Vol. 2, No. 10 October 1992

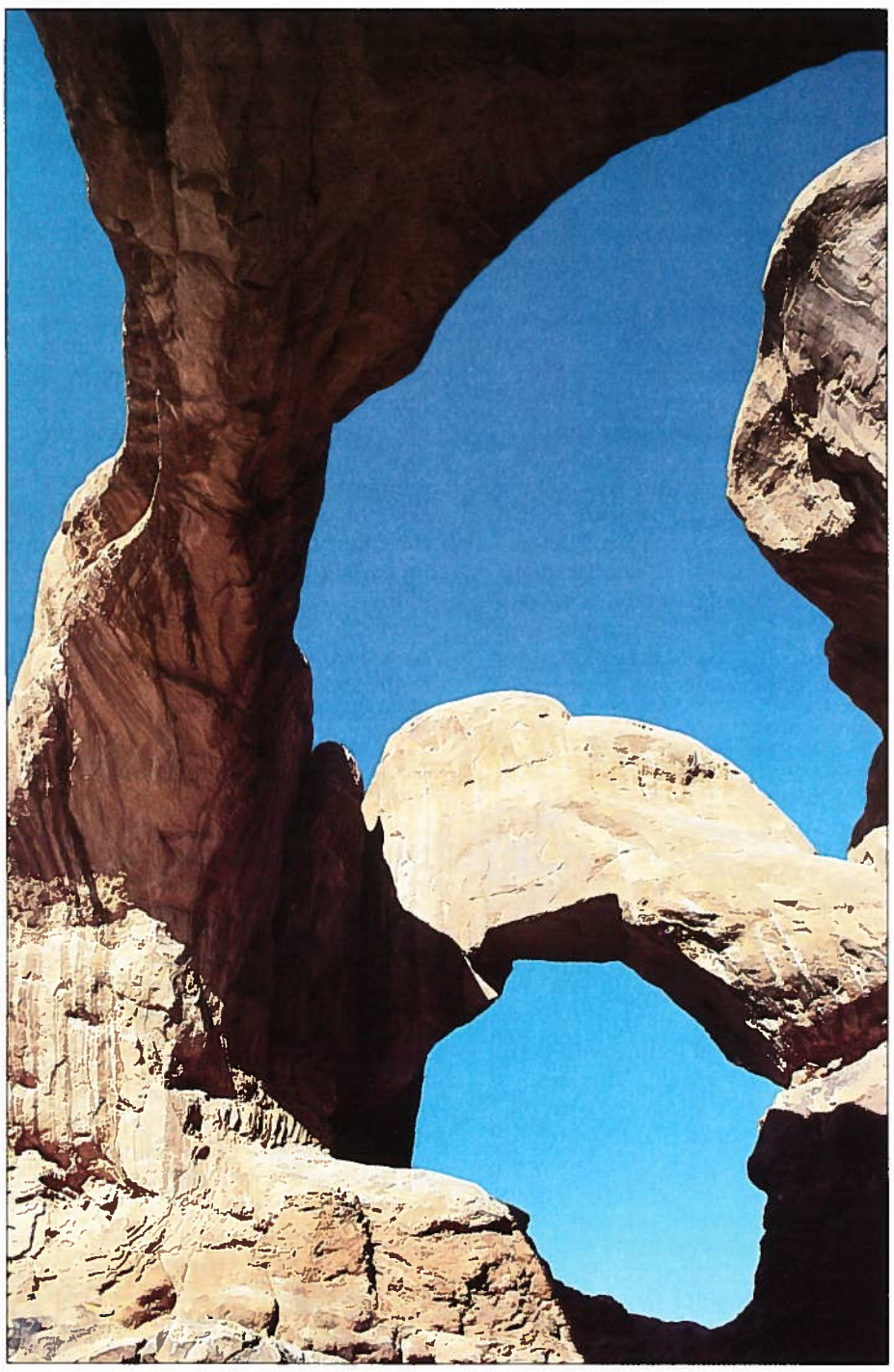
GSA TODAY

A Publication of the Geological Society of America

INSIDE

Encounters with the Land

Lauret E. Savoy
Department of Geology and Geography, Mount Holyoke College, South Hadley, Massachusetts 01075



Double arch in eroded sandstone, Arches National Park, Utah.

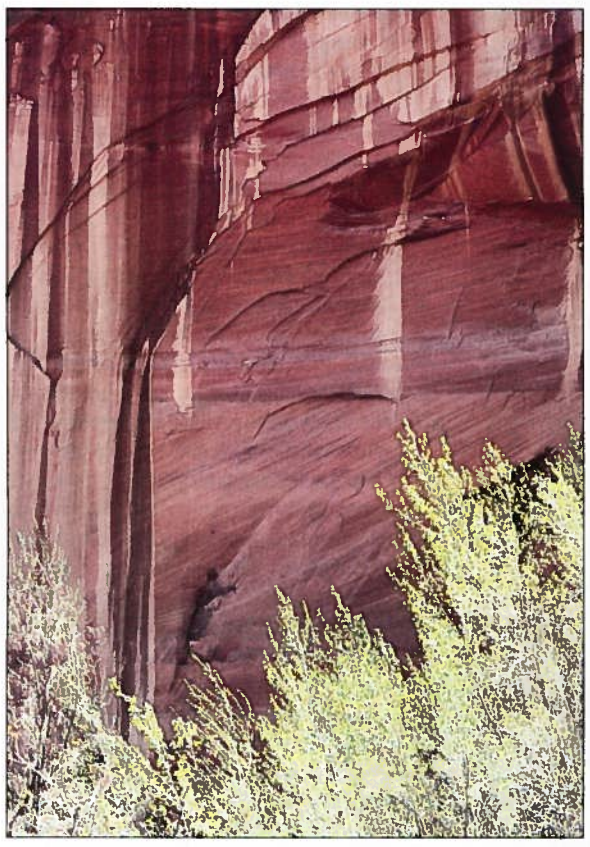
October 1992 marks the 500th anniversary of Christopher Columbus's arrival in North America and his "discovery" of a "New World." Sailing west in an attempt to find an oceanic route to the Orient, Columbus encountered a very old, populated world, whose peoples had diverse and complex histories and cultures. Although the Americas had been visited by other transoceanic voyagers, this encounter in 1492 placed the Eastern and Western hemispheres into permanent contact, and the cultural consequences of this contact continue to unfold in the late 20th century.

An exploration of America's past reveals that to a great degree the lifeways of peoples and the history of exploration and settlement can be viewed in terms of encounters between landscape and culture. The occasion of the quincentenary presents an appropriate opportunity to consider the interaction between humans and the American landscape, particularly the West. This photographic essay presents selected aspects of the links between physical landscape and cultural landscape and very different perspectives on the American West—Native American landscape and tradition, and connections between physical setting and the history and direction of Euro-American exploration. The perspectives of different cultures reflect distinct approaches to knowing the Earth.

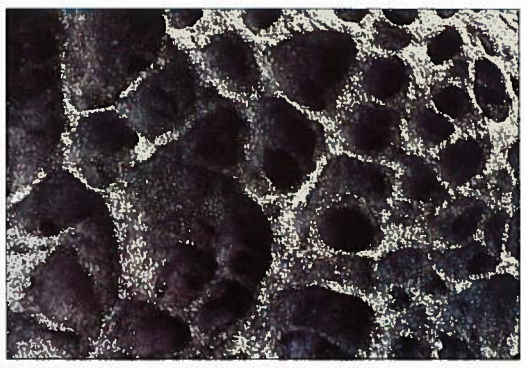
What is meant by "knowing the Earth"? Geology, as the scientific discipline that seeks to understand the Earth, has over the past two centuries provided a type of knowledge of Earth properties, processes, and history based increasingly on analytic description, abstraction, and specialization. In *A Sense of the Earth* (1971), David Leveson asked if geology and geologists were aware of, or capable of, interpreting the Earth and the nature of Earth-human relationships—the "geologic experience"—to society. Rather than being a complete set of details, our knowledge of the Earth is informed by inquiry that extends beyond the confines of specialized scientific disciplines to a larger human experience.

Communicating an understanding of the history and place of Earth or landscape in human affairs has commonly fallen within the domains of historians, geographers, and anthropologists. Geologists can also be a part of this group and examine the role and impact of the science in society and the interdisciplinary nature of relationships between the Earth and humans in time and space. There are many connections beyond traditional boundaries of the discipline. For example, geologic setting strongly influences the paths of cultures. Second, great diversity in views of the Earth—from science to myth—exists among peoples of the world. Third, perspectives on landscapes are shaped by encounters with the land as well as expectations or preconceptions based on cultural images of the time. What did Euro-Americans seek and what did they see in the western lands? How was this an impetus for scientific (geographic and geologic) exploration? In addition, with regard to the American West, geographic and geological studies played a significant role in the historical development of the region.

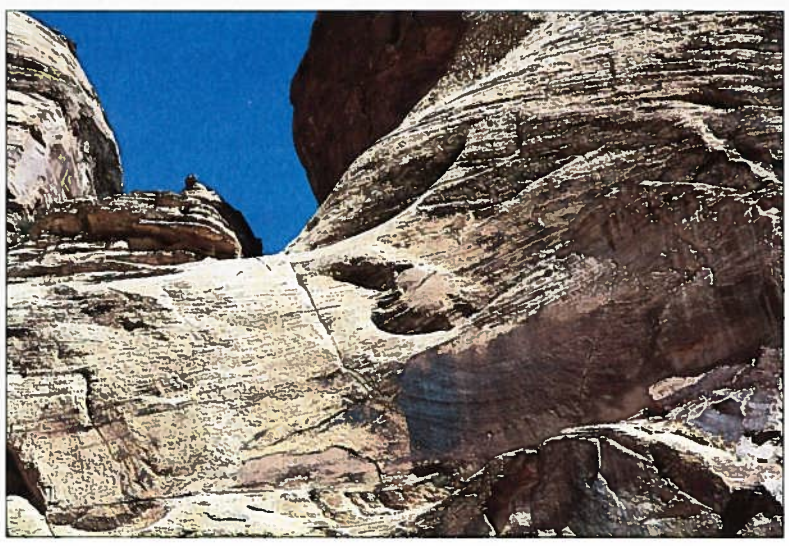
Encounters *continued on p. 216*



Desert varnish and cottonwoods, Escalante Canyon, Utah. "One learns a landscape finally not by knowing the name or identity of everything in it, but by perceiving relationships in it"—*Barry H. Lopez.*



Patterned rock, Point Lobos, California.



Canyon walls, Capitol Reef National Park, Utah.

Tufa tower, Mono Lake, California.

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GSA TODAY *October 1992*
Vol. 2, No. 10

GSA TODAY (ISSN 1052-5173) is published monthly by The Geological Society of America, Inc., with offices at 3300 Penrose Place, Boulder, Colorado. Mailing address: P.O. Box 9140, Boulder, CO 80301-9140, U.S.A. Second-class postage paid at Boulder, Colorado, and at additional mailing offices. **Postmaster:** Send address changes to *GSA Today*, Membership Services, P.O. Box 9140, Boulder, CO 80301-9140.

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Penrose Conference Report

Tectonic Evolution of the Coast Mountains Orogen

A Penrose conference on the "Tectonic Evolution of the Coast Mountains Orogen" was held May 17–22, 1992, in southwestern British Columbia. The conveners were Maria Luisa Crawford, George Gehrels, and James Monger. The conference consisted of two parts. A two-day field trip (led by Monger and Murray Journeay) focused on the geology and crustal structure of the southern Coast Mountains, using new seismic reflection data. This was followed by three and a half days of informal discussions and poster displays at Bowen Island Lodge, in the southwestern Coast Mountains.

Most discussions during the conference concerned the nature, age, and significance of the tectonic boundary that trends acutely across the Coast Mountains, from the eastern side at its south end (lat 49°N) to the western side north of the British Columbia–Alaska boundary (lat 54°N). This feature was examined in light of (1) stratigraphic and magmatic characteristics of terranes that can be traced into the Coast Mountains and are juxtaposed along the boundary; (2) the structural, stratigraphic, metamorphic, and magmatic features associated with their juxtaposition; and (3) the linkages between formation of the Coast Mountains orogen, tectonic events elsewhere in the Cordillera, and Mesozoic-Cenozoic plate reconstructions. The latter suggest that >13,000 km of lithosphere may have been subducted beneath western North America in the last 150 million years. This subduction may have occurred close to the present continental margin and be recorded in the Cretaceous-Tertiary accretionary complexes (e.g., Chugach terrane and equivalents), and may be partly accommodated and/or concealed by the complex structures of the Coast Mountains orogen.

Features of the North Cascades and contiguous southern Coast Mountains were compared and contrasted. The origins and emplacement modes of the Jurassic through Tertiary igneous rocks that constitute ~80% of the Coast Mountains were touched upon in discussions, but did not feature prominently.

Most conferees agreed on the following aspects of the tectonic boundary.

1. Significant differences in the Paleozoic and Triassic histories of inboard (Stikine, Cache Creek, Quesnel, and Yukon-Tanana) terranes and outboard (Wrangellia and Alexander) terranes suggest that they were juxtaposed after Triassic time.

2. Pre-Triassic metasedimentary and subordinate metavolcanic rocks of continental margin affinity extend southward along the east side of the boundary as far south as lat 52°N. These rocks may correlate with the Yukon-Tanana terrane and may in part underlie or grade laterally into the Stikine terrane.

3. Jurassic through Lower Cretaceous strata within the eastern part of the southern Coast Mountains and in contiguous parts of the Cascade Mountains may record subduction-related processes leading to accretion of outboard terranes. No record of Jurassic-Cretaceous subduction along the boundary within the Coast Mountains has been recognized north of 51°N.

4. Early and Middle Jurassic deformation, magmatism, and metamorphism occurred in both inboard and outboard terranes, but the connection of these features across the boundary within the Coast Mountains is uncertain. Paleomagnetic data permit juxtaposition of inboard and outboard terranes at any time between the Late Triassic and Late Cretaceous.

5. Upper Jurassic and Lower Cretaceous basinal clastic rocks crop out along the length of the tectonic boundary. These strata accumulated on the eastern margin of outboard terranes and, in the southern Coast Mountains, also along the western margin of inboard terranes. In the south, the mid-Mesozoic clastic rocks locally appear to stratigraphically overlie Mississippian through Middle Jurassic oceanic rocks (Bridge River terrane); no record of the latter is recognized north of 51°N.

6. Mid-Cretaceous (100–85 Ma) contraction of these clastic basins, accompanied by high-pressure, low- to medium-temperature regional metamorphism, large-scale displacement along west- and east-vergent thrust faults, and widespread emplacement of dioritic through granodioritic plutons with associated contact metamorphic aureoles, record accretion of the outboard Alexander and Wrangellia terranes.

7. This event was followed by Late Cretaceous through early Tertiary eastward-migrating plutonism across the boundary, by uplift and erosion of deep-level metamorphic rocks, and, in the southern Coast Mountains, by orogen-parallel deformation.

8. The Coast shear zone, prominent in the northern and central Coast Mountains but not obvious at their southern end, is an 800-km-long steeply dipping to vertical feature with both normal and reverse slip. This shear zone was closely associated with the emplacement of tabular tonalite plutons of latest Cretaceous–Paleocene age.

9. Jurassic through early Tertiary igneous rocks in and adjacent to the Coast Mountains probably result mainly from subduction-related processes. During mid-Cretaceous through early Tertiary time, east-dipping subduction clearly occurred along the outboard margin of the Alexander and Wrangellia terranes. The facing direction of Jurassic and Early Cretaceous arc-trench systems is uncertain.

10. Anomalous paleomagnetic data from plutons within the Coast Mountains can be explained by a combination of northeast-side-up tilting of parts of the orogen and 500–1000 km of dextral displacement on inboard strike-slip faults.

Three preconference tectonic scenarios existed: (1) Mid-Cretaceous accretion of outboard terranes as the end product of Jurassic(?) through Early Cretaceous subduction of an intervening ocean basin. (2) Initial juxtaposition of inboard and outboard terranes and formation of pull-apart basins along dextral transcurrent faults during Late Jurassic–Early Cretaceous time, followed by mid-Cretaceous collapse of the basins and accretion of outboard terranes. (3) Pre–Late Jurassic amalgamation of inboard and outboard terranes producing a single large terrane, which was rifted in Jurassic-Cretaceous time to form basins; these subsequently collapsed in mid-Cretaceous time as the outboard components of the terrane were accreted.

These three scenarios remain viable alternatives largely because mid-Cretaceous through early Tertiary thrusting, metamorphism, and plutonism have obscured the pre–mid-Cretaceous relations between inboard and outboard terranes. Although probable Jurassic-Cretaceous subduction-related stratigraphic assemblages have been recognized in the south (and are definitely present in along-strike parts of the North Cascades), these have not been seen to the north. In scenario one, northern continuations of these assemblages may have been tectonically buried by mid- to Late Cretaceous thrusts or elevated by such structures and eroded. In scenario two, pre–Late Jurassic accretionary complexes may have been removed from the central and northern Coast Mountains by Late Jurassic–Early Cretaceous strike-slip displacements. Such assemblages in the southern part of the orogen may be remnants of an outboard subduction assemblage (e.g., southern extension of the Chugach terrane) that were trapped inboard of Wrangellia by sinistral transcurrent faulting. In scenario three, the subduction-related assemblages may have been emplaced by strike-slip faults in the southern Coast Mountains but were never present farther north.

Finally, although fundamental tectonic questions remain, the 44 conferees now are familiar with the observations and ideas of workers from all parts of the Coast Mountains, and this cannot but help lead to a better understanding of the orogen. It seems to the conveners that this is the real purpose of a Penrose conference. ■

List of Participants

Bob Anderson
Mary Lou Bevier
Dave Brew
Bob Butler
Harvey Cohen
Darrel Cowan
Bill Crawford
Maria Luisa Crawford
Yao Cui
Susan DeBari
Dave Engebretson
Carol Evenchick
Richard Friedman
Susie Gareau
John Garver
George Gehrels
Charlie Greig
Peter Haeussler
Craig Hart
Mary Lou Hill
Linc Hollister
Gary Ingram
Murray Journeay
Bryan Kriens
Peter Lewis
Brian Mahoney
Bill McClelland
Robert Miller
Mitch Mihalynuk
Jim Monger
Jim Mortensen
Scott Paterson
Robert Pinsent
Brian Ricketts
Jim Roddick
Charlie Rubin
Paul Schiarizza
Krishna Sinha
Dale Sketchley
Tom Vandall
Peter van der Heyden
John Varsek
Nick Walker
Glenn Woodsworth

IEE Annual Environmental Forum To Address Issues Related to Ground-water Cleanup vs. Ground-water Protection

Fred A. Donath, Executive Director, GSA Institute for Environmental Education

Mindful of its charge to promote the "application of geology to the wise use of Earth," the GSA Institute for Environmental Education has selected the subject of ground-water pollution for its first Annual Environmental Forum, to be presented Sunday, October 25, at the GSA Annual Meeting in Cincinnati. IEE is joined in this effort by the American Ground Water Trust and the GSA Hydrogeology Division. The forum is entitled "Ground-water Cleanup vs. Ground-water Protection: Where Should the $$$ Go?" Eight speakers will discuss various societal, technological, economic, and regulatory considerations relevant to the subject.

In the two decades since Earth Day, April 22, 1970, the heightened awareness among the public of the extent of air, water, and land pollution has led to numerous outcries for environmental protection. Significant legislation has been passed, and the technical community has taken the lead in efforts to reverse the effects of years of activities that led to widespread pollution. But serious questions remain as to whether these efforts are adequate, and, if not, what can be done about it. The debate is perhaps no more sharply focused than on ground-water pollution.

Water is arguably our most important resource, and wise use of Earth dictates that humans conserve and protect that resource. Because water is a factor in many geologic processes and human activities that involve the solid earth, earth scientists are intimately familiar with those factors that influence water quality and production. In the wide-ranging debate on ground-water protection, ranging from sources of contamination such as landfill and mill tailings to the effectiveness of remediation technologies, it is essential that earth scientists be involved.

What constitutes contamination, what can be done to reduce it, and what priorities might be set, in consideration of various risk assessments and economic realities, are among the topics to be addressed directly or indirectly in the presentations, in questions from the audience, and in panel discussion. The forum is intended to inform attendees of various societal, technologic, economic, and regulatory considerations that need to be addressed in dealing with ground-water contamination problems and ground-water protection.

Andrew Stone of the American Ground Water Trust, leadoff speaker at the forum, points out that ground-water contamination and the need for protective measures were clearly recognized in the earliest American colonies, as exemplified by a 1610 proclamation by Governor Gage at Jamestown. What has happened since then largely reflects the concentration of people and activities that creates wastes beyond the capacity of natural chemical and biological processes to deal with them. In addition, the industrial contamination problem can be related, in part, to the resource exploitation mentality that humans should harness nature and make it serve their needs.

A major concern of the public—whether contaminated ground water at industrial and waste disposal sites represents a significant health threat—will be addressed by Robert Harris of Environ Corporation. Harris comments that the ground-water remediation required at a site is usually determined by the cleanup standards for chemical carcinogens. Although the question of acceptable cancer risk levels must be answered within a policy context, the commonly used methods of monitoring contamination and of calculating exposures might be overly protective and could translate into costly remedies that strain technological feasibility.

Fletcher Driscoll of Geraghty and Miller emphasizes the demands being placed on environmental scientists and engineers, and the need for improving personnel management and field investigation practices. He points out that we cannot wait for miracle innovative remedial techniques, but must use proven field techniques and improved managerial skills to meet the demands of federal cleanup programs.

