established its J. Hoover Mackin Research Grants in 1974 to support graduate student research on Quaternary geology or geomorphology. Applications for this grant are available from the secretary of the division, Deborah R. Harden, Dept. of Geology, San Jose State University, San Jose, CA 95192-0102. The deadline for applications for 1992 is *February 15, 1992*. Grant awardees are announced in April.

Five GSA divisions—Archaeological Geology, Geoscience Education, History of Geology, International, and Planetary Geology—do not currently award grants for student research.

Section Grants

Recipients for research grants from the South-Central Section are selected from applicants to the GSA general research grants program who are recommended by the Committee on Research Grants to the Management Board of the South-Central Section for final selection. Eligibility is restricted to graduate students attending a college or university within the geographic area of the South-Central Section.

The South-Central Section also awards grants to undergraduate students; applications for these awards are available from the Section secretary, Rena M. Bonem, Department of Geology, Baylor University, Waco,

The Geological Society of America



Research Grants Program 1992

The primary role of the Research Grants Program is to provide partial support for research by graduate students who are candidates for the M.S. or Ph.D. degree at universities in the United States, Canada, Mexico, and Central America. GSA strongly encourages women, minorities, and persons with disabilities to participate fully in this grants program. Eligibility is not restricted to GSA members. New application forms for the current year and detailed requirements are available each fall in the geology departments of colleges and universities offering graduate degrees in earth sciences. Forms are mailed annually to GSA Campus Representatives and department secretaries and chairmen in the United States and Canada. They are also available upon request from the Research Grants Administrator, Geological Society of America, P.O. Box 9140, Boulder, Colorado 80301. *Please use only the 1992 application and appraisal forms.*

Confidential evaluations from two faculty members are required from candidates for the M.S. or Ph.D. degree and must accompany applications submitted. PLEASE USE THE "APPRAISAL OF APPLICANT" FORMS, WHICH ACCOMPANY THE 1992 APPLICATION FORMS. Application forms will not be accepted by facsimile.

The Geological Society of America awarded \$278,500 in grants in 1991. The grants went to 240 students doing research for advanced degrees. The average amount awarded was \$1161. The largest grants were \$2000, but there is no predetermined maximum amount.

The Committee on Research Grants will meet in March to evaluate applications and award grants. In April, all applicants for grants will be informed of the committee's actions by the Executive Director of the Geological Society of America.

**ALL APPLICATIONS MUST BE SUBMITTED ON THE 1992 FORMS
AND POSTMARKED BY FEBRUARY 15, 1992**

TX 76798. Undergraduate student recipients are selected by the Management Board of the South-Central Section. The deadline for undergraduate applications is *October 15*; the grants are awarded in late December.

The North-Central Section will award grants to undergraduate students within the geographic boundary of the Section beginning in 1992. For further information contact the Section secretary, George R. Hallberg, Iowa Geological Survey Bureau, Trowbridge Hall, University of Iowa, Iowa City, IA 52242.

The Southeastern Section awards grants for both undergraduate and graduate GSA Student Associates who are enrolled in an institution within the geographical boundaries of the Section. The grants are competitive. Application forms can be obtained from the Section secretary, Michael J. Neilson, Department of Geology, University of Alabama, Birmingham, AL 35294. The deadline for 1992 applications is *February 14, 1992*. The grants will be awarded in April.

The remaining three sections—Northeastern, Rocky Mountain, and Cordilleran—do not currently offer research grants. ■

In Memoriam

Richard L. Armstrong
Vancouver, Canada
August 9, 1991

Harry J. Klepser
Knoxville, Tennessee
August 14, 1991

Warren B. Weeks
Bartlesville, Oklahoma
July 3, 1991

Douglas G. Brookins
Albuquerque, New Mexico
April 30, 1991

Andre F. Laurin
Ste-Foy, Quebec, Canada
March 4, 1991

Wayne M. Brewer
Meadville, Pennsylvania
January 27, 1991

Grant T. Wickwire
Eastford, Connecticut
July 14, 1986

Lamprophyres. N. M. S. Rock, 1991. Blackie and Son Ltd., Glasgow and London. Published in the United States by Van Nostrand Reinhold, New York, 285 p., \$99.95.

Lamprophyres have long been one of the more poorly studied and least understood of all igneous rock clans. During the past decade, however, a surge of interest in lamprophyres has resulted in a proliferation of new research papers on the topic. This outpouring of new data has provided the impetus for the first monograph devoted entirely to lamprophyric rocks.

This book serves as an up-to-date compendium of virtually all of the factual information currently available on lamprophyres. Rock has built up an

exhaustive computer database (LAMPDA) that contains a variety of data for over 5000 individual rock specimens. The first seven chapters of the book are primarily descriptive summaries of the information from this database. Throughout the text, the author attempts to identify those characteristics that are unique to a particular branch of the lamprophyre family, while at the same time showing the common links that tie together this extremely diverse group of rocks.

Chapter topics include: the research history and classification of lamprophyres, global distribution and igneous associations, field geology and petrography, mineralogy, whole-rock geochemistry, types of inclusion suites, and plutonic and volcanic equivalents of lamprophyres. Chapter 8 discusses current ideas regarding the origin and

petrogenesis of lamprophyric magmas. Chapter 9 briefly discusses economic deposits associated with lamprophyres with an emphasis on diamond- and gold-bearing systems. The text is accompanied throughout by an abundance of tables, graphs, and illustrations.

Among the most valuable aspects of the book are its extensive bibliography, containing approximately 1500 selected references, and its appendices. Appendix A summarizes the plethora of abbreviations and symbols that are used throughout the text. Appendix B is a glossary of lamprophyric rock names and related petrological terms. Appendix C is a fully documented compilation of approximately 500 known lamprophyre occurrences worldwide.

This book provides a valuable reference text on lamprophyres and out-

lines our current understanding of their origin, evolution, and petrogenetic significance. I would recommend it to anyone interested in pursuing research related to this topic or who may be involved in exploration for mineral deposits associated with lamprophyres. ■

Timothy P. Rose
University of California
Davis, CA 95615

advertisement

Announcement of Scientific Proposal Opportunities Associated with Research Drilling in the Manson Impact Structure, Iowa

PROJECT DESCRIPTION

The U.S. Geological Survey and the Iowa Department of Natural Resources-Geological Survey Bureau plan to drill 3 to 6 continuously cored NX holes to depths as much as 450 m, dedicated to scientific research, in the Manson impact structure in western Iowa. This feature was formed about 65-66 million years ago by an impact into flat-lying sedimentary units about 3.7 km thick that overlie a complex crystalline basement. The impact appears to have produced a large flat-floored crater about 35 km in diameter, with a large central uplift and terraced rims overlain by an ejecta blanket. Holes should penetrate (a) the post-impact depositional sequence filling the crater, (b) the upper part of the central uplift, (c) the surrounding breccia lens and melt-rock sequences, and (d) the deformed rim and any remaining ejecta. This drilling is being undertaken as part of the U.S. Continental Scientific Drilling Program coordinated by the U.S. Geological Survey, National Science Foundation, and Department of Energy. The FY91 phase of drilling will take place from August into late 1991; these core samples should be available in early 1992. The FY92 phase of drilling is planned for mid-1992, and these core samples should be available in late 1992 or early 1993. Downhole geophysical logging of FY91 and FY92 holes could be accomplished from late 1991 to late 1992.

The goals of this project are to improve understanding of the Manson impact cratering event, define its relation to the K/T boundary, and examine effects of this large impact event on the terrestrial environment. Objectives are to refine the age of the impact, complete a geochemical search for the type of impactor, improve definition of relations between target rocks and ejected materials found in the K/T boundary (mainly western U.S.), and evaluate potential climate and environmental effects. Core drilling will provide opportunities for geologic, geochemical, isotopic, and geophysical logging studies of this large-scale impact crater, as well as permit studies of the ejection process and its contribution to the regional environment. In addition, the formation of a large impact crater permits studies of sedimentation and diagenesis in a closed topographic environment.

RESEARCH OPPORTUNITIES

Research proposals for core studies and for downhole experiments of up to two years duration will be considered for funding support by the three Federal agencies on a written proposal basis. The Department of Energy will accept proposals as part of its fundamental research program in energy-related geosciences. The National Science Foundation will accept proposals for basic scientific research as part of its Continental Dynamics Program. The U.S. Geological Survey will accept proposals from USGS employees only. The National Aeronautics and Space Administration may also participate in this program, under NASA Research Announcement NRA91-OSSA-1 (for further information,

contact Joseph Boyce, Code SL, at NASA Headquarters in Washington, D.C., telephone 202-453-1597). Interagency cooperative research will be considered. Each proposal will be reviewed and recommended for funding or declination using normal procedures for the Agency receiving the proposal. A Science Experiments Panel will be constituted to develop technical comments on proposals for appropriate use in Agency reviews.

PROPOSAL FORMAT AND SUBMISSION INFORMATION

Proposals should be in the format required by the Agency to which the proposal is submitted. Guidelines are available from:

DOE
William C. Luth
Office of Basic Energy Sciences
Department of Energy (ER-15)
Washington, DC 20585

NSF
Leonard E. Johnson
Division of Earth Sciences
National Science Foundation
1800 G Street, NW
Washington, DC 20550

USGS
Steven R. Bohlen
Mail Stop 910, U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

Each proposal should contain the following: (1) a maximum one page listing of goals and objectives, (2) a maximum 3-page statement of scientific rationale, (3) a maximum 3-page statement of work to be done, (4) a statement of any special drilling, core handling, casing, etc. requirements, (5) literature references, (6) a current Vita with a listing of pertinent publications during the past 5 years, and (7) a budget containing the type and level of information comparable to that in the NSF or DOE Grant Application format, along with appropriate budget justifications. Figures and tables are excluded from the above page limitations. Twenty copies of each proposal should be submitted to the appropriate Agency no later than *January 15, 1992*. For further technical information about this project and to inquire about earlier access to drilled holes than the proposal deadline (eg, for geophysical logging), contact:

David J. Roddy
U.S. Geological Survey
2255 North Gemini Dr.
Flagstaff, AZ 86001
602-556-7177, FTS 765-7177

Campus Rep Program Seeks Volunteers

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 Services department, explain to interested students the benefits of being a GSA Student Associate:

- GSA Today every month
- Reduced subscription rates for *Bulletin* and *Geology*
- 20% discount on GSA books, maps, and charts
- \$30 discount for GSA's Employment Service (applicants)
- \$10 discount for registration fees for Penrose Conferences
- \$20 reduction in student registration fees for GSA's Annual Meeting
- Reduced registration fees for many GSA section meetings
- 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

All GSA sections participate in the program, and there are now 536 active campus representatives. We thank the current campus representatives now serving to keep the program growing. However, **we need more volunteers**. If you are a Member or Fellow (not Student Associate) and are interested in serving GSA as a campus representative for your college or university, please contact: T. Michael Moreland, Membership Services Manager, Geological Society of America, P.O. Box 9140, Boulder, CO 80301; (303) 447-2020. ■

and Thelin, 1989). Among highlights of the map, shown here at reduced scale (Fig. 1), are the following.

Large Features

Major topographic styles contrast vividly on the map. Two tectonic regimes, the static eastern United States—a passive continental margin—and the active plate margin of the west, differ in surface roughness, structural and coastline patterns, and freshness of relief. Topography north of the Pleistocene ice limit (5 in Fig. 1) is muted and lacks the strong, mature fluvial texture characteristic of unglaciated terrain to the south. Rough islands of the unglaciated driftless area in Wisconsin (4) stand out sharply from surrounding glaciated ground.

Physiographic units of the United States are based largely on topography (Fenneman and Johnson, 1946). Particularly distinctive in Figure 1 are the lithologic and structurally controlled folded Valley and Ridge province of the Appalachian Mountains (1), the Basin and Range province (21)—a complex region of fault-block structures formed by extension of a thin continental crust, the west-tilted Sierra Nevada fault block (2), the eroded domed strata of the Black Hills (3), and such sharp boundaries as the Fall Line (15)—which divides dramatically unlike rocks of the Piedmont and Coastal Plain provinces. Statistics of elevation and slope angle (Pike and Thelin, 1989) indicate that some Fenneman and Johnson (1946) boundaries (for example, that delimiting California's Central Valley) are so generalized that they do not accurately follow topographic contrasts. This new map and its raw data may aid in visualizing, refining, and interpreting such boundaries.

Small Features

Small but distinct features in Figure 1 include the southernmost volcano in the Cascade chain, the Pleistocene Sutter Buttes (17)—erupted through Upper Cretaceous and Tertiary sedimentary strata that fill the Central Valley; the many low Quaternary shields on the basalt-flooded Snake River plain (18)—which mark the tracks of two time-transgressive volcanic systems (Christiansen and McKee, 1978); and Trail Ridge (19, a major source of ilmenite and zircon) and other north-trending ridges in Florida—evidently coast-parallel transgressive complexes of Pleistocene dunes (Force and Rich, 1989).

Somewhat subtler are cuesta ridges of the Connecticut Valley (6)—eroded basalt flows intercalated in tilted redbeds during Mesozoic rifting; late Pleistocene terminal moraines that controlled much of the geomorphic evolution of Long Island and western Cape Cod (7); such late Cenozoic caldera-forming volcanoes as Valles (New Mexico; 8) and Crater Lake (Oregon; 9); and the complex, diffuse, and long-active San Andreas transform-fault zone (California; 10). Mount St. Helens (11) lies mostly hidden among the many peaks in the Cascade Range (southwestern Washington).

Midcontinent

The map is unique in its clear portrayal of low-relief features in the central United States. Among these are the broad and extraordinarily flat Pleistocene and Holocene alluvial plain of the Mississippi River (20) and the Llano Estacado of western Texas and eastern New Mexico (12)—an uplifted High Plains surface on permeable and virtually undissected fluvial sediments

(Miocene) and their eolian veneer (Quaternary); the fine hummocky texture of Nebraska's late Holocene Sand Hills (13)—the largest dune field in the Western Hemisphere; and Crowleys Ridge (14)—a late Pleistocene erosional remnant in the upper Mississippi Embayment near the epicenter of the 1811–1812 New Madrid earthquakes.

