

GSA TODAY

A Publication of the Geological Society of America

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Aridity, Continental Weathering, and Ground-Water Chemistry

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ABSTRACT

Naturally occurring acid ground water is more abundant than previously thought and appears to have been important in the geologic past. Acid (pH <4) saline ground-water and lake systems are found across southern Australia, are abundant as alkaline-hypersaline systems in East Africa, and are thought to represent processes associated with laterization, red-bed formation, authigenic potassium feldspar formation, and the formation of trace metal, bauxite, and opal deposits. The basic problems in understanding modern acid systems and their importance

in the past are the cause and maintenance of the acidity. The extensive nature of these systems in Australia indicates that the stage of continental denudation and climates may be important variables. As continents evolve through denudation, there are changes in the minerals available to be weathered, the geomorphology of the weathered surface, the availability of water, and the types and rates of biogeochemical processes. We hypothesize that as a consequence of these changes, the chemistry of terrestrial water must change and that during late-stage continental denudation with appropriate climate

conditions, dramatic changes can occur in the chemistry of terrestrial water. The acid-saline to hypersaline conditions of ground-water and playa systems in Australia may be an example of the type of changes that could occur.

INTRODUCTION

Without anthropogenic interferences such as acid-mine drainage and acid rain, the acidification of natural water has been thought to be uncommon (Drever, 1988). However, increasing evidence indicates that naturally occurring acid ground water is more

abundant than previously thought and has been important in the geologic past.

There are natural acid ground-water systems in Bowman County, North Dakota; Paint Pots, British Columbia; Engineer Creek, Yukon Territory; and in a region northeast of Fort Norman, Northwest Territories (van Everdingen et al., 1985). This type of environment is found in the southern Urals (Igoshin, 1966) and Summit County, Colorado (McKnight and Bencala, 1989; Kimball et al., 1992). An intriguing example is the acid ground-water and lake system, Colour Lake, on Axel Heiberg Island in the high Canadian Arctic. The pH of the dilute, H₂SO₄, lake water and the major streams feeding it is 3.7 (Allan et al., 1987).

On a much larger scale, numerous acid systems are found across the southern half of the Australian continent from Victoria and New South Wales in the east to South Australia and Western Australia (Bettenay et al., 1964; McLaughlin, 1966; Williams, 1967; Johnson, 1980; Mann, 1982, 1983; Macumber, 1983, 1992; Lyons et al., 1987; Lock, 1988; McArthur et al., 1989, 1991; Kling, 1989). These systems are characterized by acid ground water (pH <4) discharging onto playa lakes (Long et al., 1992a; McArthur et al., 1989, 1991). Australian acid-hypersaline systems appear to be as abundant as alkaline-hypersaline systems in East Africa (Eugster and Jones, 1979). Not all hypersaline systems in southern Australia are acidified, but in South Australia there are at least 22 acid-lake systems (Lock, 1988), and in Western Australia there are at least 12 (Lyons et al., 1987). Because the playas are ground-water discharge zones, vast areas of ground water in these areas are acid. For example, the Murray Basin in Victoria, New South Wales, and South Australia covers an area of 10⁴ km², and much of its saline ground water at intermediate depth is acid. These Australian systems are thought to represent processes associated with laterization, red-bed formation, authigenic potassium feldspar formation, and the formation of trace-metal, bauxite, and opal deposits (e.g., Brimhall et al., 1988; Duffin et al., 1989; Long and Lyons, 1990; Thiry and Milnes, 1991).

The basic problems in understanding modern acid systems and their importance in the past concern the cause and maintenance of the acidity (DeDecker, 1983; Mann, 1983;

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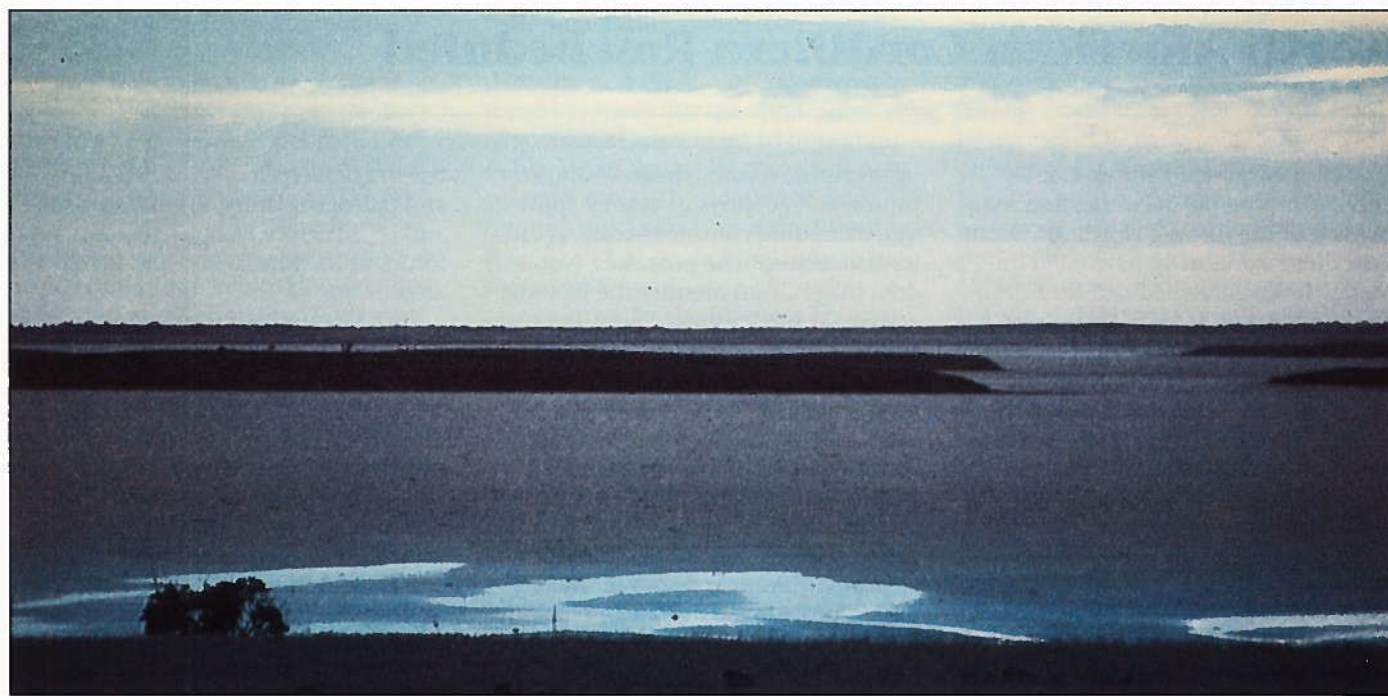


Figure 1. Spring zone of Lake Tyrrell, Victoria, Australia. Field of view approximately 3 km. In this zone, regional ground water that is oxidic, acid (pH <4), and saline (>35 000 mg/L TDS) discharges onto the surface of the lake. This water evaporates, and the acid brine refluxes through the sediments of the lake. Evaporitic minerals formed include halite, gypsum, alunite, jarosite, and possibly iron oxides.

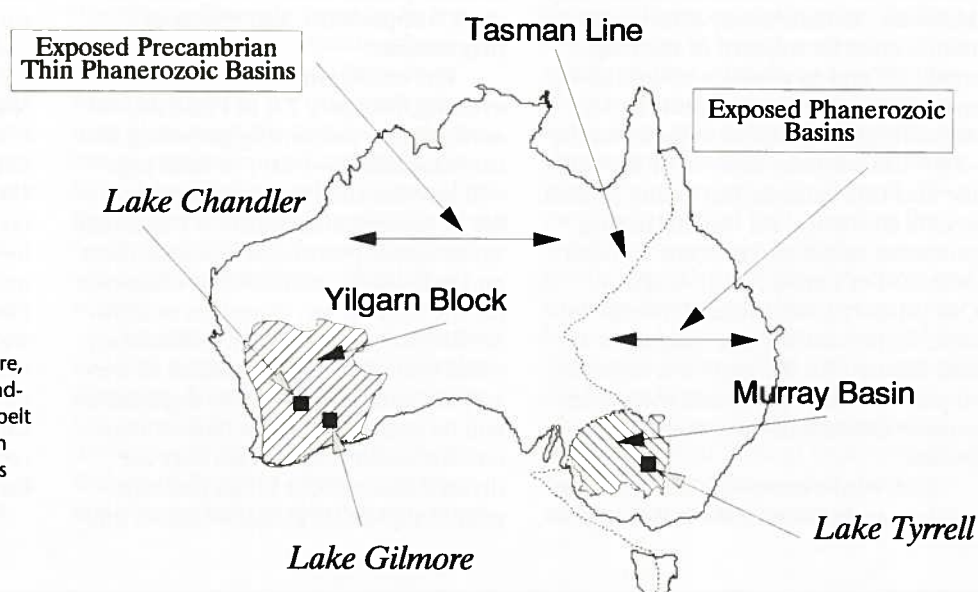


Figure 2. Locations of Lakes Tyrrell, Gilmore, and Chandler. The Tasman Line is the boundary between the Phanerozoic Tasman fold belt and the Precambrian terrane to the west. In the western terrane exposed Precambrian is overlain by thin Phanerozoic basins; in the eastern terrane, exposed Phanerozoic fold belts are overlain by younger Phanerozoic basins.

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GSA TODAY September Vol. 2, No. 9 1992

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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Printed in the U.S.A.

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McArthur et al., 1989). Some insight into this problem can be obtained from small-scale examples of acid systems, whether natural or anthropogenic (e.g., Filipek et al., 1987). In most cases the drive for acidification is the oxidation of sulfides, typically pyrite (e.g., Nordstrom, 1982; Risacher and Fritz, 1991). Acidity is maintained in the systems because its production is greater than that of alkalinity. The relative rates of production of acidity and alkalinity

are a function of the abundance of dissolved oxygen and/or the buffering capacity of the rock and soil (Galloway and Cowling, 1978; Drever, 1988). The basic principles learned from the study of acid systems caused by anthropogenic processes could be applied to understanding the acid systems in Australia. However, the extensive nature of acid ground water and lakes in Australia and only local cases of active systems in other continents indicate that the stage of continental denudation and climate also may be important vari-

ables on a large scale. As continents evolve through denudation, there are changes in the minerals available to be weathered, the geomorphology of the weathered surface, the availability of water, and the types and rates of biogeochemical processes (e.g., Barron et al., 1989). We hypothesize that because of these changes, the chemistry of terrestrial water must change. It is possible that during late-stage continental denudation with appropriate climatic conditions, dramatic changes can occur in the chemistry of terrestrial water. This paper investigates this hypothesis through the idea that the acid-saline to hypersaline conditions of ground-water and playa-lake systems in Australia may be an example of the type of changes that could occur.

ACID SYSTEMS AND CONTINENTAL WEATHERING

The most intensely studied acid ground-water lake system is Lake Tyrrell in Victoria (Figs. 1 and 2). The initial research on this location was done by Macumber (1983, 1991). A more detailed geochemical description of the waters in the ground-water basin is in Lyons et al. (1992).

Rocks and sediments of watersheds with acid ground water are of low, acid-buffering capacities and include the Parilla Sand in Victoria, granites and gneisses of Archean age greenstone belts in the Yilgarn block of Western Australia, and Proterozoic age gneissic

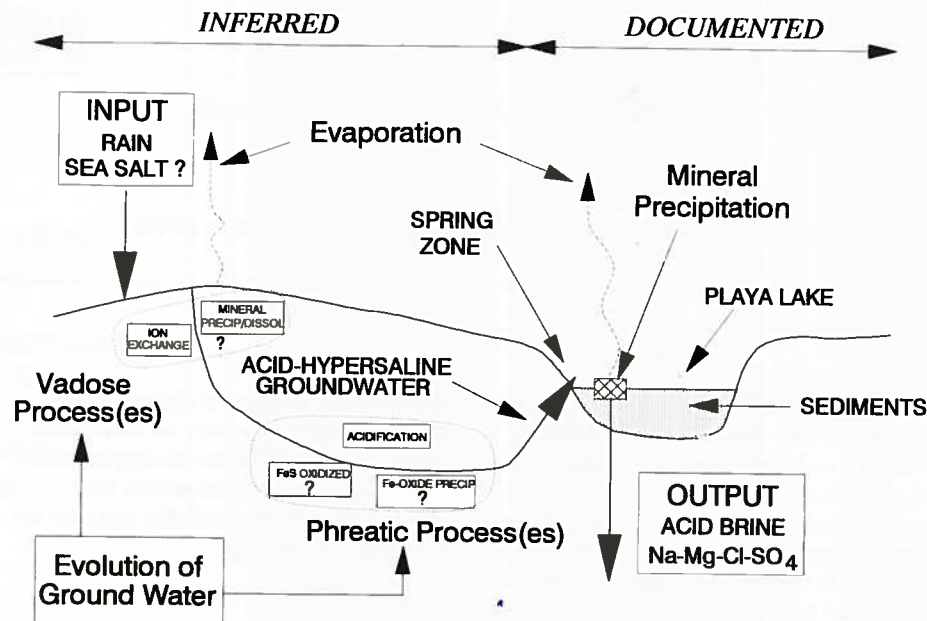


Figure 3. The general nature of changes in ground-water chemistry in the Lake Tyrrell system from recharge site to discharge site on the floor of lake. This model is suggested to be representative of all acid-hypersaline systems in Australia. Our work to date has concentrated on processes near the lake.

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Penrose Conference on North American Cordillera Rescheduled

The postponed Penrose Conference, "Continental Tectonics and Magmatism of the Jurassic North American Cordillera" (originally scheduled for March 1992) is rescheduled for February 27 to March 4, 1993, in Havasu City, Arizona. The conveners are Dave Miller, (415) 329-4923, and Dick Tosdal, (415) 329-5423, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025, and Bob Anderson, (604) 666-2693, Geological Survey of Canada, 100 West Pender Street, Vancouver, B.C. V6B 1R8, Canada. **All applicants accepted for the 1992 conference will be accepted automatically for the rescheduled meeting.** More openings are available, so additional applications are encouraged.

The intent of this conference is to examine the first magmatic-tectonic events, from when continental-margin subduction was established in the early Mesozoic, to extensively affect continental crust far inboard of the magmatic arc and to produce voluminous magmas both in and behind the arc. Accordingly, we expect to focus on the ~180–135 Ma time interval of the Middle and Late Jurassic, but earlier Jurassic events are critical for understanding precursor stages and tectonic collages outboard of native North America. Our primary goal is to understand continental tectonics at the magmatic arc and inboard (to the east) as a response to plate-tectonic processes, including terrane movements and accretionary events.

The conference will focus on magmatism and isotopes, the cratonic pale-

ogeographic record, structure and tectonics, and geophysics as they apply to understanding continent-scale tectonics and lithospheric processes. Not only does magmatism identify the tectonic activity as subduction-related, but also study of the magmas provides clues for deep-lithosphere processes, the ultimate source of energy for most continental tectonics. Because the Jurassic continental tectonics was the first widespread orogenic effect of the Mesozoic subduction system, depositional patterns in the continental interior contain a complete record of the tectonics, providing a unique opportunity to meld paleogeographic information from stratigraphy with tectonics and magmatism. Comparing tectonic styles, magmatic characteristics, and timing of events along the Cordillera from Mexico to the Yukon should provide much information about interactions with oceanic plates, effects of continental crust composition, and effects of magmatism.

The conference begins on Saturday evening, February 27, in Phoenix, Arizona, with a welcoming gathering and introduction. Two days of field trips will traverse the Jurassic magmatic arc of Arizona and southern California. Voluminous pyroclastic volcanic rocks and calc-alkalic plutons that characterize the Jurassic arc, examples of intra-arc deformation, and the sedimentary rocks that record the cessation of arc activity and its subsequent degradation will be examined. Three days of conference sessions in Havasu City are divided among four broad but inter-related topics: (1) global tectonics and

terrane movements, (2) stratigraphy and paleogeography, (3) magmatism, and (4) structure, geophysics, and tectonics of the Jurassic arc and inboard areas.

The conference is organized to involve every participant. Each session commences with a talk summarizing the topic region-wide and identifying the main problems and questions. A two-hour poster session follows during which participants present data relevant to the topic of that session. A short time is allowed for very brief oral presentations. At the end of the session, the keynote speaker plus other participants will summarize the session and promote discussion among the conference participants.

Participation in the conference is limited to 60 persons. All those invited in 1992 will be invited for the 1993 conference. Additional participants should apply by submitting a short summary of their contributions and their proposed topics for the conference and appropriate session(s) by **November 6, 1992**, to Dave Miller, U.S. Geological Survey, 345 Middlefield Road, MS 975, Menlo Park, CA 94025, phone (415) 329-4923, fax 415-329-4936. The registration fee will be approximately \$600, and includes all transportation from Phoenix to the site at Havasu City and return, food, lodging (double occupancy), and all costs associated with the conference field trips. Applicants will be informed regarding procedures for payment of deposits for formal registration. ■

Letter to Members of the Society

Dear fellow members of GSA,

I would like to tell you about some of the activities our Society has been engaged in since the 1991 Annual Meeting.

In response to the difficult issues raised by the "Global Perspective" symposium at the San Diego meeting, organized by Gordon Gastil, and to the challenges laid down by Norman Newell in his 1990 Penrose Medal acceptance speech and by Bill Fyfe in his 1990 Day Medal acceptance speech, I asked Bill Fyfe to chair a committee to consider the following question: What, if anything, can the Geological Society of America do, and what ought it to do, to help ensure that Earth will continue as a viable life-support system in the future? Our contributions, if any, must be in the area of geology, which we are best qualified to deal with. Moreover, anything we do must be something that is important and is not already being done adequately; it also must be within the means of our resources. The committee consists, in addition to Bill Fyfe, of Councilor Bill Fisher, Past President Ray Price, Vice-President Bob Hatcher, Fred Donath, executive director of our Institute for Environmental Education, Sue Kieffer, a member of our former Committee on the Path to the Year 2000, and Gordon Gastil. The committee has made several interesting and exciting recommendations, which were discussed during the May meeting of the Council. You will see the first fruit of their ideas in a forum, at the Cincinnati Annual Meeting, on the future of Earth as a habitat, as seen by young geologists from different parts of the globe.

In January I was invited, along with the presidents and/or executive directors of 26 professional societies in the physical and mathematical sciences, to attend a briefing and open-ended discussion with Allan Bromley, the President's Science Advisor, and the senior staff of the White House Office of Science and Technology Policy. In preparation for this meeting, I consulted extensively with the Council and prepared six brief issue papers submitted to Bromley and distributed to those attending the meeting. The issues are: Establishing a framework for setting research priorities across discipline boundaries; interface between pre-college and college-level science education; graduate student research support; global perspective on environmental issues and understanding the workings of Earth as a feedback system; challenge of transforming event-based historical data into predictive tools; and seeking consensus among industry, environmental groups, and government institutions on technical earth-related issues having major social impact. I was able to discuss three of these issues at the meeting. The meeting was very collegial and stimulating. Bromley strongly urged members of the scientific community to seek out their members of Congress and express their views on important issues for which their scientific knowledge has special bearing. As Bromley stated, even if these issues are not immediately of legislative interest, this kind of discussion could provide background information that might affect the Congress members' thinking in the future. As a tax-exempt organization, of course, GSA cannot lobby, but as individuals we can make our personal views known. I've

had a good discussion with the legislative assistant of my Congress member. Geology needs this kind of public attention.

Since last summer GSA has been an active member of the Coalition for Earth Science Education (CESE) which is a liaison group including not only the major "earth science" societies (as the term is used in the public school system, to include geology, meteorology, oceanography, hydrology, and astronomy), but also teachers' groups, teacher preparation and enhancement groups, and some federal science agencies. GSA Education Coordinator Ed Geary has been an active and effective member of this collaborative effort. It is important that the earth science community has pooled its resources and energy to work together for the common goal of improving earth science education in the K-12 grades. One example of this increased cooperation is the Partners for Excellence program, which has been expanded to include other societies interested in or actively involved in partnering. I attended a meeting of the steering group in February, and I was deeply impressed with the serious purpose, the open and realistic discussions, and the spirit of collaboration and sharing. With a common voice, we should also be able to speak better to others engaged in pre-college science education. Teachers will have a single source of contact and will not be bewildered and beleaguered by a plethora of societies competing for their attention. I am excited by this turn of events, and I hope you will be too and will get involved in some way with our education program.

Last October the Council authorized the new Presidential Conference format to deal with the application of geological knowledge to important public issues. Each GSA President may convene one such conference, and funding must come from grants rather than from Society sources. I chose the subject of Earth Science Education because I consider the interface between college-level and precollege-level education to be an important but much-neglected area. The constraints that this interface pose directly affect the quality and viability of precollege earth science curricula. For instance, if colleges do not accept earth science as a lab science for admission purposes, then college-bound students will be steered away from such courses by school counselors. If good and effective teachers of lower-level science classes in colleges are not adequately recognized, respected, and rewarded for their contribution at a level commensurate with rewards for research and graduate-student guidance, then the quality of teaching at such levels will suffer, and the effect will surely show up in the quality of training of future school teachers. Ed Geary and I have been working together on this conference, to explore ways the two levels of education can better work together. We have submitted a funding proposal to the National Science Foundation. If our funding application is approved, we will hold the conference this fall or winter.

We have been engaged in an effort to reach out to our colleagues in other countries. Our International Division has a Student Committee, which, under the dedicated guidance of Jim Skehan of Boston College, is developing ways to help students from other

countries who come on field trips or to attend universities. Jim's effort already has benefited a group of students from Ballarat University, Australia, who will spend part of this summer studying the geology of the Front Range in Colorado. We have other expressions of interest as well. At the May meeting, the Council approved a set of guidelines prepared by a committee chaired by Brian Skinner, for cooperation with geoscience societies in other nations. Already we are discussing reciprocal exchange of information, meeting notices, publication order forms, etc., with the geological societies of several countries, including Great Britain and Australia, and we hope we can extend our collaboration, especially with our counterparts in the developing nations.