The health risks and the technological capabilities clearly represent key factors in the debate on ground-water pollution, but, at the same time, the high cost of policies to remediate past contamination or to reduce the likelihood of ground-water contamination is also recognized. In addressing the need to set priorities for ground-water protection efforts, Robert Raucher of RCG/Hagler, Bailly points out that we need to know the benefits of alternative policies for protecting and cleaning up ground water, and how these benefits compare to the costs. In addition to health benefits, the benefits of avoided costs, resource availability, and bequest values must be considered.

In spite of lessons being learned about the technical difficulties and expense associated with the cleanup of waste sites, the United States still does not have an adequate hazardous waste dump site prevention program. Moreover, as Linda Greer of the Natural Resources Defense Council emphasizes, the Resource Conservation and Recovery Act (RCRA), designed to prevent the creation of new Superfund sites, regulates only 12% of the wastes generated by industry today. Thus, the creation of Superfund sites is clearly not a problem of the past; it continues to be a problem today even though we should know better.

Part of the solution to the problem undoubtedly lies in the active involvement of state and local government. Dusty Hall of the City of Dayton, Ohio, describes the transition from cleanup to prevention represented by Dayton's technically founded multi-jurisdictional well-field protection program. The WFPP includes zoning districts that restrict existing and future hazardous materials inventories, and it provides incentives for business-initiated risk-reduction efforts, ground-water monitoring, and enhanced emergency preparedness and response capabilities.

Ultimately, the solution to ground-water pollution problems must be tied to the guidance, regulations, and funding that reflect the ground-water policy and strategy of the U.S. Environmental Protection Agency. Alvin Alm, now with Science Applications International, served as Deputy Administrator in the EPA during the critical years of EPA ground-water strategy development. Alm will discuss the EPA's ground-water policy and strategy, which since 1984 has emphasized the building of state ground-water programs. Recognizing the need for coherent state programs in the context of the inherent inconsistencies and rigidities in existing federal ground-water programs, the EPA introduced in 1991 the concept of Comprehensive State Ground-Water Protection Programs (CSGWPPs) that would allow the states to address their own unique circumstances and priorities.

The task before us is enormous, however. As John Cherry of the Waterloo Centre for Groundwater Research points out, the problem of ground-water contamination is one that has been developing for many decades. Most cases of industrial contamination of ground water owe their primary origin to chemical releases prior to the 1980s, when the long-term adverse impacts on ground water were not adequately understood by regulatory agencies and industry, nor by the scientific community. To restore to drinking-water standards a typical aquifer impacted appreciably by chlorinated industrial organic chemicals is generally beyond the capabilities, at acceptable cost, of existing cleanup technologies. Billions of dollars have been spent on site cleanups, but a reversal in the trend of ever-increasing ground-water contamination has not been achieved. The challenge now facing government and industry is how to use these financial resources to reverse the trend.

The formal presentations by these speakers will be followed by a panel discussion and questions from the audience.

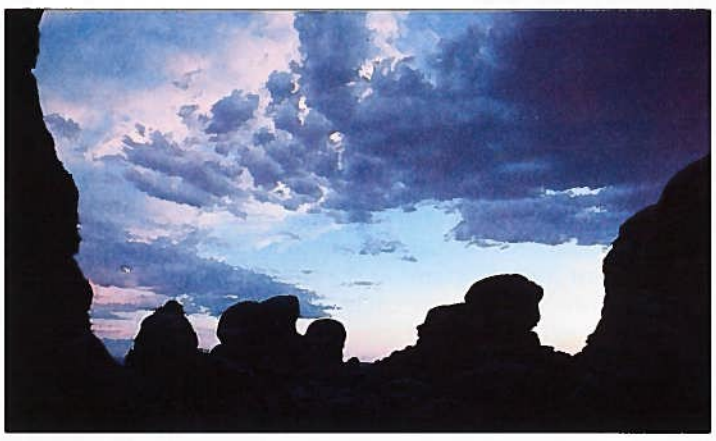
Proposals Solicited for 2nd Annual Environmental Forum—Boston

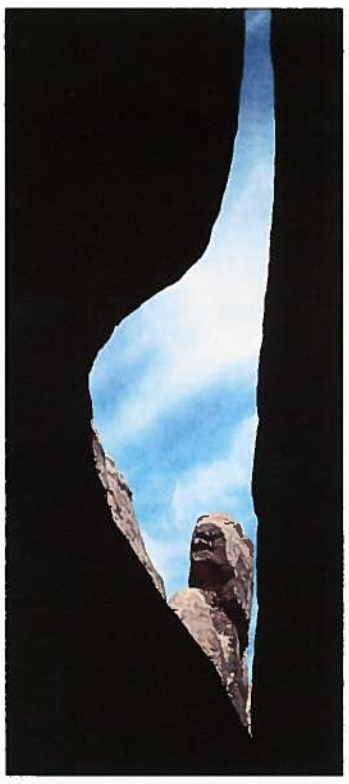
The Institute for Environmental Education, in cooperation with the GSA Committee on Geology and Public Policy, is soliciting proposals for the 2nd Annual Environmental Forum, to be held in conjunction with the 1993 GSA Annual Meeting, in Boston. The IEE Annual Environmental Forum is intended to increase awareness among geoscientists and the public of the role of geoscience in addressing environmental concerns.

Subjects particularly appropriate for the Boston forum include environmental issues relevant to Boston Harbor and the Gulf of Maine, energy needs of New England and the impacts of energy resource development, or environmental issues related to densely populated urban environments. Although selection of the topic for the forum will take into consideration the geologic setting of the meeting place and environmental issues of particular interest there, the subject should have global significance. The speakers should present public-interest, legal, regulatory, management, and other viewpoints, as appropriate, in addition to the purely scientific.

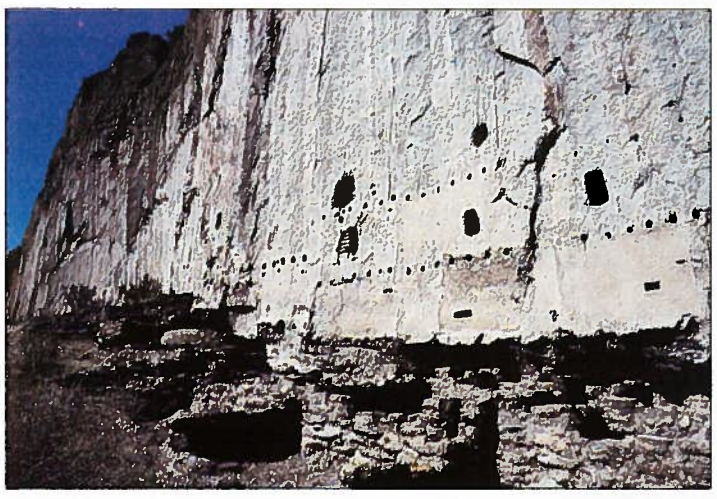
Proposals should include a brief summary of the proposed forum subject, perspectives to be represented (including possible proponents), and name(s) of the person(s) who will serve as organizer(s). Submit no later than *December 15, 1992,* to Fred A. Donath, Executive Director, Institute for Environmental Education, Geological Society of America, P.O. Box 9140, Boulder, CO 80301. ■

Desert hoodoos at dusk, Arches National Park, Utah. "Rocks and rock formations are prominent in the geography of Hopi Country, and in the mythological interpretation of the Hopi world.... Where a stranger to Hopi land will perceive only the barren starkness, and perhaps desolateness all around, the Hopi people see a strength and beauty that comes from intimate familiarity with it...." —*Emory Sekaquaptewa (1981)*

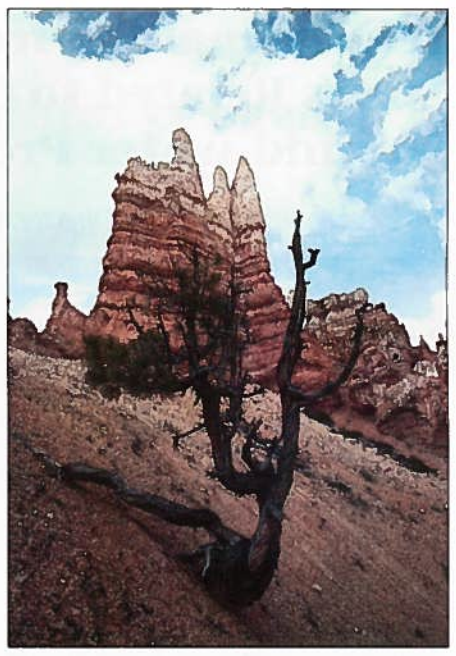




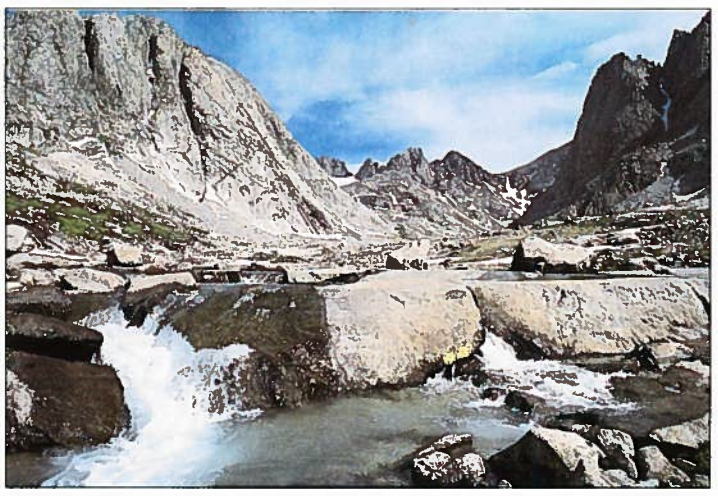
View through a canyon slot, Utah.



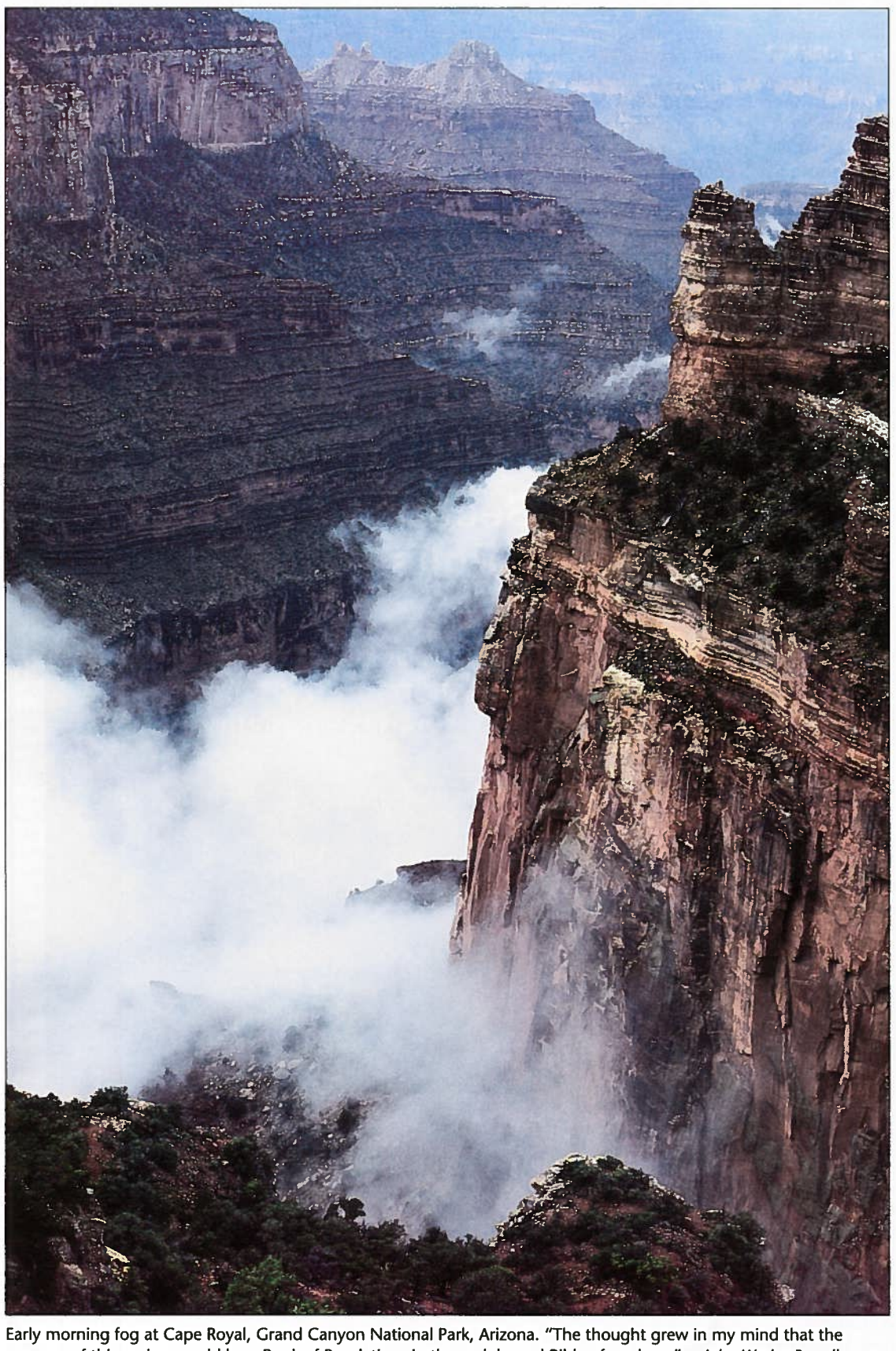
Masonry cliff ruins, Frijoles Canyon, Bandelier National Monument, New Mexico.



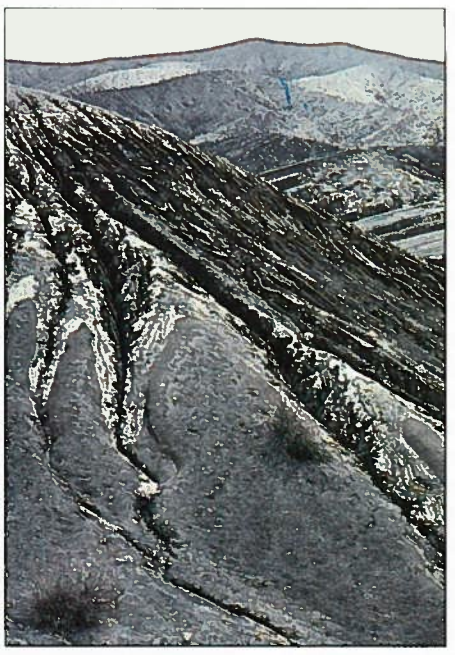
Gnarled pine, Bryce Canyon National Park, Utah.



Alpine peaks and meltwater, Titcomb Basin, Wind River Range, Wyoming.



Early morning fog at Cape Royal, Grand Canyon National Park, Arizona. "The thought grew in my mind that the canyons of this region would be a Book of Revelations in the rock-leaved Bible of geology." —*John Wesley Powell.*



Eroded volcanic landscape, Death Valley National Monument, California.

Erosion and the mud-laden Colorado River, Grand Canyon National Park, Arizona. The desert and canyon country of the Colorado Plateau was a natural laboratory for scientists and explorers like John Wesley Powell who, in the late 19th century, developed significant new ideas concerning landscape-shaping processes, the importance of geologic time, and land use in arid regions.

NARRATIVE—A DIFFERENT LANDSCAPE

The part of the North American continent that we now call the American West is much more than a region of distinct physiographic provinces, and more than a physical record of the history of westward movement and expansion. At the end of the 15th century when Columbus landed in the Caribbean, the West had been explored, adapted to, and inhabited by diverse groups of peoples for thousands of years. The human record of occupation in the Four Corners region of the American Southwest (southern Utah and Colorado, and northern New Mexico and Arizona), for example, is long, if not continuous over this period (Martin et al., 1991; Cordell, 1985). Prehistoric inhabitants of cultural traditions such as Anasazi and Mogollon emerged later as Pueblo Indians, who remain in this area. To survive, or even flourish at times, in such a marginal environment with variable climate and unpredictable water resources required adaptive change.

The great diversity and distinctiveness of Native American cultures, lifeways, and environmental perspectives resist distillation into simple generalizations. It is true, however, that Indian America has not functioned in the same ways that Euro-America has, and cannot be viewed with the same assumptions (Turner, 1974, 1980; Bergon and Papanikolas, 1978; Matthiessen, 1984; Allen, 1986). The Native American West was (and is) a visionary and inclusive world in which landscape was a literal and spiritual home, and conceptions of the world were not narrowly tied to proof and evidence (Beck et al., 1977; Bergon and Papanikolas, 1978; Allen, 1986; Silko, 1986). The particularities of the land around a people—the canyons, mountains, and deserts—were commonly known with the precision of a mapmaker, as well as mystic and partner (Bergon and Papanikolas, 1978; Turner, 1980). The peoples' lifeways tended to erase the distinction between what was mythical (spiritual) and what was real; history, time, and space merged in views of the world—a world in which, for many, all beings were part of a living whole, part of the landscape.

> The land, the sky, and all that is within them—the landscape—includes human beings. Interrelationships in the Pueblo landscape are complex and fragile. The unpredictability of the weather, the aridity and harshness of much of the terrain in the high plateau country explain in large part the relentless attention the ancient Pueblo people gave the sky and the earth around them. Survival depended upon harmony and cooperation not only among human beings, but among all things—the animate and the less animate, since rocks and mountains were known to move, to travel occasionally.
>
> *—Leslie Marmon Silko (Laguna Pueblo), 1986, p. 85–86*

For many American Indian cultures the land exhibits a sacred order that forms the basis of ritual, mythology, and oral tradition (Lopez, 1988). Oral narratives and communal ritual provide a collective, racial memory, maintaining and transmitting experience, custom, and world view from older generations to younger (Turner, 1980; Silko, 1986). Turner (1974) remarked that such narratives are, perhaps, as close as others can get to a sense of the way the natural world seemed to aboriginal Americans prior to European contact. In this sense, oral tradition is an important referential and historical base.

Landscape or geography plays central roles in narratives on boundaries, and the origin of things, places, and humans. As such, the land serves as a map defining physical area and mythical paths, protection, resource, way of life, and cultural reminder, among other things (commonly ineffable). Rather than reflecting primitive or uncomplicated beliefs, oral tradition is but one record of a people's organic relationship with the land, and may reflect a reality of landscape as vital as science or history.

> Among the many people who subscribe to the belief that four mountains define tribal territory are the Navajos, all of the Pueblos, the Pima, and the Yuman tribes of the Gila River.... But mountains are more, much more, than boundary markers defining the tribal boundaries within which a people lives and carries on most of its meaningful, purposeful activities. The Pueblo people, for instance, believe that the four sacred mountains are pillars which hold up the sky and which divide the world into quarters. As such they are imbued with a high aura of mystery and sanctity. And this sacred meaning transcends all other meanings and functions. The Apaches, the most recent mountain dwellers among the southwestern Indians, believe that mountains are alive and the homes of supernaturals called "mountain people." They further believe that mountains are protectors from illness as well as external enemies, that they are the source of the power of shamans as well as teachers of songs and other sacred knowledge to ordinary humans, and that, finally, mountains are defenders as well as definers of tribal territory.
>
> *—Alfonso Ortiz (San Juan Pueblo), 1973, p. 91–92*

HISTORY—CONFRONTATION OF THE UNKNOWN

Euro-America of the late 1700s was essentially a narrow strip of land stretching along the Atlantic seaboard. To the west beyond the Appalachians lay the frontier, and the land beyond it was considered immense, if not infinite, virgin land. In fact, most Euro-Americans did not know what was west of the frontier, although explorers like Coronado (in the 1500s) had ventured across the continental interior, and settlements dotted the West Coast and the Southwest (Perrin, 1986). According to Hector St. John de Crevecoeur in *Letters from an American Farmer* (1782), which was a best-selling account of early American rural life, "Many ages will not see the shores of our great lakes replenished with inland nations, nor the unknown bounds of North America entirely peopled. Who can tell how far it extends?" Even the map of the West in the first American geography book (1797) contained mainly blank spaces or mythical features (Goetzmann, 1982)—truly terra incognita.

The attempt to investigate western lands and resources through geographic and geological expeditions was but one of several major driving forces behind 19th century exploration and expansion. With the MacKenzie expedition (across western Canada in 1793), the Louisiana Purchase (1803), and the Lewis and Clark expedition (1804–1806), the trans-Mississippi West became more than a direction, a receding line of wilderness, or an immense unknown to Euro-Americans (Bergon and Papanikolas, 1978). The continental interior became a distinct region—immense but with boundaries and hints of geographic and ecologic variability.

Historians have pointed out that while the West was being discovered by Americans it was also being invented.

In the 1803 acquisition of the Louisiana Territory from France, the United States claimed almost 757 million acres of what is now the central and western regions of the country. The next step was to determine exactly what was out there. Lewis and Clark's mission was, in President Jefferson's view, political and economic, as well as scientific ("literary") in motive (Goetzmann, 1982, 1986). In this first official, government-sponsored scientific expedition, the Corps of Discovery was to locate "the most direct and practicable water communication across this continent for the purposes of commerce" by traveling up the Missouri River and crossing the Rocky Mountains to the Columbia River basin. Finding a navigable water route to the Pacific (the fabled Northwest Passage or elusive San Buenaventura River), would enhance territorial claim, as well as commerce with Asia and the Native Americans (Boorstin, 1965; Goetzmann, 1966, 1982, 1986). In addition to studying the Indians, Lewis and Clark were to investigate the "soil and face of the country" by noting the geography and identifying and collecting natural resources (including fur-bearing animals and minerals) that might be of commercial or scientific value.