An intriguing midcontinent landform, the Coteau des Prairies, is "a flat-iron-shaped plateau some 200 miles (300 km) long, pointing north" (Flint, 1955) in and near eastern South Dakota (16). The ice-scoured lowlands that flank this feature hosted the James and Des Moines lobes of the last ice sheet and then drained ice meltwater and ice-dammed lakes during deglaciation. The lowlands and intervening plateau bear remarkable resemblance in size and shape to Martian outflow channels with associated point bars observed on spacecraft images (Kehew and Lord, 1986). However, the Martian features usually are attributed to erosion by water, not ice (Mars Channel Working Group, 1983).

Linear Trends

Discontinuous linear features form throughgoing patterns on the map. Three of them are seen clearly perhaps for the first time here. An unmapped west-trending lineament in the Rocky Mountains (lat 38°30'N, long 105°–109°W) includes the Morrow Point–Blue Mesa Reservoir segment of the Gunnison River (22) and marks the northern edge of the Tertiary San Juan volcanic field. The other two lineaments parallel the Murray fracture zone, an inactive transform-fault zone system on the eastern Pacific sea floor. One seems to extend the trend of the Garlock fault zone east-northeast from Death Valley; the alignment persists as far as the Colorado Front Range near Fort Collins (23). The second is an east-northeast alignment (24) of parts of the Gila and Salt rivers (Arizona) and the Canada River (Texas). Better known are the northwest-trending Olympic-Wallowa lineament (25), which may include currently active faults (Mann, 1989), and many alignments subparallel to it in the Rocky Mountains to the southeast (26).

A 325°-striking grain characterizes erosional topography in the central part of the map (27), but its geological interpretation on an image such as this requires caution. Oblique illumination can enhance, subdue, or artificially create the appearance of terrain lineaments (Wise, 1969; Howard and Larsen, 1972). The 300° lighting of this map could be expected to emphasize linear features that lie at symmetrical acute angles to this azimuth—e.g., at 325°. The pattern is evident as aligned discontinuous ridges and valleys carved by north-northwest-striking segments of streams, especially on the Great Plains.

The grain may be a real geologic feature, on the basis of its abrupt disappearance or muting north and east of the glacial margin (5), its presence on the manually shaded 1:500 000-scale U.S. Geological Survey state map of South Dakota, its persistence on images using a different sun azimuth (360°), faintness of a complementary acute (275°-striking) linear pattern, and Wise's (1969) analysis of lineaments in the Black Hills area. The great extent of the pattern suggests a regional rather than a local cause and thus points toward tectonic rather than surface processes. If the aligned stream segments reflect preferentially etched bedrock fractures, it is noteworthy that they strike normal to the greatest principal horizontal compressive stress now prevailing in the west-

ern midcontinent (Zoback and Zoback, 1980, Fig. 5).

CONCLUSIONS

Topographic features shown on this new U.S. map highlight several advantages of computer-visualization methods for the synoptic interpretation of geology. Mechanized relief shading portrays landforms accurately and discloses their real complexity (here at 0.8 km resolution), two properties often lost in small-scale sketches and diagrams. Surface features are viewed continuously in a broad context limited only by size of the digital dataset—unlike plastic relief models, aerial photographs, and radar images. The map is without distortion and is free of the vegetation and culture that mask topographic form on satellite images. Finally, lighting conditions and viewer location can easily be varied for a different perspective on a landform or to enhance subtle physiographic features.

ACKNOWLEDGMENTS

Gail P. Thelin created the map in collaboration with me; it was produced by Chip Stevens and Victor Badal, with the assistance of Joe Vigil. I thank Keith Howard and David Harwood for helpful suggestions.

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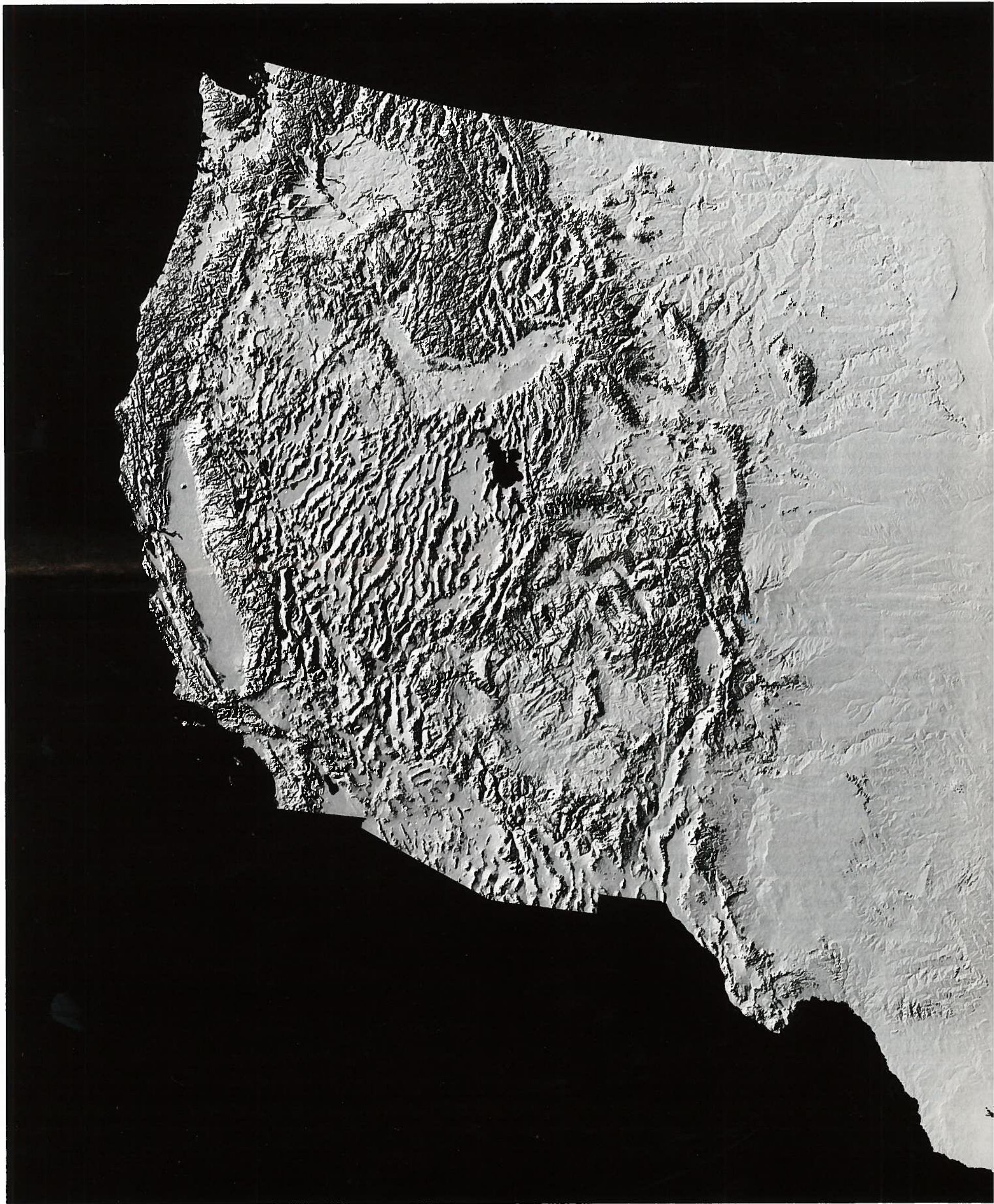
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Landforms of the Conterminous United States a Digital Shaded-relief Portrait



Scale: 1:3 500 000, G.P. Thelin and R.J. Pike, 1991, USGS Map I-2206

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SOUTH-CENTRAL SECTION, GSA 26TH ANNUAL MEETING

Houston, Texas
February 23-25, 1992

The South-Central Sections of the Geological Society of America and the Paleontological Society of America, and the Midcontinent Section of the National Association of Geology Teachers will meet in Houston, Texas, February 23-25, 1992. The meeting is sponsored by Rice University, the University of Houston, and the Houston Geological Society, and will take place on the campus of Rice University.

HOUSTON

Since its founding in 1836 by entrepreneurs from New York, Houston has grown into the fourth largest metropolitan area in the United States, with a population in excess of 3.2 million. It is a center for the petroleum and petrochemical industries and for medical and aerospace research and training. Ships from around the world dock at the Port of Houston. Reached by the man-made Houston Ship Channel, the port is the second largest in the country.

Cultural amenities include the Museum of Fine Arts, the Contemporary Arts Museum, the Menil Collection, Museum of Natural Sciences, and sports facilities such as the Astrodome stadium and the Summit arena. The Alley Theatre, Houston Symphony, Houston Grand Opera, and Houston Ballet are permanent performing arts companies. The broad ethnic diversity of the city is represented by the numerous specialty shops, restaurants, and theatres throughout the metropolitan area.

Average daily temperatures in late February range from lows in the 40s to highs in the 60s. Rainfall during the month of February is normally about three inches.

SPONSORS

William Marsh Rice University, incorporated in 1891, is a private, independent, nonsectarian, and coeducational university, which today has about 4000 students. The Department of Geology and Geophysics, founded in 1952, has programs in marine geology, sedimentology, stratigraphy, structural geology, tectonics, reflection seismology, geodynamics, geochemistry, and petrology.

The **University of Houston**, founded in 1927, became a state-supported university in 1963. The enrollment at the main campus is about 33,000. The Department of Geosciences, founded in 1934, has strength in geo-

chemistry, exploration physics, hydrogeology, structural geology and tectonics, igneous and metamorphic petrology, and micropaleontology.

The **Houston Geological Society** was chartered in 1923. Currently it has about 5200 members, making it the largest local geological society in the world. The Houston Geological Society offers technical meetings, field trips, continuing education courses, and workshops; it publishes books; and it awards student loans and scholarships.

REGISTRATION

PREREGISTER TODAY! Preregistration deadline is *January 20, 1992*.

Please note:

1. You will save on registration if you register before the deadline. Advance registration is required for all special activities, including the Welcoming Party. Please use the registration form provided in this announcement.

Preregistered attendees may pick up registration packets at the Holiday Inn—Medical Center on Sunday, February 23, 4:00 p.m. to 8:00 p.m., on Floor P-1 in front of the Houston Room. On-site registration will be at the Rice University Memorial Center on Monday, February 24, from 7:00 a.m. to 4:30 p.m. and on Tuesday, February 25, from 7:30 a.m. to 12:00 noon.

2. Badges must be worn for access to ALL activities.
3. Registration discounts are given to members of GSA, GSA associated societies, and the Houston Geological Society. Associated societies that qualify for this discount are indicated on the registration form. Please indicate your affiliation(s) and member number to register at member rates. Students and secondary school science teachers have a special discount.

4. Full payment must accompany registration. Unpaid purchase orders are not accepted as valid registration. Charge cards are accepted, as indicated on the preregistration form. If using a charge card, please recheck the card number, as errors will delay your registration. Your confirmation letter from GSA will be your receipt. No other receipt will be sent.
5. Please register only one professional or student per form. Copy the form for your records.
6. Guest registration is required for guests attending guest activities and the Welcoming Party. Guest registrants must be accompanied by a registered professional or registered student.
7. Current student ID is required to obtain student rates at both the on-site and preregistration counters. Students must display their current student ID when they pick up registration materials, or else they will be required to pay the professional fee.

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for registration additions, changes, and cancellations must be made in writing and received by *January 27, 1992*. **NO REFUNDS WILL BE MADE ON CANCELLATION NOTICES RECEIVED AFTER THIS DATE.** Refunds will be mailed from GSA after the meeting. Refunds for fees paid by credit card will be credited according to the card number on the preregistration form. **NO** refunds will be given for on-site registration.

HOUSING

Rooms have been reserved at four nearby hotels (see map on p. 256). The room rates are shown in the chart on p. 256. Reservations can be made by calling the hotel directly or by using the toll-free number. To obtain these special prices, be sure to identify yourself as attending the GSA conference. These rooms will be held only until *January 20, 1992*. After that they will be released to the many people who will be attending the Houston Livestock Show and Rodeo. Normal room rates are considerably higher, if rooms are available.

TECHNICAL PROGRAM

Scheduled symposia and their conveners are:

1. **Tectonics and Evolution of the Gulf of Mexico Basin.** D. S. Sawyer (Rice University) and R. T. Buffler (University of Texas, Austin).
2. **Late Pleistocene-Holocene Climatic Record of the Gulf Coast.** J. B. Anderson (Rice University) and M. B. Lagoe (University of Texas, Austin).
3. **Comparison of North American and Eastern European Folded Belts.** Sponsored by GSA International Division. A. W. Bally (Rice University) and M. A. Schuepbach (Maxus Energy Co., Dallas).
4. **Response of Carbonate Platform to Sea-level Fluctuations: Cases in the Caribbean and the Gulf of Mexico.** A. W. Droxler (Rice University) and R. N. Ginsburg (University of Miami).
5. **Sequence Stratigraphy of the Gulf Coast Paleogene: A Global Comparison.** P. R. Vail (Rice University), W. W. Wornardt (Micro-Strat, Houston), and R. M. Mitchum (Geological Consultant, Houston).
6. **Evolution of Grenville Basement.** V. B. Sisson (Rice University), S. Mosher (University of

Texas, Austin), and W. M. Lamb (Texas A&M University).

7. **Hydrogeologic Controls on Contaminant Transport.** Sponsored by GSA Hydrogeology Division. R. M. Capuano (University of Houston) and C. W. Kreitler (University of Texas, Austin).
8. **Mesozoic/Cenozoic Micropaleontology.** Sponsored by Paleontological Society. R. N. Rosen (Arco Oil and Gas Co., Houston) and R. W. Scott (Amoco Production Co., Tulsa).
9. **The Role of Planetary Geology in the Undergraduate Geology Curriculum.** Sponsored by the National Association of Geology Teachers. D. H. Locke (Richland College).
10. **Magellan to Venus.** V. L. Sharp-ton (Lunar and Planetary Institute, Houston) and E. R. Stofan (Jet Propulsion Laboratory, Pasadena, California).

FIELD TRIPS

Houston rests on Pleistocene fluvial and deltaic deposits that overlie about 15 km of Tertiary strata. They are intruded diapiroically by numerous salt stocks and cut by thousands of normal faults, a few hundred of which reach the surface and are currently active. Field trips before and after the meeting offer opportunities to view many of these features as well as geologic phenomena farther afield.

PREREGISTRATION FOR ALL FIELD TRIPS IS REQUIRED. All participants are accepted on a first-come, first-served basis through GSA headquarters.