Meanwhile, all these activities (and others I have not specifically cited) are adding demands on our fiscal, human, and workspace resources at the Society headquarters. If we are to continue to be a forward-looking professional society not content with the status quo, then we need to develop new support resources. Active discussion has been proceeding during the past year in the Council on ways to address these demands and various options are being considered. As a direct consequence of these discussions, a sampling of our membership was surveyed on their views of the Society. While there is strong support for the purpose of the Society, there is also indication that some of our members are unfamiliar with the Society's activities and have the impression that the affairs are run by male, white, old, and stodgy people. Whether this view is correct is beside the point; if the perception is there, then we need to deal with it, not by propaganda but by factual demonstration. The Council has discussed these issues during the past couple of years. We want to strengthen greatly and give increased prominence to our Committee on Minorities and Women in the Geosciences. It is now a standing committee of the Council, and innovative ways to attract minority and women colleagues, and provide them with support in a traditionally white and male profession, are being considered. We are also interested in improving the services (everything from the nature of our journals to in-service education) that the Society provides to our members; an ad hoc committee, headed by Councilor Arden Albee (other members are Councilors Genevieve Atwood, Marie Morisawa, Karen Prestegaard, Jack Sharp, and Section Representative Ken Kolm), will report their findings to the Council at Cincinnati.



GSA President
E-an Zen

At its May meeting, the Council expressed concern about the age distribution of GSA Fellows. At the moment, exactly half of our Fellows are 65 or older, and too few Fellows are under 45. Clearly, many of our members deserving election to Fellowship have not been recognized. I have asked the entire Council to pitch in and identify those Members who ought to be considered. But we need your input and help. Please send us names of people whom you feel ought to be Fellows of the Society or, better yet, sponsor the nomination yourself or persuade a Fellow to do so. I know the Membership Committee would appreciate your help in this matter as well. Nomination forms are available on request from GSA's Membership Services department.

This is an unprecedented time for the earth sciences: our institutional structures are being stressed (witness the proposed closing of departments of geology across the land, and the severe trimming if not extirpation of Geological Surveys at state levels), but paradoxically, the importance of earth science in the future of Earth as a healthy habitat and robust life-support system is apparently being recognized at last (witness the strong involvement of geologists in the preparatory work for the June meeting in Rio, as reported by Cordani, McLaren, Silver, Skinner, and Wolman in "The H-F Boundary," May 1992 *GSA Today*). My own view is that geology and, indirectly, our Society, will prosper and grow or wither and become irrelevant, depending in part on whether we collectively respond positively to this opportunity and meet the large challenge of the contemporary world. We must, of course, plan thoughtfully and act prudently, and as a Society we need to insist on acting and speaking within our areas of scientific competence, but we need to be active and to demonstrate intellectual leadership not by demanding a place at the feeding trough, but by showing how geology, an integrative science, can indeed bring all of the relevant subject areas together and work toward making the world a better place for life.

Finally, I take this opportunity to thank the many GSA members who were moved to write to me and discuss facets of the affairs of the Society and of the role of geology in the public arena. It's been a great source of stimulation and enjoyment to correspond with you. See you all in Cincinnati!

A handwritten signature in black ink, which appears to be "E-an Zen".

E-an Zen

granites of the Gawler block in South Australia (Fig. 2). Acid-hypersaline, ground-water playa-lake systems (Lake Tyrrell is an example) are further characterized by the following geochemical-hydrogeologic parameters: (1) saline ground water flowing onto the playa surfaces is an oxic, sulfuric acid solution (pH 2.8–4.0) (Long et al., 1992a) (Figs. 1 and 3); (2) authigenic minerals include combinations of jarosite $[KFe_3(SO_4)_2(OH)_6]$, alunite $[KAl_3(SO_4)_2(OH)_6]$, and iron oxides (Figs. 4 and 5) (Long et al., 1992b); (3) jarosite and alunite and possibly iron oxides precipitate as evaporitic minerals (Long et al., 1992b); and (4) wind-blown marine aerosols appear to be a major source for solutes in these systems (Long et al., 1992a).

The occurrence of alunite, jarosite, and possibly iron oxides as evaporitic minerals is previously unknown (Long et al., 1992b). Previous occurrences have been documented in areas of acid-mine drainage (Nordstrom, 1982; Chapman et al., 1983; Filipek et al., 1987; Alpers et al., 1988; Karlsson et al., 1988), natural sulfide mineral oxidation (Nickel, 1984; Scott, 1987; Sullivan et al., 1986), hydrothermal activity (Raymahashay, 1968; Altaner et al., 1988), and weathering in acid soils (VanBreemen, 1973). Evaporitic alunite and jarosite have now been documented in lakes in Western Australia, South Australia, and the Raak Plain, Victoria (e.g., Lock, 1988). The formation of iron oxides is a major process occurring in the acid seeps along the margins of some of the lakes such as

Lake Tyrrell. This process is leading to the formation of ironstones (Macumber, 1983, 1991; Lyons et al., 1992).

We have also worked with Australian scientists on several modern Western Australia acid-hypersaline systems that include Lakes Gilmore and Chandler (Fig. 2) (McArthur et al., 1989, 1992; Lyons et al., 1987, 1992; Kling, 1989). Extensive geochemical analyses at the Lake Gilmore location indicate ground-water pHs in the range 2.9–3.5 (McArthur et al., 1989). Only one sample is available from Lake Chandler; the pH was extremely low—2.7 (Lyons et al., 1987). Lake Gilmore sediments contain abundant iron oxyhydroxides and alunite, but no jarosite was observed. The entire floor of Lake Chandler is alunite with traces of kaolinite and quartz (Bird et al., 1990). No Fe-bearing authigenic minerals have been observed. Lake Tyrrell, of course, has all three minerals.

Table 1 lists the major differences in water chemistries between these two Western Australia lakes and Lake Tyrrell. Acid ground water from Lake Chandler has lower total iron (Fe_t) concentrations, lower K/Cl ratio, and higher Ca/Cl ratio than either Lake Tyrrell or Lake Gilmore. Apparently the K^+ has been removed through alunite formation, and the low concentration of Fe_t in the ground water limits the formation of Fe-bearing minerals such as goethite and jarosite.

The Fe_t concentration in the low-pH water of the spring zone at Lake Gilmore is intermediate between those of Lake Chandler and Lake Tyrrell (Table 1). The lack of jarosite at Lake Gilmore suggests that the Fe_t

TABLE 1. COMPARISON OF SELECTED AUSTRALIAN ACID-HYPERSALINE GROUND-WATER LAKE SYSTEMS

Lake	K/Cl (M)	Ca/Cl (M)	Fe (mM)	Minerals
Tyrell	7.5	4.3	225	Alunite Iron Oxides Jarosite
Gilmore	6.0	4.3	61	Alunite Iron Oxides
Chandler	4.8	15.0	11	Alunite

concentrations are too low to allow its formation, although Fe-oxyhydroxides can form. If so, the concentration of Fe_t in these low-pH waters (especially that of Fe^{3+}) throughout southern Australia is the most important factor in determining what authigenic (evaporitic) minerals form in the spring-zone areas. Obviously, without dissolved Fe being transported, no authigenic Fe minerals can be formed at the ground-water discharge sites. Therefore, the depth and length of weathering and ground-water oxidation-reduction conditions undoubtedly control the types of evaporitic Fe-Al minerals that can form on the lake floor.

Lake Tyrrell may be an example of an acid system in its earliest stage of evolution, whereas Lake Chandler is an example of a system in its latest stage. This idea fits well with what is known concerning the depth and length of weathering in these regions. The Yilgarn block (e.g., Lake Chandler), which is an older geologic region, has been weathered longer and therefore to a greater depth than the less heavily weathered Tertiary sequence in the Murray Basin of Victoria, as represented by Lake Tyrrell (Fig. 1). From the authigenic mineral sequence discussed above, we suggest that acid-hypersaline systems evolve from Fe-rich to Fe-poor ones.

One of the most intriguing and important questions raised in our previous work is, Why do we see this phenomenon in such a large scale only in Australia? To answer this question, one must understand, in part, the recent climatic history of the continent. After the break from Antarctica, begun at 65 Ma, Australia moved into the subtropical region. The climate through the Eocene was humid and warm, and periods of laterization occurred (Bowler, 1986; Mann, 1984). Laterite profiles are especially abundant in Western Australia and display deeply weathered bedrock depleted in alkalis and alkaline earths but enriched in Fe, Al, and Si oxides (Mann, 1984; Macumber, 1983, 1991). The depth of weathering reaches

100 m in some places on the Yilgarn block in Western Australia (Webster and Mann, 1984). Although aridity appears to have become well established in Australia by at least the Pleistocene, processes similar to laterization may still be occurring in trunk valleys of Miocene paleo-drainages today (Mann, 1984).

Little chemical weathering is occurring on the Australian continent today, except in a small band of tropical and semitropical regions of north-central and northeast Australia. Garrels and Mackenzie (1971) showed that of the six ice-free continents, Australia has the lowest annual chemical denudation rate, 12 times lower, per unit area, than the next lowest continent, Africa (2 and 24 t/km², respectively) (Fig. 6). Aridity must be a factor in slowing the rate of chemical denudation. However, Garrels and Mackenzie (1971) also showed that for stream discharge vs. continental area, Australia falls near the trend line for all continents (Fig. 7). Sufficient water is available, when compared to other continents, for chemical weathering, even though the continent is largely arid. The lack of chemical weathering today presupposes that the regolith of Australia has been extensively weathered in the past.

We believe that these acid-hypersaline systems occur in such large geographic areas because of both climatic and tectonic conditions. Much of Australia appears to be in the last stages of land surface reduction associated with a long period of tectonic stability. The waters are acid simply because the continent has been weathered to the point where only relatively unreactive residues are left and therefore there is little to titrate the acid in the system. What causes the acidity in these systems continues to be debated (McArthur et al., 1991; Macumber, 1992). Change from humid to arid conditions after laterization and the peneplanation of the continent has led to the retention of solutes in the landscape and the formation of hypersaline solutions. The conditions in present-



Figure 4. Evaporitic jarosite (yellow) and iron oxides (red) in sediments of a spring zone.



Figure 5. Iron oxides in sediments of a spring zone.

Annual denudation (metric tonnes/km²)

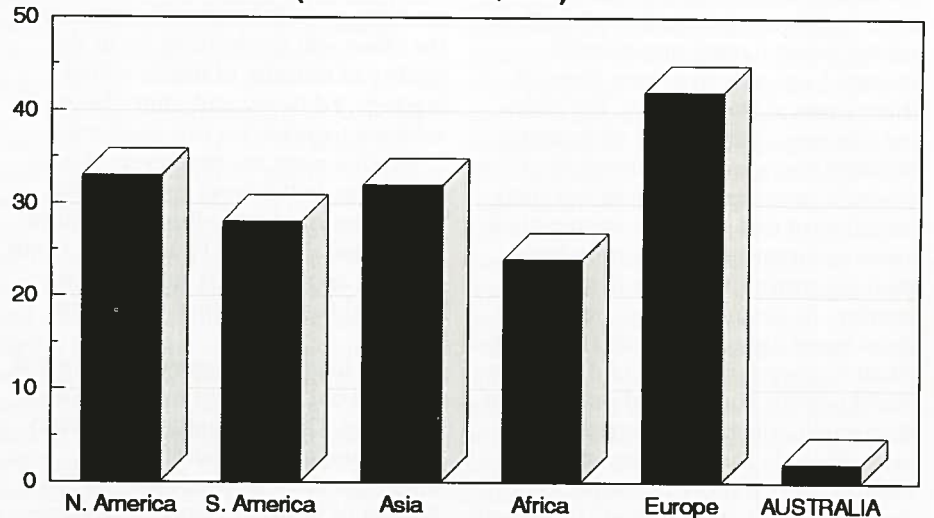


Figure 6. Annual chemical denudation of the continents (from Garrels and Mackenzie, 1971).

day Australia may be one of the last stages of terrestrial water development under arid and semiarid conditions.

GEOLOGIC IMPORTANCE OF ACID SYSTEMS

Recently Ollier (1988) and Mabbutt (1988) have argued that the conditions found in Australia would be similar to the geomorphic conditions that existed in the interiors of ancient supercontinents such as Gondwanaland and Laurasia. These supercontinents would have had interior regions great distances from the oceans, and rivers would have been long and would have had low gradients (Ollier, 1988). Land surfaces would have been generally flat and, late in their history, highly weathered. If these supercontinents then became arid, conditions such as those observed today in Australia could have existed over extensive areas of Earth in the Mesozoic and even into the Paleozoic. For example, the Australian deposits may provide a model for formation of ferricretes surrounding shallow-water lake margins in the Silurian of southwest Ireland and in the Permian-Carboniferous of Spain that are associated with semiarid paleosols (V. P. Wright, 1990, personal commun.).

As pointed out above, in the hypersaline systems, major sedimentary "products" are the minerals halite, gypsum, alunite, jarosite, ferric oxyhydroxides, and opaline silica. What happens to these "telltale" minerals when the acid systems are gone? In some cases, a part of these minerals can be preserved—e.g. silica, ferric-oxhydroxides, gypsum. The best samples of this preservation are the now nonacidic regions of north and central South Australia and inactive salinas in Victoria. South Australia is currently the major opal-producing region of the world, as well as one of the driest regions of the world.

Thiry and Milnes (1991) have argued that opalite in South Australia was produced by epigenetic processes in an acidic environment in which Al^{3+} is more soluble than Si^{4+} . The Si^{4+} is retained in the form of opal-A, and alunite commonly is present in the opal-rich profiles (Thiry and Milnes, 1991). Alunite in the South Australian opal fields both predates and postdates opal formation. Recently, K/Ar dating of these alunites suggested ages of formation ranging from 18 to 8.4 Ma (Miocene; Bird et al., 1990). Deuterium values of these alunites indicate that the alunite was formed in equilibrium with evapoconcentrated meteoric waters (Bird et al., 1989); all the available data suggest that alunite formation either occurred at the end of the Miocene weathering event, described

by numerous Australian authors, or postdates it slightly. The alunite is preserved because the region is arid and thus lacks runoff to dissolve it. The presence of alunite can be associated with the end of the acid weathering processes that formed the opal. It must be emphasized that alunite formation cannot be synchronous with active weathering, but is related to the gradual desiccation of the regolith (Bird et al., 1989, 1990).

Similar geologic weathering profiles as described above in the territory of South Australia are also present in the middle Miocene sedimentary rocks of western Portugal (Meyer and Pena dos Reis, 1985), the Miocene of the Paris basin (Thiry, 1981), other Miocene weathering profiles in Australia (King, 1953), and profiles in southern Australia (McArthur et al., 1989, 1991; Lock, 1988; Long et al., 1992a). The similarities of lateritic profiles in southern Australia and in the Transvaal of South Africa (Milnes et al., 1987) imply formation under similar geochemical conditions.

Brimhall et al. (1988) recently hypothesized that the acid weathering of Western Australia is the primary factor in the development of high-grade Jarrahdale bauxite deposits "downflow" of these acid systems. They postulate a genetic relation for the sequence of surficial deposits; laterite and ferricrete duricrust regions in closed-basin acid water drainages, to bauxite deposits (Jarrahdale type), to shoreline detrital heavy-mineral deposits, and to offshore kaolinite-rich marine sediments. The sequence results from the selective deposition of eolian material derived from the acid regions (Brimhall et al., 1988). They also suggested that other large bauxite and laterite deposits at tectonically stable continental margins, such as those in Ghana, Guinea, and Sierra Leone in West Africa, as well as in India, formed by processes similar to those in Western Australia. African and Indian bauxite deposits also have large heavy-mineral beach deposits associated with them (Brimhall et al., 1988). The inference is, of course, that the formation of these bauxite deposits is directly related to the development of acid systems.

When the acid solutions containing Al (and Si) (Long et al., 1992b; McArthur et al., 1991) are neutralized, alumino-silicates could also form. For example, some of the alumino-silicate cements in the western Australian acid aquifer and lake sediments are authigenic (Butt, 1983, 1985; Thornber et al., 1987; Kling, 1989). Authigenic K-feldspar in sandstones is well documented, but its origin is debated (Berg, 1952; Odom, 1974; Kastner and Siever, 1979; Duffin et al., 1989; Baskin, 1985).

The Mt. Simon Sandstone in northwest Illinois has abundant authigenic K-feldspar that may have formed by the movement of K-rich, high-Eh, low-pH water enriched in metals such as Pb and Zn (Duffin et al., 1989) in a manner similar to the Lake Tyrrell environment.

Finally, the modern acid environments in Australia may be analogs for the ancient environments that formed red beds (Long and Lyons, 1990). The reddened sediments of Lake Tyrrell (Fig. 5) look very similar to reddened Jacobsville Sandstone (Cambrian, upper peninsula, Michigan). The Jacobsville Sandstone also contains authigenic K-feldspar that occurs as a cryptocrystalline cement (Sibley, 1978). The K-feldspar could have formed by replacement of a nonstable precursor mineral (alunite?) (D. Sibley, 1991, personal commun.).

The reddening of near-surface sediments occurs in oxidizing environments, in various sediment types (e.g., clay and sands), in different geologic settings (e.g., playa lakes, alluvial fans), and in all climates (Walker, 1967, 1974; Clark, 1962). However, only near-neutral to alkaline pH solutions are important in red-bed formation (Turner, 1980). The similarity of the Australian acid systems to ancient red beds implies that the latter, especially those associated with playa lake sediments, could have formed in an acid environment.

Acid ground-water systems clearly play very important roles in the generation of economically significant deposits such as opals and bauxite, and possibly major roles in the formation of sedimentary base-metal deposits. Further study of these systems not only is scientifically important, but could also improve our knowledge of the development of important economic resources.

ACKNOWLEDGMENTS

This paper is a culmination of lengthy discussions with numerous colleagues. Although we take complete responsibility for our statements, we also deeply appreciate fruitful discussions with A. L. Herczeg, M. E. Hines, J. M. McArthur, C. Alpers, K. Nordstrom, B. Jones, J. Turner, P. G. Macumber, B. Dickson, and A. Giblin. We thank R. Lent, N. Fegan, and A. E. Carey for help in sample collection at Lake Tyrrell. We appreciate the K^+ and Cl^- analysis of Lake Chandler water by A. Chivas and E. Kiss. We are especially grateful to P. G. Macumber and the people of Sea Lake, Victoria. This work was supported by National Science Foundation grants EAR-86-12065 and INT-8814568.

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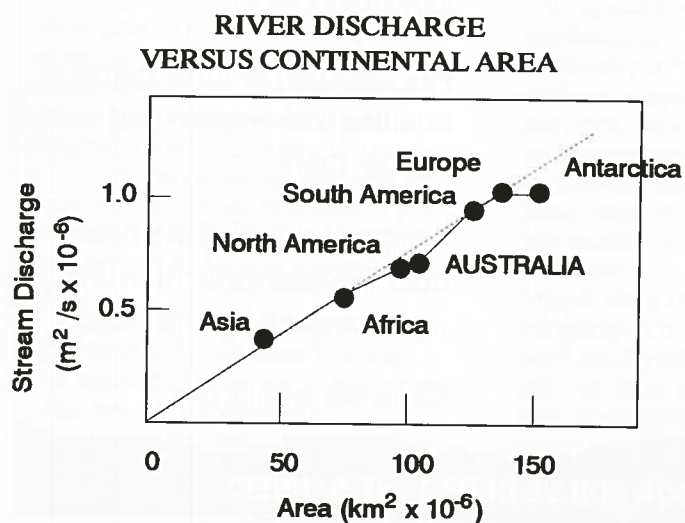


Figure 7. River discharge vs. continental area (from Garrels and Mackenzie, 1971).

Ground Water continued on p. 190

Ground Water continued from p. 189

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Manuscript received March 27, 1992; revision received June 15, 1992; accepted June 18, 1992. ■

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Geologic Mapping Comes of Age

May 18, 1992, marked a major milestone for the U.S. geological community. On that day, President Bush signed into law Public Law 102-285, the National Geological Mapping Act of 1992. The act was passed by Congress on April 30 (H.R. 2763 amended) and sent to the President for signature. Although the legislation was opposed by the Administration on budgetary grounds, the Office of Management and Budget did not recommend that the President veto the legislation.

The mapping act is the result of a multi-proponent effort to reverse the decline of geologic mapping activities in the United States and to provide an action plan for geologic mapping of the 80% of the country that still is unmapped at intermediate to detailed scale. The act is clearly written with a lucid justification for the necessity of developing a national capability in geologic mapping. Additionally, the act officially changes the names of the Geological Survey and the Bureau of Mines to the United States Geological Survey (USGS) and the United States Bureau of Mines (USBM). When established in 1879 and 1910, respectively, neither organization's name included the country designation.

Support for the legislation came from a number of professional earth science and geology societies and organizations. The American Association of State Geologists (AASG) actively lobbied for the passage of the act. The AASG, the American Mining Congress, and the Society of Exploration Geophysicists all testified in favor of the proposed legislation at hearings of the House Subcommittee on Mining and Natural Resources. The Geological Society of America did not testify, but wrote a strong letter of support for the legislation. The bill was sponsored in the House (H.R. 2763) by Rep. Nick Rahall (D—WV), Chairman of the House Subcommittee. A Senate version (S. 1179) was introduced by Sen. J. Bennett Johnston (D—LA), Chairman of the Committee on Energy and Natural Resources.

The following paragraphs summarize the act, focusing on areas of specific interest to the earth science community.

Section 2(b) of the act states that the purpose of the act is "to expedite the production of a geologic-map data base for the Nation ... which can be applied to land-use management, assessment, and utilization, conservation of natural resources, groundwater management, and environmental protection." The act proscribes that the data base will be located within the USGS.

Section 2(a) of the act presents eight "findings" that serve to clarify what motivated Congress to enact this legislation. The findings are:

1. Geologic map production has been "drastically curtailed" during the past 20 years.

2. "Geologic maps are the primary data base for virtually all applied and basic earth science investigations...."

3. Government, industry, and the public "depend on the information provided by geologic maps to determine the extent of potential environmental damage" prior to beginning activities that "could lead to preventable, costly environmental problems or litigation."

4. U.S. "national security, environmental protection, and energy self-sufficiency" requirements will not be met by the combined geologic mapping capabilities of government and academia.

5. There is a willingness on the part of the individual states to contribute half of the cost "to complete the mapping of the geology within the State."

6. "The lack of proper geologic maps has led to the poor design of such structures as dams and waste-disposal facilities."

7. Geologic maps are "indispensable" aids in "needed fossil-fuel and mineral resources" exploration.

8. "A comprehensive nationwide program of geologic mapping is required in order to systematically build the Nation's geologic-map data base at a pace that responds to increasing demand."

Section 4(a) establishes a "National Cooperative Geologic Mapping Program" to be developed at the USGS in consultation with an external advisory committee.