As the first major Euro-American expedition to cross the continent, it established a new far western frontier for the United States, and focused America's attention on the interior of the continent beyond the Mississippi and the exploration of its geography and resources. Over the next 50 years this land of vast plains, mountains, and deserts became known to the nation primarily through the efforts of expeditions by Pike (1806–1807), Long (1820), Wilkes (1838–1842), and Fremont (1840s), other mapping reconnaissances of the Army's Corps of Topographical Engineers, and the travels of individual explorers or mountain men.

Historians have pointed out that while the West was being discovered by Americans it was also being invented (Boorstin, 1965; Goetzmann, 1966, 1986; Turner, 1980; Limerick, 1987, 1989). In this "confrontation of the unknown" (following Goetzmann, 1966), trans-Mississippi landscapes assumed almost mythical dimensions, as perceptions of these lands were based as much on myth as fact. The vagueness and uncertainty of the region were preserved for decades—the idea of the West as a wasteland prevailed well into the 1800s. Myths such as the arid plains beyond the 98th meridian as a Great American Desert or the yet-to-be-discovered transcontinental waterway, the old Spanish San Buenaventura River, died slowly. This mythical river finally did dry up, in a sense, with geographic discovery—John C. Fremont's expedition, in 1844, mapped the region between the Sierra Nevada and Wasatch Mountains (Utah) as a land of interior drainage, a "Great Basin," with no outlets to the sea (Boorstin, 1965).

What good was this western land then? Prior to the 19th century, and essentially beginning with Columbus, the West's immediate value was judged in terms of trade routes to the Pacific and Asia (Bergon and Papanikolas, 1978). The value of opening the western interior in the 19th century was ultimately translatable into the promise of individual opportunity and national expansion and development (Limerick, 1987). Land was commonly viewed by many in terms of its potential for fur trade, agriculture, and, significantly, mineral resources. Mineral discoveries, including gold in California (1848) and silver in Nevada (1859), prompted rapid expansion and westward migration, and mining essentially put the West into the forefront of the nation's industrialized economy for a time (Limerick, 1987).

With the movement of emigrants in the mid- to late 19th century—and the "opening" of the West by railroads to settlement and industry—the country now required more specific and accurate information on the mining, agricultural, ranching, and timber potential (Viola, 1987). This need stimulated a new era of systematic, scientific exploratory surveys in the West (Goetzmann, 1966, 1982, 1986). Between 1867 and 1879, the federal government funded major expeditions in which assessments of the geology, geography, and mineral resources of the trans-Mississippi West were to be the principal objectives (Boorstin, 1965; Rabbitt, 1989). These surveys, led by John Wesley Powell, Clarence King, Ferdinand V. Hayden, and George M. Wheeler, covered an immense region that included the western plains, Rocky Mountains, Colorado Plateau, Great Basin, and Sierra Nevada.

Major questions and concerns about natural processes, geologic time, and human history emerged in this latter phase of western exploration, and represented what historian William Goetzmann has described as the "nation's 'coming of age' scientifically." Progress in the fields of geology and physical geography, as well as simply learning about the western landscape, owed much to the explorations and discoveries of the 19th century surveys. For example, J. W. Powell, who explored and named the Colorado Plateau region, investigated geologic processes and history of the Southwest,

Encounters *continued on p. 218*

Editor's Note

The feature article this month, "Encounters with the Land," commemorates the 500th anniversary of Columbus's landing in North America. As such, it is a departure from the usual science article.

Lauret E. Savoy is of African-American–Native American heritage. She received an A.B. in geology *cum laude* from Princeton University in 1981, her M.S. in earth sciences from the University of California, Santa Cruz, in 1983, and her Ph.D. from Syracuse University in 1990. She combines interests in the role of earth science in American culture (including visual arts and literature), perspectives on the Earth (focusing on Native American and African-American), environmental geology, sedimentology, and environmental stratigraphy. In addition, her landscape photography exhibits have been displayed in several galleries.

—E. M. Moores

Encounters *continued from p. 217*

ethnography of the Indians, and use of arid lands. He sought to understand large-scale landscape-shaping forces and, with his team of scientists, developed significant new ideas on the work of uplift and erosion (and time) and defined and advanced many basic principles and terms of geomorphology and structural geology. Powell's intense interest in the relationship of people to arid lands resulted in *A Report Upon Lands of the Arid Regions of the United States*, which proposed that viable settlement and land use strategies in the arid West could not follow the practices of the humid East.

Powell and other explorer scientists also produced literature that celebrated the western landscape "on its own terms" (following Bergon and Papanikolas, 1978).

> Stand at some point on the brink of the Grand Canyon where you can overlook the river, and the details of the structure, the vast labyrinth of gorges of which it is composed, are scarcely noticed; the elements are lost in the grand effect, and a broad, deep, flaring gorge of many colors is seen. But stand down among these gorges and the landscape seems to be composed of huge vertical elements of wonderful form. Above, it is an open, sunny gorge; below, it is deep and gloomy. Above, it is a chasm; below, it is a stairway from gloom to heaven....
>
> The carving of the Grand Canyon is the work of rains and rivers. The vast labyrinth of canyon by which the plateau region drained by the Colorado [River] is dissected is also the work of waters. Every river has excavated its own gorge and every creek has excavated its gorge. When a shower comes in this land, the rills carve canyons—but a little at each storm; and though storms are far apart and the heavens above are cloudless for most of the days of the year, still, years are plenty in the ages, and an intermittent rill called to life by a shower can do much work in centuries of centuries....
>
> We think of mountains as forming clouds about their brows, but the clouds have formed the mountains. Great continental blocks are upheaved from beneath the sea by internal geologic forces that fashion the earth. Then the wandering clouds, the tempest-bearing clouds, the rainbow-decked clouds, with mighty power and with wonderful skill, carve out valleys and canyons and fashion hills and cliffs and mountains. The clouds are the artists sublime....
>
> The wonders of the Grand Canyon cannot be adequately represented in symbols of speech, nor by speech itself. The resources of the graphic art are taxed beyond their powers in attempting to portray its features. Language and illustration combined must fail....
>
> —*John Wesley Powell, 1895, p. 386–394.*

Earth science is an open inquiry into the workings of nature. As scientists, we must also remember that geologic and geographic setting of regions—the physical landscape—has influenced or controlled patterns of human exploration and settlement, as well as lifeways of peoples and their cultural landscapes. Knowledge of the Earth—the "geologic experience"—can have varied expressions beyond systematic scientific analysis. Ideally, a holistic perception of the Earth might include an understanding of the general concepts of how the natural world operates, a familiarity with the nature and methods of scientific inquiry, and a realization of the importance of earth science in everyday life and the interdisciplinary relationships between the earth and human existence.

REFERENCES CITED

Allen, Paula Gunn, 1986, The sacred hoop: Recovering the feminine in American Indian traditions: Boston, Beacon Press, 311 p.

Beck, Peggy V., Walters, Anna Lee, and Francisco, Nia, 1977 (redesigned 1990), The sacred: Ways of knowledge, sources of life: Tsaile, Navajo Community College Press, and Flagstaff, Northland Publishing Co., 365 p.

Bergon, Frank, and Papanikolas, Zeese, eds., 1978, Looking far west: The search for the American West in history, myth, and literature: New York, New American Library, 476 p.

Boorstin, Daniel J., 1965, The Americans: The national experience: New York, Random House, Inc., 517 p.

Cordell, Linda S., 1985, Why did they leave and where did they go?, *in* Noble, David G., Understanding the Anasazi of Mesa Verde and Hovenweep: Exploration, Annual Bulletin of the School of American Research, p. 35–39.

Goetzmann, William H., 1966, Exploration and empire: New York, Alfred A. Knopf, 674 p.

Goetzmann, William H., 1982, Explorer, mountain man, and scientist, *in* Exploring the West: 1803–1879: National Park Service Handbook 116, p. 17–95.

Goetzmann, William H., 1986, New lands, new men: America and the second great age of discovery: New York, Viking Penguin, Inc., 528 p.

Leveson, David, 1972, A sense of the Earth: New York, Anchor Natural History Books, 176 p.

Limerick, Patricia N., 1987, The legacy of conquest: The unbroken past of the American West: New York, W. W. Norton & Company, 396 p.

Limerick, Patricia N., 1989, Desert passages: Encounters with the American desert: Niwot, University of Colorado Press, 218 p.

Lopez, Barry, 1988, Crossing open ground: New York, Charles Scribner's Sons, 208 p.

Martin, Debra L., Goodman, Alan H., Armelagos, George J., and Magennic, Ann L., 1991, Black Mesa Anasazi health: Reconstructing life from patterns of death and disease: Southern Illinois University Center for Archeological Investigations Occasional Paper No. 14, 314 p.

Matthiessen, Peter, 1984, Indian country: New York, Viking Press, 338 p.

Ortiz, Alfonso, 1973, Look to the mountaintop, *in* Ward, E. Graham, ed., Essays on reflection: Boston, Houghton-Mifflin.

Perrin, Noel, 1986, Forever virgin: The American view of America, *in* Halpern, Daniel, ed., On nature: Nature, landscape, and natural history: San Francisco, North Point Press, p. 13–22.

Powell, John Wesley, 1895, Canyons of the Colorado (republished in 1961 as The Exploration of the Colorado River and Its Canyons: New York, Dover, 400 p.).

Rabbitt, Mary C., 1989, The United States Geological Survey: 1879–1989: U.S. Geological Survey Circular 1050, 52 p.

Sekaquaptewa, Emory, 1981, Wunuuqam: Ones who stand: Plateau, v. 53, p. 18–23.

Silko, Leslie Marmon, 1986, Landscape, history, and the Pueblo imagination, *in* Halpern, Daniel, ed., On nature: Nature, landscape, and natural history: San Francisco, North Point Press, p. 83–94.

St. John de Crevecoeur, Hector, 1782, Letters from an American farmer: London, T. Davies.

Turner, Frederick, ed., 1974, The Portable North American Indian reader: New York, Viking Press, 626 p.

Turner, Frederick, 1980, Beyond geography: The western spirit against the wilderness: New York, Viking Press, 329 p.

Viola, Herman J., 1987, Exploring the West: Washington, D.C., Smithsonian Books, 256 p.

Manuscript received June 22, 1992; revision received July 6, 1992; accepted July 8, 1992. ■

GSAF UPDATE

Robert L. Fuchs

Sixty Years of Research Grants

An important milestone in GSA history was passed on March 27, 1992, when the Committee on Research Grants concluded its 1992 meeting in Boulder. The Committee had reviewed 533 proposals and awarded 248 grants in the total amount of $315,769. More important from the historical standpoint is the observation that this was the 60th time that the annual grant-making process was successfully implemented.

Sixty years is essentially a lifetime (except for field geologists who have a tendency to expire in their 90s and beyond) and like any lifetime, that of the GSA Research Grants program has had its share of highs, lows, and memorable events. The first grant in 1933 went to R. V. Anderson to study the geology of the coastal Atlas Mountains in western Algeria. That year the Society awarded $50,000 in total grants. There were two bleak periods in subsequent years when annual grant totals slipped below the initial level—the World War II years when the program reached a low of $20,000 in 1944, and the eleven years from 1958 through 1968 when the average was $30,000.

Contrast these low periods with the 1980s and early 1990s when available funds broke through the $100,000 level in 1985 and have since risen to last year's record-setting $315,769. When the committee gavel came down after John-Paul Zonneveld's grant to study Eocene vertebrate assemblages in the Green River Basin, he became the 5086th recipient of a GSA grant, and the cumulative 60-year total reached $4.6 million.

For many geologists, a GSA student research grant was the first financial nudge onto a career path that led to scientific discovery, satisfying life work, and recognition as one of a select group possessing an understanding of Earth's complexities. The careers of 22 Penrose medalists, 10 Day medalists, two Donath medalists, and 19 GSA presidents included a research grant from GSA in the formative years.

The first GSA research grants were paid out of Penrose endowment income. In contrast, 1992's funding originated from a variety of sources, of which the Penrose Endowment amounted to just 48%. Additional monies were supplied by NSF, the GSA Foundation, and four GSA Divisions. The Foundation has been carrying a greater role in the financing of research grants through its GEOSTAR, unrestricted, and several designated funds.

GSA was fortunate to receive funding for the Research Grants program from the National Science Foundation—$300,000 over three years. This has allowed a much-needed increase in average grant size, and the number of rejections each year has been reduced. Two-thirds of this money has been used, and GSA and the Foundation must look to new funding by 1994 if the number and dollar amount of awards are to be maintained at current levels. Contributions to GEOSTAR are important to the continued success of the program.

Please use the accompanying coupon for this purpose. Also, should you wish to consider some form of planned gift for Research Grants that would augment the endowment, such as a bequest, trust, annuity, or the Pooled Income Fund, please call us at (303) 447-2020 or write the Foundation office at GSA headquarters. Better still, visit the Foundation booth, #670, in the exhibit area in Cincinnati, view the research grants display, and talk to one of the trustees or staff about your gift. ■

GEOSTAR
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Publicity is Good for the Complexion

...The complexion of geology, that is—using Webster's definition of "a complex of attitudes and inclinations." The public's attitude toward science is dictated by what it reads and hears in the popular media, and you can help in that regard.

GSA is dedicated to furthering the science of geology, and part of that effort is public information. All too often in preparing GSA press releases, a call to the public information officer at the geologist's institution is met with the grateful reply, "Thank you so much for letting us know what's going on here—those scientists never tell us what they're doing!"

Your public information officer would be happy to publicize your endeavors, if you would only let them know about what you are doing. Publicity can range from on-campus and alumni publications to newspaper articles or TV/radio interviews, to articles in publications such as *Science* or *Science News*.

Likewise, GSA's public information staff would like to know if you are working on something newsworthy. Feel free to stop in at the News Room in the Cincinnati Convention Center at the 1992 Annual Meeting, or call Sandra Rush at (303) 443-8489, and let us know what's new.

GSA 50-Year Fellows Honored

GSA annually honors those individuals who have attained their 50th year of membership in the Society. Each of the 50-year members listed below, all of whom are GSA Fellows, will receive a specially designed lapel pin and a certificate of recognition.

This list of 50-year Fellows includes all current members who joined the Society in 1943.

Chalmer L. Cooper
Sarasota, Florida

Louis C. Conant
Cupertino, California

Edward C. Dapples
Sun City, Arizona

H. Garland Hershey
Iowa City, Iowa

Shailer S. Philbrick
Ithaca, New York

James A. Noble
Spearfish, South Dakota

Manuel Tello-B.
Caracas, Venezuela

Memorial Preprints

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

Ira S. Allison
Lehi F. Hintze

Richard Lee Armstrong
Randall R. Parrish

Garth Merrill Crosby
Thomas E. Gillingham

John T. Hack
W. R. Osterkamp, C. R. Hupp

John W. Harshbarger
Eugene S. Simpson, Errol L. Montgomery

John W. Hosterman
Sam H. Patterson

Francis A. Kohout
Frederick W. Meyer, Howard Klein

John Franklin Lance
John W. Anthony

André Laurin
Claude Drouin

Burton Hampton Marliave
Robert T. Bean

Harry J. Werner
Robert B. Lieber

Congressional Science Fellows Make a Difference

Sandra Rush, GSA Public Information Consultant

As it approaches its twentieth year, the Congressional Science and Engineering Fellows Program has gained a level of respect on Capitol Hill that transcends political partisanship. Through this program, administered by the AAAS and supported by GSA and other scientific organizations, Fellows serve on the staffs of senators, representatives, and congressional committees as science or engineering resources. Fellows have an opportunity to make significant public service contributions, and they also obtain first-hand experience in the legislative and political processes.

A total of 25 to 30 Fellows are chosen each year to participate in the program. Each of about 20 participating organizations selects and sponsors an early- or mid-career scientist to be a Fellow. GSA has sponsored one Fellow per year since 1986, jointly with the U.S. Geological Survey. In recent years, members of Congress have requested about five times this many Fellows to be assigned to their staffs or committees, and the recommendation has been made to increase the number of Congressional Science Fellows to at least 50 by the year 2000.

At the end of an intensive two-week orientation program organized by AAAS, Fellows interview with more than ten offices. They typically receive offers from several offices and then choose which among these they wish to work with—demand far exceeds supply in this case. The orientation program includes briefings by key federal agencies, public interest groups, the National Academy of Sciences, the World Bank, lobbyists, and academics, among others. Thus, Fellows start their assignments with more than a basic knowledge of the legislative process and working environment on the Hill. During the year, Fellows are invited to attend a series of seminars, usually two per month, which provide additional exposure to issues currently before the Congress, public interest groups, and other ideas and people.

What Does a Fellow Do?

Fellows generally work as regular staff members, performing every type of task normally asked of the permanent staff, whether they are in individual offices or with committees. In many cases, Congressional Science Fellows are like human reference books—actually encyclopedias—to the people with whom they work. Any question, situation, or legislation related to science—any science—goes to the Fellow, who is expected to explain the situation in terms that can be readily understood, and then perhaps to research it and come up with a recommendation dictated not by lobbyists or special interest groups, but by pure scientific reasoning.

The sources of the information upon which Fellows base their input are varied. Fellows have access to information before its publication. In addition, much information is shared with staffers (and Fellows) on the Hill in briefings by scientists from NASA, NOAA, EPA, and other government organizations, as well as constituents knowledgable in a specific area.

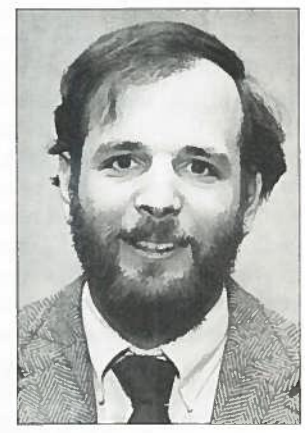
In addition to issues related to their particular earth science interests, GSA-sponsored Fellows work on many other science-related areas. For example, Jim Evans worked on space and forestry issues as well as Indian water rights issues, although his background is in sedimentology. Craig Schiffries, with a background in the geological sciences, worked in the area of computer viruses, semiconductors, and patents. On the other hand, Daniel Sarewitz, whose previous research was in tectonics, came to the office of Congressman George E. Brown, Jr., of California, just four days before the Loma Prieta earthquake occurred. Earthquake policy thus occupied much of his time as a Fellow, and he was involved in legislation to establish a federal earthquake insurance program.

For a hearing of the Committee on Environment and Public Works on global warming and stratospheric ozone depletion, Jennifer Hess was tasked with establishing the goals and agenda of the hearing, identifying and contacting witnesses, writing the background memo for the staff, and preparing opening statements and questions for the senators at the hearing. This level of involvement is not unusual for Congressional Science Fellows.

Seeing a bill through to completion is like running a marathon that you have trained for extensively. The "training" may take months rather than years, but they both involve intensity and sometimes frustration; and finally there is the exhilaration as the bill is passed into law—crossing the finish line at last! This "finish" is not accomplished easily, nor too often. Of the more than 10,000 bills introduced into Congress each session, only a few hundred become law. Schiffries, in his year as a Fellow, was fortunate enough to have a bill on semiconductors, for which he gave substantial input, passed into law.

Incidentally, Schiffries, whose year as a Fellow was the historical year that saw the Gulf War, the fall of the Iron Curtain, and the Clarence Thomas hearings, is sometimes recognized on the streets ("Don't I know you from somewhere?") because he staffed the Thomas hearings and was seen on national TV seated directly behind the Senate Judiciary Committee.

Elizabeth Robinson



Daniel Sarewitz

Jennifer Hess

James Evans

How Important Is the Program?

Elizabeth Robinson observes that "Congress needs scientists on an immediate day-to-day level to simply sort through the good and bad technical analyses that are used to substantiate legislation." Having an independent source of technical people to perform appraisal and analysis is essential to a congressional office. According to current Fellow Ken Taylor, "The more compact and understandable you can make your information, the higher a value the members of Congress as well as others will place on your information. Having accurate and relevant information is important, but having someone with a technical background to quickly analyze new information is essential."

Evans asserts, "Many of the issues facing Congress today cut across the traditional boundaries of various scientific disciplines, and require an interdisciplinary approach to their solutions. Our congressional representatives require accurate, concise, current, and unbiased information in order to vote intelligently on these issues." Taylor adds, "Fellows offer unbiased technical analysis. We brief the member so that a very busy person is informed about the issues; we draft questions that reach to the heart of the matter during a hearing; and we help forge the compromises needed on the technical issues that are so often a part of controversial pieces of legislation."

How important are the insights of the Science Fellows to the work of Congress? Just ask Jennifer Hess, who was called for information on the Clean Air Act, in which she had an integral role, while she was in labor in the hospital, to provide vital information because her area of expertise happened to be on the floor at that time. Hess had spent hours and hours during her pregnancy, sometimes into the early morning, behind closed doors working on the Clean Air Bill, in a hot and stuffy room 224 in the Capitol. After giving birth, as she was coming out of the anesthesia, she heard the hospital attendant say that she was being transferred to—you guessed it—room 224 in the hospital!

"The program serves to improve the science literacy of policymakers and the political literacy of the scientific community."

Where Are They Now?

Jennifer Hess (1986–1987, Subcommittee on Hazardous Wastes and Toxic Substances, Senate Committee on Environment and Public Works) is currently a full-time mother to two young children. She is on leave from the Senate Committee on Environment and Public Works.