All field trips begin and end in Houston. For further details, contact the respective field trip leaders. General questions should be addressed to the field trip coordinator, Carl E. Norman, Department of Geosciences, University of Houston, Houston, TX 77204-5503; (713) 749-1803.

PREREGISTRATION DEADLINE: *January 20, 1992*. The registration form is provided in this announcement. Participants registering for a field trip *only* must pay a \$10 service fee in addition to the field trip charge.

CANCELLATION DEADLINE: *January 27, 1992*. No refunds will be given if cancellation is received after this date. All cancellations must be in writing. If GSA must cancel a field trip due to logistics or registration requirements, a full refund will be issued after the meeting. Be aware of cancellation deadlines and possible penalties imposed by airlines. You may wish to cancel flight arrangements if a trip you have registered for is canceled.

Premeeting

1. **Mid-Cretaceous Carbonates in Central Texas and Sea-level Variations** (2 days). The trip will depart Friday, February 21, at 4:00 p.m. by bus from the parking lot of the Department of Geology and Geophysics, Rice University, and will return on Sunday afternoon, February 23. A. W. Droxler and J. L. Wilson (Rice University), and R. W. Scott (Amoco Production Co., Tulsa). Fee: \$110/person (includes transportation, two nights motel—double or triple occupancy—lunches, guidebook; breakfasts and dinners are not included). Limit: 40 persons.

On this field trip we will study the different facies of the Albian sedimentary deposits (Fredericksburg Division of the Comanchean Series), cropping out along the Balcones fault zone from Fort Worth to Austin. The visit to these out-

REGISTRATION FEES

	Advance (by Jan. 20)	On-Site	One-Day Advance	One-Day On-Site
Professional—Member	\$50	\$60	\$35	\$40
Professional—Nonmember	\$65	\$75	\$35	\$40
Student—Member	\$25	\$30	N/A	N/A
Student—Nonmember	\$30	\$35	N/A	N/A
Secondary School Teacher	\$12	\$14	N/A	N/A
Guest	\$12	\$12	N/A	N/A
Nonregistrant Fee (Field Trips and Short Courses)	\$10			

crops will illustrate the systematic change of facies from shales and fossiliferous limestones characteristic of the East Texas Embayment to rudist reefs, grainstone shoals, and bank interior facies (Edwards) characteristic of the Comanche platform. In addition, during this two-day excursion, we will tie these facies types to sea-level fluctuations, identify the key fossils that have served as the biostratigraphic framework for these deposits, and integrate these commercially important strata into a more regional paleogeographic model.

2. **NASA Johnson Space Center** (1 day). Saturday, February 22. The trip will depart at 8:00 a.m. by bus from the Rice University stadium parking lot and return at approximately 3:00 p.m. J. W. Dietrich and D. L. Amsbury (Solar System Exploration Division, NASA Johnson Space Center, Houston). Fee: \$18/person (includes bus transportation and refreshments). Participants will purchase their own lunches at the NASA cafeteria. Each must be a U.S. citizen or present a valid green card for admission to NASA. Limit: 45 persons.

This trip centers around a slide presentation of space images and discussions of the lunar rock samples. The leaders will present information derived from lunar rock samples, surface observations, and experiments emplaced on the lunar surface by the Apollo crews. The trip will begin in the Lunar Sample Building at the NASA Johnson Space Center; then we will visit the museum and observation room and discuss lunar rocks on display and equipment used in the Lunar Sample Laboratory. The tour will conclude with a visit to Mission Control Center.

3. **United Salt Corporation Hockley Mine, Hockley, Texas** (1 day). Saturday, February 22 (two sessions: 5:30 a.m.–11:00 a.m. and 8:15 a.m.–1:30 p.m.). The trip will depart by van from the Rice University stadium parking lot and return in late morning or early afternoon. D. Wilson (United Salt Corporation) and J. McCartney (Texas Brine Corporation). Fee: \$50/person (includes transportation, breakfast with first session, lunch with second session, refreshments, and guidebook materials). Limit: 20 persons (10 per session).

The Hockley Mine is a salt dome located 31 miles from Houston where rock salt is mined at the 1500 ft level. The trip will descend into the mine via a cage on a hoist, to view the various mining operations and salt dome structures. Sample collecting will be permitted at one pillar where large recrystallized salt is found. The participants will receive a safety orientation prior to entering the mine. Casual attire suitable for mine walking is recommended. Since December through February is traditionally the busiest time of year for the mine, United Salt Corporation reserves the right to cancel the visits in case of an emergency. In this event, registration fees will be refunded.

4. **Recent Sediments of Southeast Texas** (1 day). Saturday, February 22. The trip will depart at 7:30 a.m. by bus from the Rice University stadium parking lot and return in the afternoon. R. J. Leblanc, Sr. (Rufe Leblanc School of Clastic Sediments, Houston). Fee: \$40/person (includes trans-

portation, guidebooks, lunch, and refreshments). Limit: 45 persons.

On this trip we will examine meandering stream sediments of the Brazos River and shoreline processes on the Galveston Barrier Island complex. The trip offers an insight into the history of fluvial and deltaic sedimentology and a colorful history of petroleum exploration in the Gulf Coast. Discussions will focus on engineering, environmental, and petroleum exploration aspects of Gulf Coast sedimentary processes. Casual attire is recommended; some light walking is involved. The trip will proceed to Richmond, stop for lunch in West Columbia, and continue to Galveston Island, returning to Rice University in the afternoon.

5. **Holocene Sea-level Rise and Its Impact on Evolution of East Texas Coastal Environments** (1 day). Sunday, February 23. The trip will depart at 8:00 a.m. by van from the parking lot of the Department of Geology and Geophysics, Rice University, and return at approximately 6:00 p.m. J. B. Anderson and F. Siringan (Rice University). Fee: \$40/person (includes transportation, box lunch, and guidebook). Limit: 20 persons.

This trip focuses on the area between Sabine Pass and the Brazos River, including the adjacent continental shelf. More than 300 sediment cores and approximately 3000 km of high-resolution seismic reflection profile data have been acquired on the continental shelf and within Sabine Lake, East Bay, Galveston Bay, and West Bay. These data provide a framework for reconstructing the Holocene evolution of coastal environments. Emphasis will be on the response of coastal systems to the rapid and episodic sea-level changes. Sediment cores provide a record of the response of coastal environments to previous sea-level events.

6. **Environmental/Engineering Geology in the Houston Metropolitan Area** (1 day). Sunday, February 23. The trip will depart at 8:00 a.m. by bus from the Rice University stadium parking lot and return in the afternoon. C. E. Norman (University of Houston) and S. Aronow (Lamar University, Beaumont). Fee: \$40/person (includes transportation, lunch, refreshments, and guidebook). Limit: 45 persons.

This trip will view and discuss active surface faults, flood-control structures, an operating landfill, and urban hazardous waste sites in the Houston metropolitan area. Casual attire is recommended; some light walking is involved.

Postmeeting

7. **Paleogene Sequence Stratigraphy of the Brazos River Valley, Texas** (1 day). Wednesday, February 26. The trip will depart at 7:30 a.m. and return at 6:00 p.m. T. E. Yancey (Texas A&M University), P. R. Vail (Rice University), and A. Davidoff (Texas A&M University). Fee: \$50/person (includes transportation, guidebook, lunch, and refreshments). Limit: 45 persons

This trip will examine the Paleocene and Eocene section in central Texas present in outcrops along the Brazos River valley which consists of marine-dominated intervals alternating with nonmarine-dominated intervals. Sediments were deposited in a

variety of inner shelf, nearshore, and coastal plain environments; most units were deposited in shallow marine and coastal plain settings. Sequence units, unconformities, and flooding horizons will be examined during the trip, and comparisons will be made to sequence stratigraphies established for lower Tertiary sections in other parts of the Gulf Coast region and to the composite stratigraphy. The Brazos River valley section exposes a more updip, shallower section than other Paleogene sections used in sequence stratigraphy studies.

8. **Modern Mixed Carbonate/Siliciclastic Systems, Belize** (6 days). Departure: Wednesday, February 26, 8:00 a.m. from Houston Intercontinental Airport. Return Houston Intercontinental late afternoon, Monday, March 2. A.W. Droxler (Rice University). Fee: \$850/person (includes transportation, lodging, meals, and guidebook). Limit: 16 persons.

Participants in this trip will start at Houston Intercontinental Airport Wednesday morning (February 26) with a scheduled flight to Belize, a charter flight to Dangriga, and a boat trip to South Water Cay; visit and snorkel in mangrove island tidal channel, back-barrier reef, and lagoon carbonate environments (February 27); snorkel along a transect through the barrier reef and patch reefs in the back-barrier reef (February 28); snorkel in rhomboid (micro-atoll) reefs (February 29); snorkel along the coastline to study the mixed siliciclastic carbonate system (March 1); board a morning overflight and return to Houston in the late afternoon (March 2). Four nights will be spent on South Water Bay (primitive lodging and local cuisine) and one night at the Pelican Beach Resort in Dangriga. Good physical condition is necessary for daily swimming and snorkeling. Passports are required.

SHORT COURSES

Short courses will be held on Saturday and Sunday, February 22 and 23, in the Department of Geology and Geophysics on the Rice campus. Pre-registration is required. Use the form provided with this announcement.

PREREGISTRATION DEADLINE: January 20, 1992. Participants registering for a Short Course *only* must pay a \$10 service fee in addition to the Short Course fee.

CANCELLATION DEADLINE: January 27, 1992. Cancellation must be in writing. If the short course is canceled by GSA due to registration requirements or other difficulties, a full refund will be made after the meeting.

1. **Geologic Interpretation of Seismic Profiles** (2 days, February 22–23). A. W. Bally (Rice University), M. O. Withjack (Mobil Research and Development, Dallas), and K. E. Meisling and D. A. Fisher (ARCO Oil and Gas Co., Dallas). Fees: Professionals \$120; Students \$60 (*faculty and students have priority*). Limit: 20 persons.

A series of seismic profiles across extensional and compressional structures will be interpreted and discussed.

2. **Geochronology and Thermochronology** (1 day, February 23). J. E. Wright (Rice University), P. Copeland (University of Houston), and K. A. Hagerty (Geotrack International, Houston). Fees: Professionals \$60; Students \$30. Limit: 75

advertisement

CHEMISTS — ENGINEERS — PHYSICISTS MATHEMATICIANS — OPERATIONS RESEARCH ANALYSTS INTERNATIONAL RELATIONS SPECIALISTS STATISTICIANS — ECONOMISTS — GEOPHYSICISTS

Under its William C. Foster Fellows Visiting Scholars program, named in honor of its first director, the U. S. Arms Control and Disarmament Agency offers an opportunity for scholars in these and other disciplines to apply their expertise to reduction and control of armaments to increase world security. During the 1992-93 academic year scholars could participate in such ACDA activities as devising treaty provisions that permit adequate verification, evaluating data relating to compliance with treaties in force, performing arms control research, estimating the effect of treaty proposals on the strategic and conventional military balance, supporting inter-agency development of arms control policy, exploring possibilities for reducing nuclear weapon proliferation and third world instability, taking part in international negotiations on arms control, and implementing ratified arms control treaties.

Visiting scholars must be citizens of the United States and on the faculty of a recognized institution of higher learning. For information call (202) 647-4695 or write to: Foster Fellows Visiting Scholars Program, Operations Analysis, Room 5726, Arms Control and Disarmament Agency, 320 21st Street, NW, Washington, DC 20451. Application deadline is January 31, 1992.

WILLIAM C. FOSTER FELLOWS VISITING
SCHOLARS PROGRAM, U.S. ARMS CONTROL
AND DISARMAMENT AGENCY
—AN EQUAL OPPORTUNITY EMPLOYER—

The application of U-Pb, Ar-Ar, and fission track dating to tectonics, crustal evolution, and thermal histories will be discussed.

PROJECTION EQUIPMENT

All slides must be 2" x 2" and fit into a standard carousel tray. Two slide projectors, one overhead projector, and two screens will be provided in each technical session. Please bring your own loaded carousel trays, if at all possible. A speaker-ready room equipped with projectors will be available for review and practice.

POSTER SESSIONS

Poster sessions will be held in the Farnsworth Pavilion of the Rice Memorial Center. If you wish to present a poster, be sure to indicate this on the GSA abstract form. Each poster presenter will have two boards, each approximately 6' x 5'.

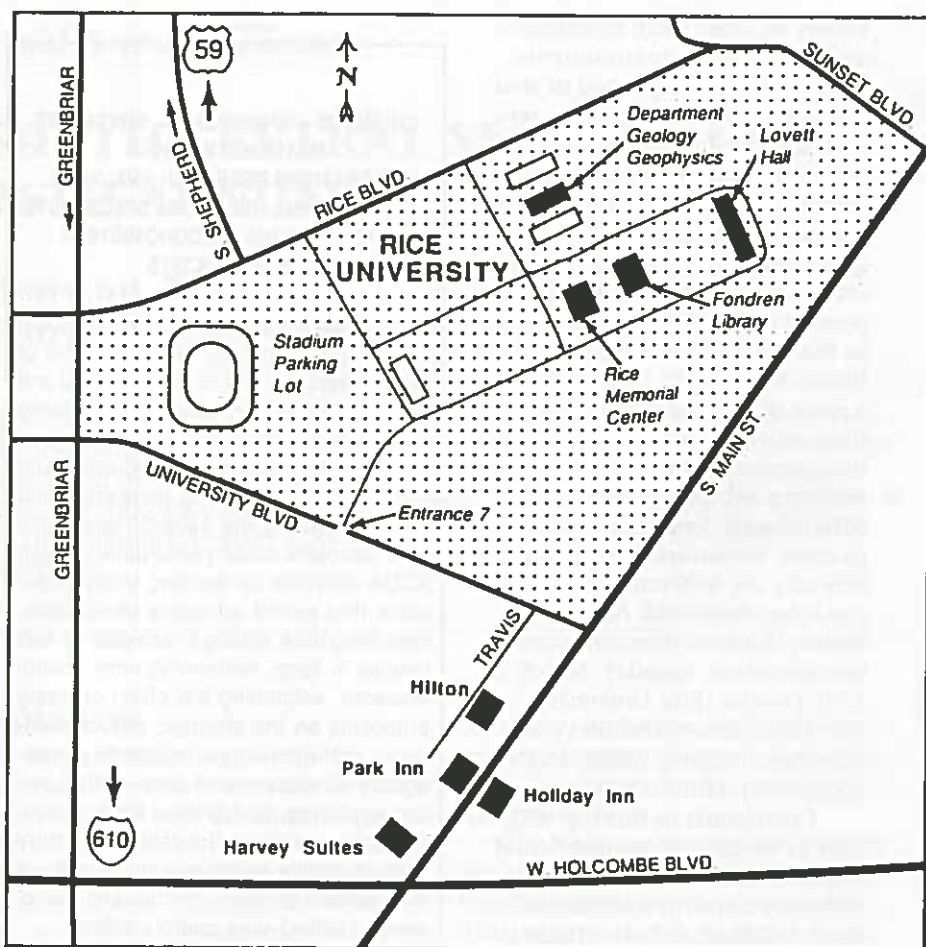
EXHIBITS

Exhibits of interest to professional and academic geologists will be located in the Rice Memorial Center. If you are interested in having an exhibit, contact William K. Peebles, Texas Gas Corporation, Houston, TX 77010; (713) 951-3526.