Section 4(b) describes USGS responsibilities in the program, stating that USGS "shall be the lead Federal agency responsible for planning, developing priorities, coordinating, and managing" the program. USGS is charged with developing an implementation plan and submitting it to Congress within 300 days of enactment of the act (March 14, 1993) and identifying its advisory committee within 90 days (August 16, 1992).

Section 4(c) presents four objectives for the program:

1. To determine the "Nation's geologic framework through systematic development of geologic maps at scales appropriate to the geologic setting and the perceived applications...."

2. To develop a "complementary national geophysical-map data base, geochemical-map data base, and a geochronological and paleontological data base that provide value-added descriptive and interpretive information to the geologic-map data base."

3. "Application of cost-effective mapping techniques that assemble, produce, translate and disseminate geologic-map information and that render such information of greater application and benefit to the public."

4. "Development of public awareness for the role and application of geologic-map information to the resolution of national issues of land use management."

Section 4(d) identifies the four components of the program. These are: (1) a Federal geologic mapping component; (2) a geologic mapping support component; (3) a state geologic mapping component; and (4) a geologic mapping education component. The objective of the state geologic mapping component is to determine "the geologic framework of areas that the State geological surveys determine to be vital to the economic, social, or scientific welfare of individual States." The act states that "Federal funding for the State component shall be *matched on a one-to-one basis with non-Federal funds.*" The objective of the geologic mapping education component is to develop academic programs "that teach earth science students the fundamental principles of geologic mapping and field analysis" and to "provide for broad education in geologic mapping and field analysis through support of field teaching institutes."

Section 5 identifies the composition and responsibilities of a 16-member advisory committee. The committee will be composed of four representatives from state geological surveys; three representatives from the private sector; three representatives from academia; two representatives from the USGS; and one representative each from the Environmental Protection Agency (EPA), the Department of Energy (DOE), the Department of Agriculture (DOA), and the Office of Science and Technology Policy (OSTP). The EPA, DOE, DOA, and OSTP represen-

tatives are appointed by the President, while the other representatives are appointed by the Secretary of Interior with the advice and consultation of the "State Geological Surveys." The Chief Geologist of the USGS is identified as the chairman of the committee. The primary responsibilities of the advisory committee are to review the "scientific progress" of the program and to "submit an annual report to the Secretary that evaluates the progress of Federal and State mapping activities and evaluates the progress made toward fulfilling the purposes of this Act."

Section 6 describes the parameters for establishing the program implementation plan to be prepared by the Secretary of Interior through the Director of the USGS. To be included are: an overall management structure; an operations plan; responsibilities of the USGS and the state surveys; mechanisms for identifying short- and long-term priorities for each of the four program components; a description of how Side-Looking Airborne Radar (SLAR) and Interferometric Synthetic Aperture Radar (IFSAR) data can be used in geologic mapping; a mechanism for adopting scientific and technical map standards; and a mechanism for monitoring completed and ongoing mapping activities on a nationwide basis.

Section 9 authorizes Congress to appropriate a total of \$184.25 million in fiscal years (FY) 1993 through 1996 to implement the act. Additional legislation is required to appropriate these monies. As we go to press, the House Appropriations Committee has suggested that the FY 1993 funding level be \$22.17 million. The act authorizes a funding level for FY 1993 of \$37.5 million.

Fossil Bone Protein Provides First Step Toward Determining Molecular Phylogeny of Dinosaurs

In the October 1992 issue of *Geology* (v. 20, no. 10) Gerard Muyzer (Leiden University, Netherlands), Philip Sandberg (University of Illinois), and colleagues will document preservation of a bone matrix protein, osteocalcin, in dinosaur bones at least 75 million years old. Although preservation of proteins in bones has been indicated by bulk amino acid assays, specific proteins, such as osteocalcin, have not previously been identified in dinosaur bones. These new findings also extend the known geologic range of specific protein preservation into the Late Cretaceous.

Perhaps the most significant aspect of the *Geology* article by Muyzer and others is its implications for discovering the molecular phylogeny of dinosaurs, although osteocalcin is a conservative macromolecule which can only reveal phylogenetic relationships at high taxonomic levels. According to Jerald Lowenstein at the University of California, San Francisco, the identification of a specific dinosaur protein "is of great interest because ... such identification opens the possibility of discovering molecular phylogenies of dinosaurs and their genetic relationships to other reptiles and to birds." The preservation of osteocalcin "fuels the hope that larger and more useful molecules may also be discovered...." Co-author Philip Sandberg also believes that their results "open the door to obtaining pure fossil proteins and molecules from dinosaurs with the goal of resolving the affinity of dinosaurs, at least at a high taxonomic level."

Lisa Robbins, at the University of South Florida, said that although the Muyzer and others discovery was not "unexpected," it does hold "real potential" for addressing the long-standing question of dinosaur phylogeny, particularly if the organic molecules are not altered during preservation. Preservation, in fact, may well be the limit to discovering more phylogenetically useful molecules. Muyzer and others believe that the preservation of osteocalcin is strongly dependent upon burial history, the most favorable conditions being an impermeable matrix and low geothermal gradient. ■

GSAF UPDATE

Robert L. Fuchs

Hoke Trust to Benefit Foundation

Charles and Floy Hoke of El Dorado, Arkansas, have named the GSA Foundation as a beneficiary of the charitable remainder annuity trust that they established in 1991. Under the terms of the trust, the Hokes will receive income for life from the trust. Following their deaths the principal will be distributed to several charitable educational and scientific organizations, including the GSA Foundation.

Charles J. Hoke has been a GSA member for 17 years and a Fellow since 1982. Born in Iowa in 1915, he graduated from the University of Illinois in 1937 and went to work for Phillips Petroleum in El Dorado, Arkansas, as a petroleum geologist. In 1946 he joined Murphy Oil where he worked for 29 years, retiring in 1975, at which time he was a vice-president and a director of Murphy and several subsidiary companies. Since retirement from the corporate arena, Charles Hoke has remained active in geology, evaluating oil and gas prospects in the northern Rockies, Arkansas, Mississippi, and Kansas. He currently serves as a GSA representative.

In discussing the motivation behind their gift to the Foundation, Charles Hoke said, "Geology has been good to me throughout my career, and this trust has given Floy and me the means, through a reinvestment in the science, of acknowledging the benefits we have received."

GSA Research Grants—Hale and Hearty at 60

The GSA Research Grants program has reached an important milestone in 1992—60 years of awards to geologists at the outset of their careers. There will be more about this significant attainment in the October GSAF Update. Also, be sure to visit the commemorative display at the Foundation booth in Cincinnati.

Life Insurance—A Versatile Financial Tool

Just about everyone has contact with life insurance during the course of a lifetime. Heads of families purchase insurance to provide financial security for spouses and children in the event of

death. Life insurance is a very common type of benefit provided to employees by employers. Policies are purchased to provide funding for college educations. Retirement programs can be financed by life insurance proceeds. Charitable gifts to institutions can be in the form of a life insurance policy or proceeds.

Life insurance takes many different forms—term, endowment, whole life, universal, variable, and single premium. Each type has specific attributes that can allow the insured to achieve desired financial planning results.

There are many features of life insurance that can be used to financial advantage:

- Your life insurance policy is a source of money. You can borrow at low interest rates against the cash value.
- Beneficiaries of life insurance policies receive the money free of income tax.
- With proper design, life insurance proceeds can pass from your estate without being subjected to estate taxes.
- Life insurance can be used in business arrangements such as for a buyout in a closely held company.
- Life insurance can be converted to an annuity that will provide retirement income.
- An insurance policy can be the method of making a very meaningful contribution to the GSA Foundation.

Tax planning is just as important in the case of life insurance as it is with other components of an estate, such as stocks, bonds, and real estate. Normally, the entire proceeds paid to a beneficiary will be included in the estate for estate tax purposes. While a married person can leave his or her estate to the surviving spouse free of tax, there may be tax upon the subsequent death of the spouse. Similarly, insurance proceeds received by a beneficiary can be taxed again when the beneficiary dies. Avoidance or reduction of this dual tax can be accomplished through the use of trusts.

Life insurance is an excellent and popular charitable gift device. A substantial gift can be made by making a series of modest payments during the donor's lifetime. Such a gift is certain in amount and does not become tied up in estate administration. The gift does not become a matter of public record, as do wills, and it is simple to

accomplish by using insurance company forms.

A USGS geologist, age 55 and in the 28% tax bracket, has a \$20,000 life insurance policy that he contributes to the GSA Foundation. The cash value of this policy is \$8,000, and the annual premium is \$600. This contribution can generate a tripartite tax saving. There is an immediate income tax savings of \$2,240, based on the current cash value of \$8,000. Assuming a \$700,000 estate, estate taxes are reduced by \$7,400. Finally, the annual premiums of \$600 paid each year on the irrevocably transferred policy qualify for the income tax charitable deduction and will produce a tax saving each year of \$168. Total income and estate tax savings during a 20-year life span after the date of the gift would be

\$13,000. The GSA Foundation receives \$20,000 at the donor's death.

A periodic review of your estate plan is important because of changing conditions. Not only should your will and retirement arrangement be examined, but also life insurance. Perhaps more insurance is needed. On the other hand, with advancing years the total amount in force may exceed your needs now. We have a booklet about insurance that will be helpful in analyzing this part of your estate and developing plans for better utilization of the life insurance tool. Call the Foundation office at (303) 447-2020, or clip and mail the accompanying coupon. ■

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International Division Sets Interaction Guidelines

For much of its 100-year life the Geological Society of America restricted its vision to inside the shores of North America. In fact, for the first half-century the view hardly extended beyond the borders of the United States to Canada and Mexico. Easy travel, low-cost communication, and the era of global geology require us to rethink our internal orientation.

The Society has now received many requests for collaborative ties with sister societies in other countries. Evidence that GSA members are ready and willing to respond favorably to these requests can be found in the vitality and rapid growth of the recently established International Division. But what form should interactions between societies take? Individual, *ad hoc* relationships between GSA members and other societies are fine for many purposes, but they are inadequate for the forging of agreements between societies. Accordingly, when a request for a draft of formal guidelines was received by the International Division from then Vice-President E-an Zen, the Division responded by appointing an *ad hoc* committee consisting of Bert Bally, Kevin Burke, Bill Greenwood (deceased 7/27/92), Bruce Molnia, John Oldow, Brian Skinner (Chair), and E-an Zen. The committee reported in March, and the Council

adopted the following guidelines at their meeting in May 1992.

Geological science is not restricted by national boundaries and geologists have a long and honored tradition of hospitality for their peers wherever they may reside. To further interactions among geologists around the world, the Geological Society of America (GSA) is pleased to establish and maintain relationships with geologically directed societies in other parts of the world.

The GSA hopes that through the establishment of formal relationships (spelled out below), members of GSA will develop informal relationships with members of other societies as the occasion may arise. An example of such an informal relationship is a forthcoming geologic field trip in North America of a group of student geologists from Ballarat, Australia, in which the arrangements at the U.S. end were made through GSA contacts.

Formal relationships:

1. The GSA agrees to a continuing exchange of information with sister societies. The GSA will send free copies of its news publication *GSA Today* and seeks in return copies of the information bulletin, or equivalent, of the sister societies.
2. The GSA offers to publish a column up to four times a year in its news

publication, *GSA Today*, discussing the activities of sister societies. Preparation of material for inclusion, and the meeting of publication deadlines, is to be the responsibility of the sister societies. Through publication of this material, *GSA Today* will serve as a worldwide information medium between societies.

3. The GSA will give advance notice of meetings to be sponsored by sister societies in return for their offering the same privilege.
4. The GSA agrees to display and distribute membership and book order forms of sister societies at the time of annual meetings and requests reciprocity from the sister societies.
5. The GSA agrees to designate one of its members to serve as the representative in North America for each collaborating society and asks the collaborating society to reciprocate. The designated member would serve, among other roles, as a point of contact for the exchange of information about earth science education and research opportunities in North America and in organizations in the country of the cooperating sister society.
6. The GSA invites presidents, vice-presidents, or immediate past presidents of sister societies, if they happen to be in the United States at the time of a Council meeting, to meet briefly with, and if appropriate to speak with, the GSA Council. In return the GSA asks the sister societies for the same privilege.

Among the informal relationships

and interactions that the GSA hopes will develop through the opening of formal affiliations with other societies are:

1. Joint sponsorship of field trips, both overseas and in the United States.
2. Bringing together GSA members with individuals and groups from other countries for specific research projects.
3. Expanding knowledge about, and interactions with, geological societies of countries whose literature is not well known in North America.
4. Cooperation between education programs, both university and pre-university, in which GSA and sister societies might be active.

Because GSA has not, and should not, enter into formal exchanges of scientific publications with other societies, that issue has not been included as a possibility for interactions. However, certain related activities, already under way or under discussion by the International Division, may meet some of the concerns that GSA members feel about making publications available. These include the Geopals program in which a division member agrees to sponsor and pay for GSA membership, plus publications, for a foreign student studying in North America; a mechanism for the division to transfer GSA journals to institutions in poorer countries; and a plan whereby division members agree to pay for a subscription to GSA publications to be sent to institutions in poor countries. ■

Students Receive Awards for Planetary Geoscience Papers

Two Arizona State University students were chosen as recipients of the Geological Society of America's Stephen E. Dwornik Planetary Geoscience Student Paper Awards.

Robert Sullivan received the award for the paper "Probing the Martian Near-Subsurface Using Stability Back-Analysis of Small Martian Avalanche Chutes," which he presented at the GSA Annual Meeting in San Diego.

Nathan T. Bridges presented his award-winning paper, "Aspect Ratios of Lava Domes on the Earth, Moon, and Venus," at the Lunar and Planetary Science Conference in Houston.

Both winners were honored at an awards ceremony held June 2, 1992, at NASA headquarters in Washington, D.C.

THE AWARD

Planetary geologist Stephen E. Dwornik established the award, in 1991, to provide encouragement, motivation, and recognition to outstanding future scientists. Two awards are given annually, each winner receiving a citation and \$500. The program is administered through the Planetary Geology Division of the Geological Society of America. The GSA Foundation manages the award fund. Arrangements for travel by the recipients to the

awards ceremony at NASA headquarters in Washington, D.C., are handled by the Planetary Geology and Geophysics Program, NASA.

Criteria

Students who are U.S. citizens and are enrolled in a college or university at any degree of their education in the field of planetary geosciences may submit abstracts for the Student Paper Award. Student applicants must be the senior author of the abstract, and the paper may be presented orally or in a poster session. Papers will be judged on the quality of the scientific contribution, including methods and results; clarity of material presented; and methods of delivery, oral or display. Two awards are given: one for the best oral presentation, the other for the best poster presentation.

To Apply

The application form and instructions may be found in the Call for Papers for the 1993 Lunar and Planetary Science Conference, March 15-19, to be held in Houston, Texas. Only one abstract per student will be considered.

Deadline for application is January 8, 1993. ■

JOI/USSAC Distinguished Lecturer Series

JOI/USSAC is pleased to announce the institutions selected to participate in the 1992-1993 Distinguished Lecturer Series.

Warren Prell (Brown University)

Evolution of the Indian Ocean Monsoon: Results from ODP Drilling and Climate Modeling

- MIT
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- UC, Berkeley

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Investigating the Plumbing of Accretionary Prisms Using the JOIDES Resolution, Alvin, and a Rock Hammer

- University of Nebraska
- University of Texas at Dallas
- University of North Carolina
- Virginia Tech

James Kennett (UC, Santa Barbara)

Cenozoic Climate Change: Paleoceanography and Event Stratigraphy

- University of Montana
- University of Utah
- University of North Dakota
- University of Wyoming

Susan Humphris (WHOI)

Hydrothermal Systems of the Mid-Atlantic Ridge

- Bryn Mawr College
- University of New Hampshire
- Humboldt State University
- College of William & Mary

Robert Zierenberg (U.S. Geological Survey)

Seafloor Hydrothermal Systems on the Gorda and Juan de Fuca Ridges

- Ohio Wesleyan University
- University of Minnesota
- University of Idaho
- University of Oklahoma

Janet Haggerty (University of Tulsa)

The Cretaceous through Cenozoic History of the Atolls and Guyots of the West Central Pacific

- Cornell University
- University of South Florida
- Purdue University

For more information please contact Mary Reagan at Joint Oceanographic Institutions, Inc., 1755 Massachusetts Avenue, NW, Suite 800, Washington, DC 20036-2102, (202) 232-3900

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GSA Awards Research Grants for 1992

June Forstrom, Research Grants Administrator

The GSA Committee on Research Grants met in Boulder, Colorado, on March 26-27, 1992, and awarded \$315,769 to 248 student applicants; \$12,000 was awarded to two postdoctoral applicants for the Gladys W. Cole and W. Storrs Cole Awards. Committee members for 1992 are Chair Stephen G. Wells, members Howard W. Day, Raymond V. Ingersoll, Molly Fritz Miller, Darryll T. Pederson, and Ben A. van der Pluijm, and National Science Foundation conferee Thomas O. Wright.

Of the 248 recipients, 92 were master's candidates and 156 were doctoral candidates. The size of the average award increased from \$1161 in 1991 to \$1273 this year. Proposal requests totaled \$790,585 from 533 applicants. Fourteen alternates were selected by the committee in the event that some of the grantees return part or all of their funds.

The committee's budget included \$150,000 from the Penrose Endowment, \$100,000 from the National Science Foundation, \$3000 income from the Harold T. Stearns Fund, and \$4200 for awards from five GSA Divisions: Engineering Geology, Geophysics, Hydrogeology, Sedimentary Geology, and Structural Geology and Tectonics. It also included \$24,000 from the GSA Foundation. The Gladys W. Cole and W. Storrs Cole Awards were funded by \$12,000 income from the two Cole Award Funds from the GSA Foundation.

Cole Awards for Postdoctoral Research

The Gladys W. Cole Memorial Research Award for 1992 was awarded to R. Craig Kochel of Bucknell University, Lewisburg, Pennsylvania, to support his project titled "Geomorphic Response to Small-scale Cyclic Climate Changes, Anza-Borrego Desert and Vicinity, San Diego County, California." This award, established in 1980, is restricted to support of research for the investigation of the geomorphology of semiarid and arid terrains in the United States and Mexico.

The W. Storrs Cole Memorial Research Award for research in invertebrate micropaleontology was established in 1989. It was presented this year to William A. Berggren, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, for his project "Taxonomy, Phylogeny and Classification of Some Paleocene Planktonic Foraminifera: The Genera *Acarinina*, *Igorina*, and *Subbotina*."

Eligibility for both Cole awards is restricted to GSA Members and Fellows between 30 and 65 years of age.

Student Awards

Gretchen L. Blechschmidt Research Award. The family and friends of Gretchen Louise Blechschmidt established a fund in her memory in 1990 to support research for women in the geological sciences. The award was presented this year to Paula J. Noble, University of Texas at Austin, for her project titled "Establishment of a Global Silurian Radiolarian Biozonation."

John T. Dillon Alaska Research Award. John Dillon was particularly noted for his radiometric dating work in the Brooks Range, the results of which have had a major impact on the geologic understanding of this mountain range. The 1992 recipient of this award is William S. Dinklage, University of California, Santa Barbara, for "A Multi-scale Kinematic and Petrographic Study of the High-Pressure-Low-Temperature Metamorphic Schist Belt Surrounding Walker Lake, South-Central Brooks Range, Alaska."

Robert K. Fahnestock Award. Robert Fahnestock was a member of the Committee on Research Grants. The award goes to the applicant with the best proposal in sediment transport or related aspects of fluvial geomorphology. The 1992 recipient is Douglas R. Hardy, University of Massachusetts, for his project titled "Sediment Transfer from a Mountainous High Arctic Watershed."

Harold T. Stearns Fellowship Award. The four recipients of this award, for research on aspects of the geology of the Pacific Islands and the circum-Pacific region, are Sara Hotchkiss, University of Minnesota, "Vegetation and Climate History of the Island of Hawaii"; Thomas A. Okey, Moss Landing Marine Laboratories, "Effects of Anthropogenic Increases in Watershed Sedimentation on Indonesian Coral Reef Structures"; Peter William Reiners, University of Washington, "Geochemistry of Early Tertiary Fore-Arc Plutons of Southern Alaska and Significance to Continental-Margin Magmatism"; and Kennen S. Tillman, University of Connecticut, "Kinematic History of the Hinterland of an Active Arc-Continent Collision, Taiwan."

Industrial Donations and Awards. Donations from Marathon Oil Foundation (\$2500) and Mobil Oil Corporation (\$2000) are funding grants to the following applicants: Kevin J. Cunningham, University of Kansas, for "Integration of Multiple Techniques to Evaluate Eustatic, Basin-wide, and Tectonic Controls of Sequence Stratigraphy of an Upper Miocene Carbonate Complex, Cap des Trois Fourches, Morocco"; Benjamin P. Flower, University of California, Santa Barbara, for "High Resolution Stable Isotopic Stratigraphy from the Miocene Monterey Formation, Naples Beach, California"; Ronald J. Hill, University of California, Los Angeles, for "Correlation between the Extent of Illitization of Smectite and Fixed Ammonium Content in I/S in Organic-Rich Sediments"; Nei-Che Ho, University of Michigan, Ann Arbor, for "Textural Evolution of Phyllosilicates under Compaction Loading: Pole Figure Analyses of Gulf Coast Shales"; Ann Elizabeth Holmes, Lamont-Doherty Geological Observatory, for "Pre-Carboniferous Sequence Stratigraphy of the Canning Basin, Australia: Paleozoic Eustasy and Applications in Petroleum Exploration."