James E. Evans (1987–1988, Office of Congressman Michael E. Lowry) is an assistant professor in the Department of Geology at Bowling Green State University in Ohio. He has introduced a new course on science and public policy into the department's curriculum.

Elizabeth M. Robinson (1988–1989, Office of Congressman Richard Gephardt) is an analyst at the Congressional Office of Technology Assessment. She has worked on a variety of reports in the broad areas of science, technology, and environmental policy.

Daniel R. Sarewitz (1989–1990, Office of Congressman George E. Brown, Jr.) is a science consultant on the staff of the House Committee on Science, Space, and Technology. He advises Rep. George Brown, chairman of the House Science Committee, on a broad range of science and technology policy issues.

Craig M. Schiffries (1990–1991, Subcommittee on Technology and the Law, Senate Committee on the Judiciary) is coordinator of the Government Affairs Program at the American Geological Institute. He works on a broad range of legislation that has significant geoscience components, including the National Geologic Mapping Act and funding for geoscience programs administered by the federal government. He recently testified before the Senate Appropriations Committee in support of the National Science Foundation budget.

Kenneth B. Taylor (1991–1992) is currently serving in the office of U.S. Senator Harry Reid (D-NV). He has followed issues concerning nuclear waste and licensing, future and alternative uses for the Nevada Test Site, earthquake hazard mitigation in Nevada, and appropriations for the Departments of Interior and Energy.

Margaret Goud Collins (1992–1993) started her term as a GSA Congressional Science Fellow on September 1, 1992.

Who Benefits From the Program?

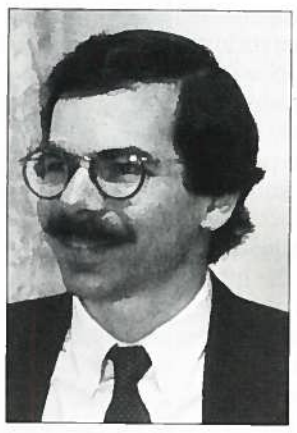
Fellows generally agree that their own impact on Congress is probably less than the impact the experience has had on them. The program provides the Fellows with a much better understanding of the legislative process, has developed their leadership potential, and has expanded their horizons. Schiffries stated it succinctly when he said that the program serves to improve the science literacy of policymakers and the political literacy of the scientific community.

According to Sarewitz: "The Fellowship program serves both the scientific and legislative communities. On the one hand, the Fellows offer their expertise to Congress, and are thus a much-needed technical resource. Conversely, the Fellows gain insight into the legislative process, and especially into the manner in which scientific considerations influence (or don't influence) the formulation of public policy."

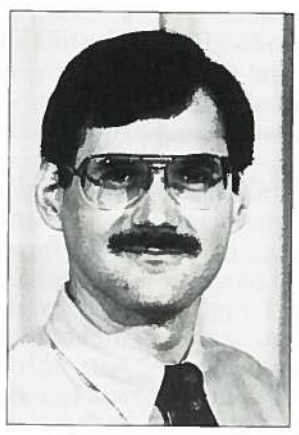
Sarewitz helped in "technology transfer" between Congress and the scientific community when he assisted Rep. George Brown in holding a congressional field hearing on earthquake hazards at GSA's annual meeting in 1991. Beth Robinson recruited Rep. Gephardt to speak on global climate change at a meeting of the American Geophysical Union. Congress and the science community both can benefit from such interactions.

So far, nearly one-third of all Fellows have pursued careers in public policy after completing Fellowships. All five former GSA Fellows have remained active in one way or another in public policy—three are working within the government in Washington, and Schiffries is coordinator of the Government Affairs Program at the American Geological Institute. Evans, who is at Bowling Green State University in Ohio, actually accepted his job in Ohio before becoming a Fellow. He was granted a "pre-employment sabbatical" for one year, and has added a course on science and public policy to the Bowling Green curriculum.

All former Fellows enthusiastically support the Fellowship program. As Hess states, "We as Fellows have the opportunity to ... bring scientific concerns to the House and Senate floors.... There is a place for scientists on the Hill, and I would strongly encourage others to apply for future Congressional Science Fellowships." Sarewitz adds, "As a group, [the Fellows] make a difference, and this difference benefits the scientific community at large, as well as the general public."



Craig Schiffries



Kenneth Taylor

How Can the Scientific Community Become Involved in Legislation?

Members of Congress take very seriously the correspondence they receive from the public, especially their own constituents. All of the GSA Fellows agree that one theme to be emphasized is "Get Involved." They enthusiastically endorse the Congressional Science Fellowship program, and they also stress that the scientific community should get involved in public policy as well. For one thing, funding for geoscience research depends on informing Congress of the importance of such research. Tying it to lives and dollars saved is one way; for example, the decision to evacuate the U.S. bases in the Philippines at the time of the impending Mt. Pinatubo eruption. But cases should also be made for geoscience research that is not necessarily tied to disasters.

An example of scientists making a difference in policy culminated in the passage of the National Geologic Mapping Act of 1992, with its importance to exploration for and development of mineral, energy, and water resources; screening and characterizing sites for waste disposal; land use evaluation; planning for environmental protection; and design and construction of infrastructure requirements; among many other applied and basic earth science investigations.

Sarewitz wants to reverse the "political naiveté that characterizes many scientists [and] cripples their ability to have any major impact on science policy."

Margaret Goud Collins

He asserts that most Members of Congress don't "wait around to hear from scientists before making decisions that affect scientists."

Evans found there are relatively few scientifically trained personnel working for Congress or its congressional agencies. No Members of Congress are earth scientists. He says, "As a general policy, it may be wise for interested earth scientists to make general contacts with the staff of committees that have jurisdiction over areas of particular interest. These general contacts might include visiting and talking to staffers on the Hill, sending them briefing papers or background information, or other activities. The goal of these activities is to make the necessary contacts so that, when important issues arise, the earth scientists are consulted."

Robinson urges, "As the technical basis of many issues becomes more complex, scientists can make a larger contribution in the legislative arena. From what I have seen on the Hill, I would encourage more scientists to get involved with the issues that they know about, to whatever degree that they wish. Congress is one of the most open institutions to outside influences. And it is our job to make sure that they are being influenced by the best information possible."

How Do I Apply for a Fellowship?

A prospective Fellow must demonstrate exceptional competence in some area of science or engineering as well as be cognizant of many matters in nonscientific areas. The candidate should be sensitive to political and social issues, and have a strong interest and some experience in applying his or her knowledge toward the solution of societal problems.

Application information for the GSA-sponsored Congressional Science Fellowship is available from GSA Heaquarters, P.O. Box 9140, Boulder, CO 80301.

Being a Congressional Fellow is not for everybody. But for those who possess the A-E-I-O-U qualities—ability to be a self-starter, enthusiasm, intelligence and integrity, open-mindedness, and understandability—this can be a most rewarding experience. ■

Since 1986, the GSA Congressional Science Fellowship has been jointly funded by GSA and by a grant from the U.S. Geological Survey.

The views and conclusions contained in this article are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

Meet the Congressional Science Fellow in Cincinnati

Kenneth B. Taylor, 1991–1992 Fellow, will report on his experiences on the Hill at the 1992 GSA Annual Meeting in Cincinnati. You can find out more about the program and ask questions at the open session sponsored by the GSA Geology and Public Policy Committee. This open session will be on Wednesday, October 28, 12:15–1:15 p.m. in Room 208, Cincinnati Convention Center.

The Geological Society of America

Congressional Science Fellowship 1993–1994

The Geological Society of America is accepting applications for the 1993–1994 Congressional Science Fellowship. The Fellow selected will spend a year (September 1993–August 1994) in the office of an individual member of Congress or a congressional committee for the purpose of contributing scientific and technical expertise to public policy issues and gaining first-hand experience with the legislative process. The American Association for the Advancement of Science conducts an orientation program to assist 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.

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, 1993

Notes from the Geosphere Alliance Committee

W. S. Fyfe
Department of Geology, University of Western Ontario, London, Ontario N6A 5B7, Canada

As GSA President E-an Zen indicated in his report in the September issue of *GSA Today,* following the GSA meeting in San Diego a small committee was established to seek ways "to advance the application of geology to the wise use of Earth." No small task for our small group! However, we are well aware that we have many friends across the world with the same problems on their minds. The earth sciences are at a critical time in their development. The other day, I was watching a TV documentary produced by geologists, and, as usual, it focused on past events—extinctions, evolution, etc., etc. Our public image is that of scientists who are obsessed by what happened millions of years ago. But, as the Rio Earth Summit demonstrated so clearly, humankind is now worried about the near future, about its very survival in the next decades and centuries. These valid concerns present us with a new challenge that we cannot ignore. We do know a lot about Earth, and Earth processes, and this knowledge must be made available in a realistic format for all those involved in planning sustainable development. When I look at so many of our undergraduate programs, I worry when I notice that 90% of the courses seem to be just the same as when I was a student in the 1940s.

As so well expressed in their article in *GSA Today* (May 1992), Cordani, McLaren, Silver, Skinner, and Wolman stress that the problems on this planet today are related to the growth of human population and the technologies that have supported this growth. Thus, our great tasks are to describe the interactions with the total life-support systems of Earth, describe the changes, and develop new systems, so that we can look to the future with optimism for all species that live on Earth.

Among the problems our small groups discussed were the following.

1. We need to greatly improve communications with our fellow citizens and, particularly, political, social, and economic leaders. It was stressed that we must form true working partnerships, at local and global levels. We must not present the results of our work after the fact, but include such people in the planning and execution of the work, from start to finish.

2. Many of us involved in high levels of planning will not see much of the next century, when human population will reach 10 billion. We must form a better partnership with those who will be here in 2020–2050. It is the children who are putting pressure on their parents to show some respect for Earth. For this reason, at the 1992 GSA Annual Meeting, in Cincinnati, we will see a forum, "Our Common Future: The Concerns of Earth Science Students." I very much hope that our senior academics will encourage their students to participate, and will even provide a little support.

3. We are concerned with the lack of the required effort by geoscience communities in facing some obvious world problems. Included are global water resources, global soil erosion, impacts of land-use change, and the state of the essential global mineral supply, including minerals related to food production. In all such cases, it is urgent that we form true partnerships, local and global. We will be considering actions related to such problems in our future work. We must work to produce the technologies and systems for prevention, and not just remediation, of environmental problems. Given 100 million more humans each year, there will be changes in the use of Earth.

4. Programs like the IGBP still do not pay sufficient attention to solid earth influences on the biosphere. Perhaps the recent Pinatubo event reminds us that local geofluctuations can have global impact, and that such events will have massive consequences as more of the world's population lives at the limit of its food and water supply.

5. We stressed the need for an improved effort to integrate interactions between all national and international geoscience organizations. For example, I would be willing to bet that most North American geologists don't know much about IUGS, EUG, and others. We must work to form more effective partnerships across the world.

6. Finally, we all agreed that we must pay more attention to science (particularly geoscience) education at all levels in our schools and communities. As E-an Zen stresses, GSA is moving on this issue, but we must be sure that there is quality control on what goes out to schools, public forums, etc. In addition, we must be sure that we address the future, not just fossils.

King and Schneider recently published their thought-provoking report, *The First Global Revolution* (Simon and Schuster, 1991). The report discusses many aspects of global problems, but, for me, one feature especially requires our consideration. King and Schneider quote Jay Forrester on systems: "In any complex system, attack—however apparently intelligent—on a single element or symptom generally leads to a deterioration of the system as a whole." Perhaps this summarizes their message. Given the state of Earth, the reasons behind the Earth Summit, we must admit the failure of our systems.

In 1991, the Alfred Wegener Foundation organized an international fair and congress, Geotechnica. The attendance by about 30,000 scientists and citizens was remarkable. In 1993, they will hold the second such gathering. The themes of the conference and displays will include the following.

Environmentally conscious utilization of resources is the basic challenge if humankind is to stay supplied with the necessary raw materials from the potentials of the lithosphere, the pedosphere, the hydrosphere, and the atmosphere today and tomorrow. In this, the subject matters of geosciences and geoeconomics bear great responsibility.

Acquisition of information forms the solid basis for the assessment of conservationist and environmentally compatible use of all resources from mineral raw materials through energy supply to agricultural utilization. The prognostics for the closed-system "earth" demands accurate acquisition and processing.

Sanitizing and landscaping are among the pressing tasks of our times and form an imperative commitment now that the environmental damage caused by the extensive utilization of all our earthly resources has become apparent. Geosciences and geotechnics provide new concepts to control waste, waste dumps, and pollution.

Preventive action and environmental protection measures require a profound knowledge of the interactions between earth, ground water, surface waters, and the atmosphere. At the forefront of efforts are the development of methods and techniques for environmental protection and thus for the conservation of a planet worth living on.

Environmental politics and acceptance of them are essential. To cope with environmental problems, rapid and targeted actions are necessary. This requires a stronger impetus and suitable structures in politics, society, and communications. To define the concepts, binding legal standards yet also freedom for competent action must be created.

In a general way, the Wegener Foundation priorities summarize many of the future demands on our science. If earth sciences are to make their needed contribution to the future planning of developments on this planet, we must leave our cocoons and work with the entire spectrum of humanity. We have, or can develop, the needed tools for global watch, and we must move to form the needed global partnerships and to provide the necessary knowledge and systems for future development. The Earth Summit is over—let's get to work. ■

GSA Division News

Divisions will be recognizing the following individuals at the 1992 Annual Meeting in Cincinnati for their service to the Division and/or contributions to the geological sciences.

Coal Geology Division
Aureal T. Cross, Distinguished Service Award
Samuel A. Friedman, Distinguished Service Award
Frank E. Kottlowski, Distinguished Service Award

Engineering Geology Division
James E. Slosson, Distinguished Practice Award
John W. Williams, Meritorious Service Award
Roy J. Shlemon, Richard H. Jahns Distinguished Lecturer

Hydrogeology Division
Eugene S. Simpson, Distinguished Service Award
Phyllis M. Garman, Distinguished Service Award
Robert N. Farvolden, Distinguished Service Award
Donald I. Siegel, Birdsall Distinguished Lecturer

Quaternary Geology and Geomorphology Division
Herbert E. Wright, Jr., Distinguished Career Award

Structural Geology and Tectonics Division
Paul F. Hoffman, Best Paper Award

For a listing of other award recipients to be honored at the Cincinnati meeting, see page 145 of the July 1992 issue of *GSA Today.* ■

SAGE REMARKS

Edward E. "Dr. Ed" Geary, Educational Programs Coordinator

Shake Up Your Students at Cincinnati

For the first time, at the 1992 Annual Meeting in Cincinnati, GSA will host a multitude of education workshops for both scientists and precollege teachers. Monday morning (October 26) activity workshops will include a visit to the red planet, a look at Earth's mineral resources, and demonstrations of Earth's internal forces. Come learn the "Wave Dance" and shake up your students this semester. For those of you interested in slightly more mundane matters, (e.g., how to obtain funding for your education programs), there will also be two grant-writing sessions on Monday morning. All workshops will be held at the Cincinnati Museum of Natural History. Following the workshops you will have the opportunity to tour the museum, eat lunch,* and listen to eminent paleontologist and scientific philosopher Stephen J. Gould, before heading back to the convention center for an afternoon of stimulating science.

The Monday morning education activities will begin at 8:00 am at the museum. So eat early, and join your colleagues and local earth science teachers for a morning of educational fun and discovery. For additional information on these and other education activities, please contact me at the Geological Society of America, P.O. Box 9140, Boulder, CO 80301, phone (303) 447-2020. ■

**Please note, the activity and grant-writing workshops are free, but lunch is $10 for precollege teachers, and $18 for other GSA members.*

Call for Nominations for 1993 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 1993, only those candidates born on or after January 1, 1958, are eligible for consideration. In choosing candidates for the Young Scientist Award, scientific achievement and age will be the sole criteria. Nominations for the 1993 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 1993 Young Scientist Award must be received at GSA headquarters by ***February 1, 1993***. Use the form below for submitting the name of a candidate for the Young Scientist Award. ■

Call for Nominations for 1993 GSA 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. Letters of nomination and any supporting information should be addressed to Executive Director, Geological Society of America, P.O. Box 9140, Boulder, CO 80301. ■

Deadline for nominations for 1993 is March 1, 1993.

Recipients to date:

1988.....	*Campbell Craddock*
	Robert D. Hatcher, Jr.
	Eldridge M. Moores
	William A. Thomas
1990	*William B. Heroy, Jr.*
1991	*Dorothy M. Palmer*
1992	*A. R. (Pete) Palmer*

1993 YOUNG SCIENTIST AWARD (DONATH MEDAL)

THE GEOLOGICAL SOCIETY OF AMERICA
Nomination for 1993 Young Scientist Award (Donath Medal)

NAME OF CANDIDATE: Date of birth: _____

ADDRESS:

REQUIRED INFORMATION (Please attach)

BIOGRAPHICAL INFORMATION
Provide in a format similar to that found in *American Men and Women of Science, Who's Who in America.*
(For the year 1993, only those candidates born on or after January 1, 1958, are eligible for consideration.)

SUMMARY OF SCIENTIFIC CONTRIBUTIONS TO GEOLOGY
Not more than 200 words.

SELECTED BIBLIOGRAPHY
No more than 10 titles.

LETTERS OF SUPPORT
Nominations for the Donath Medal MUST BE SUPPORTED by signed letters from five (5) scientists. The letters may be attached to this nomination form or may be sent to the Executive Director separately.

Name of person making the nomination: _____

Address: _____

Date: _____ Signature: _____

Letters of support will be submitted by:

1. _____
2. _____
3. _____
4. _____
5. _____

RETURN TO: Executive Director
The Geological Society of America
P.O. Box 9140
Boulder, CO 80301
(303) 447-2020

DEADLINE: Please return this form to headquarters by ***February 1, 1993***.

Call for Nominations for 1993 Penrose and Day Medals and Honorary Fellows

Nominations for GSA's Penrose and Day Medals and for Honorary Fellowships of the Society are due at headquarters by ***February 1, 1993***. Members and Fellows of the Society are encouraged to participate in this important process by nominating candidates for these high honors.

Penrose Medal

The Penrose Medal was established in 1927 by R.A.F. Penrose, Jr., to be awarded in recognition of eminent research in pure geology, for outstanding original contributions or achievements that mark a major advance in the science of geology. The award is made only at the discretion of the Council. Nominees are selected by the Council, may or may not be members of the Society, and may be from any nation. Penrose's sole objective in making the gift was to encourage original work in purely scientific geology. **Scientific achievements should be considered rather than contributions in teaching, administration, or service. Mid-career scientists who have already made exceptional contributions should be given full consideration for the award.**

Day Medal

The Day Medal was established in 1948 by Arthur L. Day to be awarded annually, or less frequently, at the discretion of the Council, for outstanding distinction in contributing to geologic knowledge through the application of physics and chemistry to the solution of geologic problems. Day's intent was to recognize outstanding achievement and inspire further effort, rather than reward a distinguished career. **Scientific achievements should be considered rather than contributions in teaching, administration, and service.**

Honorary Fellows

Geologists who have distinguished themselves in geological investigations or in notable service to the Society may be elected as Honorary Fellows. In practice, nearly all candidates have lived and worked outside of North America. The most noteworthy exceptions were astronauts.

Most Honorary Fellows have been elected toward the evenings of their careers, after lifetimes of outstanding and internationally recognized contributions to the science.

How To Nominate

To ensure thorough consideration by the respective committees, please submit for each candidate a brief biographical sketch, such as used in *American Men and Women of Science* and *Who's Who in America*, a summary of the candidate's scientific contributions to geology that qualify the individual for the award, and a selected bibliography of no more than 20 titles.

A nomination for any one of these three awards MUST BE SUPPORTED by signed letters from each of five (5) GSA Fellows or Members. The letters may be attached to this form or may be sent to the Executive Director separately. For Honorary Fellow nominations, please *verify degrees received, publications, positions held, etc.* The names of unsuccessful candidates proposed to the Council by the respective committees will remain for consideration by those committees for three years. FOR THOSE STILL UNDER CONSIDERATION, IT IS RECOMMENDED THAT AN UPDATED LETTER OF RENOMINATION BE SENT TO THE EXECUTIVE DIRECTOR.

The deadline for receipt of nominations at the office of the Executive Director is ***February 1, 1993***.

Please use the form at right for submitting the name of a candidate for any one of the awards.

Recipients of the awards to date are listed on p. 226. ■

About the Honorary Fellow Program

Below you will find a form to be used in nominating candidates for Honorary Fellowship in the Geological Society of America. Each year this honor is bestowed on those individuals who have lived and worked outside of North America and have distinguished themselves in geological investigations or in notable service to the Society. Under exceptional circumstances, North Americans have been named Honorary Fellows. This amendment to the bylaws was made in 1969 when the Apollo II astronauts who first walked on the moon—Neil Armstrong, Edwin A. Aldrin, Jr., and Michael Collins—were elected.

The program was established by the GSA Council in 1909, and since then, except during a few war years, one or more Honorary Fellows have been elected annually. Most Honorary Fellows have been elected after many years of outstanding and internationally recognized contributions to the science. At present there are 57 living geologists who have received this honor.

The Council of the Society encourages the membership to submit names of qualified candidates for this honor. In preparing a nomination, it is imperative that the original research and scientific advances of the candidate be stressed. All supporting data, especially degrees received, publications, positions, etc., should also be verified by the nominator. Use the form below for nominating a candidate for Honorary Fellowship. ■

For a complete listing of past recipients of the Penrose Medal, Day Medal, Young Scientist Award (Donath Medal), and Honorary Fellowship, please see p. 226.