STUDENT AWARDS

Three cash awards (\$200, \$100, and \$50) will be presented for the best student papers. Awards for outstanding papers will be based on quality of research and effectiveness of presentation. To be eligible, the abstract form may list only students as authors and must identify the abstract as a student paper. For further information contact André W. Droxler, Department of Geol-

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South-Central continued from p. 255

ogy and Geophysics, Rice University, Houston, TX 77251-1892.

STUDENT SUPPORT

Funds are available for grants to GSA Student Associates of the South-Central Section who are giving oral or poster presentations. Students are encouraged to apply for these grants, and we hope to give some degree of support to most students who qualify. Application letters are to be sent to André W. Droxler, Department of Geology and Geophysics, Rice University, Houston, TX 77251-1892. Applications should include a copy of the abstract and certification that the student is a GSA Student Associate of the South-Central Section. Application letters must be received by *January 20, 1992*.

SPECIAL EVENTS

Welcoming Party. A welcoming party will be held in the Ballroom (P-1 Level) of the Holiday Inn—Medical Center on Sunday, February 23, from 5:30 to 8:00 p.m. There will be a partially hosted bar, and light snacks will be served. *Note: Only persons who have preregistered will be able to attend this event.*

Daily Lunches. There are restaurants and cafes in the Rice Village west of campus, and along Main Street south of campus, but these are normally busy, and a car is suggested. Why not join us for lunch at noon on campus at the Grand Hall of the Rice Memorial Center? Monday will be a Mexican buffet, complete with fajitas and guacamole. Tuesday will be good ol' South Texas barbecue. Purchase tickets on the preregistration form for \$7 (preregistration required).

Paleontological Society Luncheon. The South-Central Section of the Paleontological Society will have a luncheon at noon on Monday, February 24, in Cohen House, the Rice Faculty Club. The annual business meeting will follow immediately. For more information contact Glen K. Merrill, University of Houston Downtown, Department of Natural Sciences, Houston, TX 77002; (713) 221-8168. Purchase tickets on the preregistration form for \$11 (preregistration required).

Monday Reception. On Monday, from 5:00 to 6:30 p.m. there will be a hosted reception in the Ray Courtyard of the Rice Memorial Center, Rice University (Grand Hall in case of rain). Come discuss the problems of geology with your friends over a cold beer.

Banquet. A special banquet will be held in the Cohen House, the Rice Faculty Club, on Monday evening, February 24, with a cash bar beginning at 6:30 p.m., dinner at 7:00. Do not miss our special speaker, Kevin C. Burke, Director of the Board of Earth Sciences and Resources, National Research Council, Washington, D.C., who will speak on Opportunities in the Solid Earth Sciences. Purchase tickets on the preregistration form for \$22.50 (preregistration required).

NAGT Luncheon. The South-Central Section of the National Association of Geology Teachers will have a luncheon at noon on Tuesday, February 25, in Cohen House, the Rice Faculty Club. The annual business meeting will follow immediately. For more information, contact Donald F. Reaser, Department of Geology, University of Texas, Arlington, TX 76019; (817) 273-2987. Purchase tickets on the preregistration form for \$11 (preregistration required).

Dinner Meeting—GSA International Division and Houston Geological Society International Explorationists. On Tuesday, February 25, there will be a joint meeting of the GSA International Division and the Houston Geological Society International Explorationists group. The guest speakers are Leigh H. Royden and B. Clark Burchfiel of Massachusetts Institute of Technology. Their presentation on Eastern European Folded Belts will include highlights of the GSA Symposium on Comparison of North American and Eastern European Folded Belts, which will be held on Tuesday. The dinner will be at the Doubletree Hotel on Post Oak Boulevard (maps will be provided for out-of-town registrants). Cash bar is at 5:30 p.m. and dinner at 6:30 p.m. For more information, contact Pinar O. Yilmaz, EXXON Production Research Company, Houston, TX 77252; (713) 973-3070. Purchase tickets on the preregistration form for \$21 (preregistration required).

TRANSPORTATION

Travel. Houston is served by two airports: Houston Intercontinental on the north side and William P. Hobby on the near southeast side (see Houston map). There is limousine service from both airports. The Airport Express from Houston Intercontinental leaves every 30 minutes; after approximately 45 minutes, it arrives in the terminal at Greenway Plaza. The cost is \$8.70. In addition, you will need a taxi to your hotel, which will be another \$8. The Hobby Airport Limousine Service runs every half-hour and takes approximately 30 minutes to reach the Medical Center area. The terminal is at the Harvey Suites Hotel (see hotel map). The cost is \$5. Taxis direct from Intercontinental Airport are \$31.50 and from Hobby Airport they are \$18.

Parking. There will be free parking in the Rice Stadium lot. A Rice shuttle bus will run between the parking lot and the Rice Memorial Center. All other lots on campus are reserved for faculty, staff, and students.

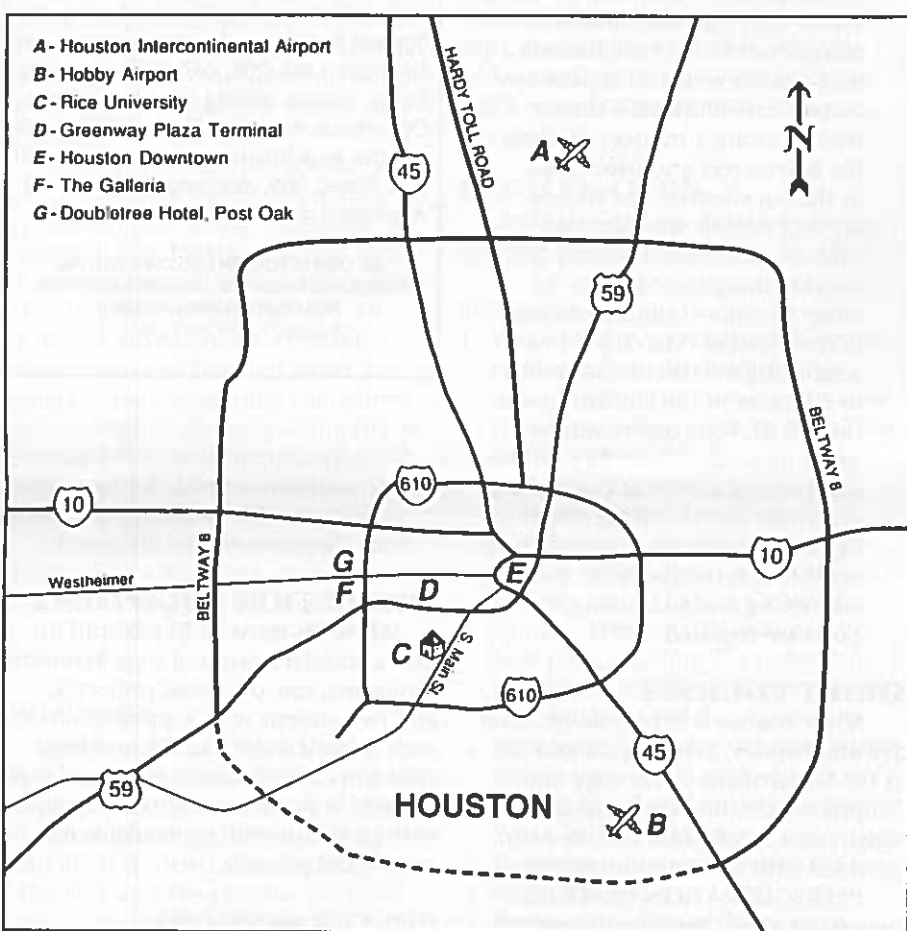
ENTERTAINMENT

Houston Livestock Show and Rodeo. A block of tickets has been reserved for the Rodeo in the Astrodome on Sunday, February 23, at 1:00 p.m. A ticket includes admission to the livestock show that begins at 10:00 a.m. Headline entertainers are not announced until mid-January but in the past have included such stars as George Strait, Charley Pride, Reba McEntire, and Clint Black. Tickets will be mailed to you in advance. Purchase tickets on the preregistration form for \$12 (preregistration required).

Houston Museum of Natural Science. The nearby Museum of Natural Science has many exciting exhibits, including the Ann and Perkins Sams Collection of Gems and Minerals and the Strake Hall of Malacology. A major traveling show from the Los Angeles Art Museum, Treasures of the Tar Pits, will be on display in February. A second special exhibit, Essence of Mexico, will also be at the Museum.

Located in the Museum are the Burke Baker Planetarium and the Wortham IMAX Theatre. *Blue Planet*, photographed by space shuttle crews, is currently scheduled through early February and may be extended.

The museum is open from 9:00 a.m. to 6:00 p.m. Monday through Saturday, and from noon to 6:00 p.m. Sunday. The IMAX shows are hourly from 10:00 a.m. to 8:00 p.m. Monday through Thursday; 10:00 a.m. to 9:00 p.m. Fri-



HOTELS

HOLIDAY INN—MEDICAL CENTER \$50 per room
6701 South Main Street
(713) 797-1110 • (800) HOLIDAY
All rooms contain two double beds

HOUSTON PLAZA HILTON \$62 per one-bedroom suite
6633 Travis
(713) 524-6633 • (800) HILTONS
Suites have two double beds and sofa-sleeper, plus kitchenettes

HARVEY SUITES
6800 Main Street
(713) 528-7744 • (800) 922-9222
\$55 per room (two queen beds)
\$60 per guest suite (queen bed and kitchenette)
\$70 per master suite (open plan room with king bed, queen sofa-bed and kitchenette)
\$75 per two-room suite with kitchenette

PARK INN INTERNATIONAL \$39 per room
6700 South Main
(713) 522-2811 • (800) 437-PARK
All rooms contain two double beds

Note: There is a 15% hotel tax

day; 10:00 a.m. to 10:00 p.m. Saturday; and 11:00 a.m. to 8:00 p.m. Sunday. Planetarium shows are mostly on the hour during museum hours. There are rock laser shows in the planetarium on Friday and Saturday evenings.

Museum of Fine Arts, Houston. This first art museum founded in Texas has a collection of over 27,000 works and ranks as the largest and most outstanding in the Southwest. Highlights include the Straus collection of Renaissance and 18th century works, the Beck collection of impressionist and post-impressionist art, and works by post-World War II American artists.

Special exhibits during February will be *On the Edge of the Maya World: Stone Vases from the ULUA Valley, Honduras, and Felix Vallotton: A Retrospective*, organized by the Yale University Art Gallery.

The museum is open 12:15 to 6:00 p.m. Sunday, and 10:00 a.m. to 5:00 p.m. Tuesday through Saturday. The museum is closed on Monday.

BUSINESS MEETINGS

GSA South-Central Section Management Board. The GSA South-Central Section Management Board will meet on Sunday, February 23, at 4:30 p.m. in the Conference Room of the Department of Geology and Geophysics at Rice University.

GSA South-Central Section Business Meeting. The GSA South-Central Section annual business meeting will be on Monday, February 25, at 5:00 p.m. in Room 106 of the Department of Geology and Geophysics at Rice University.

South-Central Section Paleontological Society. See Special Events.

South-Central Section NAGT. See Special Events.

GUEST PROGRAM

We are looking forward to seeing you in Houston. We have a variety of planned activities for your enjoyment.

Monday, February 24, we will visit **Sam Houston Park**, where the Heritage Society Docents will give us a guided tour of seven homes dating from 1823 (Old Place) through 1905 (Statti House), plus St. John's Church, which was built in 1891. We will then have a casual lunch in the Tea Room. There will be time to browse in the Heritage Shop for unusual books, crafts, and Texan gifts. Cost: \$15.

Monday, February 24, or Tuesday, February 25, **The Galleria** (300 shops plus movies, ice skating, and restaurants) opens at 10:00 a.m. and for a small fee you may take the Rice van there to shop on your own on either day. Cost: \$4.

Tuesday, February 25, there will be a tour of **Rice University** and you will be able to view India Along the Ganges, photographs by Rughubir Singh from the Smithsonian Institution's traveling exhibition. Cost: \$2.

Directly following the Rice University tour you can leave to have an elegant lunch at the **Manor House**, the former home of President and Mrs. George Bush. Wear your walking shoes. After lunch we will take you to The Galleria for several hours of shopping, or we will return you to the hotel. Cost: \$23.

1991 GSA SHORT COURSE NOTES FOR SALE



A limited supply of short course notes is available from some of the courses presented at the San Diego Annual Meeting. Prices range from approximately \$19 to \$25 per copy. Credit cards are gladly accepted.

A list of available titles and prices will appear in the December issue of *GSA Today*, but if you would like this information now, please call:

Edna A. Collis
Meetings Department
1-800-472-1988

For those who would like to explore Houston on their own, there will be a table for brochures and a person to assist you each day from 8:30 a.m. to 11:30 a.m. on the P-1 level of the Holiday Inn—Medical Center.

All guest events will originate from the Holiday Inn.

ADDITIONAL INFORMATION

For additional information concerning the program, please contact

Hans G. Avé Lallemand, general chairman, or James E. Wright, program chairman at Rice University, Department of Geology and Geophysics, P.O. Box 1892, Houston, TX 77251-1892; (713) 527-4880. Questions concerning housing, entertainment, guest activities, and other local arrangements may be addressed to Martha Lou Broussard at the same address and number. ■

PREREGISTRATION FORM South-Central Section, GSA February 23-25, 1992

Please print or type • Copy for your records • Shaded areas are for your badge.