Outstanding Mention. The committee on Research Grants specially recognized 41 of the proposals as being of exceptionally high merit in conception and presentation: Barbara Anne am Ende, University of North Carolina, Chapel Hill, for "Sedimentology and Isotope Geochemistry of Glauconite from the Upper Continental Slope, North Carolina"; Ramon Arrowsmith, Stanford University, for "The Temporal and Spatial Development of Deformation and Degradation within a Restraining Bend along the San Andreas Fault, Central California"; Eric Beam, University of Texas, Austin, for "Deformation in the Maclaren Glacier Metamorphic Belt"; Vladimir Benes, University of Toronto, for "Rift Propagation into a Continental Margin and Kinematics of Microplate Rotation within a Transpressional Convergence Zone"; Kenneth A. Bevis, Oregon State University, for "Reconstruction of Late Quaternary Paleoclimatic Characteristics in the Northern Great Basin and Adjacent Areas"; Peter M. Blisniuk, Dartmouth College, for "Tectonic Evolution of Structural Re-entrants in Foreland Fold-and-Thrust Belts: The Kalabagh Re-entrant, Northern Pakistan"; Theresa M. Boundy, University of Michigan, Ann Arbor, for "Uplift of Deep Crustal Rocks in Continental-Collisional Orogens: An Example from Western Norway"; Mark Brandriss, Stanford University, for "Addition of Meteoric Water to Gabbroic Magma by Dehydration of Metabasalt Xenoliths"; Roland Burgmann, Stanford University, for "Permanent Deformation Associated with Restraining Steps and Bends along Strike-Slip Faults"; Jay P. Busch, University of Michigan, Ann Arbor, for "Significance of the Robertson Lake Mylonite Zone, Grenville Orogen, Ontario, Canada"; Karen Chin, University of California, Santa Barbara, for "Biogeochemical and Petrographic Analysis of Presumed Dinosaurian Coprolites"; Douglas H. Clark, University of Washington, Seattle, for "Late Quaternary Climate Variations in California: Integrated Evidence from the Alpine Glacial Record"; Ronald B. Cole, University of Rochester, for "Transtensional Basin Evolution during a Transition from a Convergent to a Transform Plate Boundary along Western North America: Sedimentation and Volcanism in the Early Miocene Plush Ranch Basin, Lockwood Valley, California"; Gary F. Davidson, University of Washington, Seattle, for "Metamorphic History of the Chiwaukum Schist: Implications for Burial Mechanisms in the North Cascades Crystalline Core, Washington"; Peter Eichhubl, University of California, Santa Barbara, for "Episodic Fluid Flow within the Upper Crust: Mechanisms of Hydraulic Brecciation and Flow Rates in Clastic Dikes"; T. Kenneth Fowler, Jr., University of Southern California, for "Pluton Roofs and Roots: Implications of the Yerington Batholith for Pluton Emplacement Studies"; Tracy D. Frank, University of Michigan, Ann Arbor, for "Meteoritic Diagenesis of the Hope Gate Formation, Jamaica: Constraints on the Evolution of Diagenetic Fluids"; Matthew C. Goss, Rutgers University, for "High Resolution Seismics and Ice-Marginal Sedimentation in Block Island Sound and Adjacent Southern Rhode Island"; Michael Grubensky, University of New Mexico, for "Breccias: Their Discrimination, Origin, and Distribution within Composite Volcanoes"; Jason F. Hicks, Yale University, for "The Radiometric Calibration of the Magnetic Polarity Time Scale for the Campanian and Maastrichtian"; Gregory J. Holk, California Institute of Technology, for "A Stable Isotope Investigation of the Southern Omineca Crystalline Belt, British Columbia: The Evolution of Hydrothermal Systems Associated with Metamorphic Core Complexes"; John Jenson, Oregon State University, for "Numerical Modelling of the Lake Michigan Lobe, Laurentide Ice Sheet: An Investigation of the Influence of Subglacial Till Rheology on Ice-Sheet Dynamics"; Timothy Leahy,

Cole Memorial Research Awards in Geomorphology and Micropaleontology

Through the generosity of W. Storrs Cole, two awards for support of research are offered through GSA. The Gladys W. Cole Memorial Research Award provides research support for the investigation of the geomorphology of semiarid and arid terrains in the United States and Mexico. It is to be given to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers on geomorphology. Funds cannot be used for work already accomplished, but recipients of a previous award may reapply if additional support is needed to complete their work. The amount of this award in 1993 will be \$7000.

The second award, the W. Storrs Cole Memorial Research Award, has been established to support research in invertebrate micropaleontology. This award will also carry a stipend of \$7000 and will be given each year to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers on micropaleontology.

Additional information and application forms may be obtained from June R. Forstrom, Research Grants Administrator, GSA, P.O. Box 9140, Boulder, CO 80301.

All applications must be postmarked on or before February 15, 1993. Actions taken by the Committee on Research Grants will be reported to each applicant in early April.

These are two of GSA's most prestigious awards; all qualified applicants are urged to apply.

CORRECTION:

It couldn't have happened to four nicer people...

The top right photo on the front page of the 1991 GSA Foundation Annual Report (*GSA Today*, v. 2, no. 6, p. 125) was captioned Dr. and Mrs. Hubert Gabrielse from Vancouver when in fact the couple are Dr. and Mrs. Andrew D. Baillie from Calgary.

We apologize for the error.

Research Grants continued on p. 195

GSA Divisions and Sections Award Grants for 1992

June Forstrom, Research Grants Administrator

Division Research Grants

Seven of the 12 GSA divisions offer grants for outstanding student research. Divisions that do not currently offer grants are Archaeological Geology, Geoscience Education, History of Geology, International, and Planetary Geology.

Coal Geology Division

The Coal Geology Division presented its 5th annual Antoinette Lierman Medlin Scholarship Award in 1992 to Lingbu Kong, University of North Dakota, for his proposal titled "New Characterization Method for Maceral Geochemistry of Western U.S. Low-rank Coals." The Division considers proposals from any full-time graduate student who is conducting research in coal geology.

In May, the Rocky Mountain Scholarship Committee selected a recipient for a scholarship jointly awarded each year by the Symposium on the Geology of Rocky Mountain Coal and the Coal Geology Division of GSA. Clifford P. Ambers, Indiana University, Bloomington, received the award for his dissertation on the origin of very well crystallized kaolinite in coal cleats and comparison with other very well crystallized kaolinites.

Engineering Geology Division

The 3rd annual Engineering Geology Division Anniversary Award for outstanding student research was presented this year to Lauren A. Hammack, M.S. degree candidate at Colorado State University. The title of her research project is "Hydraulics of Debris Flows and Floods at Warm Springs Rapids on the Yampa River, Colorado."

Geophysics Division

The Geophysics Division presented its fifth annual Allan V. Cox Student Research Award in 1992 for an outstanding student research proposal submitted to the GSA Research Grants Program. Darryl Keith Willis, a master's candidate at the University of New Orleans, received the award for his research project titled "The Southern Death Valley Fault Zone: A Study of the Strike-slip System, Noble Hills, California."

Hydrogeology Division

The third annual awards for outstanding student research from the Hydrogeology Division were presented in 1992 to six students: Anne E. Carey, Univer-

sity of Nevada, for "Salt Water Intrusion: Numerical Modeling of the Sharp Interface Problem"; Ivan K. Gall, Wright State University, for "A Quantified Study of the Vertical Stratification of ^{222}Rn in Ground Water and Total U content in Corresponding Strata of Silurian Bedrock, Southwestern Ohio"; Jeff Jarriel, University of Maryland, for "Examination of $^{87}\text{Sr}/^{86}\text{Sr}$ Isotopic Ratios as a Tracer for Hydrograph Separation at a Maryland Coastal Plain Watershed"; Thomas E. McKenna, University of Texas, Austin, for "Fluid and Heat Flow in Sedimentary Basins: Geologic and Hydrologic Constraints on a Thermal Anomaly in South Texas, Northern Gulf of Mexico Basin"; Michael E. O'Connell, University of Maryland, for "Use of Nitrogen Isotopes, CFC Dating Techniques and Multi-Level Sampling (MLS) Wetlands in Pamlico and Albemarle Sounds, North Carolina: A Study of Wetland Methods to Identify and Monitor Geochemical Redox Gradients Associated with Denitrification in Shallow Groundwater Aquifers"; and David B. Rogers, University of California, Santa Cruz, for "Hydrological Processes and Salt Flat Development on the Shorelands of Mono Lake, California."

Quaternary Geology and Geomorphology Division

The Quaternary Geology and Geomorphology Division awarded Mackin grants to two students in 1992. Matthew C. Goss, M.S. candidate at Rutgers University, will study "High Resolution Seismics and Ice-marginal Sedimentation in Block Island Sound and Adjacent Rhode Island." Judith Kay Haschenburger, Ph.D. candidate at the University of British Columbia received the award for her project titled "Scour and Fill in Gravel Bed Rivers."

Thirty-seven Mackin Grants have been awarded since the Division made its first award in 1974.

Sedimentary Geology Division

The Sedimentary Geology Division presented its sixth annual award for an outstanding student research proposal submitted to the GSA Research Grants Program to Katie Joe McDonough, Ph.D. candidate at Colorado School of Mines. The award was for her research project titled "Evolution of a Carbonate Platform: Processes and Products (S. Vercors, France)."

Structural Geology and Tectonics Division

The Structural Geology and Tectonics Division presented its 7th annual award

Division and Section Awards continued on p. 196

Research Grants continued from p. 194

Dartmouth College, for "The Relationship between Uplift, Fluid Flow and Magmatism at Nanga Parbat, Pakistan"; Stephen A. Leslie, Ohio State University, for "Upper Middle Ordovician Conodont Biofacies in North America and Northwestern Europe"; David Henry Malone, University of Wisconsin, Madison, for "Mechanisms, Kinematics, and Spatial Relations of Chaotic Deformation, Lower Wapiti Formation, Absaroka Volcanic Supergroup (Eocene), Wyoming"; Ted McHenry, Wichita State University, for "Biotic Composition and Depositional History of Holocene Patch-Reef Complexes, Northern Belize, Central America"; Christopher A. McRoberts, Syracuse University, for "The Triassic-Jurassic Boundary in the Lombardian Alps (Italy): A Faunal and Ecostratigraphic Analysis"; Michael E. O'Connell, University of Maryland, for "Use of Nitrogen Isotopes, CFC Dating Techniques and Multi Level Sampling (MLS) Methods to Identify and Monitor Geochemical Redox Gradients Associated with Denitrification in Shallow Groundwater Aquifers"; Craig W. Oyen, University of Florida, Gainesville, for "Echinoid Evolution: Interpreting Heterochronic, Ontogenetic, and Paleocologic Patterns"; Lisa Ellyn Park, University of Arizona, for "Effects of Environmental Change on Ostracod Biodiversity: Examples from Recent and Ancient Rift Lakes"; Michael C. Pope, Virginia Polytechnic Institute and State University, for "Cyclic Sedimentary and Diagenetic Record During Ordovician 'Greenhouse' to 'Icehouse' Transition"; Shari J. Preece, Miami University, Oxford, Ohio, for "Geochemical Evolution and Provenance of Alaskan Silicic Tephra"; David B. Rogers, University of California, Santa Cruz, for "Hydrological Processes and Salt Flat Development on the Shorelands of Mono Lake, California"; James R. Rougvie, University of Texas, Austin, for "The Effects of Metamorphic Fluid Flow on Rb-Sr Systematics, Llano Uplift, Central Texas"; Ronald C. Schott, University of Wisconsin, Madison, for "Mesozoic Gabbros and Related Rocks in the San Andreas Fault Zone: Evidence for Pre-Neogene Movement?"; Jeffrey C. Strasser, Lehigh University, for "Frazil Ice Growth at the Terminus of the Matanuska Glacier, Alaska, and Implications for Basal Freezing and Sediment Entrainment"; Margaret E. Venable, University of Arizona, for "A Comparison of the Geologic Characteristics of the Chortis Block with those of the Guerrero Terrane of Southwestern Mexico"; Peter J. Wagner III, University of Chicago, for "A Phylogenetic and Morphometric Analysis of Early Paleozoic Archaeogastropods"; Kathleen A. Ward, University of Nevada, Reno, for "Dike Emplacement and Deformation of the Sierra Nevada Batholith"; Marc Worona, University of Oregon, Eugene, for "The Late-Quaternary Vegetation and Climate History of the Central Coast Range, Oregon"; Xiaoming Zhai, University of California, Davis, for "Metamorphic Petrology of the Tongbai Mountains in the Qinling Fold Belt, Central China."

Other Successful Applicants. Other applicants recommended for funding are the following: Mark Abbott, Jeffrey M. Amato, Clifford P. Ambers, Andres Aslan, David H. Backus, Eric M. Baer, Nina Lucille Baghai, Dana Bahar, Christopher Bailey, Jolanta Barbara Bednarczyk, Karen G. Bemis, Damon P. Bickerstaff,

Katharina Billups, Nancy E. Bowers, Julie L. Boyd, Sue Braumiller, William J. Buelow, Enrique Cabral-Cano, S. Christopher Caran, Anne E. Carey, Melanie Robin Carpenter, Mark W. Carter, Katharine A. Cartwright, Joyce Chapman-Fahey, Clinton H. Christensen, Peter P. Christiansen, Mark A. Ciampone, Marek Cichanski, Philippe Claeys, M. Brooks Clark, Maurice Colpron, Craig Emerson Cooper, Kevin Cornwell, Juliet G. Crider, Catherine E. Cullicott, Joseph Neil Daniell, Cole M. Davison, Carol Merritt Dehler, Jack Deibert, Steven R. Dent, Sharon C. Diekmeyer, Peter A. Drzewiecki, Mathiew L. Duvall, Gail Frances Eaton, Catarina M.S.M. Silva De Echols, R. James Elliot, Timothy Fagan, Mitra Johanna Fattahipour, Curtis J. Faulkner, Elisa M. Ferguson, Jeffrey A. Fillipone, Sara L. Finnemore, Timothy Gordon Fisher, David J. Fruit, Piotr Galar, Ivan K. Gall, Eric J. Gardner, Hongxing Ge, W. Roland Gehrels, Miquette Gerber, Susan A. Gilbert, John C. Gosse, Gregory R. Grant, Charles J. Greig, Jonathan E. Grimes, David Aaron Grimley, Amy Halleran, Lauren A. Hammack, Alexandre G. Haralampiev, Judith K. Haschenburger, Stephen T. Hasiotis, Christopher A. Hedlund, Patricia A. Heiser, Eileen A. Herrstrom, Gregory T. Hill, Michael K. Horsley, Bernard A. Housen, Gary A. Huckleberry, Pierre Hudon, Bradley R. Ilg, Peter M. Jacobs, Jeff Jarriel, Mary Katherine Johns, Beverly J. Johnson, Anthony T. Jones, Charlotte E. Kelchner, Mary Ann Kelly, Diann S. Kiesel, Jonathan Kim, Kent Charles Kirkby, Gretchen Kohler, Lis Kathrin Konnecke, J. Thomas Kostalek, Michael A. Krol, Keith A. Krugh, Christian Lacasse, Maria Ester Lara, Amy C. Larson, Alfredo Luis Leon-Gonzales, Halard Lescinsky, Janet Arlene Leventhal, Li Li, Anneliese Lilje, Karl D. Lillquist, William W. Little, Thomas R. Loftin, Jr., Tamara K. Lowe, Jose Luis Macias-Vazquez, James W. MacLean, Daniel P. Mancano, Barbara A. Marin, Anna M. Martini, Sandra Matthews, Kyle Mayborn, Katie Joe McDonough, Thomas E. McKenna, Brendan A. McNulty, Douglas E. McVey, Andrew J. Meigs, Christopher A. Miller, Raoul Miller, Marcus E. Milling, Jr., Sarah E. Mock, Shirley Ann Morikawa, Jared R. Morrow, Billy Edgar Moss, Thomas G. Muhich, Ivette Marie Munoz, Jeffrey Alan Myers, Ross H. Nehm, Phillip D. Noll, Jr., Gregg C. Oetting, Beatrix Packmohr, Matthew Lyon Paige, Teufelin Peare, Nemesio M. Perez, Harold T. Pile, Terry R. Pollock, Michael J. Quinn, Pedro A. Restrepo, Joyce Christine Alexis Riter, Michael Wayne Rockow, David J. Rood, Steven R. Roof, Timothy Patrick Rose, Gregory T. Roselle, Steve Paul Rowe, Marc Ervin Salak, Matthew Ross Saltzman, Beverly Saylor, Jean M. Self-Trail, Pamela J. Seney, Glenn S. Shell, Jr., Kevin J. Smart, Christine H. Smith, Jeffrey A. Snyder, Gabriela N. Solis-Pichardo, Ian Stewart Spooner, Libby Stern, Martin J. Streck, Uwe Strecker, John Tacinelli, Regina N. Tempel, Richard E. Terry, Edward Robert Thieler, Gustavo Tolson, Paul Brian Tomascak, Weixing Tong, Ricardo Torres, Slawomir M. Tulaczyk, Elizabeth C. Turner, Leslie A. Turrini, Ashraf Uddin, David Ulicny, Linda Urzendowski, Nicholas Van Wyck, Charles A. Ver Straeten, Sonja Anne Ward, Marian J. Warren, Steven Paul Welter, Oona L.O. West, Robert B. West, Maya M. Wheelock, Darryl Keith Willis, David M. Winslow, Darrell Todd Woodford, Wan Yang, J. Douglas Yule, John F. Zaengle, Chuanlun Zhang, Xiaoping Zhou, Xiaoyuan Zhou, Da Zhou, Susan G. Zimmerman, John-Paul Zonneveld. ■

Be a GSA Campus Rep

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

The Campus Representative Program began in 1979 in GSA's Southeastern Section. Active GSA members in the section were recruited to serve as campus representatives, establishing a communications link between GSA headquarters and present and prospective Student Associates. Campus representatives, with the aid of a notebook of information provided by GSA's Membership Services, explain to interested students the benefits of being a GSA Student Associate:

- *GSA Today* every month
- Reduced subscription rates for *Bulletin* and *Geology*
- 20% discount on GSA books, maps, and charts
- \$30 discount for GSA's Employment Service (applicants)
- \$10 discount for registration fees for Penrose Conferences
- \$20 reduction in student registration fees for GSA's Annual Meeting
- Reduced registration fees for many GSA section meetings
- 25% discount on Member Standing Order Plan
- Opportunity to participate in GSA's specialized divisions and to receive their newsletters
- Group term life insurance plan at reduced member rates
- Discount for National car rentals

All GSA sections participate in the program, and there are now 532 active campus representatives. We thank the current campus representatives now serving to keep the program growing. However, we need more volunteers. If you are a Member or Fellow (not Student Associate) and are interested in serving GSA as a campus representative for your college or university, please contact

T. Michael Moreland, Membership Services Manager
Geological Society of America
P.O. Box 9140
Boulder, CO 80301
(303) 447-2020, fax 303-447-1133

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

Campuses that DO NOT have GSA Campus Representatives:

Cordilleran Section

Alaska
University of Alaska—Anchorage

Arizona

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

California

Antelope Valley College
Bakersfield College
California Lutheran College
California State Polytechnic University—
San Luis Obispo
California State Polytechnic University—
Pomona
California State University—Stanislaus
Chaffey College

Chapman College
Citrus College
Contra Costa College
College of the Desert
Diablo Valley College
East Los Angeles College
Foothill College
Fullerton College
Gavilan College
Glendale Community College
Golden West College
Lawrence Livermore National Laboratory—
University of California
Los Angeles City College
Los Angeles County Museum of
Natural History
Los Angeles Harbor College
Los Angeles Valley College
Merced College
Moss Landing Marine Laboratories—
Oakland Museum

Napa Valley College
Naval Postgraduate School
Ohlone College
College of the Redwoods
Rancho Santiago College
Riverside City College
Sacramento City College
San Bernardino County Museum
San Bernardino Valley College
San Joaquin Delta College
San Jose City College
Santa Barbara City College
Sonoma State University
Southwestern College
Ventura College
Yuba Community College

Hawaii

University of Hawaii—Honolulu
University of Hawaii at Hilo, College
of Arts & Sciences

Nevada

Wassuk College

Oregon

Central Oregon Community College
Clatsop Community College
Willamette University

Washington

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

British Columbia

Capilano College
Cariboo College
University of Victoria

Rocky Mountain Section

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

Idaho

College of Southern Idaho

Montana

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

New Mexico

College of Santa Fe
Los Alamos National Laboratory/
University of California
New Mexico Highlands University
Sandia National Laboratories
Western New Mexico University

North Dakota
Dickinson State University

South Dakota
Augustana College

Wyoming

Casper College

Alberta

Athabasca University
University of Lethbridge
Mount Royal College
Northern Alberta Institute of Technology
Royal Tyrrell Museum of Palaeontology
Southern Alberta Institute of Technology

Saskatchewan

University of Regina

North-Central Section

Illinois
University of Chicago
Columbia College
Concordia University
Elgin Community College
Field Museum of Natural History
College of Lake County
Northeastern Illinois University
Lincoln Land Community College
Principia College
Wabash Valley College

Indiana

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

Iowa

Drake University

Michigan

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

Minnesota

Anoka-Ramsey Community College
Concordia College
Itasca Community College
MacAlester College
Mesabi Community College
Southwest State University
St. Cloud State University

Campus Representatives
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Division and Section Awards *continued from p. 195*

for outstanding student research in 1992. The recipient is Ramon Arrowsmith, a doctoral degree candidate at Stanford University. His project title is "The Temporal and Spatial Development of Deformation and Degradation within a Restraining Bend along the San Andreas Fault, Central California."

SECTION RESEARCH GRANTS

North-Central Section

The North-Central Section of GSA will award grants to undergraduate students within the section beginning in 1993.

South-Central Section

The South-Central Section of GSA presented its fifth annual research awards to qualified graduate students in the section in 1992. Recipients are students who attend a college or university in the South-Central Section geographic area and have submitted applications to the GSA Research Grants Program. The awards presented this year went to Erika L. Frantz, Rice University, for "Geochemical and Sedimentological Study of Biogenic Sediments of the Late Eocene Yumaque Formation, East Pisco Basin, Peru"; Gregory Scott Holt, Baylor University, for "Trace Element Partitioning in Rhyolites of the Trans-Pecos Magmatic Province"; Mark Alan Ouimette, University of Texas, El Paso, for "Petrology, Geochemistry and Mineralization of Laramide and Tertiary Igneous Rocks in the Vicinity of the Tincup Mining District, Colorado Mineral Belt, Colorado"; Susan E. Smith, University of Houston, for "Petrogenesis of Basaltic Liquids and Mantle Source Variations in the Hayes Transform Region, Mid-Atlantic Ridge"; Matthew W. Totten, University of Oklahoma, for "Investigation of Authigenic Magnetic Minerals during Mudrock Diagenesis"; and Tracey Elizabeth Whitesell, University of Kansas, for "Diagenesis Associated with Sequence Boundaries, Upper Miocene Carbonate Strata, South-eastern Spain."