PENROSE MEDAL, DAY MEDAL, OR HONORARY FELLOWSHIP

THE GEOLOGICAL SOCIETY OF AMERICA
Nomination for Penrose Medal, Day Medal, or Honorary Fellowship
(please circle one)

NAME OF CANDIDATE:

ADDRESS: Telephone: _____

REQUIRED INFORMATION (Please attach)

BIOGRAPHICAL INFORMATION

Suggested sources: *American Men and Women of Science*
Who's Who in America
GSA Service Record (obtainable from headquarters)
Other

SUMMARY OF SCIENTIFIC CONTRIBUTIONS TO GEOLOGY

Not more than 200 words.

SELECTED BIBLIOGRAPHY

No more than 10 titles.

LETTERS OF SUPPORT

Nominations for any one of these three awards MUST BE SUPPORTED by signed letters from five (5) GSA Fellows or Members. The letters may be attached to this form or may be sent to the Executive Director separately. Supporting letters must discuss the original research and scientific advances of the candidates. Plese also verify all other supporting data.

Name of person making the nomination: _____

Address: _____

Date: _____ Signature: _____

Letters of support will be submitted by:

1. _____
2. _____
3. _____
4. _____
5. _____

RETURN TO: Executive Director
The Geological Society of America
P.O. Box 9140
Boulder, CO 80301
(303) 447-2020

DEADLINE: Please return this form to headquarters by ***February 1, 1993***.

Help Direct GSA's Future

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 1994 officers and councilors must be received at GSA headquarters no later than **FEBRUARY 15, 1993.**

Please send nominations and back-up material to Administrative Department, Geological Society of America, P.O. Box 9140, Boulder, CO 80301.

GSA Medalists and Honorary Fellows

Richard A.F. Penrose, Jr., Medalists

1927 Thomas Chrowder Chamberlin
1928 Jakob Johannes Sederholm
1929 *No award given*
1930 Francois Alfred Antoine Lacroix
1931 William Morris Davis
1932 Edward Oscar Ulrich
1933 Waldemar Lindgren
1934 Charles Schuchert
1935 Reginald Aldworth Daly
1936 Arthur Philemon Coleman
1937 *No award given*
1938 Andrew Cowper Lawson
1939 William Berryman Scott
1940 Nelson Horatio Darton
1941 Norman Levi Bowen
1942 Charles Kenneth Leith
1943 *No award given*
1944 Bailey Willis
1945 Felix Andries Vening-Meinesz
1946 T. Wayland Vaughan
1947 Arthur Louis Day
1948 Hans Cloos
1949 Wendell P. Woodring
1950 Morley Evans Wilson
1951 Pentti Eskola
1952 George Gaylord Simpson
1953 Esper S. Larsen, Jr.
1954 Arthur Francis Buddington
1955 Maurice Gignoux
1956 Arthur Holmes
1957 Bruno Sander
1958 James Gilluly
1959 Adolf Knopf
1960 Walter Herman Bucher
1961 Philip Henry Kuenen
1962 Alfred Sherwood Romer
1963 William Walden Rubey
1964 Donnel Foster Hewett
1965 Philip Burke King
1966 Harry H. Hess
1967 Herbert Harold Read
1968 J. Tuzo Wilson
1969 Francis Birch
1970 Ralph Alger Bagnold
1971 Marshall Kay
1972 Wilmot H. Bradley
1973 M. King Hubbert
1974 William Maurice Ewing
1975 Francis J. Pettijohn
1976 Preston Cloud
1977 Robert P. Sharp
1978 Robert M. Garrels
1979 J Harlen Bretz
1980 Hollis D. Hedberg
1981 John Rodgers
1982 Aaron C. Waters
1983 G. Arthur Cooper
1984 Donald E. White
1985 Rudolf Trümpy
1986 Laurence L. Sloss
1987 Marland P. Billings
1988 Robert S. Dietz
1989 Warren Bell Hamilton
1990 Norman D. Newell
1991 William R. Dickinson
1992 John Frederick Dewey

Arthur L. Day Medalists

1948 George W. Morey
1949 William Maurice Ewing
1950 Francis Birch
1951 Martin J. Buerger
1952 Sterling Hendricks
1953 John F. Schairer
1954 Marion King Hubbert
1955 Earl Ingerson
1956 Alfred O. C. Nier
1957 Hugo Benioff
1958 John Verhoogen
1959 Sir Edward C. Bullard
1960 Konrad B. Krauskopf
1961 Willard F. Libby
1962 Hatten Schuyler Yoder
1963 Keith Edward Bullen
1964 James Burleigh Thompson, Jr.
1965 Walter H. Munk
1966 Robert M. Garrels
1967 O. Frank Tuttle
1968 Frederick J. Vine
1969 Harold C. Urey
1970 Gerald J. Wasserburg
1971 Hans P. Eugster
1972 Frank Press
1973 David T. Griggs
1974 A. E. Ringwood
1975 Allan Cox
1976 Hans Ramberg
1977 Akiho Miyashiro
1978 Samuel Epstein
1979 Walter M. Elsasser
1980 Henry G. Thode
1981 Donald L. Turcotte
1982 Eugene M. Shoemaker
1983 Harmon Craig
1984 Wallace S. Broecker
1985 Freeman Gilbert
1986 E-an Zen
1987 Don L. Anderson
1988 Claude J. Allègre
1989 Dan McKenzie
1990 William S. Fyfe
1991 Ian Carmichael
1992 Susan Werner Kieffer

Young Scientist Award (Donath Medalists)

1989 Mark Cloos
1990 Leigh Handy Royden
1991 Brian Philip Wernicke
1992 John Peter Grotzinger

Honorary Fellows

Neil Armstrong
Jean A. Aubouin
Krzysztof Ludwik Birkenmajer
Roland Brinkmann
S. Warren Carey
Maria Bianca Cita
Michael Collins
William Compston
Douglas Saxon Coombs
Gabriel Dengo
Kingsley C. Dunham
Stanislaw Dzulynski
Hans Füchtbauer
William S. Fyfe
Augusto Gansser
David Headley Green
Dorothy Hill
Kenneth J. Hsü
Jiqing Huang
Valdar Jaanusson
Emilie Jager
Ihsan Ketin
Teiichi Kobayashi
Hans Laubscher
Henno Martin
Michael W. McElhinny
German K. Müller
Mervyn Silas Paterson
Leo Y. Picard
Wallace S. Pitcher
Jean Piveteau
Isabella Premoli-Silva
Desmond A. Pretorius
B. P. Radhakrishna
Hans Ramberg
John G. Ramsay
Alfred Rittmann
Alexander B. Ronov
Rupert W. R. Rutland
Rushdi Said
Hitoshi Sakai
Mircea Sandulescu
Harrison Hagan Schmitt
Eugen Seibold
Ahti J. Simonen
Boris Sergeevich Sokolov
Richard L. Stanton
John Sutton
Rashid A. Khan Tahirkheli
Bernard P. Tissot
Livio Trevisan
Rudolf Trumpy
Guangzhi Tu
Harry B. Whittington
Alwyn Williams
Yang Zun-yi
Quido Zaruba

See page 223 and 225 for 1993 nomination forms.

Preliminary Announcement and Call for Papers

SOUTHEASTERN SECTION, GSA 42nd Annual Meeting

Tallahassee, Florida
April 1–2, 1993

The Southeastern Section of the Geological Society of America will meet in the Florida State Conference Center next to the campus of Florida State University in Tallahassee. The meeting will be hosted by the Department of Geology, Florida State University, in cooperation with the Florida Geological Survey.

CALL FOR PAPERS

Papers are invited for oral presentations, poster sessions, symposia, and theme sessions. Papers dealing with all aspects of the southeastern region of the United States and the Caribbean are especially encouraged, although papers of general geological interest are welcome. All oral technical sessions, symposia, and theme sessions will allow 15 minutes for presentation and 5 minutes for discussion of each paper. Poster sessions will be set up for 4 hours; authors will be present to discuss the papers for a minimum of 2 hours. Conveners of symposia and theme sessions, together with the program committee, are responsible for determining the format of their sessions. Abstracts not accepted for symposia or theme sessions will be considered for regular technical sessions.

ABSTRACTS

Abstracts must be submitted camera-ready on official 1993 GSA abstract forms according to instructions on the forms. Forms are available from Abstracts Coordinator, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, (303) 447-8850.

ABSTRACTS MUST BE RECEIVED BY DECEMBER 7, 1992

An original and five copies of all volunteered and invited abstracts should be sent to David Furbish, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-5892. Authors who think their paper might be suitable for inclusion in a symposium or theme session should send an extra copy of the abstract to the appropriate convener. Likewise, an extra copy of an invited abstract should be sent to the appropriate symposium convener. Abstracts will be reviewed for substantive content, format, and originality. Only one volunteered paper may be presented by each individual, although an individual may present additional papers invited for symposia, and may also be a co-author of papers presented by others.

SYMPOSIA

The following symposia have been organized. Those interested in participating are encouraged to contact individual symposium conveners for more information.

1. **Episodic Sea-Level Change During the Quaternary: Evidence from the Southeastern U.S.** Joseph F. Donoghue, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-5860; Richard A. Davis, Department of Geology, University of South Florida, Tampa, FL 33620, (813) 974-2236.
2. **George DeVore Symposium on Geochemistry.** Roy Odom, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-3788.
3. **Public Policy Issues in the Geological Sciences.** Walter Schmidt, Florida Geological Survey, Gunter Building, 903 W. Tennessee St., Tallahassee, FL 32304-7700, (904) 488-4191.
4. **Character and Origin of Pre-Cretaceous Rocks Beneath the Southeast Coastal Plain.** Jon Arthur, Florida Geological Survey, Gunter Building, 903 W. Tennessee St., Tallahassee, FL 32304-7700, (904) 488-9380; Paul Mueller, Department of Geology, 1112 Turlington Hall, University of Florida, Gainesville, FL 32611-2036, (904) 392-6595.
5. **Ground-Water Hydraulics and Transport in Complex Hydrogeologic Settings of the Southeast.** John Vecchioli, U.S. Geological Survey, 227 N. Bronough St., Suite 3015, Tallahassee, FL 32301, (904) 681-7620; Morris Maslia, ATSDR, 1600 Clifton Road, Bldg. 31, MS-E32, Atlanta, GA 30333, (404) 639-0674.
6. **10th Coastal Sedimentology Symposium: Beach Ridges.** William Tanner, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-3208.
7. **Southeastern Mineral Deposits and Resources.** P. Geoffrey Feiss, Department of Geology, CB 3315, Mitchell Hall, University of North Carolina, Chapel Hill, NC 27599-3315, (919) 966-4516; C. Michael Lesher, Department of Geology, University of Alabama, Tuscaloosa, AL 35487-0338, (205) 348-5095.
8. **Evolution of the Florida Platform.** Douglas L. Smith, Department of Geology, 1112 Turlington Hall, University of Florida, Gainesville, FL 32611-2036, (904) 392-6766; Paul A. Mueller, Department of Geology, 1112 Turlington Hall, University of Florida, Gainesville, FL 32611-2036, (904) 392-6595.
9. **Extensional Tectonics in the Southern Appalachians.** Mark Steltenpohl, Department of Geology, 210 Petrie Hall, Auburn University, Auburn, AL 36849-5305, (205) 844-4282; Harmon Maher, Department of Geology, University of Nebraska at Omaha, Omaha, NE 68182, (402) 554-2662.
10. **Design of Well Networks in Ground-Water Supply Studies of the Southeast.** Richard Spruill, Department of Geology, University of North Carolina at Greenville, Greenville, NC 27858, (919) 757-6016.
11. **Neoproterozoic to Middle Paleozoic Clastic Sedimentation and Stratigraphy in the Southern Appalachian Orogen.** Loren A. Raymond, Department of Geology, Appalachian State University, Boone, NC 28608, (704) 262-3049; Fred Webb, Jr., Department of Geology, Appalachian State University, Boone, NC 28608, (704) 262-3049.
12. **Geologic Mapping and Public Needs.** Steven Schamel, Earth Sciences & Resources Institute, University of South Carolina, Columbia, SC 29208, (803) 777-6484; Donald C. Haney, Kentucky Geological Survey, University of Kentucky, Lexington, KY 40506-0059, (606) 257-3758.
13. **Tempo and Mode of Evolution in the Fossil Record.** Anthony Arnold, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-4228; Michael L. McKinney, Department of Geological Sciences, University of Tennessee, Knoxville, TN 37996-1410, (615) 974-6359.

Special Symposium

A special symposium, The Geology of the Southeastern U.S.: An Overview, will be convened. This symposium is designed to appeal to laypersons and earth science educators at the middle- and high-school levels, as well as specialists in geology. We seek broad-based, dynamic talks that provide overviews of all aspects of the geological sciences. For information, contact James Cowart, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-5784.

THEME SESSIONS

Theme sessions are similar to symposia in their focus on specific topics, but each is an open forum where all papers are volunteered (whereas symposia include invited papers). Individuals interested in convening a theme session should contact David Furbish, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-5892.

1. **Hydrogeology of the Southeast.** Dick Johnston, 4311 9th St., East Beach, Saint Simons Island, GA 31522, (912) 638-6224.
2. **Geologic Considerations in Delineating and Remediating Contaminants in Ground Water.** Charles W. Welby, Department of Marine, Earth and Atmospheric Sciences, Box 8208, North Carolina State University, Raleigh, NC 27695-8208, (919) 515-7158.
3. **Biostratigraphy and Geochronology of Florida: An Integrated Approach.** Lynn Wingard, U.S. Geological Survey, MS 970, Branch of Paleontology and Stratigraphy, Reston, VA 22092, (703) 648-5352.

POSTER SESSIONS

Four half-days of poster sessions will be convened. Please indicate your preference for a poster session on the GSA abstract form if you wish to present a paper in this effective format.

Special Poster Session

Council on Undergraduate Research Special Poster Session of Undergraduate Research. Undergraduate students are encouraged to submit papers regarding their senior thesis or similar independent-study projects. Abstracts should be submitted on official 1993 GSA forms. For information, contact: William A. Ranson, Department of Geology, Furman University, Greenville, SC 29613, (803) 294-3364.

FIELD TRIPS

Premeeting and postmeeting field trips are planned. For details, contact the field trip leader indicated by an asterisk (*) or William Parker, Chair, Field Trip Committee, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-1568, parker@geomag.gly.fsu.edu.

Premeeting

1. **K-T Boundary in Alabama.** Two days. Ernest Mancini* and Berry Tew, Alabama Geologic Survey, 420 Hackberry Lane, Tuscaloosa, AL 35486, (205) 349-2852.
2. **Florida Phosphate Deposits.** Two days. Tom Scott*, Florida Geologic Survey, 903 W. Tennessee St., Tallahassee, FL 32304-7700, (904) 488-9380.

Postmeeting

1. **Late Eocene and Early Oligocene Carbonate Facies and Paleoenvironments of the Eastern Gulf Coastal Plain.** Jon Bryan*, Antarctic Research Facility, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-2407.
2. **Quaternary Sedimentation along the Northeastern Gulf Coast.** One day. William Tanner*, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-3208.
3. **Modern Fluvial Processes in a Sand-Bedded Meandering Stream: Flow Structure, Sediment Transport, Bed Forms, and Bend Migration.** One day. David Furbish*, Stephen Thorne and Valerie Croup, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-5892.
4. **Karst Features of Northern Florida.** One day. Frank Rupert*, Florida Geologic Survey, 903 W. Tennessee St., Tallahassee, FL 32304-7700, (904) 488-9380.
5. **Coastal Geology of the Florida Panhandle—An Introduction for Undergraduates and Science Teachers.** One day. William Parker*, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-1568.
6. **Hydrogeology of the Western Santa Fe River Basin.** One day. Katherine Kelly Ellins*, Department of Geology, 1112 Turlington Hall, University of Florida, Gainesville, FL 32611-2231 (904) 392-6219.
7. **Pliocene-Pleistocene Sediments of South Florida.** Two days. Edward Petuch*, Department of Geology, Florida Atlantic University, Boca Raton, FL 33431-3310, (407) 367-3727.

SHORT COURSES

Premeeting

1. **Kriging Techniques and Applications.** One day (March 31). William Parker, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-1568.
2. **Technical Aspects of Environmental Site Assessments and Industrial Compliance Audits.** One day (March 31). Thomas Missimer, Missimer and Associates, Inc., Route 8, Box 625-D, 428 Pine Island Road, Cape Coral, FL 33991, (813) 574-1919.
3. **Workshop on Antarctic Glacial-Marine and Biogenic Sedimentation.** Two days (March 30–31). John Anderson (Rice University), Amy Leventer (Ohio State University), Scott Ishman (U.S. Geological Survey). Contact Jonathan R. Bryan, Curatorial Director, Antarctic Marine Geology Research Facility, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-2407.

PROJECTION EQUIPMENT

All slides must be 2" x 2" and fit a standard 35 mm carousel tray. Please bring your own loaded carousel trays.

Southeastern Meeting

continued on p. 228

Southeastern Meeting
continued from p. 227

Two 35 mm slide projectors and screens will be available for each oral technical session.

EXHIBITS

Exhibit booths for business, educational, and governmental institutions will be available at the Florida State Conference Center. The exhibit area will be open all day Thursday and Friday. For further information and space reservation, contact Sherwood Wise, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-6265.

SOCIAL EVENT

A welcoming reception will be held on the evening of Wednesday, March 31, at a location to be disclosed in the final announcement.

TRAVEL TO TALLAHASSEE

Tallahassee is next to Interstate 10 in the eastern corner of the Florida Panhandle, an hour from Gulf Coast resort beaches and 6 hours from Atlanta. Meeting hotels are 2 miles south of the interstate and 4 blocks from the Florida State Conference Center. The Tallahassee regional airport south of the city is serviced by Delta, US Air, American Eagle, ASA, and Conair. Ground transportation to the downtown area is available. Amtrak service to Tallahassee is scheduled to be restored by spring 1993.

STUDENT ASSISTANCE

A limited amount of support for travel expenses of students presenting papers at the meeting is available from the Southeastern Section. For information, contact: Michael J. Neilson, Department of Geology, University of Alabama, Birmingham, AL 35294, (205) 934-5102.

SPECIAL PROGRAM FOR UNDERGRADUATES AND SCIENCE EDUCATION TEACHERS

A special program is being organized for undergraduate students and science education teachers, and will include an undergraduate research poster session (see poster sessions), and a postmeeting coastal field trip (see field trip list).

REGISTRATION

Free registration will be offered with early registration to precollege earth science teachers. A reduced registration fee is available to students. One-day registration is available for those unable to attend the full meeting. Field trip and short course attendees must register for the meeting.

HOUSING

A large block of rooms has been reserved for meeting participants in hotels in the downtown area a few blocks from the Florida State Conference Center. For conference planning purposes, it is important that you reserve your room well in advance of the meeting.

ADDITIONAL INFORMATION

More detailed information concerning fees and registration, hotel accommodations, field trips, and other activities will appear in the January 1993 issue of *GSA Today* and as part of the GSA Southeastern Section *Abstracts with Programs* for 1993. Symposia, theme sessions, and field trips listed in this announcement are tentative; additional suggestions are appreciated. Inquiries or suggestions should be directed to: James Tull, Meeting Chair, Department of Geology, B-160, Florida State University, Tallahassee, FL 32306-3026, (904) 644-1448. ■

Preliminary Announcement and Call for Papers

CORDILLERAN AND ROCKY MOUNTAIN SECTIONS, GSA Joint Meeting

Reno, Nevada
May 19–21, 1993

The Cordilleran and Rocky Mountain Sections of the Geological Society of America will have a joint meeting, together with the Pacific Coast and Rocky Mountain Sections of the Paleontological Society of America, at the Reno Hilton in Reno. The meeting is being hosted by the Department of Geological Sciences, University of Nevada, Reno, and the Department of Geosciences, Boise State University.

ENVIRONMENT

The meeting will be held at the Reno Hilton (formerly Bally's Grand Hotel) on Second Street in Reno. The meeting site is centrally located with easy access to numerous restaurants, a variety of lodging options, and various casinos and resorts. Reno is located in the Truckee Meadows, a fertile Basin-and-Range valley situated between the Carson Range, a spur off the Sierra Nevada, on the west and the Virginia Range to the east. The weather in mid-May should be warm and springlike, with average daily temperatures in the upper 70s and overnight lows in the 40s. The area receives an average of about one inch of rain during the month of May. Travel to Reno is easy; Interstate 80 passes east-west through Reno and Sparks, just north of the Reno Hilton, and U.S. 395 runs north-south, immediately adjacent to the hotel. The Reno-Cannon International Airport is serviced by America West, American, Delta, Northwest, Reno Air, Southwest, United, and USAir airlines.

CALL FOR PAPERS

Papers are invited for presentation in oral technical sessions, symposia, theme sessions, and poster sessions. Papers dealing with all aspects of the Cordilleran and Rocky Mountain regions of North America, as well as those of general geologic interest, will be considered for presentation and discussion. Technical sessions will allow 12 minutes for presentation and 3 minutes for discussion. Symposia may allow equivalent or longer times for presentation at the option of the conveners and symposium coordinators.

FIELD TRIPS

Both premeeting and postmeeting field trips are planned. For details, contact the respective field trip leaders. General questions should be addressed to Jim Trexler or Mary Lahren, Field Trip Coordinators, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-1504, and (702) 784-6610, fax 702-784-1766, or Claude Spinosa, Department of Geosciences, Boise State University, Boise, ID 83725, (208) 385-1581, fax 208-385-4061. Preregistration forms will be available in the Final Announcement in the February 1993 issue of *GSA Today*.