IMPORTANT

1. Full payment must accompany registration. Unpaid purchase orders not accepted as valid registration.
2. Use separate form for each registrant, professional or student.
3. PREREGISTRATION MUST BE POSTMARKED NO LATER THAN MONDAY, JANUARY 20, 1992. Cancellation deadline for full refund is January 27, 1992.
4. For registration information, please call the GSA registration coordinator at (303) 447-2020.

Name (Last) _____ (First) _____ Initial _____
 Employer/University/Affiliation (for badge) _____
 Mailing address of affiliation indicated above _____
 Address _____
 City _____ State _____ ZIP code _____
 Work Phone _____ Home Phone _____ Fax _____
 Guest/Spouse Name (Last) _____ (First) _____
 City _____ State/Country _____

Membership Affiliation A GSA Member No. _____ B NAGT C PS D AWG E HGS

PREREGISTRATION FEES (Registration required for participation in all exhibits and technical sessions.)	(PLEASE CHECK ONE):		Qty	Col. A Amount
	Full Meeting	or 1 Day		
Professional Member	(1) \$50 <input type="checkbox"/>	(2) \$35 <input type="checkbox"/>	1	\$ _____
Professional Nonmember	(3) \$65 <input type="checkbox"/>	(4) \$35 <input type="checkbox"/>	1	\$ _____
Student Member	(5) \$25 <input type="checkbox"/>	N/A	1	\$ _____
Student Nonmember	(7) \$30 <input type="checkbox"/>	N/A	1	\$ _____
Guest (fill in name above for badge)	(9) \$12 <input type="checkbox"/>	N/A	1	\$ _____
Secondary School Teacher	(42) \$12 <input type="checkbox"/>	N/A	1	\$ _____
For field trips and short courses only				
—Nonregistrant fee	(98) \$10 <input type="checkbox"/>	N/A	1	\$ _____
			Total Column A	\$ _____

- To help us with scheduling of symposia, circle which symposia (up to four) you would like to attend:
1. Tectonics and Evolution of the Gulf of Mexico
 2. Late Pleistocene-Holocene Climate Record of the Gulf Coast
 3. Comparison of North American and Eastern European Folded Belts
 4. Response of Carbonate Platform to Sea-level Fluctuation: Cases in the Caribbean and the Gulf of Mexico
 5. Sequence Stratigraphy of the Gulf Coast Paleogene: A Global Comparison
 6. Evolution of Grenville Basement
 7. Hydrogeologic Controls on Contaminant Transport
 8. Mesozoic/Cenozoic Micropaleontology
 9. The Role of Planetary Geology in the Undergraduate Geology Curriculum
 10. Magellan to Venus

Preregistration is required for *all* events below.

		Qty	Col. B Amount
FIELD TRIPS	1. Mid-Cretaceous Carbonates in Central Texas, Feb. 21-23	(100)	\$110.00
	2. NASA Johnson Space Center, Feb. 22	(101)	\$ 18.00
	3. a. United Salt Corporation Hockley Mine, Feb. 22, 5:30 a.m.	(102)	\$ 50.00
	b. United Salt Corporation Hockley Mine, Feb. 22, 8:15 a.m.	(103)	\$ 50.00
	4. Recent Sediments of Southeast Texas, Feb. 22	(104)	\$ 40.00
	5. Holocene Sea-level Rise & Its Impact on Evolution of East Texas Coastal Environments, Feb. 23	(105)	\$ 40.00
	6. Environmental/Engineering Geology in the Houston Metropolitan Area, Feb. 23	(106)	\$ 40.00
	7. Paleogene Sequence Stratigraphy of the Brazos River Valley, Texas, Feb. 26	(107)	\$ 50.00
SHORT COURSES	8. Modern Mixed Carbonate-Siliclastic Systems, Belize, Feb. 26-Mar. 2	(108)	\$850.00
	1. Geologic Interpretation of Seismic Reflection Profiles, Feb. 22-23		
SPECIAL EVENTS	Professionals	(150)	\$120.00
	Students	(151)	\$ 60.00
LUNCH	2. Geochronology and Thermochronology, Feb. 23		
	Professionals	(152)	\$ 60.00
GUEST EVENTS	Students	(153)	\$ 30.00
	1. Houston Livestock Show and Rodeo, Feb. 23	(40)	\$ 12.00
	2. Paleontological Society Luncheon, Feb. 24	(60)	\$ 11.00
	3. Banquet, Feb. 24	(61)	\$ 22.50
	4. NAGT Luncheon, Feb. 25	(62)	\$ 11.00
	5. GSA and HGS International Dinner, Feb. 25	(63)	\$ 21.00
	1. Feb. 24, Mexican food	lunch (64)	\$ 7.00
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	2. Tour of Rice University, Feb. 25	(21)	\$ 2.00
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GSA Penrose Conferences**March 1992**

Continental Tectonics and Magmatism of the Jurassic North American Cordillera, March 28–April 3, 1992, Lake Havasu City, Arizona. Information: David M. Miller, U.S. Geological Survey, 345 Middlefield Road, MS-975, Menlo Park, CA 94025; (415) 329-4923; fax 415-329-4936; or Richard M. Tosdal (same address); (415) 329-5423.

May 1992

The Origin and Evolution of the Coast Mountains, British Columbia, Yukon, and Alaska, May 16–22, 1992 (tentative), Whistler, British Columbia. Information: George E. Gehrels, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721; (602) 621-6026; fax 602-621-2672; Maria Luisa Crawford, Dept. of Geology, Bryn Mawr College, Bryn Mawr, PA 19010; (215) 526-5111; fax 215-526-5086; James W.H. Monger, Geological Survey of Canada, 100 West Pender Street, Vancouver, B.C. V6B 1R8, Canada; (604) 666-6743 or 0529; fax 604-666-1124.

September 1992

Applications of Strain: From Microstructures to Mountain Belts, September 8–12, 1992, Liscomb Mills, Nova Scotia, Canada. Information: Mark Brandon, Dept. of Geology and Geophysics, Yale University, P.O. Box 6666, New Haven, CT 06511-8130, (203) 432-3135; or Scott R. Paterson, Dept. of Geological Sciences, University of Southern California, Los Angeles, CA 90089-0740; (213) 740-6130.

October 1992

■ **Fluid-Volcano Interactions**, October 4–9, 1992, Kahneeta, Oregon. Information: Steve Ingebritsen, U.S. Geological Survey, MS 439, 345 Middlefield Road, Menlo Park, CA 94025; (415) 329-4422; fax 415-329-4463; Bruce Christenson, Geothermal Research Centre, Private Bag 2000, Taupo, New Zealand; Craig Forster, Dept. of Geology and Geophysics, University of Utah, 719 W.C. Browning Building, Salt Lake City, UT 84112; Grant Heiken, Los Alamos National Laboratory, MS-D462, Los Alamos, NM 87545; Craig Manning, Dept. of Earth and Space Sciences, University of California, 405 Hilgard Avenue, Los Angeles, CA 90024.

Other Meetings—1991**November**

Geological Association of New Jersey 8th Annual Meeting and Field Trip, November 1–2, 1991, King of Prussia, Pennsylvania. Information: Sue Halsey, 1 Heritage Court, West Trenton, NJ 08628; (609) 777-0339; fax 609-633-7950.

Hydrology and Hydrogeology in the '90s: Issues, Strategies and Technologies, November 3–7, 1991, Orlando, Florida. Information: AIH, 3416 University Ave. S.E., Minneapolis, MN 55414; (612) 379-1030.

Carolina Geological Society 1991 Field Conference, November 8–10, 1991, Murphy, North Carolina. Information: Stephen A. Kish, Dept. of Geology B-160, Florida State University, Tallahassee, FL 32306; (904) 644-2064.

5th International Circum-Pacific Terrane Conference, November 11–28, 1991, Santiago, Chile. Information: D. G. Howell, U.S. Geological Survey, MS 902, 345 Middlefield Rd., Menlo Park, CA 94025; (415) 329-5430.

Eastern Oil Shale Symposium, November 13–15, 1991, Lexington, Kentucky. Information: Geaunita H. Caylor, University of Kentucky/OISTL, 411 Breckinridge Hall, Lexington, KY 40506-0056; (606) 257-2820; fax 606-258-1049.

Ore Deposits and Exploration Potential of the Soviet Union, November 18–19, 1991, Golden, Colorado. Information: Poul Emsbo, Symposium chairman, CSM-SEG student chapter, Colorado School of Mines, Golden, CO 80401-1887; (303) 273-3859.

Clean Seas 91, International Conference on Marine Pollution, November 19–22, 1991, Valletta, Malta. Information: Lesley Ann Sandbach, Project Manager, Clean Seas 91, The Spearhead Group, Rowe House, 55-59 Fife Road, Kingston upon Thames, Surrey KT1 1TA, UK; phone 081 549 5831 (intl: +44-81-549-5831); telex 928042 SPEARS G; fax 081-541-5657 (intl: +44-81-541-5657).

Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection and Restoration, November 20–22, 1991, Houston, Texas. Information: Petroleum Hydrocarbons Conference/National Water Well Association, P.O. Box 182039, Dept. #017, Columbus, OH 43218; (614) 761-1711.

December

Paleozoic-Mesozoic Inversion Tectonics, Southern Africa, December 2–6, 1991, Cape Town, South Africa. Information: Maarten de Wit or Ian Ransome, Dept. of Geology, University of Cape Town, Rondebosch 7700, South Africa; phone 021-6502921/25; fax 021-6503783.

IGCP 264 Remote Sensing Spectral Properties (5th Meeting)—Geological Applications of Remote Sensing with Emphasis on Spectral Properties, December 2–12, 1991, Pune, India. Information: Melvin Podwysocki, Co-Chairman IGCP264, USGS, National Center, MS 913, Reston, VA 22092; fax 703-648-6057.

■ **Third Conference on Hydrogeology, Ecology, Monitoring, and Management of Ground Water in Karst Terranes**, December 4–6, 1991, Nashville, Tennessee. Information: National Water Well Association, 6375 Riverside Drive, Dublin, OH 43017; (614) 761-1711.

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

■ **Second Forum for Continental Scientific Drilling**, December 8, 1991, San Francisco, California. Information: John C. Eichelberger, chairman, Geophysical Institute, University of Alaska, Fairbanks, AK 99775-0800; (907) 474-5530; fax 907-474-7290.

American Geophysical Union Fall Meeting, December 9–13, 1991, San Francisco, California. Information: 1991

Fall Meeting, American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 20009.

1992**February**

6th International Symposium on Landslides, February 10–14, 1992, Christchurch, New Zealand. Information: ISL 1992 Secretariat, c/o Guthreys Pacific Ltd., P.O. Box 22-255, Christchurch, New Zealand; fax 643-790-175; telex NZ4243 Guthreys.

U.S. Geological Survey 8th Annual McKelvey Forum on Energy Resources, February 18–20, 1992, Houston, Texas. Information: Christine Turner, USGS, Box 25046 MS 939, Federal Center, Denver, CO 80225; (303) 236-1561.

First South Asia Geological Congress—GEOSAS-I, February 23–27, 1992, Islamabad, Pakistan. Information: Hilal A. Raza, GEOSAS-I Secretary General, Hydrocarbon Development Institute of Pakistan, P.O. Box 1308, Islamabad, Pakistan; phone 9251-823690 or 821417; telex 5516 HDIP PK; fax 9251-828773.

GSA South-Central Section Meeting, February 24–25, 1992, Houston, Texas. Information: Hans G. Avé Lallemant, Dept. of Geology and Geophysics, P.O. Box 1892, Rice University, Houston, TX 77251; (713) 527-4889. (Abstract deadline: November 6, 1991.)

Society for Mining, Metallurgy, and Exploration Annual Meeting, February 24–27, 1992, Phoenix, Arizona. Information: Meetings Department, SME, P.O. Box 625002, Littleton, CO 80162; (303) 973-9550; fax 303-979-3461.

March

21st Computer Simulated Mineral Exploration Workshop, March 3–30, 1992, Fontainebleau, France. Information: L. Zanone, Ecole des Mines de Paris, CGGM-IGM, 35, rue Saint-Honoré, 77305 Fontainebleau Cédex, France; phone (33 1) 64 69 49 30; telex 694 736 F; fax (33 1) 64 69 47 01.

Circum-Pacific Council for Energy and Mineral Resources Symposium, Sustainable Development: Energy and Mineral Resources and the Environmental Impact of Their Utilization in the Circum-Pacific Region, March 9–12, 1991, Bangkok, Thailand. Information: Mary Stewart, Circum-Pacific Council, 5100 Westheimer, Suite 500, Houston, TX 77056; fax 713-622-5360.

■ **GSA Southeastern Section Meeting**, March 18–20, 1992, Winston-Salem, North Carolina. Information: Paul D. Fullager, Dept. of Geology, CB 3315 Mitchell Hall, University of North Carolina, Chapel Hill, NC 27599-3315; (919) 962-0677. (Abstract deadline: November 6, 1991.)

AGU Chapman Conference on Climate, Volcanism, and Global Change, March 23–27, 1992, Hilo, Hawaii. Information: Stephen Self, Dept. of Geology and Geophysics, University of Hawaii at Manoa, Honolulu, HI 96822; or Richard P. Turco, Dept. of Atmospheric Sciences, University of California, Los Angeles, CA 90024-1565.

Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, March 25–28, 1992, Hayward, California. Information: Sue Ellen Hirschfeld, Dept. of Geological Sciences, California State University, Hayward, CA 94542; (415) 881-3486.

■ **GSA Northeastern Section Meeting**, March 26–28, 1992, Harrisburg, Pennsylvania. Information: Donald M. Hoskins, Pennsylvania Geological Survey, Dept. of Environmental Resources, P.O. Box 2357, Harrisburg, PA 17105; (717) 787-2169. (Abstract deadline: December 5, 1991.)

Structural Styles in the Southern Midcontinent, March 31–April 1, 1992, Norman, Oklahoma. Information: Kenneth S. Johnson, Oklahoma Geological Survey, University of Oklahoma, 100 East Boyd, Rm. N-131, Norman, OK 73019; (405) 325-3031.

April

XVII General Assembly of the European Geophysical Society, April 6–10, 1992, Edinburgh, Scotland. Information: EGS Office, Postfach 49, 3411 Katlenburg-Lindau, Germany; phone (49) 5556-1440; fax 49-5556-4709; telex 965564 zil d; E-mail SPAN: LINMPI::EGS; EARN: U0085@DGOGWDG5.