Southeastern Section

GSA's Southeastern Section awarded research grants to 13 qualified students within the section. They are Joseph L. Allen, University of Kentucky, for "Timing and Controls on Paleozoic Reactivation of Selected Intracratonic Basement Faults, Central Colorado"; David C. Campbell, Davidson College, for "New Middle Eocene Faunas from the McBean Formation and the Santee Limestone of South Carolina: Support for Gosport and Cook Mountain Equivalency"; Kendall B. Fountain, University of Florida, for "Geochemistry and Origin of Phosphorite from the West Florida Shelf: Implications for Genetic Relationships among Neogene Massive Phosphorite Deposits along the Southeastern United States Continental Shelf"; Stephen B. Harper, University of Georgia, for "Distribution and Causes of Landslides in the Nakjon Si Thammarat Range in Southern Thailand"; Richard A. Hisert, University of Florida, for "Using SF₆ and ²²²Rn to Investigate the Surface and Groundwater Connections in the Karstic Environment of the Western Santa Fe River Basin, Florida"; G. Paul Londeree, West Virginia University, for "Stratigraphy and Petrology of the Upper Mississippian Greenbrier Group, Randolph and Tucker Counties, West Virginia"; Changsheng Lu, University of Tennessee, for "Stable Isotope and Fluid Inclusion Study of Alumino-silicate Hydrothermal Alteration and Mineralization at Brewer Gold Mine, Carolina Slate Belt, South Carolina"; James M. Montgomery, Jr., University of Kentucky, for "Basement-fault-related Stratigraphic Controls on Internal Structures that Contribute to Curvature of Thrust Belts"; Courtney Nugent, West Virginia University, for "Stratigraphy and Holocene Geological History of Alluvial Facies of the Kanawha River near St. Albans Archeological Site, West Virginia"; David W. Valentino, Virginia Polytechnic Institute, for "Transpressional Tectonic Assembly of Terranes in the Central Appalachians and a Structural Model for Ductile Transpression"; Bethanie Waddel, University of Alabama, for "Crustal Evolution of Calc-Alkaline Andesite Magmas: Loggers Lake Complex, S.W. British Columbia."

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

Campus Representatives

continued from p. 196

College of St. Thomas
Willmar Community College

Missouri
Central Methodist College
St. Louis Community College at Florissant Valley
St. Louis Community College at Forest Park
Stephens College
William Jewell College

Nebraska
Kearney State College

Ohio
Ashland University
Central State University
Cincinnati Museum of Natural History
Cleveland Museum of Natural History
Mount Union College
Muskingum College
Oberlin College
Ohio University—Lancaster

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

Manitoba
Manitoba Museum of Man and Nature

South-Central Section

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

Kansas
Cowley County Community College

Oklahoma
Northeastern Oklahoma A&M College
Northeastern State University
Phillips University
University of Oklahoma

Texas
Amarillo Junior College
Angelo State University
Brookhaven College
Del Mar College
Houston Community College System
Kilgore College
Laredo Junior College
Lee College
Odessa College
Rice University
San Antonio College
South Plains College
Tarrant County Junior College
Texas Christian University
University of Texas at Dallas
University of Texas—Pan American

Northeastern Section

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

Delaware
University of Delaware—College of Marine Studies

District of Columbia
Carnegie Institute of Washington
University of the District of Columbia—Van Ness Campus
Howard University
Smithsonian Institution/National Air and Space Museum
Smithsonian Institution/National Museum of Natural History

Maine
Colby College
University of Maine at Presque Isle

Maryland
Catonsville Community College
Montgomery College
Towson State University

Massachusetts
Bentley College
Berkshire Community College
Fitchburg State College
Greenfield Community College
University of Massachusetts at Boston/Harbor Campus
North Adams State College

Woods Hole Oceanographic Institution
Worcester State College

New Hampshire
New England College
Plymouth State College

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

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

Pennsylvania
Carnegie Museum of Natural History
Drexel University
Elizabethtown College
Gannon University
Lycoming College
Mansfield University
Montgomery County Community College
Pennsylvania State University—Erie
Pennsylvania State University—Monaca
Susquehanna University
Thiel College
Wilkes College
York College of Pennsylvania

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

Vermont
Castleton State College
Middlebury College
University of Vermont

New Brunswick
University of New Brunswick
University of New Brunswick—Saint John

Nova Scotia
St. Mary's University
University College of Cape Breton

Ontario
University of Guelph
University of Ottawa
Royal Ontario Museum
Sir Sandford Fleming College
University of Western Ontario

Quebec
Concordia University
Ecole Polytechnique
Université du Québec
Université du Québec à Montréal
Université du Québec à Rimouski
Université du Québec à Trois Rivières

Southeastern Section

Alabama
University of Alabama—Dauphin Island
University of Montevallo
University of North Alabama

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

Georgia
Emory University—Oxford College

**1992 GSA ANNUAL MEETING
Cincinnati, October 26-29**

Planning to Go to Graduate School?

Shortcut your search for just the right graduate school program to suit your needs. Come to the Cincinnati Annual Meeting and meet with your favorite school without spending the travel time and money to go to each school for interviews. The schools participating (at press time) are listed below.

If you would like to receive a complete list of schools with the contact persons and telephone numbers, so that you can set up an appointment separately or during the scheduled time in Cincinnati, please write, call, or fax Kathy Ohmie Lynch or Matt Ball, GSA Meetings Department, (303) 447-2020 or fax (303) 447-0648.

**Graduate School Information Forum Schedule
Cincinnati Convention Center, Rooms 240 & 241
8:00 a.m. to 5:00 p.m. Daily**

Participating Schools	MONDAY October 26	TUESDAY October 27	WEDNESDAY October 28
Bowling Green State University	•		
Brooklyn College			•
Bryn Mawr College	•	•	•
California Institute of Technology	•	•	•
East Carolina University	•	•	
George Washington University		•	
Illinois State University	•	•	
Indiana University	•	•	
Kansas State University	•		
Lehigh University	•		
Louisiana State University	•		
Miami University	•		
New Mexico Institute of Mining & Technology		•	
Northern Illinois University	•	•	•
Notre Dame	•		
Ohio State University			
Old Dominion University		•	
Rice University		•	
Southern Illinois University at Carbondale	•	•	•
University of Alabama	•	•	
University of Alaska, Fairbanks		•	
University of California, Los Angeles		•	
University of California, Riverside	•	•	•
University of Delaware		•	
University of Georgia	•	•	
University of Idaho		•	
University of Illinois at Urbana-Champaign		•	
University of Kentucky		•	
University of Massachusetts		•	
University of Missouri, Columbia		•	
University of Nebraska, Lincoln	•	•	•
University of North Carolina at Chapel Hill	•	•	
University of North Dakota	•	•	
University of Pennsylvania	•	•	•
University of South Carolina	•	•	
University of Tennessee	•		
University of Texas at El Paso	•		
University of Utah		•	
Utah State University		•	
Vanderbilt University	•		
Virginia Polytechnic Institute & State University	•	•	
Washington University	•		
West Virginia University	•	•	•
Wright State University	•	•	•

Gainesville Junior College
Georgia Southwestern College
Gordon College
Kennesaw College
Mercer University
Shorter College
Valdosta State College

Kentucky
Berea College
Henderson Community College
Morehead State University
Northern Kentucky University

Louisiana
Louisiana Tech University
McNeese State University
Northwestern State University

Mississippi
Gulf Coast Research Laboratory
Millsaps College
Mississippi University for Women

North Carolina
Catawba College
University of North Carolina—Asheville

North Carolina Agricultural & Tech State University

South Carolina
Coker College
Wofford College

Tennessee
Oak Ridge National Laboratory
Rhodes College

Virginia
Emory & Henry College
Hampton University
Lynchburg College
Northern Virginia Community College
Virginia State University
Virginia Western Community College

West Virginia
Glennville State College
Potomac State College
West Virginia University—Parkersburg ■

Overview of 1992 Cincinnati Annual Meeting Program

OCTOBER 26-29, 1992 CINCINNATI CONVENTION CENTER

There will be 140 technical sessions presented during the course of the meeting. Of these, symposia (invited papers) and theme sessions (volunteered papers submitted to a specific topic) are referred to by a number that precedes the title. All other sessions are referred to by discipline, such as Geochemistry I, II. Sessions are oral unless poster is indicated.

Symposia

- S1. From Columbus to Magellan—Discovery. 1992 Annual Meeting Committee. Oct. 26 a.m.
- S2. History of Late Glacial Runoff from the Southern Laurentide Ice Sheet. Quaternary Geology and Geomorphology Division. Oct. 28 p.m.
- S3. The History of the Use of Imagery (Art, Photography, Maps, and Other Illustrations) in Geological Literature. History of Geology Division. Oct. 27 a.m.
- S4. Preserving Geoscience Imagery. Geoscience Information Society. Oct. 27 p.m.
- S5. Frontiers of Chemical Mass Transport in Contaminant Systems. Hydrogeology Division, Institute for Environmental Education. Oct. 27 a.m.
- S6. Reform in Science Education. National Association of Geology Teachers. Oct. 26 p.m.
- S7. Mineralization Related to Continental Rifts. Society of Economic Geologists. Oct. 25 a.m./p.m.
- S8. Black Shales and Related Ore Deposits. Society of Economic Geologists. Oct. 26 p.m.
- S9. Ground Truth: Geology of the Earth and Planets from Rocks and Analogs. Planetary Geology Division. Oct. 27 a.m.
- S10. Applications of Stable Isotope Geochemistry to Problems in High-Temperature Petrogenesis. Geochemical Society. Oct. 27 p.m.
- S11. Geologic Aspects of Development Projects in Latin America and the Caribbean Basin. International Division, Engineering Geology Division. Oct. 27 p.m.
- S12. Instability on Clay and Shale Hillslopes. Engineering Geology Division. Oct. 28 a.m.
- S13. Physical and Chemical Responses to Allogenic Processes in Carboniferous Coal-Bearing Strata. Coal Geology Division. Oct. 26 a.m.
- S14. Controls on Carbon Preservation. Organic Chemistry Division of the Geochemical Society. Oct. 25 a.m./p.m.
- S15. The Role of Fluids in Crustal Deformation. Structural Geology and Tectonics Division. Oct. 26 p.m.
- S16. Synergism: Archaeological and Geological Sciences. Archaeological Geology Division. Oct. 27 p.m.
- S17. Paleosols: Their Geologic Applications (Part I). Sedimentary Geology Division. (Part II is T16.) Oct. 28 a.m.
- S18. Speciation in the Fossil Record. Paleontological Society. Oct. 27 a.m.

Program by Scientific Disciplines

KEY: I, II, ... X = Discipline session number in a series; P = Poster; S = Symposium; T = Theme Session (listed under disciplines having the majority of the abstracts).
*Keynote Symposium: From Columbus to Magellan—Discovery.

DISCIPLINE	SUN, OCT. 25 8:00 a.m.–12:00 N 1:00–5:00 p.m.		MON, OCT. 26 8:00 a.m.–12:00 N 1:00–5:00 p.m.		TUES, OCT. 27 8:00 a.m.–12:00 N 1:30–5:30 p.m.		WED, OCT. 28 8:00 a.m.–12:00 N 1:30–5:30 p.m.		THURS, OCT. 29 8:00 a.m.–12:00 N 1:00–5:00 p.m.	
	AM	PM	AM *Keynote	PM	AM	PM	AM	PM	AM	PM
ARCHAEOLOGY			I, P			S16				
COAL			S13		I		P			
ECONOMIC	S7	S7	I	S8	II		P		III	IV
ENGINEERING			P, T14			S11, T23	S12		I	
ENVIRONMENTAL			P	I			T6	T7		
GEOCHEMISTRY, AQUEOUS			I				P	II	T18	III
GEOCHEMISTRY, OTHER	S14	S14				I, S10	P, II		III	
GEOLOGY EDUCATION				S6	P				I	II
GEOMORPHOLOGY					I				P	
GEOPHYSICS/ TECTONOGEOPHYSICS				I	T3		P			
GEOSCIENCE INFORMATION					P	S4		I		
HISTORY			I		S3					
HYDROGEOLOGY			T9		S5		T4	I, T5	P	II
MARINE				P		I				
MICROPALAEONTOLOGY			I	P	T11					
MINERALOGY/ CRYSTALLOGRAPHY			T10	T10	I	II		P		
PALEOCEANOGRAPHY/ PALEOCLIMATOLOGY				P			I	II		
PALEONTOLOGY/ PALEOBOTANY			I	P, T20	S18		II	III	IV	V
PETROLEUM			P						I	
PETROLOGY, EXPERIMENTAL							P	I		
PETROLOGY, IGNEOUS			I	II				P		
PETROLOGY, METAMORPHIC							I	P, T24	II	III
PETROLOGY, SEDIMENTARY			P	I			II			
PLANETARY/ REMOTE SENSING					S9, P	T15				
PRECAMBRIAN				I	II	P			T25	T25
QUATERNARY			I	PI, T13		II	T12	S2	PII	III
SEDIMENTOLOGY			I		II		S17	III, T16		P
STRATIGRAPHY			T8	I		T19			II, T26	P, III
STRUCTURAL				S15	I, T22	P	T17		II	III
TECTONICS			I	T2	II	P, T1	III	IV, T21		
VOLCANOLOGY						I		P		

Theme Sessions

- T1. Tectonic Settings and Paleoenvironments of the Paleo-Pacific Margin—Antarctic and Related Gondwana Sequences. Oct. 27 p.m.
- T2. New Discoveries in Neoproterozoic Earth History. Oct. 26 p.m.
- T3. Intraplate Neotectonics. Oct. 27 a.m.
- T4. Hydrogeochemistry and Isotope Hydrology of Regional Aquifer Systems. Oct. 28 a.m.
- T5. Hydrogeology, Hydrogeochemistry, and Ground Water Contamination in the Midwest Basin and Arches Region. Hydrogeology Division. Oct. 28 p.m.
- T6. Environmental Geology: The Voice of Warning. GSA Geology and Public Policy Committee, Institute for Environmental Education. Oct. 28 a.m.
- T7. Environmental Geology: The Voice of Reason. GSA Geology and Public Policy Committee, Institute for Environmental Education. Oct. 28 p.m.
- T8. Gulf Coast Cretaceous Project Biostratigraphy and Correlation; Sea-level Change and Paleogeography; Depositional Environments and Diagenesis. Global Sedimentary Geology Program. Oct. 26 a.m.
- T9. Discovery in Hydrogeology—Heritage, Wisdom, and Vision. Hydrogeology Division, History of Geology Division. Oct. 26 a.m.
- T10. Transmission Electron Microscopy in Mineralogy and Petrology. Mineralogical Society of America. Oct. 26 a.m./p.m.
- T11. Paleozoic Depositional Sequences; Contrasts in Environments and Fossil Diversity. Cushman Foundation for Foraminiferal Research. Oct. 27 a.m.
- T12. Origin and Nature of Meltwater Release from the Laurentide Ice Sheet and Its Impact on Late Glacial Oceans. Quaternary Geology and Geomorphology Division. Oct. 28 a.m.
- T13. Environmental Issues in Urban Settings. Quaternary Geology and Geomorphology Division, Institute for Environmental Education. Oct. 26 p.m.
- T14. Consultants' and Industries' Innovative Applications in Environmental Investigations. Institute for Environmental Education. Oct. 26 a.m.
- T15. Magellan, Galileo, and Planetary Frontiers: The Discovery of New Worlds Continues. Oct. 27 p.m.
- T16. Paleosols: Their Geologic Applications (Part II). Sedimentary Geology Division. (Part I is S17.) Oct. 28 p.m.
- T17. Thrust Fault Sesquicentennial. Oct. 28 a.m.
- T18. Quantitative Chemical Hydrogeology: Calculation of Solute Transport and Water Rock Interaction in Geochemical Processes. Oct. 29 a.m.
- T19. Ordovician K-bentonites. Oct. 27 p.m.
- T20. Biotic Responses to Allogenic Processes in Carboniferous Coal-Bearing Strata. Paleontological Society. Oct. 26 p.m.
- T21. Time and Place of Compressional Events in the Appalachian Orogen. Oct. 28 p.m.
- T22. Formation of Fault Systems. Oct. 27 a.m.
- T23. Advances in Investigation, Characterization, and Monitoring of the Geologic Environment for Waste Disposal. Engineering Geology Division, Institute for Environmental Education. Oct. 27 p.m.
- T24. Metamorphism in North and Central America: Regional Studies and Digital Compilation Techniques (Poster Mode only). Oct. 28 p.m.
- T25. Late Proterozoic Rifting of the North American Craton. Oct. 29 a.m./p.m.
- T26. New Cretaceous-Tertiary Boundary Discoveries—Caribbean and High Latitudes. Oct. 29 a.m.

Program Calendar

Sunday, October 25 a.m.

SESSION 1, 8:20 a.m., CCC:208
GS—ORGANIC GEOCHEMISTRY DIVISION SYMPOSIUM (S14): CONTROLS ON CARBON PRESERVATION (PART I)

SESSION 2, 8:30 a.m., CCC:222-232
SEG SYMPOSIUM (S7): MINERALIZATION RELATED TO CONTINENTAL RIFTS (PART I)

Sunday, October 25 p.m.

SESSION 3, 1:30 p.m., CCC:208
GS—ORGANIC GEOCHEMISTRY DIVISION SYMPOSIUM (S14): CONTROLS ON CARBON PRESERVATION (PART II)

SESSION 4, 1:00 p.m., CCC:222-232
SEG SYMPOSIUM (S7): MINERALIZATION RELATED TO CONTINENTAL RIFTS (PART II)

Monday, October 26 a.m.

SESSION 5, 8:00 a.m., CCC:208
ARCHAEOLOGICAL GEOLOGY

SESSION 6, 8:00 a.m., CCC:Level 1
ARCHAEOLOGICAL GEOLOGY (POSTERS)

SESSION 7, 8:00 a.m., CCC:302
CF—MICROPALEONTOLOGY

SESSION 8, 8:00 a.m., CCC:207-215
COAL GEOLOGY DIVISION SYMPOSIUM (S13): PHYSICAL AND CHEMICAL RESPONSES TO ALLOCYCLIC PROCESSES IN CARBONIFEROUS COAL-BEARING STRATA

SESSION 9, 8:00 a.m., CCC:Level 1
ENGINEERING GEOLOGY (POSTERS)

SESSION 10, 8:00 a.m., CCC:Level 1
ENVIRONMENTAL GEOLOGY (POSTERS)

SESSION 11, 8:00 a.m., CCC:202-212
GS—GEOCHEMISTRY, AQUEOUS I: GEOCHEMISTRY OF CARBONATE MINERALS AND ROCKS

SESSION 12, 10:15 a.m., CCC:200-201
HISTORY OF GEOLOGY

SESSION 13, 8:00 a.m., CCC:Ballroom C
KEYNOTE SYMPOSIUM (S1): FROM COLUMBUS TO MAGELLAN—DISCOVERY

SESSION 14, 8:00 a.m., CCC:300-301
MSA—IGNEOUS PETROLOGY I

SESSION 15, 8:00 a.m., CCC:Level 1
PETROLEUM GEOLOGY (POSTERS)

SESSION 16, 8:00 a.m., CCC:Ballroom A
PS—PALEONTOLOGY/PALEOBOTANY I: PATTERNS OF EVOLUTION

SESSION 17, 8:00 a.m., CCC:252-253
QUATERNARY GEOLOGY I

SESSION 18, 8:00 a.m., CCC:203-213
SEDIMENTOLOGY I

SESSION 19, 8:00 a.m., CCC:Level 1
SEDIMENTARY PETROLOGY (POSTERS)

SESSION 20, 8:00 a.m., CCC:210-211
SEG—ECONOMIC GEOLOGY I: RIFTS AND BLACK SHALES

SESSION 21, 8:00 a.m., CCC:250-251
TECTONICS I: SOUTH AMERICAN AND NORTH AMERICAN CORDILLERAS

SESSION 22, 10:00 a.m., CCC:222-232
T 8. GLOBAL SEDIMENTARY GEOLOGY PROGRAM: GULF COAST CRETACEOUS PROJECT: BIOSTRATIGRAPHY AND CORRELATION; SEA-LEVEL CHANGE AND PALEOGEOGRAPHY; DEPOSITIONAL ENVIRONMENTS AND DIAGENESIS

SESSION 23, 8:00 a.m., CCC:200-201
T 9. HYDROGEOLOGY DIVISION, HISTORY OF GEOLOGY DIVISION: DISCOVERY IN HYDROGEOLOGY—HERITAGE, WISDOM, AND VISION

SESSION 24, 8:00 a.m., CCC:220-231
T 10. MSA: TRANSMISSION ELECTRON MICROSCOPY IN MINERALOGY AND PETROLOGY (PART I)

SESSION 25, 8:00 a.m., CCC:204-214
T 14. IEE: CONSULTANTS/INDUSTRIAL INNOVATIVE APPLICATIONS IN ENVIRONMENTAL INVESTIGATIONS

Monday, October 26 p.m.

SESSION 26, 1:00 p.m., CCC:Level 1
CF—MICROPALEONTOLOGY (POSTERS)

SESSION 27, 1:00 p.m., CCC:300-301
ENVIRONMENTAL GEOLOGY

SESSION 28, 1:00 p.m., CCC:252-253
GEOPHYSICS/TECTONOPHYSICS

SESSION 29, 1:00 p.m., CCC:Level 1
MARINE GEOLOGY (POSTERS)

SESSION 30, 1:00 p.m., CCC:207-215
MSA—IGNEOUS PETROLOGY II: MAGMA CHAMBER PROCESSES, LAYERED INTRUSIONS, ANORTHOSITES, AND THE MANTLE

SESSION 31, 1:00 p.m., CCC:220-231
NAGT SYMPOSIUM (S6): REFORM IN SCIENCE EDUCATION

SESSION 32, 1:00 p.m., CCC:Level 1
PALEOCEANOGRAPHY/PALEOCLIMATOLOGY (POSTERS)

SESSION 33, 1:00 p.m., CCC:210-211
PRECAMBRIAN GEOLOGY (I)

SESSION 34, 1:00 p.m., CCC:Level 1
PS—PALEONTOLOGY/PALEOBOTANY (POSTERS)

SESSION 35, 1:00 p.m., CCC:Level 1
QUATERNARY (POSTERS I)

SESSION 36, 1:00 p.m., CCC:203-213
SEDIMENTARY PETROLOGY I: CARBONATE PETROLOGY AND GEOCHEMISTRY

SESSION 37, 1:00 p.m., CCC:208
SEG SYMPOSIUM (S8): BLACK SHALES AND RELATED ORE DEPOSITS

SESSION 38, 1:00 p.m., CCC:202-212
STRATIGRAPHY I: STRATIGRAPHIC RESPONSE TO SEA LEVEL CHANGE

SESSION 39, 1:00 p.m., CCC:Ballroom A
STRUCTURAL GEOLOGY & TECTONICS DIVISION SYMPOSIUM (S15): THE ROLE OF FLUIDS IN CRUSTAL DEFORMATION

SESSION 40, 1:00 p.m., CCC:200-201
T 2. NEW DISCOVERIES IN NEO-PROTEROZOIC EARTH HISTORY

SESSION 41, 1:00 p.m., CCC:204-214
T 10. MSA: TRANSMISSION ELECTRON MICROSCOPY IN MINERALOGY AND PETROLOGY (PART II)

SESSION 42, 1:00 p.m., CCC:250-251
T 13. QUATERNARY GEOLOGY AND GEOMORPHOLOGY DIVISION, IEE: ENVIRONMENTAL ISSUES IN URBAN SETTINGS

SESSION 43, 1:00 p.m., CCC:222-232
T 20. PS—BIOTIC RESPONSES TO ALLOCYCLIC PROCESSES IN CARBONIFEROUS COAL-BEARING STRATA

Tuesday, October 27 a.m.