Premeeting

1. **Cenozoic Tectonics and Basin Evolution in the Northern East Humboldt Wood Hills Metamorphic Complex, Northeastern Nevada.** May 16–18. Arthur W. Snoke and Karl Mueller, Department of Geology, University of Wyoming, Laramie, WY 82071, (307) 766-5457.
2. **Volcanic-Plutonic Magma Systems in the Colorado River Extensional Corridor.** May 15–18. Rodney V. Metcalf and Eugene I. Smith, Department of Geosciences, University of Nevada, Las Vegas, NV 89154, (702) 739-3262, fax 702-597-4064; and James Mills.
3. **Tectonics of the Central Nevada Thrust Belt.** May 15–18. John M. Bartley, Department of Geology and Geophysics, University of Utah, Salt Lake City, UT 84112, (801) 581-7937, fax 801-581-7065, Wanda Taylor, Jim Schmidt, and Joan Fryxell.
4. **Exposed Cross Sections of Tilted Paleozoic and Mesozoic Volcano-Plutonic Systems in the Northern Sierra Terrane: Implications for Arc Evolution.** May 16–18. Richard E. Hanson, Department of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270; Gary H. Girty, David S. Harwood, Richard A. Schweickert, and Jeff Templeton.
5. **Jurassic to Cretaceous Transpressional Deformation of the Mesozoic Marine Province of the Northwestern Great Basin.** May 16–18. John S. Oldow and Joseph Satterfield, Department of Geology and Geophysics, Rice University, Houston, TX 77251, (713) 285-4067, fax 713-285-5214; and Norman J. Silberling.
6. **Three-Dimensional Aspects of the Neogene Strain Field, Nevada-Utah-Arizona Tricorner Area.** May 16–18. R. E. Anderson, U.S. Geological Survey, Branch of Geologic Risk Assessment, MS 966, Denver Federal Center, Denver, CO 80225, (303) 236-1584; and R. G. Bohannon.
7. **The Ordovician Vinina and Valmy Formations of the Roberts Mountains Allochthon and Coeval Strata of the Autochthon.** May 15–18. Stanley C. Finney, Department of Geological Sciences, California State University, Long Beach, CA 90840, (310) 494-8637, (310) 498-4809; and Raul Madrid.

Day and Half-Day Trips During Meeting

a. **Geology of the Reno Area for High School Teachers.** May 21. Patricia Cashman, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-6924, fax 702-784-1766; Tom Lugaski, and Becky Purkey.
b. **Virginia City History, Mining, and Geology.** May 19. Don Hudson, Reno, NV, (702) 358-4903.
c. **Lake Tahoe Geology.** May 20. Joseph C. Lintz, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-6994, fax 702-784-1766.
d. **Magma Mingling and Fracturing at Donner Pass, Northern Sierra Nevada.** May 20. Richard Schultz and M. J. Hibbard, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-4318 or 784-6970, fax 702-784-1766.

Postmeeting

8. **Oligocene-Miocene Caldera Complexes, Associated Ash-Flow Sheets, and Tectonics in the Southeastern Great Basin.** May 22–24. Myron Best and Eric Christiansen, Department of Geology, Brigham Young University, Provo, UT 84602, (801) 378-3918; Alan Deino, Sherman Gromme, Lyle Phillips, Pete Rowley, Bob Scott, and Anne Harding.
9. **Phanerozoic Tectonics of the Eastern Sierra Nevada—Saddlebag Lake and Ritter Range Pendants.** May 22–24. Richard A. Schweickert and Mary M. Lahren, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-6901 or 784-6610, fax 702-784-1766.
10. **Neogene Tectonism from the Southwestern Nevada Volcanic Field to the White Mountains, California.** May 22–23. Edwin H. McKee, U.S. Geological Survey, Branch of Western Mineral Resources, 345 Middlefield Road, Menlo Park, CA 94025, (415) 329-5477, fax 415-329-5490; Donald C. Noble, Marith Reheis, and Steven I. Weiss.
11. **Lower Mesozoic Tectonosequences from the Southwestern Colorado Plateau to the Eastern Mojave Desert and Inyo Mountains: Implications for the Development of the Late Paleozoic and Early Mesozoic Cratonal Margin.** May 22–24. John Marzolf, Department of Geology, Southern Illinois University, Carbondale, IL 62901, (618) 453-3351, fax 618-453-7393; George C. Dunne, Paul Stone, and Zeke Snow.
12. **Neotectonics of the Walker Lane: Pyramid Lake to Tonopah.** May 22–23. James C. Yount, U.S. Geological Survey, Mackay School

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Cordilleran–Rocky Mountain Meeting *continued from p. 228*

of Mines, University of Nevada, Reno, NV 89557, (702) 784-5565, fax 702-784-5079; John Bell, Craig DePolo, and Alan Ramelli.
13. **Tertiary Structural Development of the Central Walker Lane.** May 22–23. John H. Dilles, Department of Geology, Oregon State University, Corvallis, OR 97331, (503) 737-1245, fax 503-737-1200; Richard F. Hardyman, and Steve Craig (tentative).
14. **Papoose Flat Pluton, Emplacement and Effects.** May 22–24. R. D. Law, Department of Geological Sciences, Virginia Polytechnic Institute, Blacksburg, VA 24061-0420, (703) 231-6521, fax 703-231-3386; Art Sylvester, and Clem Nelson.
15. **Cenozoic Extension, Panamint Range to Nopah Range, Death Valley, California.** May 22–24. Brian P. Wernicke, Division of Geological and Planetary Science, California Institute of Technology, Pasadena, CA 91125, (818) 356-6123.

SYMPOSIA

The following symposia will include both invited papers and selected volunteered papers. Prospective authors are encouraged to contact the respective conveners. General questions should be addressed to Don Noble, Symposium Coordinator, Department of Geological Sciences, University of Nevada, Reno, Nevada, 89557, (702) 784-6928, fax 702-784-1766.
1. **Stratigraphic Paleobiology: Analyzing Significant Biotic Trends in the Phanerozoic.** Mary Droser, Department of Earth Sciences, University of California, Riverside, CA 92521, (714) 787-3797, fax 714-787-4324; and Claude Spinosa.
2. **Basin and Range Seismic Hazard.** James Brune, Seismology Laboratory, Mackay School of Mines, University of Nevada, Reno, NV 89557, (702) 784-4975, fax 702-784-1766; and John Anderson.
3. **Influence of Magmatic and Tectonic Processes on the Formation of Hydrothermal Mineral Deposits** (sponsored jointly by the Geological Society of Nevada). Donald C. Noble, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-6928, fax 702-784-1766; and Eric Seedorff.
4. **Tectonic Evolution of Northern California—Cape Mendocino to the Basin and Range.** David S. Harwood, U.S. Geological Survey, 345 Middlefield Road, MS 975, Menlo Park, CA 94025, (415) 329-4932, fax 415-329-4936.
5. **Reconstruction of pre-Cenozoic Sedimentary Basins, Western Colorado Plateau Across the Great Basin.** John E. Marzolf, Department of Geology, Southern Illinois University, Carbondale, IL 62901, (618) 453-3351, fax 618-453-7393.
6. **Cenozoic Magmatism in the Colorado River Extensional Corridor and Adjacent Areas.** Rodney V. Metcalf, Department of Geosciences, University of Nevada, Las Vegas, NV 89154, (702) 739-3262, fax 702-597-4064; Eugene I. Smith, and James Mills.
7. **Mesozoic Evolution of Nevada and Environs.** John M. Bartley, Department of Geology and Geophysics, University of Utah, Salt Lake City, UT 84112, (801) 581-7937, fax 801-581-7065.
8. **Neogene Tectonism from the Southwestern Nevada Volcanic Field to the White Mountains, California.** Edwin H. McKee, U.S. Geological Survey, Branch of Western Mineral Resources, 345 Middlefield Road, Menlo Park, CA 94025, (415) 329-5477, fax 415-329-5490; Donald C. Noble, Marith Reheis, and Steven I. Weiss.
9. **Origin and Timing of Cenozoic Normal and Strike-Slip Faulting in the Walker Lane and Adjacent Areas, Western Nevada.** John H. Dilles, Department of Geology, Oregon State University, Corvallis, OR 97331, (503) 737-1245, fax 503-737-1200; David A. John, and John S. Oldow.
10. **Cenozoic Crustal Extension North of Snake River Plain.** David R. Lageson, Department of Earth Sciences, Montana State University, Bozeman, MT 59717, (406) 994-3331, fax 406-994-6923; and David Rodgers.
11. **Latest Pleistocene and Holocene Surface Faulting, Basin and Range Province.** Craig DePolo, Nevada Bureau of Mines and Geology, University of Nevada, Reno, NV 89557, (702) 784-6691; and Alan Ramelli.
12. **Magmatic Constraints on Basin and Range Evolution.** Allen F. Glazner, Department of Geology, CB#3315, University of North Carolina, Chapel Hill, NC 27599, (919) 962-0689, fax 919-966-4519; Drew S. Coleman, and William P. Leeman.
13. **Stratigraphy of the Roberts Mountains Allochthon.** Stanley C. Finney, Department of Geological Sciences, California State University, Long Beach, CA 90840, (310) 494-8637, fax 310-498-4809.
14. **Reconstructing the Structural History of Basin and Range Extension Using Sedimentology and Stratigraphy.** Kathi Beratan, Department of Geology and Planetary Science, University of Pittsburgh, Pittsburgh, PA 15620, (412) 624-1408, fax 412-624-3914; and James Schmitt.
15. **Constraints on Relative Motion between Mesozoic Batholiths and Cratonic North America in Cenozoic Time.** Brian P. Wernicke, Division of Geological and Planetary Science, California Institute of Technology, Pasadena, CA 91125, (818) 356-6123.
16. **The Neogene of West-Central Nevada.** James R. Firby, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-6696, fax 702-784-1766; and Howard E. Schorn.
17. **Geology Division of the Council on Undergraduate Research Poster Session for Undergraduate Research.** To showcase undergraduate student research on any subject. Indicate CUR on abstract form.

ABSTRACTS

Abstracts are limited to about 250 words and must be submitted camera-ready on official 1993 GSA abstract forms, available from the Abstracts Coordinator, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, (303) 447-8850.

ABSTRACTS DEADLINE: JANUARY 26, 1993

An original and five copies are required for each abstract. Authors of symposium papers should send their abstracts directly to the appropriate convener (see lists above). Other abstracts should be sent directly to R. A. Schweickert, Department of Geological Sciences, Mackay School of Mines, University of Nevada, Reno, Nevada, 89557-0138, (702) 784-6901, fax 702-784-1766.

Abstracts will be reviewed for information content and format, appropriate geographic coverage (Cordilleran and Rocky Mountain regions), and originality. Only one volunteered paper may be presented by each individual, although a person may also co-author papers presented by others and may present additional papers invited for symposia.

PROJECTION EQUIPMENT

All slides must be 2" x 2" and fit standard 35 mm carousel trays. Two projectors and two screens will be available for all oral sessions. Overhead projectors will *not* be available. Please bring loaded carousel trays, if possible.

POSTER SESSIONS

Poster sessions will be located adjacent to the exhibit area. If you wish to take advantage of this highly effective means of communication, please indicate your preference for a poster session on the GSA abstract form.

EXHIBITS

Exhibits will be located in the Goldwyn Ballroom. The cost of exhibits will be $300 for commercial exhibitors and $150 for educational and nonprofit institutions. For further information and space reservations, please contact Richard Schultz, Exhibits Coordinator, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-4318, fax 702-784-1766.

STUDENT SUPPORT

The GSA Cordilleran and Rocky Mountain Sections have funds available for grants to support GSA Student Associates of the respective sections who are presenting papers at the meeting. Students are strongly encouraged to apply for these grants, and we anticipate that most students who qualify will be funded to some degree. Cordilleran Section Student Associates should send applications to Cordilleran Section Secretary Bruce A. Blackerby, Department of Geology, California State University, Fresno, CA 93740, (209) 278-2955 (direct) or 278-3086 (department). Rocky Mountain Section Student Associates should send applications to Rocky Mountain Section Secretary Kenneth E. Kolm, Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO 80401, (303) 273-3800. Applications should include certification that the student is presenting a paper and is a GSA Student Associate of the Cordilleran Section or the Rocky Mountain Section. *All letters must be received by March 15, 1993.*

SPECIAL EVENTS

After-hours events will include a no-host welcoming party for all registrants on Wednesday evening, May 19, in the Exhibits Area of the Goldwyn Ballroom. The annual luncheon for the Pacific Coast Section of the Paleontological Society of America will be held Thursday at noon.

GUEST PROGRAM

A dinner cruise on Lake Tahoe on the M.S. *Dixie*, a historical tour of Virginia City, and a scenic tour of Lake Tahoe, with lunch, will be offered if there is sufficient interest.

ACCOMMODATIONS

A block of rooms at the Reno Hilton, site of the meeting, has been reserved for attendees. A special reduced rate of $75 has been arranged. A variety of less expensive housing options is also available within one mile of the meeting site. Specific information and reservation forms will be provided in the February 1993 issue of *GSA Today*.

DETAILED INFORMATION

Information concerning registration, accommodations, and activities will appear in the February 1993 issue of *GSA Today* and as part of the Cordilleran–Rocky Mountain Section *Abstracts with Programs* for 1993. Preliminary questions and suggestions should be addressed to the meeting co-chairmen: Richard A. Schweickert, Department of Geological Sciences, University of Nevada, Reno, NV 89557, (702) 784-6901, fax 702-784-1766; or Walter S. Snyder, Department of Geosciences, Boise State University, Boise, ID 83725, (208) 385-3645, fax 208-385-4061. ■

CORRECTION

The abstract deadline for the **Northeastern Section Meeting,** March 22–24, 1993 in Burlington, Vermont, is **November 24, 1992.**

MEETINGS

GSA ANNUAL MEETINGS

■ 1992

GSA Annual Meeting
Cincinnati, Ohio
Cincinnati Convention Center
October 26–29

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

See August *GSA Today* for housing, registration, and transportation information.

See September *GSA Today* for technical program information.

For general information: GSA Meetings Department, P.O. Box 9140, Boulder, CO 80301; (303) 447-2020.

■ 1993

GSA Annual Meeting
Boston, Massachusetts
Hynes Convention Center
October 25–28

Chairman: James W. Skehan, S. J., Boston College

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

Call for Field Trip Proposals: Please contact the Field Trip Chairmen listed below.

John T. Cheney
Dept. of Geology
Amherst College
Amherst, MA 01002
(413) 542-2233 (Dept.)

J. Christopher Hepburn
Dept. of Geology and Geophysics
Boston College
Chestnut Hill, MA 02193
(617) 552-3640 (Dept.)

Call for Short Course Proposals

Have you thought about giving a short course? The GSA Committee on Short Courses invites those interested in proposing a GSA sponsored or 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 1993 Annual Meeting in Boston or the 1994 Annual Meeting in Seattle.

Proposals for the Boston meeting must be received by **December 1, 1992.** Selection of courses will be made by February 1, 1993, leaving eight months for preparing course manuals and making arrangements.

For proposal guidelines or information contact: Edna A. Collis, Short Course Coordinator, GSA headquarters, 1-800-472-1988.

■ FUTURE

Boston	October 25–28	1993
Seattle	October 24–27	1994
New Orleans	November 6–9	1995
Denver	October 28–31	1996

For general information on technical program participation (1993 or beyond) contact: Sue Beggs, Meetings Manager, GSA headquarters.

■ GSA SECTION MEETINGS

South-Central Section, Texas Christian University, Fort Worth, Texas, March 15–16, 1993. John A. Breyer, Department of Geology, Room 207, Sid Richardson Building, Corner of Bowie and Cockrell, Texas Christian University, Ft. Worth, TX 76129-0001, (817) 921-7270. *Abstract Deadline: November 20, 1992*

Northeastern Section, Sheraton Inn Conference Center, Burlington, Vermont, March 22–24, 1993. Barry L. Doolan or Rolfe S. Stanley, Department of Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405-0122, (802) 656-0247. *Abstract Deadline: November 24, 1992*

North-Central Section, University of Missouri, Rolla, Missouri, March 29–30, 1993. Richard D. Hagni, Department of Geology & Geophysics, University of Missouri– Rolla, Rolla, MO 65401-0249, (314) 341-4616. *Abstract Deadline: December 2, 1992*

Southeastern Section, Florida State Conference Center, Tallahassee, Florida, April 1–2, 1993. James F. Tull, Department of Geology, Florida State University, Tallahassee, FL 32306-3029, (904) 644-5892. *Abstract Deadline: December 7, 1992*

Cordilleran and Rocky Mountain Sections, Reno Hilton (formerly Bally's Hotel), Reno, Nevada, May 19–21, 1993. Richard A. Schweickert, Department of Geological Sciences, Mackay School of Mines, University of Nevada–Reno, Reno, NV 89557-0138, (702) 784-6050; or Walter S. Snyder, Department of Geosciences, Boise State University, Boise, ID 83725, (208) 385-3645, fax 208-385-4061. *Abstract Deadline: January 26, 1993*

GSA Penrose Conferences

October 1992

Fluid-Volcano Interactions, October 4–9, 1992, Warm Springs, 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.

Late Precambrian Tectonics and the Dawn of the Phanerozoic, October 18–23, 1992, Death Valley, California. Information: Ian W.D. Dalziel, Institute for Geophysics, University of Texas, Austin, TX 78759-8345, (512) 471-6156, fax 512-471-8844; Andrew H. Knoll, The Botanical Museum, Harvard University, Cambridge, MA 02138, (617) 495-9306 (on sabbatical in Cambridge, UK); Eldridge M. Moores, Dept. of Geology, University of California, Davis, CA 95616, (916) 752-0352 or 752-0350, fax 916-752-0951.

February 1993

■ **Continental Tectonics and Magmatism of the Jurassic North American Cordillera,** February 27–March 4, 1993, Havasu City, Arizona. Information: Dave Miller, (415) 329-4923, and Dick Tosdal, (415) 329-5423, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025; or Bob Anderson, (604) 666-2693, Geological Survey of Canada, 100 West Pender Street, Vancouver, BC V6B 1R8, Canada.

1992 Meetings

October

Pennsylvania Geologists 57th Annual Field Conference, Geology of the Upper Allegheny River Region in Warren County, Northwestern Pennsylvania, October 1–3, 1992, Warren, Pennsylvania. Information: Field Conference of PA Geologists, P.O. Box 1124, Harrisburg, PA 17108-1124, (717) 787-2379.

Association of Engineering Geologists Annual Meeting, October 2–9, 1992, Long Beach, California. Information: John W. Byer, 444 "A" East Broadway, Glendale, CA 91205, (818) 549-9959, fax 818-242-2442.

■ **Risk Assessment/Management Issues in the Environmental Planning of Mines Conference,** October 5–7, 1992, St. Louis, Missouri. Information: Meetings Department, SME, P.O. Box 625002, Littleton, CO 80162, (303) 973-9550, fax 303-979-3461.

■ **National Association of Black Geologists and Geophysicists 11th Annual Conference,** October 8–10, 1992, New Orleans, Louisiana. Information: Patricia M. Hall, 1992 Conference Chairperson, P.O. Box 50879, New Orleans, LA 70150-0879.

SEPM Midcontinent Section Annual Meeting, Paleosols, Paleoweathering Surfaces and Sequence Boundaries, October 9–11, 1992, Knoxville, Tennessee. Information: Steven G. Driese, Dept. of Geological Sciences, University of Tennessee, Knoxville, TN 37996-1410, (615) 974-2366, fax 615-974-2368.

■ **Northwest Petroleum Association Annual Symposium,** New Exploration Concepts & Opportunities for the Pacific Northwest, October 11–13, 1992, Lincoln City, Oregon. Information: Robert Deacon, Wright/Deacon Associates, 19 N.W. 5th Ave., Suite 208, Portland, OR 97205, (503) 227-5102.

Energy, Environment and Technological Innovation 2nd International Congress, 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.

Seismological Society of America Eastern Section Annual Meeting, October 14–16, 1992, Richmond, Virginia. Information: John Filson or Henry Spall, U.S. Geological Survey, 904 National Center, Reston, VA 22092, (703) 648-6078.

American Institute of Hydrology Conference, Interdisciplinary Approaches in Hydrology and Hydrogeology, October 17–22, 1992, Portland, Oregon. Information: AIH, 3416 University Ave. S.E., Minneapolis, MN 55414-3328, (612) 379-1030.

■ **Disaster Management 3rd National Conference,** October 20–23, 1992, Hamilton, Ontario, Canada. Information: NCDM '92, Regional Municipality of Hamilton-Wentworth, 119 King St. West, P.O. Box 2911, Hamilton, Ontario L8N 3V9, Canada, (416) 546-3911, fax 416-546-2340

Gulf Coast Association of Geological Societies and Gulf Coast Section of SEPM Joint Annual Convention, October 21–23, 1992, Jackson, Mississippi. Information: Cragin Knox, GCAGS Convention 1992, P.O. Box 2474, Jackson, Mississippi 39225-2474.

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.

Geological Association of New Jersey 9th Annual Meeting and Field Trip, October 30–31, 1992, New Brunswick, New Jersey. Information: Howard Parish, Jersey City State College, 2039 Kennedy Blvd., Jersey City, NJ 07305, (201) 200-3164, fax 201-200-2298.

November

28th Annual Conference and Symposia: Managing Water Resources During Global Change, November 1–5, 1992, Reno, Nevada. Information: Raymond Herrmann, NPS, WR-CPSU, WRD, Colorado State University, Ft. Collins, CO 80523, (303) 491-7825.