1992 SEPM Permian Basin Section Annual Fieldtrip, Paleokarst, Karst-related Diagenesis, and Reservoir Development: Examples from Ordovician-Devonian–Age Strata of West Texas and the Mid-Continent, April 9–11, 1992. Information: Magell Candelaria, Arco Oil & Gas Co., P.O. Box 1610, Midland, TX 79702; (915) 688-5254; fax 915-688-5756.

American Association of Petroleum Geologists Southwest Section, April 12–14, 1992, Midland, Texas. Information: West Texas Geological Society, P.O. Box 1595, Midland, TX 79702; (915) 683-1573. (Abstract deadline: December 1, 1991.)

1992 International High-Level Radioactive Waste Management Conference, April 12–16, 1992, Las Vegas, Nevada. Information: James Tulenko, Attn: TRANSACTIONS Office, American Nuclear Society, 555 N. Kensington Avenue, La Grange Park, IL 60525.

Fifth Annual Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP), April 26–29, 1992, Oakbrook, Illinois. Information: Mark Cramer, 11100 E. Dartmouth Ave., Suite 190, Aurora, CO 80014; (303) 752-4951.

■ **GSA North-Central Section Meeting**, April 30–May 1, 1992, Iowa City, Iowa. Information: Raymond R. Anderson, Iowa DNR, Geological Survey, University of Iowa, 123 N. Capital St., Iowa City, IA 52242; (319) 335-1575. (Abstract deadline: December 30, 1991.)

May

First Canadian Symposium on Geotechnique and Natural Hazards, May 6–9, 1992, Vancouver, British Columbia. Information: Organizing Secretary, Geohazards '92, 970 Burrard St., Vancouver, BC V6Z 1Y3, Canada; (604) 663-1651; fax 604-663-1940.

Institute on Lake Superior Geology Annual Meeting, May 7–9, 1992, Hurley, Wisconsin. Information: Albert B.

Dickas, 203 Administration, University of Wisconsin-Superior, Superior, WI 54880; (715) 394-8311; fax 715-394-8107.

Third Goldschmidt Conference, May 8-10, 1992, Reston, Virginia. Information: Bruce R. Doe, U.S. Geological Survey, 923 National Center, Reston, VA 22092; (703) 648-6205; fax 703-648-6191.

Lower Palaeozoic of Ibero-America (International Conference, IGCP-IUGS/UNESCO) and International Workshop: Natural Resources of the Circum-Gondwanan Lower Palaeozoic, May 8-12, 1992, Mérida, Spain. Information: Juan Carlos Gutiérrez-Marco, Instituto de Geología Económica, Facultad de Ciencias Geológicas, 28040-Madrid, Spain; fax 34-1-5439162.

GSA Cordilleran Section Meeting, May 11-13, 1992, Eugene, Oregon. Information: A. Dana Johnston, Dept. of Geological Sciences, University of Oregon, Eugene, OR 97403-1272; (503) 346-5588. (Abstract deadline: January 21, 1992.)

GSA Rocky Mountain Section Meeting, May 13-15, 1992, Ogden, Utah. Information: Sidney R. Ash, Dept. of Geology, Weber State University, Ogden, UT 84408-2507; (801) 626-6908. (Abstract deadline: January 29, 1992.)

International Congress on Technology and Technology Exchange, May 13-15, 1992, Evry, France. Information: Janet Weisgerber, (412) 391-2913, or Ruby Glasgow, (412) 795-5300, 7125 Saltsburg Rd., Pittsburgh, PA 15235-2297; fax 412-795-5302.

Pan-American Current Research on Fluid Inclusions (PACROFI IV), May 22-24, 1992, Lake Arrowhead, California. Information: Michael A. McKibben, Department of Earth Sciences, University of California, Riverside, CA 92521-0423; (714) 787-3444; fax 714-787-4324. (Abstract deadline: March 1, 1992.)

The Euramerican Coal Province: Controls on Tropical Peat Accumulation in the Late Paleozoic, May 24-27, 1992, Wolfville, Nova Scotia, Canada. Information: John H. Calder, Nova Scotia Dept. of Mines and Energy, P.O. Box 1087, Halifax, Nova Scotia B3J 2X1, Canada; (902) 424-5364; fax 902-424-0528; or Martin R. Gibling, Dept. of Geology, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada; (902) 494-2355.

Project PANGEA (GSGP) Research Workshop, May 24-29, 1992, Lawrence, Kansas. Information: Project Pangea, P.O. Box 5061, Station A, Champaign, IL 61825-5061; (217) 333-2076.

Geological Association of Canada/Mineralogical Association of Canada Joint Annual Meeting, May 25-27, 1992, Wolfville, Nova Scotia, Canada. Information: Aubrey Fricker, General Secretary, Atlantic Geoscience Centre, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2, Canada; (902) 426-6759; fax 902-426-4465.

Third International Conference on Engineering, Construction and Operations in Space, May 31-June 4, 1992, Denver, Colorado. Information: Stein Sture, SPACE 92 Technical Co-

Chairman, Dept. of Civil, Environmental, & Architectural Engineering, University of Colorado, Boulder, CO 80309-0428; (303) 492-7651; fax 303-492-7317.

June

33rd U.S. Symposium on Rock Mechanics, June 8-10, 1992, Santa Fe, New Mexico. Information: Wolfgang R. Wawersik, Geomechanics Division 6232, Sandia National Laboratories, Albuquerque, NM 87185; (505) 844-4342; fax 505-844-7354.

6th Symposium on the Geology of the Bahamas, June 11-15, 1992, Bahamian Field Station, San Salvador, Bahamas. Information: Donald T. Gerace, Executive Director, Bahamian Field Station, Ltd., P.O. Box 2488, Port Charlotte, FL 33949.

American Association of Petroleum Geologists Annual Meeting, June 21-24, 1992, Calgary, Alberta, Canada. Information: George Eynon, General Chairman, Bow Valley Industries, Ltd., P.O. Box 6610, Postal Station D, Calgary, Alberta T2P 3R7, Canada; (403) 261-6100; or AAPG Convention Department, P.O. Box 979, Tulsa, OK 74101; (918) 584-2555.

Interpraevent 1992—Protection of Habitat against Floods, Debris Flows and Avalanches, June 29-July 3, 1992, Berne, Switzerland. Information: Interpraevent 1992, c/o Bundesamt für Wasserwirtschaft, Postfach 2743, CH-3001 Berne, Switzerland.

July

7th International Symposium on Water-Rock Interaction, July 13-22, 1992, Park City, Utah. Information: Yousif Kharaka, Secretary-General, U.S. Geological Survey, MS 427, 345 Middlefield Road, Menlo Park, CA 94025; (415) 329-4535; fax 415-329-5110.

Society for Industrial and Applied Mathematics Annual Meeting, July 19-24, 1992, Los Angeles, California. Information: SIAM Conference Department, 3600 University City Science Center, Philadelphia, PA 19104-2688; (215) 382-9800; fax 215-386-7999; E-mail siamconfs@wharton.upenn.edu. (Abstract deadline: January 6, 1992.)

International Committee for Coal Petrology 44th Meeting, July 20-24, 1992, University Park, Pennsylvania. Information: Alan Davis, Penn State University, 205 Research Bldg. E, University Park, PA 16802; (814) 865-6544; fax 814-865-3573.

Society for Organic Petrology, 9th Annual Meeting, University Park, Pennsylvania, July 23-24, 1992. Information: Jim Hower, Center for Applied Energy Research, 3572 Iron Works Pike, Lexington, KY 40511; (606) 257-0261; fax 606-257-0302.

Northeastern Science Foundation—History of Earth Sciences Society Meeting on the History of Geology, July 29-August 1, 1992, Troy, New York. Information: Gerald M. Friedman, Northeastern Science Foundation, P.O. Box 746, Troy, NY 12181-0746; (518) 273-3247; fax 518-273-3249.

August

29th International Geological Congress, August 24-September 3, 1992, Kyoto, Japan. Information: Secretary

General, IGC-92 Office, P.O. Box 65, Tsukuba, Ibaraki 305, Japan; phone 81-298-54-3627; fax 81-298-54-3629; telex 3652511 GSJ).

Second International Conference on Asian Marine Geology, August 19-22, 1992, Tokyo, Japan. Information: Shin'ichi Kuramoto, Ocean Research Institute, University of Tokyo, 1-15-1, Minamidai, Nakano-ku, Tokyo, 164 Japan; phone 03-3376-1251; fax 03-3375-6716; telex 25607/ORIUT; E-mail: kuramoto@tansei.cc.u-tokyo.ac.jp or kuramoto@jpnoriut.bitnet. (Abstract deadline: March 31, 1992.)

IAS/SEPM Research Conference on Carbonate Stratigraphic Sequences: Sequence Boundaries and Associated Facies (Emphasis on Outcrop and Processes Studies), August 30-September 3, 1992, La Seu, Spain. Information: Toni Simo, Dept. Geology and Geophysics, University of Wisconsin, 1215 W. Dayton St., Madison, WI 53706; (608) 262-5987; fax 608-262-0693; E-mail simo@geology.wisc.edu; or Mark Harris, Dept. Geosciences, University of Wisconsin, P.O. Box 413, Milwaukee, WI 53201; (414) 229-5452; or Evan Franseen, Kansas Geological Survey, 1930 Constant Ave., Lawrence, KS 66047; (913) 864-5317.

International Conference on Large Meteorite Impacts and Planetary Evolution, August 31-September 2, 1992, Sudbury, Ontario, Canada. Information: B. O. Dressler, Ontario Geological Survey, 77 Grenville St., 9th Floor, Toronto, Ontario M7A 1W4, Canada; (416) 965-7046; fax 416-324-4933.

September

International Conference on Arctic Margins, September 2-4, 1992, Anchorage, Alaska. Information: David Steffy or Dennis Thurston, U.S. Minerals Management Service, 949 E. 36th Ave., Anchorage, AK 99508; (907) 271-6553; fax 907-271-6805. (Abstract deadline: February 1, 1992.)

5th International Symposium on Seismic Reflection Profiling of the Continental Lithosphere, September 6-12, 1992, Banff, Alberta, Canada. Information: R. M. Clowes, Lithoprobe Secretariat, 6339 Stores Road, University of British Columbia, Vancouver, BC V6T 1Z4, Canada; (604) 822-4202; fax 604-822-6958; or A. G. Green, Geological Survey of Canada, 1 Observatory Crescent, Ottawa, Ontario K1A 0Y3, Canada, Canada; fax 613-992-8836.

International Symposium on the Geology of the Black Sea Region, September 7-11, 1992, Ankara, Turkey. Information: ISGB Sekreterliği, MTA Genel Müdürlüğü, 06520 Ankara, Türkiye; phone (90)-(4)-223 69 27; fax 90-(4)-222 82 78. (Abstracts deadline: March 1, 1992.)

The Transition from Basalt to Metabasalt: Environments, Processes, and Petrogenesis, September 9-15, 1992, Davis, California. Information: Peter Schiffman, Dept. of Geology, University of California, Davis, CA 95616; (916) 752-3669; E-mail PSchiffman@UCDavis.edu.

4th International Conference on Paleocyanography, September 21-25, 1992, Kiel, Germany. Information: ICP IV Organizing Committee c/o

GEOMAR, Wischhofstrasse 1-3/Bldg. 4, D-2300 Kiel 14, Germany.

23rd Annual Binghamton Geomorphology Symposium: Geomorphic Systems, September 25-27, 1992, Oxford, Ohio. Information: Bill Renwick, Dept. of Geography, Miami University, Oxford, OH 45056; (513) 529-1362; E-mail BRENWICK@MIAMIU.BITNET, or Jonathan Phillips, Dept. of Geography, East Carolina University, Greenville, NC 27858; (919) 757-6082; E-mail GEPHILLI@ECUVM1.BITNET.

American Institute of Professional Geologists Annual Meeting, September 27-October 1, 1992, Lake Tahoe, Nevada. Information: Jon Price, AIPG, P.O. Box 665, Carson City, NV 89702; (702) 784-6691.

October

Association of Engineering Geologists Annual Meeting, October 3-9, 1992, Long Beach, California. Information: John Byer, Kovacs-Byer, Inc., 11430 Ventura Blvd., Studio City, CA 91604; (818) 980-0825.

2nd International Congress on Energy, Environment and Technological Innovation, October 12-16, 1992, Rome, Italy. Information: Secretaria CPA: Comisión de Promoción Académica, Facultad de Ingeniería, Universidad Central de Venezuela, Edif. Decanato, Caracas 1050, Venezuela; phone 58-2-6627538/7612; fax 58-2-6627327.

Geological Society of America Annual Meeting, October 26-29, 1992, Cincinnati, Ohio. Information: GSA, Meetings Dept., P.O. Box 9140, Boulder, CO 80301; (303) 447-2020; fax 303-447-1133. (Abstract deadline: July 8, 1992.)

Send notices of meetings of general interest, in format above, to Editor, *GSA Today*, P.O. Box 9140, Boulder, CO 80301.