SESSION 44, 8:00 a.m., CCC:200-201
GEOMORPHOLOGY

SESSION 45, 8:00 a.m., CCC:Level 1
GIS—GEOSCIENCE INFORMATION (POSTERS)

SESSION 46, 8:00 a.m., CCC:207-215
HISTORY OF GEOLOGY DIVISION SYMPOSIUM (S3): THE HISTORY OF THE USE OF IMAGERY (ART, PHOTOGRAPHY, MAPS, AND OTHER ILLUSTRATIONS) IN GEOLOGICAL LITERATURE

SESSION 47, 8:00 a.m., CCC:202-212
HYDROGEOLOGY DIVISION, IEE SYMPOSIUM (S5): FRONTIERS OF CHEMICAL MASS TRANSPORT IN CONTAMINANT SYSTEMS

SESSION 48, 8:00 a.m., CCC:204-214
MSA—MINERALOGY/CRYSTALLOGRAPHY I

SESSION 49, 8:00 a.m., CCC:Level 1
NAGT—ENHANCING GEOSCIENCE EDUCATION (POSTERS)

SESSION 50, 8:00 a.m., CCC:250-251
PLANETARY GEOLOGY DIVISION SYMPOSIUM (S9): GROUND TRUTH: GEOLOGY OF THE EARTH AND PLANETS FROM ROCKS AND ANALOGS

SESSION 51, 8:00 a.m., CCC:Level 1
PLANETARY GEOLOGY/REMOTE SENSING (POSTERS)

SESSION 52, 8:15 a.m., CCC:203-213
PRECAMBRIAN GEOLOGY II

SESSION 53, 8:00 a.m., CCC:Ballroom A
PS—PALEONTOLOGICAL SOCIETY SYMPOSIUM (S18): SPECIATION IN THE FOSSIL RECORD

SESSION 54, 8:00 a.m., CCC:252-253
SEDIMENTOLOGY II: CARBONATE SEDIMENTOLOGY

SESSION 55, 8:00 a.m., CCC:Ballroom C
SEG—ECONOMIC GEOLOGY II: MAGMATIC SYSTEMS AND HYDROTHERMAL FLUIDS

SESSION 56, 8:00 a.m., CCC:220-231
STRUCTURAL GEOLOGY I: DIAPIRS, PLUTONS, DETACHMENTS, AND SHEARS

SESSION 57, 8:00 a.m., CCC:300-301
TECTONICS II: SOUTHERN CARIBBEAN AND METATECTONIC MODELS

SESSION 58, 8:15 a.m., CCC:222-232
T 3. INTRAPLATE NEOTECTONICS

SESSION 59, 8:10 a.m., CCC:208
T 11. CF—PALEOZOIC DEPOSITIONAL SEQUENCES; CONTRASTS IN ENVIRONMENTS AND FOSSIL DIVERSITY

SESSION 60, 8:00 a.m., CCC:210-211
T 22. FORMATION OF FAULT SYSTEMS

Tuesday, October 27 p.m.

SESSION 61, 1:30 p.m., CCC:252-253
ARCHAEOLOGICAL GEOLOGY DIVISION SYMPOSIUM (S16): SYNERGISM: ARCHAEOLOGICAL AND GEOLOGICAL SCIENCES

SESSION 62, 1:30 p.m., CCC:250-251
COAL GEOLOGY

SESSION 63, 1:30 p.m., CCC:207-215
ENGINEERING GEOLOGY DIVISION AND INTERNATIONAL DIVISION SYMPOSIUM (S11): GEOLOGIC ASPECTS OF DEVELOPMENT PROJECTS IN LATIN AMERICA AND THE CARIBBEAN BASIN

SESSION 64, 1:30 p.m., CCC:222-232
GIS SYMPOSIUM (S4): PRESERVING GEOSCIENCE IMAGERY

SESSION 65, 1:30 p.m., CCC:300-301
GS—GEOCHEMISTRY, OTHER I: FLUIDS, CLAYS, AND WEATHERING

SESSION 66, 1:30 p.m., CCC:208
GS—GEOCHEMICAL SOCIETY SYMPOSIUM (S10): APPLICATIONS OF STABLE ISOTOPE GEOCHEMISTRY TO PROBLEMS IN HIGH-TEMPERATURE PETROGENESIS

SESSION 67, 1:30 p.m., CCC:202-212
MARINE GEOLOGY: HOT AND COLD

SESSION 68, 3:30 p.m., CCC:220-231
MSA—MINERALOGY/CRYSTALLOGRAPHY II

SESSION 69, 1:30 p.m., CCC:220-231
MSA—VOLCANOLOGY

SESSION 70, 1:30 p.m., CCC:Level 1
PRECAMBRIAN GEOLOGY (POSTERS)

SESSION 71, 1:30 p.m., CCC:200-201
QUATERNARY GEOLOGY II

SESSION 72, 1:30 p.m., CCC:Level 1
STRUCTURAL GEOLOGY (POSTERS)

SESSION 73, 1:30 p.m., CCC:Level 1
TECTONICS (POSTERS)

SESSION 74, 1:30 p.m., CCC:204-214
T 1. TECTONIC SETTINGS AND PALEO-ENVIRONMENTS OF THE PALEO-PACIFIC MARGIN—ANTARCTIC AND RELATED GONDWANA SEQUENCES

SESSION 75, 1:30 p.m., CCC:203-213
T 15. MAGELLAN, GALILEO, AND PLANETARY FRONTIERS: THE DISCOVERY OF NEW WORLDS CONTINUES

SESSION 76, 1:30 p.m., CCC:210-211
T 19. ORDOVICIAN K-BENTONITES

SESSION 77, 1:30 p.m., CCC:302
T 23. ENGINEERING GEOLOGY DIVISION, IEE: ADVANCES IN INVESTIGATION, CHARACTERIZATION, AND MONITORING OF THE GEOLOGIC ENVIRONMENT FOR WASTE DISPOSAL

Wednesday, October 28 a.m.

SESSION 78, 8:00 a.m., CCC:Level 1
COAL GEOLOGY (POSTERS)

SESSION 79, 8:00 a.m., CCC:222-232
ENGINEERING GEOLOGY DIVISION SYMPOSIUM (S12): INSTABILITY ON CLAY AND SHALE HILLSLOPES

SESSION 80, 8:00 a.m., CCC:Level 1
GEOPHYSICS/TECTONOPHYSICS (POSTERS)

SESSION 81, 8:00 a.m., CCC:230-231
GS—GEOCHEMISTRY, OTHER II:
EXPERIMENTAL AND THEORETICAL
STUDIES OF HYDROTHERMAL MINERAL
FLUID INTERACTION

SESSION 82, 8:00 a.m., CCC:Level 1
GS—AQUEOUS GEOCHEMISTRY
(POSTERS)

SESSION 83, 8:00 a.m., CCC:Level 1
GS—ORGANIC, IGNEOUS, AND
SEDIMENTARY GEOCHEMISTRY
(POSTERS)

SESSION 84, 8:00 a.m., CCC:210-211
MSA—METAMORPHIC PETROLOGY I:
MINERALS, TEXTURES, TEMPERA-
TURES, AND FACIES

SESSION 85, 8:00 a.m., CCC:Level 1
MSA—EXPERIMENTAL PETROLOGY
(POSTERS)

SESSION 86, 8:00 a.m., CCC:200-201
PALEOCEANOGRAPHY/PALEO-
CLIMATOLOGY I

SESSION 87, 8:00 a.m., CCC:202-212
PS—PALEONTOLOGY/PALEOBOTANY II:
INVERTEBRATE PALEONTOLOGY

SESSION 88, 8:00 a.m., CCC:252-253
SEDIMENTARY GEOLOGY DIVISION
SYMPOSIUM (S17): PALEOSOLS: THEIR
GEOLOGIC APPLICATIONS (PART I)

SESSION 89, 8:00 a.m., CCC:300-301
SEDIMENTARY PETROLOGY II

SESSION 90, 8:00 a.m., CCC:Level 1
SEG—ECONOMIC GEOLOGY
(POSTERS)

SESSION 91, 8:00 a.m., CCC:203-213
TECTONICS III: TECTONICS AND THER-
MOCHRONOLOGY OF THE APPALA-
CHIAN AND CALEDONIDE OROGENS

SESSION 92, 8:00 a.m., CCC:208
T 4. HYDROGEOCHEMISTRY AND
ISOTOPE HYDROLOGY OF REGIONAL
AQUIFER SYSTEMS

SESSION 93, 9:30 a.m., CCC:207-215
T 6. GSA GEOLOGY AND PUBLIC POL-
ICY COMMITTEE, IEE: ENVIRONMENTAL
GEOLOGY: THE VOICE OF WARNING

SESSION 94, 10:00 a.m., CCC:250-251
T 12. QUATERNARY GEOLOGY AND
GEOMORPHOLOGY DIVISION: ORIGIN
AND NATURE OF MELTWATER RELEASE
FROM THE LAURENTIDE ICE SHEET
AND ITS IMPACT ON LATE GLACIAL
OCEANS

SESSION 95, 8:00 a.m., CCC:204-214
T 17. THRUST FAULT
SESQUICENTENNIAL

Wednesday, October 28 p.m.

SESSION 96, 1:30 p.m., CCC:203-213
GIS—GEOSCIENCE INFORMATION

SESSION 97, 1:30 p.m., CCC:220-231
GS—AQUEOUS GEOCHEMISTRY II:
APPLICATION OF STABLE ISOTOPE
GEOCHEMISTRY TO METAMORPHIC
PETROLOGY

SESSION 98, 1:30 p.m., CCC:250-251
HYDROGEOLOGY I

SESSION 99, 1:30 p.m., CCC:200-201
MSA—EXPERIMENTAL PETROLOGY

SESSION 100, 1:30 p.m., CCC:Level 1
MSA—MINERALOGY/CRYSTAL-
LOGRAPHY (POSTERS)

SESSION 101, 1:30 p.m., CCC:Level 1
MSA—IGNEOUS PETROLOGY
(POSTERS)

SESSION 102, 1:30 p.m., CCC:Level 1
MSA—METAMORPHIC PETROLOGY
(POSTERS)

SESSION 103, 1:30 p.m., CCC:Level 1
MSA—VOLCANOLOGY (POSTERS)

SESSION 104, 1:30 p.m., CCC:210-211
PALEOCEANOGRAPHY/PALEO-
CLIMATOLOGY II

SESSION 105, 1:30 p.m., CCC:Ballroom A
PS—PALEONTOLOGY/PALEOBOTANY
III: VERTEBRATES/PLANTS

SESSION 106, 1:30 p.m., CCC:207-215
QUATERNARY GEOLOGY AND GEOMOR-
PHOLOGY SYMPOSIUM (S2): HISTORY
OF LATE GLACIAL RUNOFF FROM THE
SOUTHERN LAURENTIDE ICE SHEET

SESSION 107, 1:30 p.m., CCC:300-301
SEDIMENTOLOGY III: SEDIMENTARY
PROCESSES

SESSION 108, 1:30 p.m., CCC:204-214
TECTONICS IV: EXTENSION AND
RIFTING: TECTONICS FROM NORTH
AFRICA TO ASIA

SESSION 109, 1:30 p.m., CCC:208
T 5. HYDROGEOLOGY DIVISION:
HYDROGEOLOGY, HYDROGEOCHEM-
ISTRY, AND GROUND-WATER CONTAMI-
NATION IN THE MIDWEST BASIN AND
ARCHES REGION

SESSION 110, 1:30 p.m., CCC:222-232
T 7. GSA GEOLOGY AND PUBLIC POL-
ICY COMMITTEE, IEE: ENVIRONMENTAL
GEOLOGY: THE VOICE OF REASON

SESSION 111, 1:30 p.m., CCC:252-253
T 16. SEDIMENTARY GEOLOGY
DIVISION: PALEOSOLS: THEIR
GEOLOGIC APPLICATIONS (PART II)

SESSION 112, 1:30 p.m., CCC:202-212
T 21. TIME AND PLACE OF
COMPRESSIONAL EVENTS IN THE
APPALACHIAN OROGEN

SESSION 113, 1:30 p.m., CCC:Level 1
T 24. METAMORPHISM IN NORTH
AND CENTRAL AMERICA: REGIONAL
STUDIES AND DIGITAL COMPILATION
TECHNIQUES (POSTERS)

Thursday, October 29 a.m.

SESSION 114, 8:30 a.m., CCC:210-211
ENGINEERING GEOLOGY

SESSION 115, 8:00 a.m., CCC:Level 1
GEOMORPHOLOGY (POSTERS)

SESSION 116, 8:00 a.m., CCC:200-201
GS—GEOCHEMISTRY, OTHER III:
ISOTOPE GEOCHEMISTRY

SESSION 117, 8:00 a.m., CCC:Level 1
HYDROGEOLOGY (POSTERS)

SESSION 118, 9:00 a.m., CCC:300-301
MSA—METAMORPHIC PETROLOGY II:
SUBDUCTION, METASOMATISM, AND
TECTONICS

SESSION 119, 8:30 a.m., CCC:208
NAGT—GEOLOGY EDUCATION I:
ENHANCING GEOSCIENCE EDUCATION:
COLLEGE LEVEL

SESSION 120, 8:00 a.m., CCC:250-251
PETROLEUM GEOLOGY

SESSION 121, 8:00 a.m., CCC:203-213
PS—PALEONTOLOGY/PALEOBOTANY (IV):
TRACE FOSSILS AND PALEOECOLOGY

SESSION 122, 8:00 a.m., CCC:Level 1
QUATERNARY (POSTERS II)

SESSION 123, 8:00 a.m., CCC:222-232
SEG—ECONOMIC GEOLOGY III:
PRECIOUS METALS PLUS

SESSION 124, 8:00 a.m., CCC:202-212
STRATIGRAPHY II: APPALACHIAN
STRATIGRAPHY

SESSION 125, 8:00 a.m., CCC:220-231
STRUCTURAL GEOLOGY II: DEFOR-
MATION MECHANISMS AND MODELS;
BRITTLE-DUCTILE TRANSITION

SESSION 126, 8:00 a.m., CCC:252-253
T 18. QUANTITATIVE CHEMICAL
HYDROGEOLOGY: CALCULATION OF
SOLUTE TRANSPORT AND WATER
ROCK INTERACTION IN GEOCHEMICAL
PROCESSES

SESSION 127, 8:00 a.m., CCC:207-215
T 25. LATE PROTEROZOIC RIFTING
OF THE NORTH AMERICAN CRATON
(PART I)

SESSION 128, 8:00 a.m., CCC:204-214
T 26. NEW CRETACEOUS-TERTIARY
BOUNDARY DISCOVERIES—
CARIBBEAN AND HIGH LATITUDES

Thursday, October 29 p.m.

SESSION 129, 1:00 p.m., CCC:302
GS—AQUEOUS GEOCHEMISTRY III

SESSION 130, 1:00 p.m., CCC:200-201
HYDROGEOLOGY II

SESSION 131, 1:00 p.m., CCC:250-251
MSA—METAMORPHIC PETROLOGY III:
PARTIAL MELTING, MIGMATITES AND
GRANULITES

SESSION 132, 1:30 p.m., CCC:208
NAGT—GEOLOGY EDUCATION II:
ENHANCING GEOSCIENCE EDUCATION:
K-12

SESSION 133, 1:00 p.m., CCC:203-213
PS—PALEONTOLOGY/PALEOBOTANY
(V): TAPHONOMY AND COMMUNITIES

SESSION 134, 1:00 p.m., CCC:210-211
QUATERNARY GEOLOGY III

SESSION 135, 1:00 p.m., CCC:Level 1
SEDIMENTOLOGY (POSTERS)

SESSION 136, 1:00 p.m., CCC:204-214
SEG—ECONOMIC GEOLOGY IV:
CARBONATE-HOSTED ORE DEPOSITS

SESSION 137, 1:00 p.m., CCC:252-253
STRATIGRAPHY III

SESSION 138, 1:00 p.m., CCC:Level 1
STRATIGRAPHY (POSTERS)

SESSION 139, 1:00 p.m., CCC:222-232
STRUCTURAL GEOLOGY III: THRUSTS
AND WEDGES

SESSION 140, 1:00 p.m., CCC:207-215
T 25. LATE PROTEROZOIC RIFTING
OF THE NORTH AMERICAN CRATON
(PART II)

Associated Societies Sponsoring Sessions

CF	Cushman Foundation
GS	Geochemical Society
GIS	Geoscience Information Society
MSA	Mineralogical Society of America
NAGT	National Association of Geology Teachers
PS	Paleontological Society
SEG	Society of Economic Geologists

Event Highlights

See on-site program for final times/locations.
CCC=Cincinnati Convention Center
OM=Omni Netherland Plaza
HY=Hyatt Regency Hotel

Sunday

Field Trips
Short Courses/Workshops/Forums
Guest Tours, OM, Indiana's Wine Country,
2:00 to 6:00 p.m.
Employment Opportunities-Roundtable
Discussions, CCC, 12:00 noon to
2:00 p.m.
IEE Annual Environmental Forum, CCC,
1:30 to 5:30 p.m.
Exhibits Opening and Welcoming Party, CCC,
6:00 to 9:00 p.m.

Monday

Keynote Symposium, CCC, 8:00 a.m. to
12 noon.
Exhibits, CCC, 8:00 a.m. to 5:00 p.m.
Workshops/Forums
Guest Seminars, OM
Welcome to Cincinnati, 8:00 to 8:30 a.m.
Seeds for the Future, 9:30 to 11:30 a.m.
Guest Tours, OM, Cincinnati—Up, Down, and
All Around, 9:00 a.m. to 2:00 p.m.
Science Theater, CCC, 9:00 a.m. to 4:00 p.m.
Geoscience Ed. Div. Lunch., Museum,
11:30 a.m. to 1:00 p.m.
GIS Lunch, HY, 12:00 noon to 2:00 p.m.
GS Lunch, HY, 12:30 to 2:00 p.m.
Half-day Mini Trips, Geologic Glimpses from
Around the World, Afternoon
GSA Presidential Address/Awards Ceremony,
CCC, 5:30 to 7:00 p.m.
Awards Reception, CCC, 7:00 to 7:30 p.m.
Alumni Night, OM, 7:00 to 9:00 p.m.

Tuesday

Association for Women Geoscientists
Breakfast, HY, 6:30 to 11:00 a.m.
Exhibits, CCC, 8:00 a.m. to 5:00 p.m.
Guest Seminar, OM, Financial Planning in the
'90s, 9:00 to 10:00 a.m.
Guest Tours, OM,
Sights/Sounds of Cincinnati, 9:15 a.m. to
3:15 p.m.
Stagecoach Stops and Antique Shops,
OM, 10:30 a.m. to 4:00 p.m.
Science Theater, CCC, 9:00 a.m. to 4:00 p.m.
Hydrogeology Lunch, HY, 11:30 a.m. to
3:30 p.m.
PS Lunch, OM, 11:30 a.m. to 5:00 p.m.
SEG Lunch, OM, 11:30 a.m. to 2:00 p.m.
NAGT Lunch, HY, 11:45 a.m. to 2:00 p.m.
Geophysics Lunch, OM, 12:00 noon to
1:30 p.m.
Geology and Public Policy Forum, CCC,
12:00 noon to 1:30 p.m.
MSA Lunch, HY, 12:15 to 2:00 p.m.
Our Common Future: The Concerns of Earth
Science Students, HY, 5:30 to 7:30 p.m.

Wednesday

5K Run, Riverfront Park, 7:00 to 8:00 a.m.
Exhibits, CCC, 8:00 a.m. to 3:00 p.m.—Last
Day!
Guest Seminar, OM, Are They Grown Up
Yet?, 9:00 to 10:30 a.m.
Science Theater, CCC, 9:00 a.m. to 4:00 p.m.
Guest Tour, OM, Saks Fifth Avenue—The Art
of Dressing, 8:45 to 9:45 a.m.
Coal Geology Div. Lunch, HY, 12:00 noon to
4:00 p.m.
Eng. Geology Div. Lunch, HY, 12:00 noon to
2:00 p.m.
History Div. Lunch, HY, 12:00 noon to
1:30 p.m.
Half-day Mini Trip, Excursion to Caesar Creek
State Park, p.m.
Meet the GSA Congressional Science Fellow,
CCC, 12:15 to 1:15 p.m.
Guest Seminar, OM, Omni Tour and High
Tea, 2:30 to 4:30 p.m.
A Taste of Cincinnati, Cincinnati Museum of
Natural History, 7:00 to 11:30 p.m.

Thursday (post-meeting)

Field Trips
Science Theater, CCC, 9:00 a.m. to 3:00 p.m.
T.A.C., CCC, 3:30 to 5:00 p.m.

Friday (post-meeting)

Field Trips
Short Course

Ocean Drilling Program Sets 1992-1993 Schedule

The Ocean Drilling Program (ODP) 1992-1993 schedule includes six 67-day drilling legs, concentrated in the Atlantic Ocean and adjacent seas. ODP is the successor to the Deep Sea Drilling Project (DSDP) and IPOD (International Phase of Ocean Drilling) and is a consortium of countries, led by the United States, with a broad mandate to conduct scientific drilling in the world's ocean basins. ODP reviews and ranks

drilling programs proposed by an international community of earth scientists, according to priorities established by ODP's Long Range Plan and Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) thematic panels (Lithosphere, Ocean History, Sedimentary and Geochemical Processes, and Tectonics). The schedule is given below.