Clay Minerals Society and Soil Science Society of America Joint Meeting, November 1–6, 1992, Minneapolis, Minnesota. Information: Jerry Bigham, Dept. of Agronomy, Ohio State University, Columbus, OH 43210, (614) 292-2001.

14th New Zealand Geothermal Workshop, November 4–6, 1992, Auckland, New Zealand. Information:

14th New Zealand Geothermal Workshop, University of Auckland, Private Bag 92019, Auckland, New Zealand, fax 64-9-373-7419.

■ **Geology and Ground Water of the Savannah River Site Vicinity, South Carolina and Georgia,** November 13–15, 1992, Augusta, Georgia. Information: Wallace Fallaw, Department of Geology, Furman University, Greenville, SC 29613, (803) 294-3361, fax 803-294-3001; Van Price, Westinghouse Savannah River Company, Building 735-A, Aiken, SC 29808, (803) 725-2035, fax 803-725-3272.

■ **International Gas Research Conference,** November 16–19, 1992, Orlando, Florida. Information: 1992 International Gas Research Conference, c/o Gas Research Institute, 8600 West Bryn Mawr Ave., Chicago, IL 60631, (312) 399-8300, Telex 253812 or 503802, fax 312-399-8170.

Eastern Oil Shale Symposium, November 18–20, 1992, Lexington, Kentucky. Information: Geaunita H. Caylor, Coordinator, University of Kentucky/OISTL, 643 Maxwelton Court, Lexington, KY 40506-0350, (606) 257-2820, fax 606-258-1049.

Geological Society of New Zealand and New Zealand Geophysical Society Joint Annual Conference, November 23–27, 1992, Christchurch, New Zealand. Information: David Shelley, Dept. of Geology, University of Canterbury, Christchurch 1, New Zealand, phone 64-3-667-001, fax 64-3-642-769.

December

■ **Industrial-Minerals Development in Oklahoma Workshop,** December 1–2, 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.

IGCP Project 274 Annual Meeting, Coastal Evolution in the Quaternary, December 7–15, 1992, Wellington, New Zealand. Information: Alan Hull, DSIR Geology & Geophysics, P.O. Box 30-368, Lower Hutt, New Zealand, +64(4) 569-9059, fax +64(4) 566-6168, E-mail: srlnagh@lhn.geo.dsir.govt.NZ.

1993 Meetings

January

■ **Results of Drilling in Western Pacific Active Margins and Marginal Basins,** January 18–21, 1993, Monterey, California. Information: Brian Taylor, University of Hawaii, 2525 Correa Rd., Honolulu, HI 96822, (808) 956-6649, fax 808-956-2538, E-mail: taylor@-elepaio.soest.hawaii.edu.

■ **Quantifying Sedimentary Geochemical Processes,** January 26–27, 1993, London, England. Information: Christine A. Johnson, Scientific Meetings Secretary, 6 Carlton House Terrace, London SW1Y 5AG, phone 071-839 5561, fax 071-930-2170, telex 917876.

February

Geologic Remote Sensing, 9th Thematic Conference, Exploration, Environment, and Engineering, February 8–11, 1993, Pasadena, California. Information: ERIM/Thematic Conferences, Nancy J. Wallman, P.O. Box 134001, Ann Arbor, MI 48113-4001, (313) 994-1200, ext. 3234, fax 313-994-5123.

■ **Earthquake Engineering Research Institute 45th Annual Meeting,** February 11–13, 1993, Seattle, Washington. Information: EERI, 499 14th St., Suite 320, Oakland, CA 94612-1902, (510) 451-0905, fax 510-451-5411.

■ **Society for Mining, Metallurgy, and Exploration 1993 Annual Meeting,** February 15–18, 1993, Reno, Nevada. Information: Meetings Department, SME, P.O. Box 625002, Littleton, CO 80162, (303) 973-3461.

March

GSA South-Central Section Meeting, March 15–16, 1993, Fort Worth, Texas. Information: John Breyer, Dept. of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

■ **Michigan Geological Survey Division Symposium,** Michigan: Its Geology and Geologic Resources, March 18–19, 1993, East Lansing, Michigan. Information: Carol L. Skillings, Dept. of Natural Resources, Geological Survey Division, Box 30028, Lansing, MI 48909-7258, (517) 334-6976.

GSA Northeastern Section Meeting, March 22–24, 1993, Burlington, Vermont. Information: Barry L. Doolan or Rolfe S. Stanley, Department of Geology, University of Vermont, Burlington, VT 05405-0122, (802) 656-0247.

Fluvial-Dominated Deltaic Reservoirs in the Southern Midcontinent, March 23–24, 1993, Norman, Oklahoma. Information: Kenneth S. Johnson, Oklahoma Geological Survey, University of Oklahoma, 100 East Boyd, Rm. N-131, Norman, OK 73019, (405) 325-3031.

GSA North-Central Section Meeting, March 29–30, 1993, Rolla, Missouri. Information: Richard Hagni, Dept. of Geology and Geophysics, University of Missouri, Rolla, MO 65401, (314) 341-4616.

April

GSA Southeastern Section Meeting, April 1–2, 1993, Tallahassee, Florida. Information: James Tull, Dept. of Geology, Florida State University, Tallahassee, FL 32306, (904) 644-1448.

■ **Computer Simulated Mineral Exploration 22nd Workshop,** April 1–30, 1993, 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.

Remote Sensing and Global Environmental Change 25th International Symposium, April 4–8, 1993, Graz, Austria. Information: Dorothy M. Humphrey, ERIM, P.O. Box 134001, Ann Arbor, MI 48113-4001, (313) 994-1200, ext. 2290, fax 313-994-5123.

■ **Mantle Composition, Structure, and Processes Workshop ,** April 4–8, 1993, Soda Springs, California. Information: Jane E. Nielson, U.S. Geological Survey, MS 975, 345 Middlefield Rd., Menlo Park, CA 94025, (415) 329-4948, fax 415-329-4936; or B. Carter Hearn, Jr., U.S. Geological Survey, 959 National Center, Reston, VA 22092, (703) 648-6768, fax 703-648-6789.

■ **Mechanisms of Deformation and Failure in Rocks and Ceramics,** April 12–16, 1993, San Francisco, California. Information: Joanne Fredrich, TerraTek, Inc., University Research Park, 420 Wakara Way, Salt Lake City, UT 84108, (801) 584-2487, fax 801-584-2432. *(Abstract deadline: November 15, 1992.)*

Integrated Methods in Exploration and Discovery, April 17–20, 1993, Denver, Colorado. Information: SEG Conference '93, P.O. Box 571, Golden, CO 80402.

Canadian Quaternary Association, April 17–21, 1993, Victoria, British Columbia, Canada. Information: Environmental Geology Section, BC Geological Survey Branch, 553 Superior Street, Victoria, British Columbia, V8V 1X4, Canada, (604) 387-6249, fax 604-356-8153.

■ **Operationalization of Remote Sensing International Symposium,** April 19–23, 1993, Enschede, The Netherlands. Information: J. L. van Genderen, ITC, P.O. Box 6, 7500 AA Enschede, The Netherlands, phone 31-53-874 254, fax 31-53-874 436, telex 44525 itc nl.

Geoscience Education and Training International Conference, April 21–25, 1993, Southampton, England. Information: Dorrik A.V. Stow or Esther Johnson, Dept. of Geology, University of Southampton, Southampton, SO9 5NH, England, phone 0703-593049, fax 0703-593052, telex: 47662 SOTONU G.

May

■ **GEOTECHNICA 1993, International Trade Fair and Congress for Geosciences and Technology,** May 5–8, 1993, Cologne, Germany. Information: KölnMesse, Messe- und Ausstellungs-Ges.m.b.H. Köln, Messeplatz 1, Postfach 21 07 60, W-5000 Köln 21, Germany, phone (0)2 21/821-0, fax (0)2 21/821-25 74, telex 8 873 426 mua d.

■ **USA/CIS Second Joint Conference on Environmental Hydrology and Hydrogeology,** Industrial and Agricultural Impacts on the Hydrologic Environment, May 15–21, 1993, Arlington, Virginia. Information: American Institute of Hydrology, 3416 University Ave. S.E., Minneapolis, MN 55414-3328, (612) 379-1030, fax 612-379-0169.

GSA Cordilleran–Rocky Mountain Section Meeting, May 19–21, 1993, Reno, Nevada. Information: Richard A. Schweickert, Department of Geological Sciences, University of Nevada, Reno, NV 89557-0138, (702) 784-6050; or Walter Snyder, Department of Geosciences, Boise State University, Boise, ID 83725, (208) 385-3645, fax 208-385-4061

International Basin Tectonics and Hyrdrocarbon Accumulation Conference, May 25–June 15, 1993, Nanjing, People's Republic of China. Information: David Howell, U.S. Geological Survey, 345 Middlefield Road, MS 902, Menlo Park, CA 94025, (415) 354-5430, fax 415-354-3224.

INQUA Commission on Formation and Properties of Glacial Deposits Field Conference and GIS Workshop, Work Groups on Glacial Tectonics and Mapping Glacial Deposits, mid-May, 1993, Regina, Saskatchewan, Canada. Information: D. J. Sauchyn, Dept. of Geography, University of Regina, Regina, Saskatchewan, S4S 0A2 Canada, (306) 585-4030, fax 306-585-4815; or J. S. Aber, Earth Science, Emporia State University, Emporia, KS 66801,

Meetings *continued on p. 235*

FORUM

Bruce F. Molnia

Forum is a regular 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: Geoscience Literature: Preserving the Geologic Record

Several years ago, when the film "Slow Fires: On the Preservation of the Human Record" aired on public television, public awareness of the problem of brittle and decaying books and journals in our libraries was greatly increased. ("Slow Fires" will be shown in the Science Theatre during the 1992 GSA Annual Meeting in Cincinnati.) The literature of the earth sciences is not immune from disintegration. In fact, due to the nature of the format of the materials and the ways in which they must be used, publications that hold the record of geological research are at particular risk. In this FORUM provided by the Geoscience Information Society (GIS), light is shed on the problem and some possible solutions. At the 1992 GSA Annual Meeting, GIS will sponsor a symposium entitled "Preserving Earth Science Imagery." In addition, the GIS Exhibit Committee will sponsor a special exhibit displaying the results of a project that derives a digital database from microfilm of a major history publication.

PERSPECTIVE 1: Introduction and Background

Connie Wick, Harvard College Library, Cambridge, Massachusetts

The record of research and inquiry in the earth sciences is preserved or archived in several ways. For instance, as sophisticated systems for gathering large amounts of geoscience data are developed, such as those from Earth-observing systems, it is vital to develop ways in which to archive the data. It is essential that these archival electronic media be usable for future generations of scientists. Another way preservation affects the geosciences is the increasing need to preserve areas of classical outcrop which have been decimated by too many geologists' hammers.

Those who work with the paper collections of the geological research record are aware of the analogies for the world of print. For while the printed journal, the map, and the book have served the researcher well until now, it is also true that these media are fragile and may not serve much longer.

Anyone who has opened a journal and unfolded a map only to have it tear apart has seen the problem first-hand. But, quite reasonably, the researcher has other things to think of at the moment than that torn paper, which is symptomatic of the virtual mass destruction of the written record of geologic research.

Paper of the postindustrial world, on which most of this research record is printed, carries within it the seeds of its own destruction. Acid is attacking the structure of the paper by breaking the bonds of the cellulose fibers. Earlier papers, those used in publications prior to the 1850s, do not have the same problems. Those researchers who utilize these older materials can attest that the papers, though worn, are generally pliable and strong.

With later volumes, starting with the mid- to late 19th century geological surveys and continuing on through much of the foreign survey-published literature of today, the emergence of wood pulp as the cheaper alternative to cotton or linen-based paper is the source of the problem. Although initially strong, the compounds in the pulp-based paper, notably lignin and acidic alum-rosin sizing, react over time to discolor and decompose the paper.

Use of geoscience collections indicates that many parts of the older literature retain their usefulness and are widely cited. Though some analysis and interpretation may have become invalidated by subsequent research, older works often continue to serve as a source of geologic information. One such example is the extent to which older theses and dissertations in the earth sciences continue to be cited in newer works. In no other scientific discipline does the major indexing source, even in its electronic form, cover the literature back to the year 1785! Such is the coverage from the American Geological Institute's GEOREF databases for North American geology.

For years librarians in the geosciences have been forced to preside over the decay of library collections. Though our attention has been brought inexorably to the "slow fires" that burn, there has been a paucity of viable alternatives to remedy the situation. For some time black-and-white microfilm has been the archival alternative for storing published information in a form that is highly stable. However, while microfilm is a useful storage tool for long, unillustrated text blocks, it is unsatisfactory for the earth sciences. Few publications in geology and related fields have been reissued in microformat. The primary reason is that the abundance of oversize color illustrations, most notably the geologic maps, do not lend themselves to preservation by this means. In the meantime, much of the literature housed in the collections of geoscience libraries continues on its way to becoming unusable.

Paper of the postindustrial world, on which most of this research record is printed, carries within it the seeds of its own destruction.

In other scholarly fields, the microfilm alternative has proved a successful, if less than convenient, alternative to the decay of acidic materials. For instance, the National Endowment for the Humanities, through its brittle books program, has funded the microfilming of the almost one-half million volumes in various humanities disciplines.

Eventually, nearly three million volumes will be preserved through these efforts. Although the project has been a boon to researchers in the humanities, the fact is that there are more than 120 million brittle or endangered volumes in research libraries in the United States, and not all of them can be saved.

How then can we ensure that vital research publications in the earth sciences are saved in a manner that is archival, yet readily accessible to researchers of the future? Librarians who oversee collections and the users of those collections must have a dialogue on these issues, and together set priorities for what can be saved and how best to save it. The good news is that there may be some new technologies and capabilities that can effectively meet the needs of the geoscience literature; although black-and-white microfilm will be viable only for that very small segment of the literature without color and oversize materials, there is now archival-quality color microfilm that can preserve materials for many years.

However, this alone does not ensure efficient access for the geoscientists of the future. One possible method is to preserve this film in a central repository, and to deliver it, "just in time," in digital or scanned form, perhaps as paper output. Such resource sharing may help to solve the problem of immense cost and the fact that no geoscience library can afford to preserve all the literature within its own collection. One possible model is that earth sciences libraries could contribute to such a "virtual library" according to the particular strengths of their current and retrospective literature collections.

Even so, it is unlikely that all published earth science materials will ever be captured on color film or digitized. Some general materials, including standard and classical texts and treatises, will continue to be of considerable interest and heavily used in many different collections. A technology is now under development which can effectively arrest the degradation of acidic paper and add an alkaline buffer to guard against further disintegration. While not an answer for books or maps that are already brittle, this technology, known as mass deacidification, may prove to be of great use in preserving that segment of the geoscience literature which is simply best suited to use in its original form. In addition to

Forum *continued on p. 233*

GSA GeoVentures

The 1992 GeoVentures offered a variety of field-based programs—something for everyone. Participant ages ranged from 23 to 70. Geologists and their friends provided an interesting mix of backgrounds.

Grand Canyon (GeoTrip) April 25–May 3, 1992

Leaders: Frederick Bachhuber, Stanley Beus, Ivo Lucchitta, Richard Young

The popular Grand Canyon trip was accompanied by a field crew from the NOVA television series produced by WGBH Boston. *The one-hour program on the geology of the Canyon airs on Tuesday, October 27, at 8:00 p.m. EST—during the Cincinnati Annual Meeting. Check your local program listing.*

Geology of the Southwestern San Juan Mountains (GeoHostel) June 27–July 2, 1992

Leaders: Gregory Holden, Kenneth Kolm

"It is difficult for me to describe how much I enjoyed the Durango GeoHostel: 'Sensory overload' was a term several of us used. We had a wonderful group, and excellent leaders."

—Kathryn Gauthier (our youngest participant, age 23), Burlington, New Jersey

"When we first read about the GeoHostel in Durango, [we] were a bit apprehensive, given our age (70) and physical condition. Would the altitude be a problem? None of our fears were realized. The GeoHostel was outstanding because it had a plan that could be adapted to a variety of people and circumstances, and it was managed by leaders whose talents were more than equal to the task."

—Paul and Katherine Crosby, St. George, Utah

Galápagos Islands (GeoTrip) July 5–15, 1992

Leader: William Wise

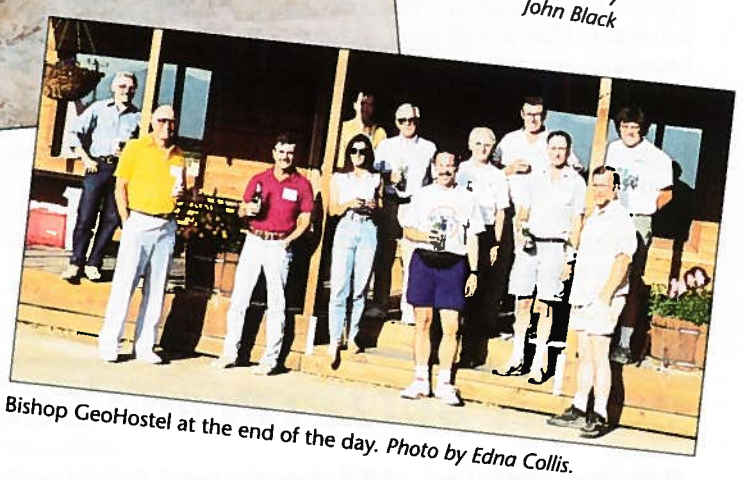
"This was one of the most wonderful trips I have ever been on. The combination of excellent accommodations ... and the many hikes among fascinating plants and animals ... was pretty close to my idea of paradise."

—Cynthia Buchwald, Northfield, Minnesota

Durango GeoHostel at Molas Pass. *Photo by Sue Beggs.*

Galápagos group in Ecuador. *Photo by John Black*

Grand Canyon trippers rafting Lava Falls. *Photo by Frank Huffman.*



Bishop GeoHostel at the end of the day. *Photo by Edna Collis.*

Geology and Natural History of Eastern California (GeoHostel) July 25–30, 1992

Leaders: Bruce Blackerby, Gary Ernst, Steven Lipshie, Clemens Nelson

"We went on more field trips than the schedule indicated, because we had a very cohesive professional group. We spent all our free time on field trips—which was good for *this* group with *these* leaders."

—Carel Otte, La Cañada, California

"By far the best trip/seminar that I have had."

—Reginald Muskett, College Park, Maryland

1993 GeoVentures—Plans in Progress

—Programs in place to date—

Santa Fe, New Mexico GeoHostel, June 5–11
Leader: Don Wolberg, New Mexico Bureau of Mines
Estimated Member Cost: $430

Yellowstone/Beartooth, Wyoming GeoHostel, July 17–23
Leaders: Greg Holden, Ken Kolm, Colorado School of Mines
Estimated Member Cost: $430

Iceland GeoTrip, August 1–15
Leaders: Haraldur Sigurdsson, University of Rhode Island
Haukur Johannesson, Iceland Geological Survey
Estimated Member Land Cost: $2650

More programs will be announced in November and December.

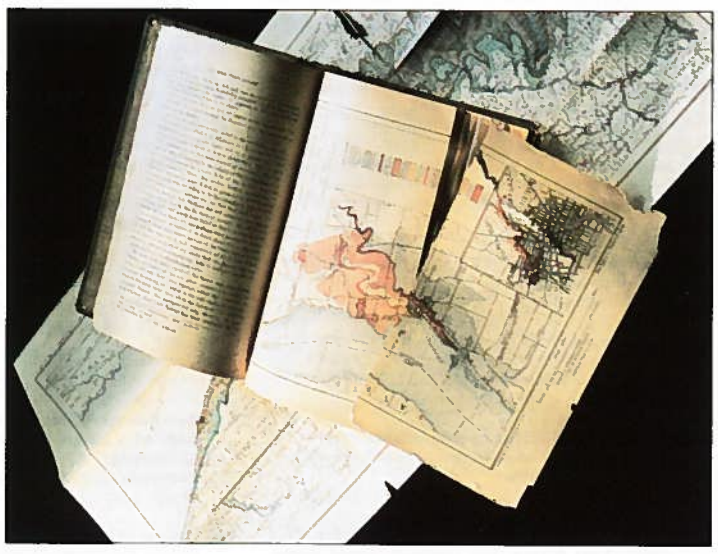
Registration begins December 1, 1992
Call 1-800-472-1988 or (303) 447-2020—Fax 303-447-0648

Forum *continued from p. 232*

monographs, older maps that are not yet brittle may be ideally suited to this treatment. It appears that the cost of this process, in terms of time and money, may be equivalent to that which libraries currently spend on the routine binding of materials.

Most of the work lies ahead, but it is clear that preservation of the published record of geological research will require more than one approach. It is the determination of the mix of the various approaches that we face in the upcoming years. The support of earth science researchers is vital in these matters. We must aggressively seek solutions and the financial means to implement them. The need to salvage deteriorating library materials competes with many other needs perceived as more urgent and visible. But those who depend on library materials in the course of research must be aware that along with the decision to obtain a costly journal subscription comes the responsibility to maintain and provide access to it. If we do not do this, then at some point in the not-so-distant future, the researcher opening a volume and unfolding a geologic map may well be the last person who uses that map.

The next time you encounter the problem, instead of trying to retape, refold, or ignore it, bring it to the attention of the administrator in charge of the collection. Find out what is being done about the problem that this symptom represents. Find out how you can help, for your concern is vital to preservation of the geologic record in written form.