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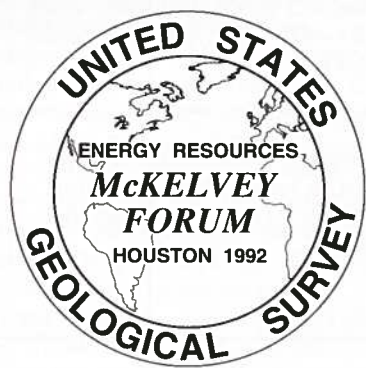
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P. D. Cole
- 1112 Asymmetric compositional layering of syntectonic metamorphic veins as way-up criterion
Jean-Pierre Burg, Pascal Philippot
- 1116 Fault orientations in extensional and conjugate strike-slip environments and their implications
Wayne Thatcher, David P. Hill
- 1121 Hydraulics of the August 7, 1980, pyroclastic flow at Mount St. Helens, Washington
Alan H. Levine, Susan W. Kieffer
- 1125 Tectonic setting of the Windermere Supergroup revisited
G. M. Ross
- 1129 Valencia gorge: Possible Messinian refill channel for the western Mediterranean Sea
M. E. Field, J. V. Gardner
- 1133 Exotic metamorphic terranes in the Caledonides: Tectonic history of the Dalradian block, Scotland
B. J. Bluck, T. J. Dempster
- 1137 New geochronologic limits on the depositional age of the Hurwitz Group, Trans-Hudson hinterland, Canada
Judith G. Patterson, Larry M. Heaman
- 1141 Heat-flow and lateral seismic-velocity heterogeneities near Deep Sea Drilling Project-Ocean Drilling Program Site 504
Robert P. Lowell, Ralph A. Stephen
- 1145 Refrigeration of the western Cordilleran lithosphere during Laramide shallow-angle subduction
Trevor A. Dumitru, Phillip B. Gans, David A. Foster, Elizabeth L. Miller

Forum

- 1149 Unusually large subsidence and sea-level events during middle Paleozoic time: New evidence supporting mantle convection models for supercontinent assembly
Comment: *David L. Macke*
Reply: *Michelle A. Kominz, Gerard C. Bond*
- 1151 A-type granites revisited: Assessment of a residual-source model
Comment: *Fred Barker*
Reply: *R. A. Creaser, R. C. Price, R. J. Wormald*



U.S. Geological Survey 8th Annual V.E. McKelvey Forum on Energy Resources

30 Oral Presentations
53 Poster Presentations

- Gulf Coast reservoirs
- Basin evolution
- Paleoclimate & rhythms
- Sequence stratigraphy
- Source rocks
- Oil field growth
- Fractured reservoirs
- Computer applications
- Diagenetic studies
- Coal & coalbed methane

Short Course: "Recent Advances in Plate Tectonics and Continental Crustal Evolution"
by Warren Hamilton

Houston, Texas
February 18-20, 1992

Technical Program
Christine Turner, USGS
(303) 236-1561

Registration Information
Jan W. Kernan, BAI, Inc.
(301) 588-4177

GSA ANNUAL MEETINGS

1992

GSA Annual Meeting, Cincinnati, Ohio
October 26-29

General co-chairmen: Raphael Unrug and J. Barry Maynard

Field trip chairmen: Thomas Berg and John Rupp

For information call the GSA Meetings Department, (303) 447-2020



Call for 1992 Short Course Proposals

Due December 1, 1991

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

Short courses may be conducted in conjunction with all GSA annual or section meetings, but we are particularly interested in identifying short courses to be offered during the 1992 Annual Meeting in Cincinnati or the 1993 Annual Meeting in Boston.

Proposals for the Cincinnati meeting must be received by December 1, 1991. Selection of courses will be made by February 1, 1992, leaving 8 months for preparing course manuals and making arrangements.

For proposal guidelines or information contact: Edna A. Collis, Short Course Coordinator, GSA Meetings Department, P.O. Box 9140, Boulder, CO 80301; (303) 447-2020.

Call for Theme Session Proposals

Due January 2, 1992

Discovery: From Columbus to Magellan—The Voyage Continues is the all-embracing theme of the 1992 technical program. Discoveries have always been at the heart of the geologic sciences. In 1992, the quincentenary of Columbus's landing in America, the Magellan satellite is still mapping Venus from space, and the theme is particularly pertinent. In 1492, Columbus journeyed to discover a "new world" on Earth. We are now discovering and charting a new world in space, and in the process we explore worlds of new ideas. To modern geoscientists the impact of new ideas is not only of theoretical importance but of practical and, increasingly, environmental importance as well.

We call for new contributions to the geosciences: descriptive and analytical; terrestrial and extraterrestrial; developmental and preservationist. In this regard, we are soliciting titles of symposia and themes for the 1992 Annual Meeting. Only an associated society or division may submit a proposal for a symposium; however, individuals, as well as the divisions and societies, are encouraged to submit proposals for cognate theme sessions. Theme sessions, with their emphasis on topicality and interdisciplinary aspects of our sciences, are consistent with our 1992 central theme of **Discovery**.

A symposium will consist entirely of invited abstracts, whereas a theme session will be entirely volunteered abstracts. The initiation of a symposium is completely within the purview of the division or associated society, as would be ONE theme session. All other proposed theme sessions compete for time slots with other theme sessions. Nevertheless, we think that the advantages and possibilities of time allocation for theme sessions will appeal to divisions and societies in preparing expanded programs.

Be as innovative as you can in your submittals. If you propose one or more theme sessions, the JTPC Chairmen will select from these the final list of topics most consistent with the overall theme of the meeting: **Discovery**.

Submit proposals (to be received by January 2, 1992) to:

Nicholas Rast, chairman
Dept. of Geological Sciences
University of Kentucky
Lexington, KY 40506-0059
(606) 257-3758

Roy Kepferle
Dept. of Geology
Eastern Kentucky University
Richmond, KY 40475-0953
(606) 622-1273

FUTURE

Cincinnati	October 26-29	1992
Boston	October 25-28	1993
Seattle	October 24-27	1994
New Orleans	November 6-9	1995
Denver	October 25-28	1996
Denver	October 25-28	1999

For general information on technical program participation (1992 or beyond) contact: Sue Beggs, Meetings Manager, GSA headquarters.

GSA SECTION MEETINGS

1992

South-Central, Houston, Texas
Rice University, February 24-25

Hans G. Avé Lallemand, Dept. of Geology and Geophysics, P.O. Box 1892, Rice University, Houston, TX 77251; (713) 527-4889

Southeastern, Winston-Salem, North Carolina
Stouffer-Winston Plaza, March 18-20

Paul D. Fullagar, Dept. of Geology, CB 3315 Mitchell Hall, University of North Carolina, Chapel Hill, NC 27599-3315; (919) 962-0677

Northeastern, Harrisburg, Pennsylvania
Harrisburg Hilton, March 26-28

Donald M. Hoskins, Pennsylvania Geological Survey, Dept. of Environmental Resources, P.O. Box 2357, Harrisburg, PA 17105; (717) 787-2169

North-Central, Iowa City, Iowa
University of Iowa, April 30-May 1

Raymond R. Anderson, Iowa DNR, Geological Survey, University of Iowa, 123 N. Capital St., Iowa City, IA 52242; (319) 335-1575

Cordilleran, Eugene, Oregon
Eugene Hilton Conference Center, May 11-13

A. Dana Johnston, Dept. of Geological Sciences, University of Oregon, Eugene, OR 97403-1272; (503) 346-5588

Rocky Mountain, Ogden, Utah
Ogden Park Hotel, May 13-15 *Note date change*

Sidney R. Ash, Dept. of Geology, Weber State University, Ogden, UT 84408-2507; (801) 626-6908

Foundation to Fund Matching Student Travel Grants

The GSA Foundation will award matching grants up to a total of \$3500 each to the six GSA Sections. The money, when combined with equal funds from the Sections, will be used to assist students traveling to the 1992 GSA Annual Meeting in Cincinnati in October and to 1992 Section meetings.

Travel grants will be awarded and administered by the Sections, whose officers should be contacted for further information.

Smithsonian Offers Fellowships in History, Art, and Science

The Smithsonian Institution announces its research fellowships for 1992-1993, including the fields of History of Science and Technology, Anthropology, Biological Sciences, Earth Sciences, and Materials Analysis.

Smithsonian Fellowships are awarded to support independent research in residence at the Smithsonian in association with the research staff and using the Institution's resources. Predoctoral and postdoctoral fellowship appointments for six to twelve months and graduate student appointments for ten weeks are awarded. Proposals for scientific research in the following areas may be made:

History of Science and Technology: History of computers, communication, and society; history of agriculture; air and space; electrical technology, engineering; industrial archaeology; mathematics, medicine and pharmacy; natural history; physical sciences; social dimensions of science and technology; and transportation.

Anthropology: Archaeology; cultural anthropology, folklife; linguistics; and physical anthropology.

Biological Sciences: Animal behavior and pathology; ecology; environmental studies; evolutionary biology; marine biology; natural history; paleobiology; systematics; and tropical biology.

Earth Sciences: Meteoritics; mineralogy; paleobiology; petrology; planetary geology; sedimentology; and volcanology.

Materials Analysis: Archaeometry and conservation science.

Applications are due *January 15, 1992*. Stipends supporting these awards are \$26,000 per year plus allowances for senior postdoctoral fellows; \$21,000 per year plus allowances for postdoctoral fellows; \$13,000 per year plus allowances for predoctoral fellows; and \$3000 for graduate students for the ten-week tenure period. Predoctoral, postdoctoral, and senior postdoctoral stipends are prorated on a monthly basis for periods less than twelve months.

Awards are based on merit. Smithsonian Fellowships are open to all qualified individuals without reference to race, color, religion, sex, national origin, age, or condition of handicap of any applicant. For more information and application forms, please write: Smithsonian Institution, Office of Fellowships and Grants, Suite 7300, 955 L'Enfant Plaza, Washington, DC 20560. Please indicate the particular area in which you propose to conduct research and give the dates of degrees received or expected. ■

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Positions Open

HYDROLOGIST/ASSISTANT PROFESSOR — TENURE TRACK

The Department of Geosciences of Rutgers University at New Brunswick, New Jersey invites applications for a tenure track position in hydrogeology at the assistant professor level, anticipated to begin September 1992. Candidates must have a Ph.D., a demonstrated ability to mount a successful research program, and a strong interest in graduate and undergraduate level teaching. Adjunct areas of expertise might include: Aqueous geochemistry, surficial processes and sedimentation, remote sensing, groundwater flow modeling, magma flow modeling, fluid flow in basins, surface and or bedrock aquifers. Research interaction with other faculty members in Quaternary geology, basin analysis, subsurface stratigraphy, geochemistry or geophysics is desirable. Teaching will include a required major course in hydrogeology and graduate courses in hydrogeology. Applicants should submit a curriculum vitae, a

brief statement of research and teaching interests, and three letters of reference to Robert E. Sheridan, Chair Search Committee, Department of Geological Sciences, Rutgers University, Busch Campus, New Brunswick, NJ 08903. Rutgers University is an equal-opportunity/affirmative-action employer.

STRUCTURAL GEOLOGIST, NORTHERN ARIZONA UNIVERSITY

The Department of Geology at NAU invites applications for a tenure-track position in structural geology assistant professor level. Duties will include teaching at the introductory, senior and graduate levels. An active research program is expected of all faculty, and the candidate will be expected to demonstrate a record of scholarly activity. The Southwest offers extensive opportunities for structural geology research.

The Department is currently composed of seventeen active full-time faculty and two research associates, and offers vigorous B.S. programs in Geology and Environmental Sciences, and M.S. programs in Geology and Quaternary Studies. Regents approval has been granted for a Ph.D. program in Geology, and we are currently seeking approval to start this program in Fall 1992.

The position will start in August 1992, at which time the successful candidate will be expected to hold a Ph.D. degree. Position will remain open until filled, but review of applications will begin December 1, 1991. Applicants should send a letter of interest stating teaching and research plans, a curriculum vita, and names, addresses and telephone numbers of three references to Chair, Structural Geology Search Committee, Department of Geology, Box 6030, Northern Arizona University, Flagstaff, AZ 86011-6030.

Northern Arizona University is a committed equal opportunity/affirmative action institution. Minorities, women, physically challenged persons, and veterans are encouraged to apply.

THE DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY expects to offer postdoctoral research fellowships in one or more of the following areas: geology, geophysics, geochemistry, cosmochemistry, and planetary sciences. Interested persons are asked to send their resumes to Prof. D. J. Stevenson, Chairman, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California 91125. An Equal Opportunity/Affirmative-Action Employer.

Four Research Positions Available BUREAU OF ECONOMIC GEOLOGY

GEOHYDROLOGISTS

Research Associate. Required: Doctoral degree in geology or engineering with graduate level courses in hydrogeology; or Master's degree in one of the specified fields and four years of research experience in hydrogeology.

Research Scientist. Required: Doctoral degree in geology or engineering with graduate level courses in hydrogeology. Five years of experience in hydrogeology with proven publications record covering hydrogeology field.

Both positions require experience in environmental geochemistry of groundwater; flow in unsaturated zone, in fractures, or in low-permeability rocks; or numerical modeling of groundwater flow; experience with both laboratory-based analysis and field measurements; and the ability to travel occasionally for field sampling investigations.

Salary for these positions is negotiable, based on qualifications.

Research Scientist Associate II. Required: Master's degree in geology or civil engineering with graduate coursework in earth sciences. Ability to travel for field investigations. Competitive applicants should have research experience in earth sciences.

Salary: \$2357 or more per month, based on qualifications.

COASTAL GEOLOGIST

Research Associate. Required: Doctoral degree in geology with graduate coursework in coastal marine processes and research experience in water zone monitoring and mapping; or Master's degree in geology with specified coursework and five years of such experience. Ability to travel for field investigations.

Salary for this position is negotiable, based on qualifications.

Funding for these positions is subject to renewal September 1, 1992. Candidate selected for the Research Scientist position will be appointed to the title "Research Scientist" or "Research Associate" based on a review of research accomplishments and professional experience and qualifications.

The Bureau of Economic Geology conducts research on a broad range of geologic, environmental, and geohydrologic topics. Candidates will join an experienced team of professionals and support staff housed in a spacious new facility at the Balcones Research Center. Salaries are commensurate with other nonprofit research groups. Publication of research results is strongly encouraged and sup-

ported. Applicants should submit a resume, a statement of research interests, and the names of three references to: Dr. Marcus E. Milling, Bureau of Economic Geology, The University of Texas at Austin, University Station, Box X, Austin, Texas 78713-7508. An Equal Opportunity/Affirmative Action Employer.

HYDROGEOLOGIST; ASSISTANT PROFESSOR WEST VIRGINIA UNIVERSITY

West Virginia University's Department of Geology and Geography invites applications for a tenure-track position at the assistant professor level with a specialty in hydrogeology, beginning August, 1992. Applicants with training and experience in modeling ground-water flow and chemical transport are preferred. The successful candidate will teach courses and develop a research program in the physical/quantitative aspects of fluid flow. This emphasis should complement our other hydrogeologist, who has strengths in chemical and environmental hydrogeology. Commitment to securing external funding and supervising graduate research is essential. The Ph.D. degree is required at time of appointment. Applicants should send cover letter, resume, graduate course transcripts, and addresses of three referees to: Dr. Alan C. Donaldson, Chairman, Department of Geology and Geography, West Virginia University, Morgantown, WV 26506. Review of candidates will begin on January 2, 1992 and continue until the appropriate candidate is found. West Virginia University is an affirmative-action/equal opportunity employer.