Opportunities exist for shipboard

participation on all of these legs. Interested scientists are urged to contact ODP headquarters at Texas A&M University, 1000 Discovery Drive, College Station, TX 77840 (409-845-2673). For additional information on the 1992-1993 ODP schedule, contact the JOIDES Office, University of Texas Institute for Geophysics, 8701 North Mopac Boulevard, Austin, TX 78759-8397 (512-471-0471). ■

Third Forum for Continental Scientific Drilling Scheduled

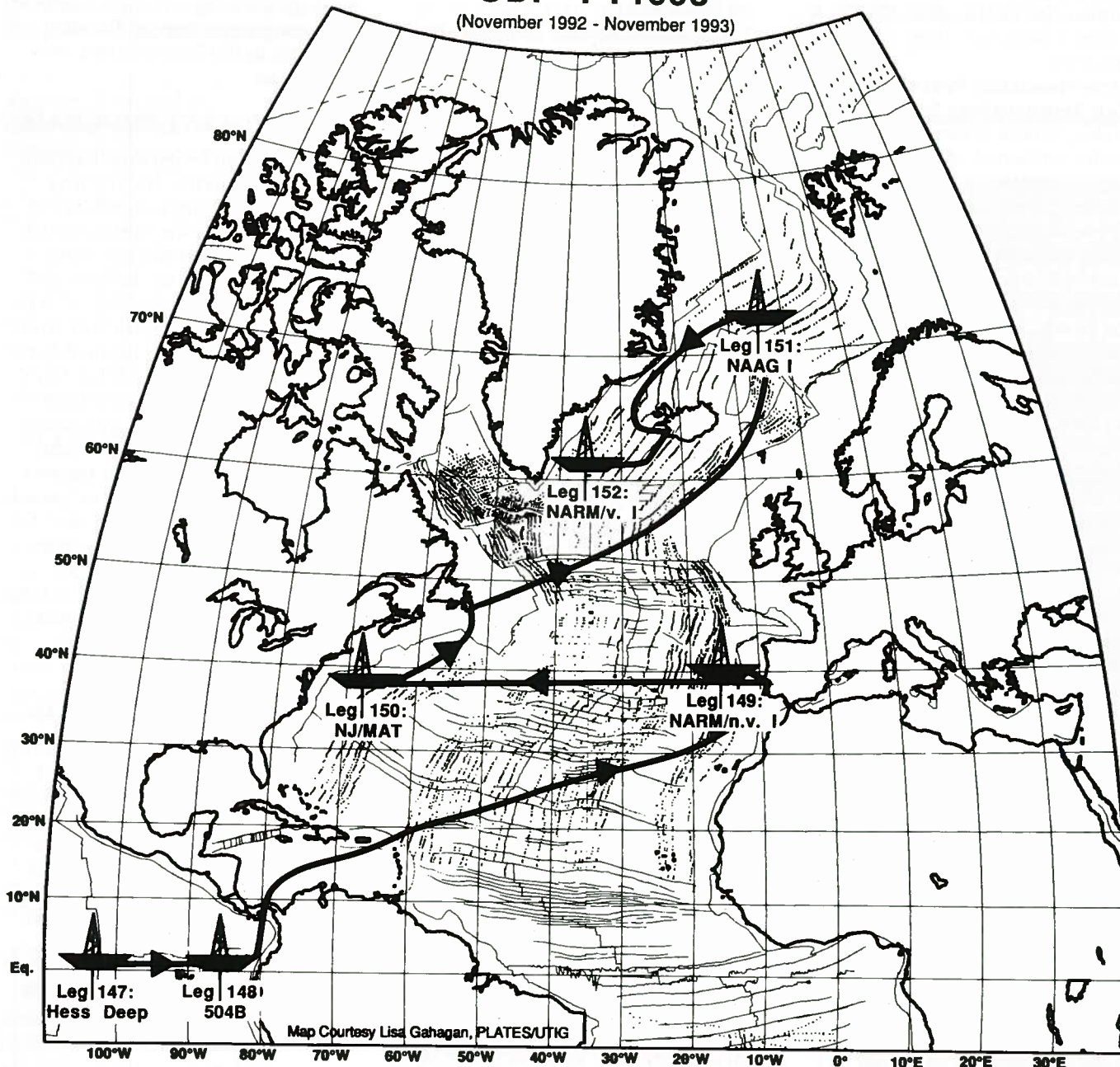
The Third Forum for Continental Scientific Drilling is scheduled for October 26-27 in Cincinnati at the Geological Society of America's 1992 Annual Meeting. The emphasis will be on new project concepts, as the primary purpose of the forum is to open and facilitate the process of proposal development. However, summaries of significant developments in ongoing projects are also welcome. Presentations will be approximately one-half hour each at the Monday session (supporting poster displays are encouraged), followed by an evening roundtable discussion on Tuesday with presenters of new project concepts, members of the forum organizing committee, and interested scientists. Monday's session will also feature a keynote address by Mark Zoback (Stanford University) entitled "Prospects for an International Continental Scientific Drilling Program." To participate, send 1-page summaries of projects to Cathy Littleton, CSD Forum, College of Geosciences, Texas A&M University, College Station, TX 77843 or fax to 409-845-0056, by September 15.

Potential contributors wanting more information may contact John Eichelberger, chairman of the Forum Organizing Committee, at the Geophysical Institute/University of Alaska, Fairbanks; (907) 474-5530.

Leg No.	Dates	Objectives
147	Nov. 1992-Jan. 1993	Sample lower oceanic crust, and if possible, upper mantle at Hess Deep (see map).
148	Jan.-April 1993	Return to Hole 504B (deepest hole ever drilled into oceanic crust) on southern flank of Costa Rica Rift, to attempt to penetrate contact between sheeted dikes and gabbros believed to represent transition from seismic layer 2 to layer 3 in world's oceans.
149	April-May 1993	Begin transect across Iberian Abyssal Plain to study a suspected nonvolcanic oceanic continental crustal transition.
150	June-July 1993	Drill across shelf and slope off New Jersey to estimate amplitudes of late Paleogene-early Neogene fluctuations of relative sea level and to assess effects of those fluctuations on development of margin's seismic stratigraphy.
151	Aug.-Sept. 1993	Consider paleoceanographic history of "North Atlantic-Arctic Gateway"—deep-water connections between Arctic Ocean and northernmost North Atlantic basins.
152	Oct.-Nov. 1993	Drill two holes on the seaward-dipping reflector sequence off southeast Greenland, in an attempt to understand its geologic evolution and relation to Iceland plume volcanism.

ODP FY1993

(November 1992 - November 1993)



Magnetic anomaly map of North Atlantic-easternmost Pacific (courtesy of L. Gahagan, Project PLATES, University of Texas Institute for Geophysics) on which the 1992-1993 ODP schedule is superimposed. Designated ports-of-call are preliminary, and ship track and drilling locations are schematic. For more detailed information, contact the JOIDES Office (address in text). NAAG is North Atlantic-Arctic Gateway program; NARM is North Atlantic Rifted Margins program; NJ/MAT is New Jersey sea level-Middle Atlantic transect program.

In Memoriam

Brewster Baldwin
Middlebury, Vermont
July 12, 1992

Vladimir Belousov
Moscow, USSR
December 25, 1990

Denise C. Gaudreau
Petersham, Massachusetts
July 15, 1992

William R. Greenwood
Reston, Virginia
July 27, 1992

John C. Griffiths
State College, Pennsylvania
June 2, 1992

James H.C. Martens
Fredericksburg, Virginia
March 27, 1992

Thomas B. Nolan
Washington, D.C.
August 2, 1992

Edward T. Schenk
Walnut Creek, California
June 16, 1992

**GSA's
Rock Color Chart
\$20 list**

SOUTH-CENTRAL SECTION, GSA 27th Annual Meeting

Fort Worth, Texas
March 14-16, 1993

The Department of Geology of Texas Christian University will host the 1993 meeting of the South-Central Section of the Geological Society of America. Meeting in conjunction with the GSA South-Central Section will be the Texas Section of the National Association of Geology Teachers and the South-Central Section of the Paleontological Society. The meetings will be held on the campus of Texas Christian University.

CALL FOR PAPERS

Papers are invited for technical sessions, symposia, and poster sessions. The technical sessions will allow 15 minutes for presentation and 5 minutes for discussion. Symposia conveners may assign more time to invited key speakers. Papers of regional interest to geologists in the South-Central Section (Arkansas, Kansas, Oklahoma, and Texas) as well as papers of general interest will be considered for the program. Poster presentations are encouraged. Abstracts for symposia should be submitted directly to the convener(s).

REGISTRATION

**Preregistration deadline:
February 19, 1993**

For lower registration fees and to assist the local committee in planning, please preregister.

Preregistration will be handled by GSA headquarters. Registration forms will appear in the December issue of *GSA Today*. Preregistrants may pick up their registration materials at the Marriott Courtyard Hotel from 4:00 to 8:00 p.m., Sunday, March 14. On-site registration will also be available at that time.

On-site registration will continue on Monday, March 15, 7:00 a.m. to 5:00 p.m., and on Tuesday, March 16, 7:00 a.m. to 12 noon, in the Brown-Lupton Student Center on the Texas Christian University campus.

HOUSING

Blocks of rooms have been reserved at two hotels. You must ask for the TCU/GSA rate when reserving a room.

- Marriott Courtyard
3150 Riverfront Drive (across the street from the Residence Inn)
Fort Worth, TX 76107
(817) 335-1300 [Worldwide reservations: 1-800-321-2211]
\$68, single or double
- Residence Inn by Marriott
1701 South University Drive
Fort Worth, TX 76107
(817) 870-1011
\$69, studio; \$79, double; \$89, penthouse (will hold four people)

SYMPOSIA

The following symposia are planned for the meetings. Please note that abstracts for symposia should be submitted directly to the convener(s) listed below.

1. **Microcomputer Applications in Geology.** Arthur B. Busbey, Department of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.
2. **Urban and Environmental Geology.** Ken M. Morgan, Department

of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

3. **Shallow Groundwater Systems.** Sponsored by the GSA Hydrogeology Division. Joe C. Yelderman, Jr., Department of Geology, Baylor University, Waco, TX 76798-7354, (817) 755-2673.

4. **Environmental Concerns in the Dallas/Fort Worth Metroplex.** Sponsored by the NAGT Texas Section. Donald F. Reaser, Department of Geology, University of Texas, Box 19049, Arlington, TX 76019-0049, (817) 273-2987.

5. **Precambrian Connections across Southern North America.** Kent C. Nielsen, Programs in Geosciences, University of Texas, Dallas, TX 75083, (214) 690-2537; Richard E. Hanson, Texas Christian University.

6. **Geologic Problems To Be Solved by Scientific Drilling.** M. Charles Gilbert, School of Geology and Geophysics, University of Oklahoma, Norman, OK 73019, (405) 325-3253; R. Nowell Donovan, Texas Christian University.

7. **Fractionation Processes in High-Temperature Systems.** David London, School of Geology and Geophysics, University of Oklahoma, Norman, OK 73019, (405) 325-3253; Barry L. Weaver, University of Oklahoma.

8. **Petroleum Geology of the South-Central United States.** R. Nowell Donovan, Department of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270; John A. Breyer, Texas Christian University.

9. **Carbonate Rocks of the Southern Mid-Continent.** R. Nowell Donovan, Department of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

10. **Caves and Karst.** Kenneth S. Johnson, Oklahoma Geological Survey, Energy Center, 100 E. Boyd, Norman, OK 73019, (405) 325-3031.

11. **Sequence Stratigraphy of Cratonic Cycles.** Arthur W. Cleaves, School of Geology, Stillwater, OK 74078-0451, (405) 744-6358.

12. **Geographic Information Systems (GIS) and Land Use Planning.** Ken M. Morgan, Department of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

13. **The Role of Planetary Geology in Teaching Geology Today.** Sponsored by NAGT Texas Section. Donald H. Lokke, 7721 El Padre Lane, Dallas, TX 75248, (214) 239-7920.

FIELD TRIPS

Both premeeting and postmeeting trips will be offered. Unless otherwise noted, all field trips begin and end in Fort Worth. Contact the field trip leaders listed for details about particular field trips.

Premeeting

1. **Sequence Stratigraphy of Middle and Late Pennsylvanian Cycles: North-Central Texas** (2 days, March 13-14). Arthur W. Cleaves, School of Geology, Stillwater, OK 74078-0451, (405) 744-6358; Darwin Boardmann, Merlynd Nestell, University of Texas at Arlington.

2. **Structural and Stratigraphic Correlations across the Grenville Deformational Front in West Texas** (3 days, March 11-14). Kent C. Nielsen, Programs in Geosciences, University of Texas, Dallas, TX 75083, (214) 690-2537; Calvin G. Barnes, Texas Tech University; Kathleen M. Marsaglia, University of Texas at El Paso; Kristian Soegaard, University of Texas at Dallas. Trip will begin and end in El Paso.

Postmeeting

3. **Geology of the Slick Hills of Southern Oklahoma: The Northern Boundary of the Wichita Uplift** (2 days March 17-18). R. Nowell Donovan, Richard E. Hanson, Ken M. Morgan, and Arthur B. Busbey, Department of Geology, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

4. **Environmental Geology and Hydrogeology of the Dallas/Fort Worth Metroplex** (1 day, March 17). Sponsored by the GSA Hydrogeology Division. Joe C. Yelderman, Jr., Department of Geology, Baylor University, Waco, TX 76798-7354, (817) 755-2673.

SHORT COURSES

1. **Valley Fills—A Core Workshop** (1 day). Stuart Strife, Union Pacific Resources, 801 Cherry Street, Mail Stop 3900, Fort Worth, TX 76102, (817) 877-6721.

2. **Subsurface Facies Analysis from Well Logs and Core** (March 14). John A. Breyer, Department of Geology, P.O. Box 30798, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

ABSTRACTS

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

Send one original and five copies of abstracts to be considered for the general technical sessions or poster sessions to Richard E. Hanson, Technical Program Co-Chair, Department of Geology, P.O. Box 30798, Texas Christian University, Fort Worth, TX 76129. Abstracts for symposia should be sent directly to the conveners.

Abstracts deadline: November 20, 1992.

PROJECTION EQUIPMENT

Projection equipment will be provided for 2" x 2" slides in standard 35 mm carousel trays. Please bring your own slide tray(s). Two slide projectors and two screens will be provided for each room. A single overhead projector will also be available in each room.

EXHIBITS

Displays of computer hardware and software and exhibits provided by other commercial vendors as well as book sellers, educational institutions, and government agencies will be on display at the meeting site. Contact Dena Hanson, Exhibits Committee

Co-Chair, Department of Geology, P.O. Box 30798, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

STUDENT SUPPORT

The South-Central Section has funds available for grants to GSA Student Associates who are contributing to the meeting. Students are encouraged to apply for these grants. Most students who qualify will receive some support. Send applications to Rena Bonem, Secretary, South-Central Section, Department of Geology, Baylor University, Waco, TX 76798, (817) 755-2361.

Application letters must be sent by *January 1, 1993*. Letters should include certification that the student is a GSA Student Associate in the South-Central Section and is presenting a paper or poster session at the meeting in Fort Worth.

SPECIAL EVENTS AND SOCIAL ACTIVITIES

A welcoming party for those who have preregistered will be held at the Marriott Courtyard Hotel from 5:30 until 8:00 p.m., Sunday, March 14. Following the technical sessions on Monday, March 15, a reception and open house will be held in the early evening in the courtyard adjoining the main floor of the Sid Richardson Building, which houses the Department of Geology. At the banquet that evening, R. Nowell Donovan, holder of the Charles B. Moncrief Chair of Geology and leader of the AAPG field seminar *GeoRoots*, will treat those in attendance to a spellbinding program on the geology of Scottish castles.

The Texas Section of the National Association of Geology Teachers and the South-Central Section of the Paleontological Society will hold luncheons and business meetings on Tuesday, March 16, in the Brown-Lupton Student Center.

SPOUSE/GUEST PROGRAM

A full menu of activities has been planned. Trips to the Amon Carter Museum and the Sid Richardson Collection of Western Art, both of which house premier collections of Western art, including many works by Russell and Remington, and sightseeing in the Stockyards district in north Fort Worth will provide a distinctly regional flavor. Those with more cosmopolitan tastes can visit the world-renowned Kimbell Art Museum, designed by internationally acclaimed architect Louis Kahn, and the Japanese Gardens at the Fort Worth Botanic Center. The city's newly renovated zoo is also a "must see." For further information contact Jeanne Donovan, Spouse/Guest Program Committee Chair, Department of Geology, P.O. Box 30798, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270.

DETAILED INFORMATION

Complete information concerning registration, accommodations, and activities will appear in the December issue of *GSA Today* and as part of the *Abstracts with Programs* for 1993. Requests for additional information or suggestions should be communicated to the General Chair: John A. Breyer, Department of Geology, P.O. Box 30798, Texas Christian University, Fort Worth, TX 76129, (817) 921-7270. ■

NORTHEASTERN SECTION, GSA 28th Annual Meeting

Burlington, Vermont
March 20-24, 1993

The University of Vermont, Middlebury College, Norwich University, Vermont State Colleges at Johnson, Lyndonville, and Castleton, the State University of New York at Plattsburgh, the Vermont Geological Society, and the Vermont Geological Survey will host the Northeastern Section of the Geological Society of America meeting at the Sheraton Conference Center in Burlington, Vermont. The Eastern Section of SEPM, the Northeastern Section of the Paleontological Society (NE-PS), the Eastern and New England Sections of the National Association of Geology Teachers (ES-NAGT), and the Association for Women Geoscientists will be meeting with the GSA's Northeastern Section. The meeting will be conducted from 8:00 a.m. Monday morning, March 22, to noon Wednesday, March 24. Short Courses and Field Trips will be held Saturday, March 20 and Sunday, March 21.

DETAILED INFORMATION

Information concerning registration, travel, accommodations, and activities will appear in the December 1992 issue of *GSA Today* and as part of the GSA Northeastern Section *Abstracts with Programs* for 1993. Requests for additional information or suggestions should be addressed to the General Cochairpersons, Barry L. Doolan or Rolfe S. Stanley, Department of Geology, University of Vermont, Burlington, VT 05401 (802) 656-0248 or (802) 656-0247.

LOCATION

The Burlington area is on the eastern shore of Lake Champlain, which is bordered to the east by the Green Mountains and to the west by the Adirondack Mountains. The metropolitan area of approximately 120,000 is conveniently located near many of the major ski areas of the east (Stowe, Sugarbush, Bolton). Temperatures during March range from the 30s to the 50s (°F), and sufficient snow is usually available for excellent spring skiing. The area is conveniently served by several major airlines, and rail and an excellent highway system connect with central and southern New England, New York, and eastern Canada.

CALL FOR PAPERS

Papers are invited from students and professionals for presentation at oral and poster theme sessions and general sessions. Fifteen minutes for presentation and five minutes for discussion will be the format for the technical sessions. Papers of regional interest to geologists in northeastern North America as well as those of general geological interest to professionals, teachers, and the general public will be considered for the program. Poster sessions are encouraged. Several special poster sessions are planned for undergraduate students and for K-12 earth science teachers (see below). Every attempt will be made to assure that oral and poster sessions will not conflict with related technical sessions.

SYMPOSIA

The following symposia will be presented at the Burlington meeting. Symposia include invited papers and selected volunteer papers. Prospective authors are encouraged to contact the conveners directly. General information regarding symposia may be

obtained by contacting Rolfe Stanley, Symposium Chairman, Dept. Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405.

1. **Origin and Emplacement History of Allochthons in the Maritime, Northern, and Central Appalachians** (in honor of E-An Zen). Barry Doolan, Dept. Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405, (802) 656-0248.

2. **Thermobarometric Studies and P-T Path Determinations in Mountain Belts**. Robert Tracy, Dept. Geological Sciences, VPI and State University, Blacksburg, VA 24061, (703) 951-6521; Frank Spear, Dept. Geology, Rensselaer Polytechnic Institute, Troy, NY 12181, (518) 270-6476.

3. **Advances in Graphic Correlation**. Keith Mann, Dept. Geology, Juniata College, Huntingdon, PA 16652, (814) 643-4310, ext. 600.

4. **Rivers and Lakes: A Tribute to Brian Rust**. Sponsored by the Eastern Section of SEPM. Martin Gibling, Dept. Geology, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada, (902) 494-2358, fax 902-494-6889; Elizabeth Gierlowski-Kordes, Dept. Geological Sciences, Ohio University, Athens, OH 45701, (614) 593-1101, fax 614-593-4229.

5. **Mineralogy and Geochemistry of Precambrian Terranes** (in honor of Howard W. Jaffe). David Elbert, Dept. Geology, Middlebury College, Middlebury, VT 05753, (802) 388-3711, ext. 5652; James Olmsted, Center for Earth and Environmental Sciences, SUNY, College at Plattsburgh, Plattsburgh, NY 12901, (518) 564-2028.

6. **Advances in the Geology of Vermont and Adjacent Regions** (in honor of Norman L. Hatch, Jr.). Rolfe Stanley, Dept. Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405, (802) 656-0243; Nick Ratcliffe, U.S. Geological Survey, Reston, VA, (703) 648-6939.

7. **Tectonics of the Appalachians, Cordillera, the Earth, Moon, Mars and Other Celestial Bodies** (in honor of Donald U. Wise). Arthur Goldstein, Dept. Geology, Colgate University, Hamilton, NY 13346, (315) 824-7201; Michael Williams, Dept. Geology and Geography, Morrill Hall, University of Massachusetts, Amherst, MA 01003, (413) 545-0745.

8. **Practical Methods for Evaluation of Groundwater in Fractured Bedrock**. Kenneth Hardcastle, Emery and Garrett Groundwater, Inc., 170 Waukegan Street, Meredith, NH 03253, (603) 279-4425, fax 603-279-8717.

9. **Glacial-Marine and Glacial-Lacustrine Environments**. Sponsored by the Eastern Section of SEPM. David Belknap, Dept. Geological Sciences, University of Maine, Orono, ME 04469-0110, (207) 581-2152, fax 207-581-2202; Gail Ashley, Dept. Geological Sciences, Rutgers University, New Brunswick, NJ 08903, (908) 932-2044, fax 908-932-3374.