Example of a deteriorating geologic map bound within a number of the 1903 *New York State Museum Bulletin*. (Clark, John M., 1903, Report of the State Paleontologist 1902, *New York State Museum Bulletin*, v. 69, p. 851–1311.) Photo courtesy of the Commission on Preservation and Access. Originally published in "Preserving the Illustrated Text," Report of the Joint Task Force on Text and Image, April 1992.

PERSPECTIVE 2: Preservation Strategies

Susan Klimley, Lamont-Doherty Geological Observatory Library, Palisades, New York

It would be hard for any educated person to be unaware in the past few years of the rising concern over the deterioration of library books. Most geologists, working in a discipline where the older literature continues to be useful, have had personal experience with books and journals that were seriously in need of repair. Some geologists have brought these materials to the attention of their librarians. But except for an admonishment not to make the problem worse by taping the pages back together, those librarians probably had little to offer in the way of remedy.

In fact, the geology literature is a problematic area for preservation. The unique characteristics of the geologic literature are so common in geology that it is easy to forget how unusual they are. Color and oversized illustrations, mainly maps, are found in many geological publications. These two traits are characteristic of maps in general; but maps used by other disciplines tend to be sheet maps, stored in separate map collections, flat and unfolded. In geology, sheet map collections have been important, but the maps have also been seen as an important auxiliary to text. Maps have often been folded up and put into the backs of journals and books. This problem has made it impossible to care for the literature using the techniques that have been successful in just about every other area of knowledge. As a result, our geology libraries are in an advanced state of deterioration, with librarians sitting on the sidelines waiting for an acceptable way of saving at least part of the literature.

The color and oversize images so common in the geological literature have not been successfully captured by the black and white microfilming techniques standard in preservation efforts. Geology librarians have held back on participating in projects using black and white microfilm and have not pur-

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Forum *continued from p. 233*

chased the few materials available, feeling that the color encoding of data on maps and in charts was an essential part of the information conveyed in the literature.

The technique of photographing oversize materials by taking a series of small overlapping photographs was also considered an unacceptable method of preservation. The GIS librarians were active for many years in trying to get University Microfilm International, the major distributor of geology dissertations on microfilm, to improve their copies of dissertations.

Meanwhile, the availability of a growing variety of computer equipment and the advent of computer modeling and visualization in geology resulted in a resurgence in the use of color in published research. It was inevitable for librarians and geologists to speculate that digitization offered a more logical solution to the preservation problem in geology.

Technological developments in the last two years may be instrumental in the search for a solution to geology preservation problems. The lack of a color film that would meet archival standards was a major stumbling block in preservation of geology materials. In 1991, the Commission on Preservation and Access initiated a test of newly available Cibachrome film, which was developed in Germany. Preliminary results indicated that the emulsion on the film will last as long as its film base, and this film is likely to be acknowledged as archivally sound.

In addition, experimentation with digitization as a preservation technique has started on several fronts. Microfilm master copies continue to be an important component of the preservation process, either as a high quality image from which the microform is derived or as a spinoff from the digital stream. Magnetic products have a life expectancy far less than has been traditionally acceptable to librarians accustomed to the 500-year stability of microfilm. A greater emphasis was placed on the importance and expense of the initial image capture, allowing digital capture at the same time as photographic preservation.

In 1989, the Commission on Preservation and Access conducted a seminar on the preservation of scholarly resources in art history which resulted in a recommendation to study the special problems posed by the preservation of text and images. In 1990, the Joint Task Force on Text and Image was established with representatives from art history, architecture, and history, as well as representatives from medical science and geology. Consultants from geography and botany provided additional input on the importance of images to these fields. As part of the funding of the Joint Task Force, a pilot project was undertaken. Twenty-eight numbers of the *New York State Museum Bulletin* (1905–1908) will be microfilmed in black and white, microfiched on color Cibachrome, and also digitized and put on a compact disc.

The selection of the *New York State Museum Bulletin* as a test case was a result of the commission's intent to have images from a wide variety of fields. The selected numbers include entomology, anthropology, botany, and other fields. The importance of this title for the geology community cannot be underestimated, because 12 numbers are classic geology titles.

Images include photographs of geologic sites, thin sections, and specimens; examples of lithographs of paleontological specimens common in the 19th century; sketch maps, engraved maps, and even a seismograph record. There are 19 page-size and 36 oversize color images, mostly geologic maps and charts.

The microfilm and digital products from this pilot project will be exhibited at the GIS booth at the 1992 GSA Annual Meeting in Cincinnati. It is very important that geologists examine the products of the pilot project at this time. It remains to be seen whether the microform or digital products will be an acceptable solution for preserving geological work. Both microfilm and digital alternatives have disadvantages. Obtaining a color printed product is as difficult as obtaining a color photocopy. Although the oversize maps will be captured on full-frame fiche or digitized as a whole rather than photographed in sections, it is unclear whether a microfilm reader or monitor will allow the geologist to see the entire map at one viewing. Both viewers will allow the reader to scan over the map, but this represents a substantial change from the way geologists currently view maps.

Also, for the first time, there will be comparative information on the cost of preservation: black and white, color microfilm, and digital. Some difficult decisions will have to be made. The volume of literature that needs to be saved and the money available to undertake preservation means that not all of the geological literature is going to be preserved. Preserving color will cost much more than black and white preservation, even in a digital world. Geologists and geology librarians will be required to make some hard decisions. Is color so essential that we are willing to preserve less in order to have what is saved done in color? Can a strong case be made to agencies providing preservation funding that the information contained in the color encoding is so essential that a much higher cost per page preserved is justified?

Geology librarians have bided their time for too long, hoping for a good solution to the complex problems of saving the geological literature. But time is running out. Visit the GIS booth in Cincinnati and evaluate the alternatives. Talk to the staff at the booth; then talk to your librarian. If the geological literature is to continue to be a foundation for present-day research, we must take action now to save it for the future. ■

October *BULLETIN* and *GEOLOGY* Contents

Are you missing out? If you're not a *Bulletin* or *Geology* subscriber, you may miss the articles listed below. But it's not too late, you can still subscribe and receive all 1992 issues, even if you've already paid your 1992 dues. Just call Membership Services today at 1-800-472-1988.

The Geological Society of America
BULLETIN
Volume 104, Number 10, October 1992

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CLASSIFIED ADVERTISING

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Positions Open

ENVIRONMENTAL EARTH SCIENTIST
UNIVERSITY OF WESTERN ONTARIO

The Department of Geology invites applications for a tenure-track faculty position at the assistant professor level, beginning preferably January 1, 1993, but may be deferred up to 6 months for the appropriate applicant. We seek a candidate with expertise in one or more of the following: hydrogeology/hydrogeochemistry, aqueous organic geochemistry, biogeochemistry. The candidate must have completed a Ph.D. prior to appointment, demonstrate the ability to develop a successful research program, and have a strong interest in undergraduate and graduate teaching. The appointee will be expected to develop an undergraduate course in hydrogeology and offer senior and graduate courses in his/her area of interest.

Opportunities for collaborative research include: mine waste remediation, environmental isotope geochemistry, geo-microbiology, clay mineralogy, acid rain and soil acidification, Quaternary studies, and coal.

Applicants should submit a curriculum vitae, brief statement of research and teaching interests, and names of at least three referees to: A. C. Lenz, Chair, Department of Geology, University of Western Ontario, London, Ontario, Canada N6A 5B7. Application deadline date: October 30, 1992.

Positions are subject to budget approval. In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian Citizens and Permanent Residents of Canada. The University of Western Ontario is committed to employment equity, welcomes diversity in the workplace, and encourages applications from all qualified individuals including women, members of visible minorities, aboriginal persons, and persons with disabilities.

BRYN MAWR COLLEGE
Junior Appointment in Sedimentary Geology/Environmental Geology

Applications are requested for a full-time non–tenure-track position (with possibility of conversion to tenure-track), starting in the Fall of 1993. Areas of expertise sought are clastic sedimentary rocks and one or more of: geomorphology, neotectonics, remote sensing, hydrogeology, and oceanography. Candidates must be committed to excellence in undergraduate and graduate teaching, be actively engaged in research, and demonstrate the ability to involve students in that research. Preference will be given to individuals who are interested in developing interdisciplinary work in environmental studies and establishing collaboration with departments of Anthropology, Classical and Near Eastern Archeology and Growth and Structure of Cities. A Ph.D. and demonstrated teaching ability are required. Send a letter of application, a statement of teaching and research goals, curriculum vitae, copies of recent research papers, and three letters of reference to: Chairman, Department of Geology, Bryn Mawr College, Bryn Mawr, PA 19010. Applications accepted until Dec. 1, 1992, or until a suitable applicant is found. Interviews will be conducted at the GSA meeting in Cincinnati. Bryn Mawr College is an equal opportunity/affirmative action employer. The College wishes particularly to encourage applications from individuals interested in joining a multicultural and international academic community.

HYDROGEOLOGY/WRIGHT STATE UNIVERSITY

The Department of Geological Sciences invites applications for a tenure-track faculty position at the assistant professor level starting September 1993. Ph.D. or equivalent is required at the time of appointment. The successful candidate will join a 13-member faculty in a department with strong M.S. programs in hydrogeology and applied geophysics (52 grad. students — 39 hydrogeology), and will contribute to the development of a Ph.D. program. He/she will teach and develop externally funded research in areas that complement departmental strengths in hydrogeochemistry, hydrological modeling, and applied field studies. A background in transport and fate of organics, soil physics, GIS, or ground water management is desirable.

Related departmental facilities/equipment, supported by 2 technicians, include a hydrogeochemistry laboratory with AA, IC, a stable isotope processing lab, state of the art computing facilities, X-ray spectrographic and fluorescence equip., microprobe, soil mech. equip., ground penetrating radar and resistivity systems, truck-mounted drill rigs, truck-mounted seismic reflection systems, 17 field vehicles, an experimental watershed and a wetlands field area both w/dedicated pumping, observation, and monitor wells. Opportunities exist for interaction with several departments including the Center for Ground Water Management.

Inquiries are welcome; the Department will have a booth in the Exhibition Hall at the G.S.A. Annual Meeting in Cincinnati (50 miles south of W.S.U. campus). Applicants are requested to send their curriculum vitae, transcripts, a statement of research and teaching interests, and names and addresses of three references by December 31, 1992, to Dr. Robert W. Ritzi, Department of Geological Sciences, Wright State University, Dayton, OH 45435, (513) 873-3455. Wright State University is an equal opportunity/affirmative action employer.

Services & Supplies

LEATHER FIELD CASES. Free brochure, SHERER CUSTOM SADDLES, INC., P.O. Box 385, Dept. GN, Franktown, CO 80116.

BUSINESS OPPORTUNITY: Profitable Engineering/Geology and Surveying business for sale. Established, respected. $150,000. Located in growing CA Sacramento valley area. W. Jaycox, broker; (707) 935-2258, P.O. Box 1293, Sonoma, CA 95476.

Opportunities for Students

Student Travel Grants. The GSA Foundation will award matching grants to each of the six GSA Sections to assist students wishing to travel to GSA Section and Annual meetings. For applications contact individual Section secretaries. For Section information contact GSA (1-800-472-1988).

PhD Research/Sedimentary Geochemistry/Univ. of South Florida. Graduate research assistantships available ($12,000/yr for a minimum of 3 yrs) in the Dept. of Marine Science at USF to work on the burial diagenesis of the Miocene Monterey Formation, California. Research topics include: Alteration of volcanic ash, and the influence of clay mineral reactions on silica transformations, dolomitization, and the maturation of organic matter/oil generation. Complete geochemical lab with state-of-the-art Scintag XDS 2000 X-Ray Diffractometer, computers, and SEM/TEM facilities.

Please send CV to Dr. J. S. Compton, Dept. of Marine Science - USF, St. Petersburg, FL 33701. 813-893-9158 (813-893-9189 FAX) E-mail: Compton@marine.usf.edu or Compton@cfrvm.bitnet.

JOI/USSAC Ocean Drilling Fellowships. JOI/U.S. Science Advisory Committee is seeking doctoral candidates of unusual promise and ability who are enrolled in U.S. institutions to conduct research compatible with that of the Ocean Drilling Program. Both two-year and one-year fellowships are available. The award is $20,000 per year to be used for stipend, tuition, benefits, research costs and incidental travel, if any. Applicants are encouraged to propose innovative and imaginative projects. Research may be directed toward the objectives of a specific leg or to broader themes.

Applications are available from the JOI office and should be submitted according to the following schedule: Shorebased Research (regardless of leg) 12/1/92.

For more information and to receive an application packet, contact: JOI/USSAC Ocean Drilling Fellowship Program, Joint Oceanographic Institutions, Inc., 1755 Massachusetts Ave., NW, Suite 800, Washington, DC 20036-2102 (Andrea Leader: 202-232-3900).

GEOLOGIST

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Woodward-Clyde, a growing international, environmental, geotechnical and waste management consulting firm, has an opening for a geologist in its Houston office. Successful candidate will have a BS or MS in geology or civil engineering; two to six years experience providing geological support on CERCLA/RCRA sites. Experience should include drilling, sampling and monitoring activities.

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Meetings *continued from p. 231*

(316) 341-5981, fax 316-341-5997. *(Abstract deadline: February 1, 1993.)*

June

■ **Global Aspects of Coral Reefs: Health, Hazards, and History,** June 7–10, 1993, Coral Gables, Florida. Information: Global Reef Meeting, University of Miami/RSMAS, 4600 Rickenbacker Causeway, Miami, FL 33149-1098, fax 305-361-4632.

Geology and Confinement of Toxic Wastes International Symposium, June 8–11, 1993, Montpellier, France. Information: Michel Barrès, BRGM—Département "Environnement," BP 6009, 45060 Orleans Cedex, France, phone 33-38 64 34 14, fax 33-38 64 30 13, Telex BRGM 780 258 F.

Rock Mechanics 34th U.S. Symposium, June 27–30, 1993, Madison, Wisconsin. Information: Bezalel C. Haimson, Dept. of Materials Science and Engineering, 1509 University Avenue, Madison, WI 53706, (608) 265-3021, fax 608-262-8353, E-Mail: haimson@macc.wisc.edu.

■ **NATO Advanced Study Institute on Feldspars and Their Reactions,** June 29–July 10, 1993, Edinburgh, Scotland. Information: Ian Parsons, Dept. of Geology & Geophysics, University of Edinburgh, Edinburgh, EH9 3JW, UK, fax 44-31-668-3184.

July

Fluvial Sedimentology 5th International Conference, July 5–9, 1993, Brisbane, Australia. Information: Continuing Professional Education, The University of Queensland, Queensland 4072, Australia, phone +61-7-365 7100, fax +61-7-365 7099, telex UNIVQLD AA40315.

■ **Geological and Landscape Conservation International Conference,** July 17–24, 1993, Great Malvern, United Kingdom. Information: D. O'Halloran, JNCC, City Road, Peterborough, PE1 1JY, UK, phone 0733-62626, fax 0733-893 971.

■ **Clays Control the Environment—10th International Clay Conference,** July 18–23, 1993, Adelaide, Australia. Information: Conference Secretariat, Elliservice Convention Management, P.O. Box 753, Norwood, SA 5067, Australia, phone +61.8.332.4068, fax +61.8.364.1968.

August

Intraplate Volcanism International Workshop, The Polynesian Plume Province, August 1993, Tahiti, French Polynesia. Information: Workshop Tahiti 1993 Organization Committee, H.G. Barsczus, Centre Géologique et Géophysique, Case 060, Université de Montpellier II, 34095 Montpellier Cedex 5, France, phone 33-67-634-983, fax 33-67-523-908.

Geochemistry of the Earth Surface 3rd International Symposium, August 1–6, 1993, University Park, Pennsylvania. Information: Lee Kump, Dept. of Geosciences, Pennsylvania State University, 210 Deike Bldg., University Park, PA 16802, (814) 863-1274, fax 814-865-3191.

■ **Belt Symposium III:** Field Conference on New Geologic Perspectives of the Middle Proterozoic Belt-Purcell Basin, August 14–21, 1993, Whitefish, Montana. Information: Belt Symposium III, c/o Western Experience, Inc., 4881 Evening Sun Lane, Colorado Springs, CO 80917.

Mine Design International Congress, Mining into the 21st Century, August 23–26, 1993, Kingston, Ontario, Canada. Information: Peter Scott, Public Relations, ICMD/Relations publiques, CICM, Department of Mining Engineering/Département de génie minier, Queen's University/Université Queen's, Kingston, Ontario, Canada K7L 3N6, (613) 545-2212, fax 613-545-6597.

September

■ **Coal Science 7th International Conference,** September 12–18, 1993, Banff, Alberta, Canada. Information: David Brown, (403) 450-5200.

■ **Fractography, Geological Society of London Thematic Meeting,** September 13–14, 1993, London, United Kingdom. Information: M. S. Ameen, GeoScience Limited, Silwood Park, Buckhurst Road, Ascot SL5 7QW, UK, phone 0344 872220, fax 0344 872438.

■ **WORLDTech I, International Congress on Mining Development,** September 15–17, 1993, Philadelphia, Pennsylvania. Information: Meetings Department, SME, P.O. Box 625002, Littleton, CO 80162, (303) 973-9550, fax 303-979-3461.

Andean Geodynamics 2nd International Symposium, September 21–23, 1993, Oxford, England. Information: P. Soler, ISAG 93, ORSTOM, CS1, 213 rue Lafayette, 75480 Paris Cedex 10, France, fax 33-1 48 03 08 29. *(Abstract deadline: April 1, 1993.)*

■ **Global Boundary Events** (Interdisciplinary Conference of IGCP Project 293, Geochemical Marker Events in the Phanerozoic), September 27–29, 1993, Kielce, Poland. Information: Barbara Studencka, Muzeum Ziemi PAN, Al. Na Skarpie 20/26, 00-488 Warszawa, Poland, phone (4822) 217 391, fax (4822) 297-497; or Helmut H.J. Geldsetzer, Geological Survey of Canada, 3303 33rd St. N.W., Calgary, Alberta T2L 2A7, Canada, phone (403) 292-7155, fax 403-292-5377.

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

Call for Nominations
1993 National Awards
(*Deadline: March 31, 1993*)

Each year AGI makes nominations on behalf of its member societies for the four national awards that are briefly described below. GSA members have been invited to participate by recommending possible candidates.

Those who wish to make nominations are urged to do so by sending BACKGROUND INFORMATION or RESUMES of their candidates *BY MARCH 31, 1993*, to the *AGI Nominating Committee, 4220 King St., Alexandria, VA 22302-1507*; (703) 379-2480; fax 703-379-7563. A roster of nominations will be prepared for final selections by the Member Society Council at its meeting in June 1993.

William T. Pecora Award

The Pecora Award, sponsored jointly by NASA and the Department of the Interior, is presented annually in recognition of outstanding contributions of individuals or groups toward the understanding of Earth by means of remote sensing.

The award recognizes contributions of those in the scientific and technical community as well as those involved in the practical application of remote sensing. Consideration will be given to sustained or single contributions of major importance to the art or science of the understanding of Earth through observations made from space.

Additional information may be obtained from the William T. Pecora Award Committee, Office of Personnel, Dept. of the Interior, MS-5203, MIB, Washington, DC 20240, Attention: Ann Meroney, (202) 208-5284.

National Medal of Science

The medal is awarded by the President to individuals "deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, engineering, or social and behavioral sciences."

There are now many younger American scientists and engineers who may be reaching a point where their contributions are worthy of recognition. The committee is giving increasing attention to these individuals as well as to those outstanding women and minority scientists who deserve recognition.

Additional information may be obtained by contacting the Secretariat Office, President's Committee on the National Medal of Science, NSF, 1800 G Street, NW, Washington, DC 20550, Attention: Susan E. Fannoney, (202) 357-7512.

Vannevar Bush Award

The Vannevar Bush Award is presented from time to time to a person who, through public service activities in science and technology, has made an outstanding contribution toward the welfare of mankind and the Nation.

The award is given to a senior statesman of science and technology and complements the NSF's Alan T. Waterman Award, which is given to a promising young scientist. The two awards are designed to encourage individuals to seek the highest levels of achievement in science, engineering, and service to humanity.

The nomination should be accompanied by a complete biography and a brief citation summarizing the nominee's scientific or technological contributions to our national welfare in promotion of the progress of science.

Additional information may be obtained from the Vannevar Bush Award Committee, National Science Board, 1800 G Street, NW, Washington, DC 20550, Attention: Susan E. Fannoney, (202) 357-7512.

Alan T. Waterman Award

The Waterman Award is presented annually by the NSF and National Science Board to an outstanding young researcher in any field of science or engineering supported by NSF.

Candidates must be U.S. citizens or permanent residents and must be 35 years of age or younger, *OR* not more than five years beyond receipt of the Ph.D. degree by December 31 of the year in which nominated.

Candidates should have completed sufficient scientific or engineering research to have demonstrated, through personal accomplishments, outstanding capability and exceptional promise for significant future achievement.

Additional information may be obtained by contacting the Executive Secretary, Alan T. Waterman Award Committee, NSF, 1800 G Street, NW, Washington, DC 20550, Attention: Susan E. Fannoney, (202) 357-7512.

Remember: BACKGROUND INFORMATION or RESUMES of nominated candidates should be sent *BY MARCH 31, 1993*, to the *AGI NOMINATING COMMITTEE, 4220 KING ST., ALEXANDRIA, VA 22302-1507, (703) 379-2480, fax 703-379-7563.* ■

ISSN 1052-5173

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