BATES COLLEGE Lewiston, Maine

HYDROGEOLOGIST, ASSISTANT PROFESSOR Applications are invited for an assistant professorship to begin in September 1992. The individual must possess a strong commitment to undergraduate education and research. The primary interest of the individual should be in hydrogeology. Other interests should include the application of geochemistry or geophysics to topics in hydrogeology. Candidates are expected to develop a program of research involving undergraduates. This is an entry-level, tenure-track position that requires the Ph.D. Women and minority group members are strongly encouraged to apply.

This appointment, a net addition to the geology faculty, is the fourth professorship in the department. It presents a significant opportunity for new curricular directions in geology, for liaisons with colleagues in the natural sciences, and for addressing student interest in environmental studies. Teaching responsi-

Springer for Geology

Mechanics in Structural Geology

By M.B. Bayly, Rensselaer Polytechnic Institute, Troy, NY

Mechanics in Structural Geology is a highly readable textbook for students and a reference book for all geoscientists interested in structural geology. Bayly's concise text, plus numerous question and answer sets, guide the reader through the concepts of structural mechanics. Although the text is both conceptually and mathematically rigorous, the topics are presented in a style that is easily grasped.

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Hardcover \$59.00 ISBN 0-387-97615-9

Sedimentary Basins

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By G. Einsele, Universität Tübingen, Tübingen, FRG

The book address both qualitative and quantitative aspects of basin analysis in the contexts of plate tectonics and sedimentary geology. Large-scale processes, facies associations, and especially sedimentary sequences are stressed in the book, rather than small-scale sedimentary, biological or petrographical characteristics, which are sufficiently described in a number of modern books.

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Physical Chemistry of Magmas

Edited by L.L. Perchuk, USSR Academy of Sciences, Chernogolovka, USSR; and I. Kushiro, University of Tokyo, Tokyo, Japan

Physical Chemistry of Magmas investigates the properties, structure, and phase relationships of silicate melts with invited contributions from an international team of experts. Presented in the first section of the book are data and various rules for estimating the properties and structures of melts, as well as the applications of the physical chemistry of silicate liquids to igneous petrology. The second section focuses on phase relationships from application of experimental and theoretical petrology to modeling the origin of magmas.

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(*Advances in Physical Geochemistry, Vol. 9*)

Theoretical Geomorphology

Third Edition
By A.E. Scheidegger, Institut für Theoretische Geodäsie und Geophysik, Technische Universität, Wien, Austria

Here is the only integrated treatment of theoretical geomorphology. *Advances in fractal geometry, general systems theory and problems involving chaos theory* have necessitated this new edition. The book covers the theory of the exogenic (geomorphic) features of the Earth: the mechanics of slope formation, the theory of river action, the systems theory of landscape evolution, the theory of aquatic effects, the theory of glacial and periglacial forms and the theory of aeolian and desert features.

1991/434 pp., 117 illus./Hardcover \$69.00
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Biochronological Correlations

By Jean Guex, Institut de Géologie, UBIL, BFSH 2, Lausanne, Switzerland

Due to the discontinuous nature of fossil records, it is often difficult to use biostratigraphic data to establish biochronological correlations and produce a relative time scale. In *Biochronological Correlations*, the author creates a deterministic mathematical model to resolve the multiple contradictions inherent to stratigraphic recording of fossil species. The book begins with theoretical interpretations of highly complex biostratigraphic data followed by presentations of computer-aided Unitary Association Method. Geologists and structural geologists, as well as micropalaentologists, will benefit from this new tool in stratigraphy.

1991/ approx. 272 pp., 154 illus./Softcover \$69.00
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Remote Sensing Geology

By R.P. Gupta, University of Roorkee, India

Remote Sensing Geology discusses various remote sensing methods and applies them to geological exploration. Here is a wealth of information on various aspects of geological remote sensing, including laboratory spectra of minerals and rocks, ground truth, and aerial and space-borne remote sensing. The book integrates photogeology into remote sensing as well as projects remote sensing as a tool in integrated geology. All researchers and students of applied geosciences will benefit from reading this book.

1991/approx. 376, 284 illus./Hardcover \$149.00
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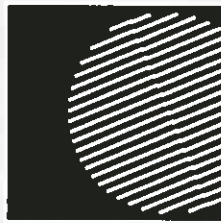


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bilities include three courses (an introductory course, and two upper-level courses) and supervision of senior thesis research during the regular academic year, and a five-week short term unit (April/May). The short term unit allows off-campus field study or intensive laboratory experiences.

Bates College is a liberal arts college in south-central Maine with a strong field-based and laboratory-supported program in geology. The geology department is housed in a new \$10 million science facility. There is ample space for teaching and research laboratories; the successful candidate will be expected to pursue outside support for specialized instrumentation. Dedicated laboratories currently support mineralogy, petrology, geochemistry, sedimentology, and SEM-EDS microscopy. The department has a substantial inventory of field equipment; geophysical field equipment for hydrogeologic studies include a six-channel signal-enhanced seismograph and an earth resistivity system. Access to on-campus mainframe and minicomputers and to national computer networks is through AT&T or Macintosh PCs provided in faculty offices and laboratories.

Applications should include a letter that discusses teaching and research, transcripts of all college work, and the names, addresses, and phone numbers of three referees from whom letters of recommendation may be solicited. The closing date is January 1, 1992. Application materials should be sent to: John W. Creasy, Chair, Department of Geology, Bates College, Lewiston, Maine 04240.

Bates College is an Equal Opportunity/Affirmative Action employer.

DEPUTY DIRECTOR

The Earth Sciences and Resources Institute (ESRI) of the University of South Carolina has a newly created position open for a Deputy Director. ESRI is an autonomous research institute within the College of Science and Mathematics, reporting directly to the Dean. Approximately 20 full-time research scientists and a support staff of 35 are dedicated to exploration-oriented research in the international energy industry, and there is a rapidly developing environmental and geohydrology research group. ESRI also administers a graduate program leading to the degree of Master of Earth Resource Management (MERM); currently more than 40 candidates are in attendance. Research funds and student support are generated entirely by Institute staff; for fiscal year 1991/92, the budget exceeds \$2.5 million. The Deputy Director position will be funded from research revenues initially, but a tenure track reassignment subsequently may be possible. Responsibilities will be to assist the Director in program administration and to develop new and challenging areas of research, which could include environmental geology or geohydrology, as well as ESRI's traditional fields of hydrocarbon exploration and basin analysis. The successful applicant should have a Ph.D. in earth sciences and a minimum of ten years of research experience beyond the doctorate, including some management responsibilities in petroleum geology and related fields such as environmental geology. Salary will be competitive and commensurate with experience. Candidates should send a resume, a statement of research interests/plans, details of administrative background, and the names of three references to: Prof. Paul G. Huray, Vice Provost for Research, The University of South Carolina, Columbia, SC 29208. Review of applications will begin immediately and continue until the position is filled. The University is an Equal Opportunity/Affirmative Action Employer.

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Opportunities for Students

UNIVERSITY OF MINNESOTA. Opportunities with the Interdisciplinary Research Training Group (RTG), for "Paleorecords of Global Change: Understanding the Dynamics of Ecosystem Response." Applications and additional information for the following are available from Sue Julson, University of Minnesota, Ecology, Evolution and Behavior, 318 Church St., S.E., Minneapolis, MN 55455. Phone (612) 625-7677; fax (612) 625-4490.

POSTDOCTORAL FELLOWSHIP: Fellowship available for research training. One year appointment, renewable second year. Application deadline January 1, 1992. **TRAVELING FELLOWSHIP:** Graduate students are invited to Minnesota for up to 3 months to enhance training in the above study. Stipend, living allowance, and tuition provided. Application deadlines November 12 (for travel January 1–June 30) and April 1 (for travel July 1–December 31). **GRADUATE TRAINEESHIP:** Four-year traineeships available for graduate study in conjunction with interdepartmental RTG in above study. Application deadline January 15, 1992.

An Equal Opportunity Educator and Employer.

The Division of Geological and Planetary Sciences at the California Institute of Technology expects to offer postdoctoral research fellowships in one or more of the following areas: geology, geophysics, geochemistry, cosmochemistry, and planetary sciences. Interested persons are asked to send their resumes to Prof. D. J. Stevenson, Chairman, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California 91125. An Equal-Opportunity/Affirmative Action Employer.



Today's society is concerned with a multitude of events affecting the Earth system, ranging from natural processes such as ocean circulation, weather systems, and geophysics to man-made concerns such as acid rain, ecotoxicology, and the greenhouse effect. To understand the impact of these events on the Earth system and to resolve environmental problems, knowledge of all the basic earth sciences and how they interact is essential.

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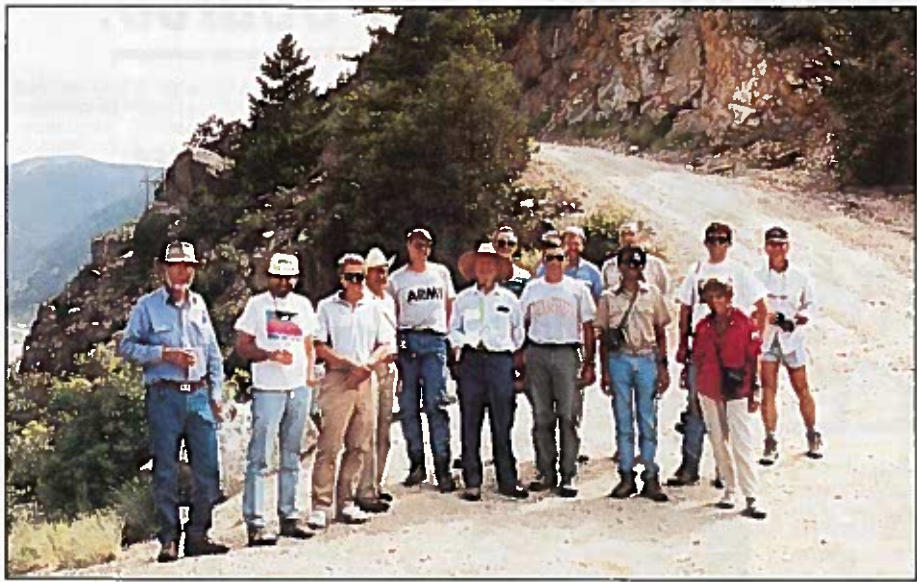
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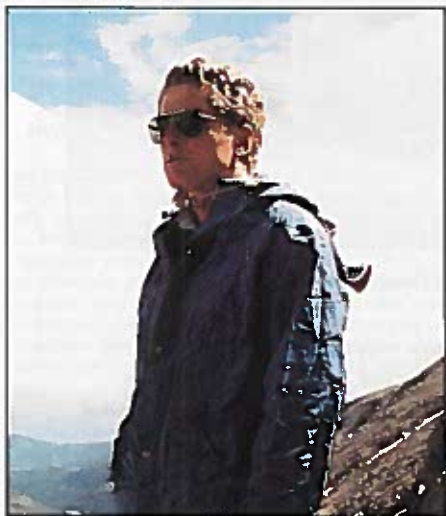
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GeoHostelers—GeoHostel Trip, June 1991



Greg Holden



Ken Kolm

GSA's First GeoHostel

Edna A. Collis, GeoHostel Coordinator

Nestled in a picturesque valley formed by the Rocky Mountains on the west and mesas on the east, Golden, Colorado, is located 15 miles from Denver. It is the home of the School of Mines and was the site of GSA's first GeoHostel, which took place from June 23 to 27, 1991.

The GeoHostel leaders were Gregory S. Holden and Kenneth E. Kolm of the Department of Geology and Geological Engineering at the Colorado School of Mines. The program consisted of a combination of classroom lectures and field trips on Evolution of Geologic Landscapes in the Colorado Rockies and Environmental and Engineering Issues in Colorado. Highlights of the technical program were lectures about each geologic time, the resulting rocks and geologic structures, and how these affect the engineering problems and hydrologic systems of today. The field trips illustrated the lectures, and analogs to environmental problems were drawn to other regions around the United States.

The program was further enriched with tours of Boulder's National Center for Atmospheric Research (NCAR) and the National Bureau of Standards (NBS).

The welcoming get-together was held on Saturday evening on the deck of the Ben Parker Student Center. The outdoor setting provided a perfect greeting, offering a breathtaking view of the front range, a warm breeze, and a Rocky Mountain sunset.

Participants were housed at the Colorado School of Mines dormitories,

and an all-you-can-eat breakfast was included in the registration fee. Each day began with a classroom lecture followed by a field trip. Afternoons were left open, leaving registrants ample time for sightseeing and relaxation. An all-day field trip to the high peaks of Colorado on the last day preceded the farewell dinner party.

Our first GeoHostelers were 11 men and two women, a diverse group, ranging in age from early 20s to early 70s. They came from California, Texas, Louisiana, and New York, and their varied fields of interest included biology, engineering, geology, the military services, mathematics, and real estate. Ten were GSA members.

The GeoHostelers were enthusiastic about the program; some comments: "Both leaders were excellent..." "superb leaders ... well informed and good humored..." "the balance of field trips and classroom lectures versus free time was just right..." "don't change the format..." "good to be able to stay on campus..." "food was good and plentiful..." "the breakfasts were great."

Their consensus: GeoHostel was a delightful experience and a definite success, and more programs should be offered. GSA agrees.

We extend a hearty thanks to our first GeoHostel leaders, Greg Holden and Ken Kolm for their excellent technical program and to our first GeoHostelers for their support and adventurous spirit.

Look for information about the 1992 GeoHostel Program in the January issue of *GSA Today*. ■

The Geological Society of America

Congressional Science Fellowship 1992-1993



The Geological Society of America is accepting applications for the 1992-1993 Congressional Science Fellowship. The Fellow selected will spend a year (September 1992-August 1993) in the office of an individual member of Congress or a congressional committee. The program provides an opportunity to gain a better understanding of science and technology issues facing Congress and to advise on a wide range of scientific issues as they

pertain to public policy questions. The American Association for the Advancement of Science conducts an orientation program and assists the Fellow seeking a congressional staff position in which he or she can work on major legislative issues.

Criteria

The program is open to 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 \$38,000 stipend, and limited health insurance, relocation, and travel allowances. The fellowship is funded by GSA and by a grant from the U.S. Geological Survey. (Employees of the USGS are ineligible to apply for this fellowship.)

To Apply

Procedures for application and detailed requirements are available in the geology departments of most colleges and universities in the United States or upon request from: Executive Director, Geological Society of America, P.O. Box 9140, Boulder, CO 80301.

DEADLINE FOR RECEIPT OF ALL APPLICATION MATERIALS IS FEBRUARY 15, 1992

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