10. **Plate Tectonics and Terrane Analysis—New Interpretations** (in honor of Philip Osberg). David C. Roy, Dept. Geology and Geophysics, Boston College, 140 Commonwealth Avenue, Devlin Hall, 209 Chestnut Hill, MA 02167, (617) 552-3640, fax 617-552-2462; Rolfe Stanley, Dept. Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405; (802) 656-0247.

11. **Exceptional Fossil Assemblages of Eastern North America: Evolutionary and Ecological Significance**. Sponsored by the Eastern Section of the Paleontological Society of America. Cathryn Newton, Dept. Geology, Syracuse University, Syracuse, NY 13244-1070, (315) 443-3710 or 443-2673.

12. **The Glacial, Lacustrine, and Marine Environment in the Lake Champlain Lowlands**. David Franzi, Center for Earth and Environmental Sciences, SUNY, College at Plattsburgh, Plattsburgh, NY 12901, (518) 564-4033; Donald Pair, Dept. Geology, University of Dayton, Dayton, OH 45469, (513) 229-2921.

THEME SESSIONS

The 1993 GSA Northeastern Section meeting invites papers related to the following broad themes of current interest. Theme sessions are similar to symposia in their focus on specific topics, but each is an open forum

where the papers are volunteered (whereas symposia are largely invited papers). Prospective authors are encouraged to contact the appropriate session conveners directly. The following theme sessions have been proposed and will be held under these titles if enough relevant papers are submitted. If insufficient papers are received, submitted papers will be considered for regular technical oral or poster sessions.

1. **Applied Environmental Geology**. Diane Conrad, State Geologist, Vermont Geological Survey, Agency of Environmental Conservation, Waterbury, VT 05676, (802) 244-5164; Ronald Parker, Wagner, Heindel, and Noyes, Inc., 285 North St., Burlington, VT 05401, (802) 658-0820.

2. **Studies of Recent Lakes**. Allen Hunt, Dept. Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405, (802) 656-0241; Patricia Manley, Dept. Geology, Middlebury College, Middlebury, VT 05753, (802) 388-3711, ext. 5430.

3. **The Use of Geochemistry in Understanding Tectonics of the Appalachians**. Raymond Coish, Dept. Geology, Middlebury College, Middlebury, VT 05753, (802) 388-3711, ext. 5423.

4. **Magma Genesis in the Appalachians**. Judith Hannah, Dept. Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405, (802) 656-0245.

5. **New Advances in Earth Science Education K-12**. Leslie Kanat, Environmental and Health Sciences, Johnson State College, Johnson, VT 05656, (802) 635-2356, ext. 325; Russell Agne, College of Education and Social Services, University of Vermont, Burlington, VT 05405-0160, (802) 656-3356.

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Northeastern Meeting
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6. Northern Appalachian Ore Deposits. Peter Nielson, Division of Science, Keene State College, Keene, NH 03431-4183, (603) 358-2554; Steve Howe, Dept. Geology, Perkins Geology Hall, University of Vermont, Burlington, VT 05405, (802) 656-0245.

POSTER SESSIONS

Poster booths (8' x 8') will be framed by pipe and drape and have three 4' x 8' tack boards. All poster sessions are located in the Lake Champlain Exhibition Hall of the Sheraton Convention Center. For general information and suggestions regarding poster sessions, contact David Westerman, Poster Session Chairperson, Dept. Earth Sciences, Norwich University, Northfield, VT 05663.

Special Poster Sessions

- 1. Undergraduate Research.** The Geology Division of the Council on Undergraduate Research will sponsor this special poster session specifically to highlight undergraduate research. Posters must be written by student(s) only, although their preparation may be facilitated by professionals. Topic emphasis will focus on undergraduate research in any discipline of geology or such related fields as water resources, hydrology, or environmental science. General questions and comments should be addressed to Barbara Tewksbury, Dept. Geology, Hamilton College, Clinton, NY 13323.
- 2. New Advances in Earth Science Education K-12.** The Northeastern and New England Sections of NAGT are cosponsoring this special poster session on earth science education. Posters are invited from K-12 teachers or other educators and professionals involved with earth science education. For general information, contact either Leslie Kanat, Environmental and Health Sciences, Johnson State College, Johnson, VT 05656, (802) 635-2356, ext. 325, or Russell Agne, College of Education and Social Services, University of Vermont, Burlington, VT 05405-0160, (802) 656-3356.

ABSTRACTS

Abstracts are limited to about 250 words and must be submitted camera-ready on the official 1993 GSA abstract

form available from: Abstracts Coordinator, Geological Society of America, P.O. Box 9140, Boulder, CO 80301, (303) 447-2020.

Send one original and five copies of abstracts to be considered for oral or poster theme or symposium sessions to Rolfe Stanley, Technical Program Coordinator, Department of Geology, Perkins Hall, University of Vermont, Burlington, VT 05401, (802) 656-0247. Authors who think that a paper might be suitable for inclusion in a theme session or symposium should send an extra copy of the abstract to the appropriate convener (see lists above).

Abstracts will be reviewed for informative content, originality, and format. Only one volunteered paper may be submitted by each individual, although a person may also be a co-author of papers presented by others. Additional papers may be presented by an individual if they are invited for a symposium.

ABSTRACTS ARE DUE BY OCTOBER 24, 1992.

PROJECTION EQUIPMENT

All slides must fit a standard 35 mm carousel tray. Two projectors and two screens will be provided in each of the technical sessions. Speakers are encouraged to bring their own loaded tray to the meeting.

SHORT COURSES

Four short courses will be offered on the Saturday and Sunday before the meeting. *Preregistration is required for all the short courses.* For further information on costs and registration, please contact the leaders of the appropriate short course or Charlotte Mehrtens, Short Course Coordinator, Department of Geology, University of Vermont, Burlington, VT 05405, (802) 656-3396.

- 1. Hydrogeochemistry.** John Tewhey. This one-day course will focus on the geochemistry of hydrological systems. It was originally presented at Portland, Maine, in 1989 and has been updated substantially since then. *Saturday, March 20, 9:00 a.m. to 5:00 p.m.*
- 2. Kriegering in Geohydrology.** William Parker, Florida State University. Although this course will focus on new statistical methods used in water resources, it has application to other areas such as mineral resources and disciplines involving spatial sampling. *Sunday, March 21, 9:00 a.m. to 5:00 p.m.*

3. Cathodoluminescence in Sedimentary Petrology. Mike Owen, St. Lawrence University. *Sunday, March 21.*

4. System Dynamics in Geology, Water Resources, and the Life Sciences. Rolfe Stanley, Jack C. Drake, E. A. Cassell, and Kenneth Williams, University of Vermont. This course is designed for college teachers, high school teachers, and other professionals who are interested in systems analysis in the geological and life sciences. The course will focus on the use of STELLA (Systems Thinking Experimental Laboratory with Animation), a Macintosh-based, object-oriented computer program written by High Performance of Hanover, New Hampshire. *Sunday, March 21.*

FIELD TRIPS

Participants attending the Burlington meeting will have a choice of several day-long field trips (three premeeting trips on Sunday, one postmeeting trip on Wednesday, and two half-day trips Sunday through Wednesday. All field trips will occur within the Champlain Valley, where snow cover is usually not a problem by the end of March. Trips planned at this time are listed below; the actual trips run at the meeting will depend on weather and participant interest. Requests for additional information and comments should be directed to: Stephen Wright, Field Trip Coordinator, Dept. of Geology, University of Vermont, Burlington, VT 05405.

- Sunday, March 21, 1993.**
The Crown Point Section, Crown Point, New York. Leaders: Lucy Harding and Brewster Baldwin, Middlebury College.
Cretaceous Intrusions and Rift Features in the Champlain Valley of Vermont. Leader: J. Gregory McHone.
Fire and Ice: The Ecology of the Jack Pine Barrens at Altona Flat Rock, Northeast New York. Leaders: David Franzi and Kenneth Adams.
Sunday, March 21 and Tuesday, March 23, 1993.
The Champlain Thrust at Lone Rock Point. Leaders: University of Vermont staff (2-3-hour trip, morning or afternoon).
Monday, March 22, and Wednesday, March 24, 1993.
The Salmon Hole/Redstone Quarry, Burlington, Vermont. Leaders: University of Vermont staff (2-3-hour trip, morning or afternoon).
Wednesday, March 24, 1993.
Groundwater Remediation, Montpelier, Vermont. Leaders: Chris Stone and others. (A one-day field trip of a wetlands area of Lake Champlain is also being considered for either before or after the meeting. Details will be in the Final Announcement.)

EXHIBITS

Exhibits will be located in the Lake Champlain Exhibition Hall of the Sheraton Convention Center. Snacks and refreshments will be continuously available for exhibit visitors. Booths (8' x 10') will be framed by pipe and drape and contain table and chairs. Special rates are available for educational or nonprofit groups or institutions. For further information and space reservations, contact: David Bucke, Exhibits Coordinator, Dept. of Geology, University of Vermont, Burlington, VT 05405 (802) 656-0246.

SPECIAL EVENTS

A wide range of special events for participants and guests is being planned for the conference. Some of the highlights are listed below. For further information, suggestions, and comments

- please contact: Ronald Parker, Wagner, Heindel, and Noyes, Inc., 285 North St., Burlington, VT 05401, (802) 658-0820.
- Sunday, March 21**
GSA Ski Day, Bolton Valley ski area
Welcoming Reception, Sheraton Hotel and Conference Center, 6-10 p.m.
- Monday, March 22**
Association for Women Geoscientists
Breakfast
NAGT Business Meeting and Luncheon
UVM Geology Building Open House and Reception, 3-7 p.m.
Ice Hockey game for GSA participants and guests, 7-9 p.m.
- Tuesday, March 23**
GSA Northeastern Section Management Board Meeting
Paleontological Society NE Section Luncheon
GSA Northeastern Section Reception and Banquet, 6-10 p.m. (presidential address by James McLelland, Colgate University)
Entertainment at Tuckaway's Lounge, Sheraton, 9:30-midnight
- Wednesday, March 24**
5 km Fun Run prior to the technical sessions

Guest Activities

A full range of activities of interest to guests, including walking tours of downtown Burlington and a shopping and historical tour of the Champlain Valley area, is planned. The Burlington area offers a wide variety of entertainment and diversionary options, including the Church Street Marketplace, the Champlain Mill (Winooski), the Vermont Pub and Brewery, the Fleming Museum, the Flynn Theater, and the Ethan Allen Homestead, as well as many fine dining and night spots. A special hospitality room will be reserved for guests. The room will feature information, refreshments, and a place to relax. This room will be the departure point for planned guest excursions.

REGISTRATION

To encourage attendance of pre-college earth science teachers, on-site registration fees will be reduced for K-12 school teachers in public and private schools. One-day registration fees will be available during the meeting for students, professionals, and guests unable to attend more than one day of the conference.

PREREGISTRATION DEADLINE: FEBRUARY 26, 1993.

HOUSING

A large block of rooms has been reserved for meeting participants and their guests at the Sheraton Hotel and Conference Center in Burlington. The Sheraton is conveniently located on Williston Road, with easy access from the I-89 interstate highway. Burlington International Airport is an easy 10-minute drive from the hotel. For conference planning and to ensure very attractive guaranteed room rates, it is important that you reserve your room before February 24, 1993. ■

NATO ADVANCED STUDY INSTITUTE
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June 29 - July 10, 1993

The Institute will treat the structure, microtextures, phase equilibria and kinetics, trace-element and isotope chemistry of feldspars, from the conditions of the upper mantle to diagenesis and weathering, under the guidance of 15 international experts. Participation is open to scientists of any discipline resident in NATC countries and the newly independent countries of Central and Eastern Europe. Membership is limited to 80, which will include doctoral students and experienced scientists selected by the Organising Committee. Some financial support is available but most participants will be expected to pay all of their travel costs and part of their living expenses, at the discretion of the Committee. Participants must stay for the entire meeting and may present research papers. Applications for membership must be submitted before January 31, 1993, on forms obtainable from the Director.

Director: Ian Parsons, Dept. of Geology & Geophysics, The University of Edinburgh, EDINBURGH, EH9 3JW, UK. Fax: 44-31-668-3184.

Organising Committee: W. L. Brown, CRPG, Nancy, France; M.A. Carpenter, Earth Sciences, Cambridge University, U.K.; B.J. Giletti, Geological Sciences, Brown University, U.S.A.; and W. Johannes, Institut für Mineralogie, Hannover, Germany.

DON'T MISS THE GSA MINI BOOKSTORE AT EACH OF THE 1993 GSA SECTION MEETINGS

NORTH-CENTRAL SECTION, GSA 26th Annual Meeting

Rolla, Missouri
March 29–30, 1993

The North-Central Section of the Geological Society of America will meet in Rolla at McNutt Hall on the University of Missouri—Rolla (UMR) campus. The meeting will be hosted by the UMR Department of Geology and Geophysics, the Missouri Geological Survey, Department of Natural Resources, the Department of Geological Engineering, and the Rolla offices of the National Mapping and Water Resources Divisions of the United States Geological Survey. Several associated societies will be meeting in conjunction with the GSA North-Central Section: the International Geological Correlation Programme Project 315 (Correlation of Rapakivi Granites and Related Rocks on a Global Scale), the Pander Society, the North-Central Section of the Paleontological Society, the Central Section of the National Association of Geology Teachers, the Great Lakes Section of the Society for Sedimentary Geology, Region 2 of the National Association of Earth Science Teachers, and the Louis Unfer Mid-Mississippi Valley Region group.

CALL FOR PAPERS

Technical sessions will include all topics listed on the GSA abstract form. Papers, poster sessions, theme sessions, and symposia on these and other subject areas (including all symposia listed below, except number 6) are solicited. Special sessions focused on specific themes or subjects will also be arranged by the local program committee after review of the abstracts. The time allotted for the oral presentations will be 15 minutes followed by 5 minutes for discussion. Due to the increased interest in groundwater and environmental geology, the 1993 meeting will include a symposium of special interest to consultants in those fields. To further GSA's focus on geoscience education, a special symposium is planned for elementary, junior high, high school, junior college, college, and university teachers of earth science or general science, and professional geologists are also encouraged to attend and participate.

REGISTRATION

**Preregistration deadline:
March 5, 1993.**

Preregistration will be by mail and sent to GSA headquarters. On-site registration will take place in the Miner Lounge, Centennial Hall, UMR, on Sunday, March 28, 4:00 to 8:00 p.m., on Monday, March 29, 7:30 a.m. to 5:00 p.m., on Tuesday, March 30, 7:30 a.m. to 2:00 p.m., and on Wednesday, March 31, 7:30 to 11:30 a.m.

Preregistration fees will be \$40 for professional GSA members, or members of associated societies participating in this meeting, and \$10 for GSA Student Associates. For those not affiliated with GSA or the associated societies, preregistration fees will be \$45 for professionals and \$15 for students. On-site registration fees will be \$10 more for professionals and students. Please take advantage of the lower preregistration fees and **register by March 5, 1993!**

SYMPOSIA

The following symposia have been organized. Authors are encouraged to contact the individual symposium organizers for information.

- 1. Midcontinent Carbonate: Depositional Systems and Diagenesis.** Jay M. Gregg, University of Missouri—Rolla, (314) 341-4664.
- 2. Conodonts.** Raymond L. Ethington, University of Missouri—Columbia, (314) 882-6470.

- 3. Clay Minerals and Applications.** Charles E. Stack, A.P. Green Refractories Co., Mexico, Missouri (314) 473-3302.

- 4. Utilization of Limestone in Clean Coal Technologies.** Ardel W. Rueff, Missouri Geological Survey, Department of Natural Resources, (314) 368-2139.

- 5. Crustal Genesis Processes on Terrestrial Planets and Moons.** Raymond E. Arvidson, Washington University, St. Louis, (314) 935-5609.

- 6. Pennsylvanian History of Ozark Uplift.** Wallace B. Howe, (314) 364-1669.

- 7. Ouachita Orogenic Belt and Potentially Related Structures in the Midcontinent.** George W. Viele, University of Missouri—Columbia, (314) 882-3757.

- 8. Petroleum and Mineral Exploration of the Midcontinent Rift Zone.** Pieter Berendsen, Kansas Geological Survey, (913) 864-4991.

- 9. New Madrid Seismic Zone.** James D. Vaughn, Missouri Geological Survey, Department of Natural Resources, (314) 368-2185.

- 10. Karst Terrain and Hydrogeology.** Jerry D. Vineyard, Missouri Geological Survey, Department of Natural Resources, (314) 368-2148.

- 11. Geology and Structure of Mississippi Valley-type Ore Deposits.** Norman Paarlberg, (314) 626-4855.

- 12. Mineralogy and Geochemistry of Mississippi Valley-type Ore Deposits.** Kevin L. Shelton, University of Missouri—Columbia, (314) 882-6568.

- 13. Olympic Dam-Type Deposits in the Midcontinent: Research and Exploration.** Eva B. Kisvarsanyi, Missouri Geological Survey, Department of Natural Resources, (314) 368-2146.

- 14. Sedimentary Ore Deposits.** Richard D. Hagni, University of Missouri—Rolla, (314) 341-4616.

- 15. Consultant's Symposium: Geological Techniques in Environmental Investigations.** John D. Rockaway, University of Missouri—Rolla, (314) 341-4799.

- 16. Hazardous and Low-level Nuclear Waste.** Dale C. Elifrits, University of Missouri—Rolla, (314) 341-4847.

- 17. Geologic Site Characterization: Essential to Waste Facility Siting and Remediation.** Allen W. Hatheway, University of Missouri—Rolla, (314) 341-4777.

- 18. Agricultural Chemicals and Their Effects on Groundwater.** James H. Barks, USGS, Rolla, (314) 341-0827.

- 19. Educator's Symposium for High School and Grade School Teachers.** Jay M. Gregg, University of Missouri—Rolla, (314) 341-4664.

- 20. New Automated Techniques for Topographic and Geological Map-Making.** Michael J. Starbuck, USGS, Rolla; E-mail: spole@atsvax.rsmas.miami.edu.

- 21. Geographical Information Systems.** Michael J. Starbuck, USGS, Rolla; E-mail: spole@atsvax.rsmas.miami.edu.
- 22. Applied Mineralogy.** Richard D. Hagni, University of Missouri—Rolla, (314) 341-4616.

- 23. Paleontological Perspectives on Global Change.** Roy E. Plotnick, University of Illinois, Chicago, (312) 996-2111.

THEME SESSIONS

- 24. Coal-Bed Methane Resources in Sedimentary Basins.** Joy Bostic, Missouri Geological Survey, Department of Natural Resources, (314) 368-2156.

- 25. Geology of the Mid-Mississippi Valley Region: Structure, Stratigraphy, and Regional Fluid Movement** (2nd Louis Unfer, Jr. Symposium). Gary R. Lowell, Southeast Missouri State University, Cape Girardeau, (314) 651-2351.

- 26. Radon in the Mid-Centinent Region.** Geza Kisvarsanyi, University of Missouri—Rolla, (314) 341-4663.
- 27. Cambrian-Ordovician Petroleum Reservoirs (Knox Unconformity).** Annabelle Foes, University of Akron, (216) 972-6990.

FIELD TRIPS

The field trip coordinator is Keith Wedge, Missouri Geological Survey, Department of Natural Resources, (314) 368-2141.

Premeeting

- 1. Ozark Region Carbonate Depositional Environment.** Jay M. Gregg,

(314) 341-4664.

- 2. Environmental Aspects of Mining in Eastern Missouri.** James C. Brown, Jr., Missouri Geological Survey, Department of Natural Resources, (314) 368-2162.

Postmeeting

- 3. Geohydrology and Waste Disposal in Eastern Missouri.** Bill Duley, Missouri Geological Survey, Department of Natural Resources, (314) 368-2163.

- 4. Viburnum Trend Lead-Zinc Deposits** (Underground Tour) Richard D. Hagni, University of Missouri—Rolla, (314) 341-4616.
- 5. Precambrian Geology, Southeast Missouri** (IGCP field trip). Eva B. Kisvarsanyi, Missouri Geological Survey, Department of Natural Resources, (314) 368-2146.

ADDITIONALLY drill-core workshops will examine core from the Boss-Bixby iron-copper-cobalt deposit and Cambrian carbonates.

POSTER SESSIONS

We strongly encourage student and professional members to take advantage of this highly effective means of communication. Please indicate Poster Session on the GSA abstract form. Each poster booth will provide three 4' x 4' boards arranged at table height. Poster sessions will be located in the same vicinity as the exhibits and refreshments and will be available for viewing for one-half day.

ABSTRACTS

Abstracts must be submitted camera-ready on official 1993 GSA abstract forms in accordance with instructions on the forms. Abstract forms are available from: Abstracts Coordinator, Geological Society of

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AAAS, Carnegie Commission Seek Names for Database

The American Association for the Advancement of Science (AAAS), in collaboration with the Carnegie Commission on Science, Technology, and Government, is assembling a database of individuals in the fields of science, technology, and public policy in the United States. The database will be used by AAAS and the Carnegie Commission to publicize and distribute reports and publications, to develop invitation lists for conferences and workshops, and for similar purposes. Our target audience includes individuals in government, universities, the private sector, media, nonprofits, and other organizations interested in general science and technology policy issues or in related policy areas, such as energy, space, science and math education, and health and biomedicine.

Individuals who would like to be considered for inclusion in the database may request a brief questionnaire from Elizabeth Broughman, Director for Science and Policy Programs, AAAS, 1333 H Street, N.W., Washington, DC 20005, phone (202) 326-6600, fax 202-289-4950.

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CO 80301, (303) 447-8850, and from GSA Campus Representatives at most college and university campuses.

ABSTRACTS DEADLINE:
December 2, 1992.

Send one original and five copies to: Richard D. Hagni, Department of Geology and Geophysics, 125 McNutt Hall, University of Missouri—Rolla, Rolla, MO 65401, (314) 341-4616. Abstracts submitted for inclusion in symposia and theme sessions should be submitted directly to the symposium or theme session organizer.

All abstracts will be reviewed for informative content, proper format, and originality. Authors will be notified of acceptance well in advance of the meeting.

STUDENT PAPERS AND TRAVEL ASSISTANCE

The North-Central Section of GSA will award \$75 for each of the eight best papers whose principal author and presenter is a graduate or undergraduate student. Abstracts submitted for these awards should be clearly indicated. In addition, awards for travel assistance will be made to students who are members of the GSA North-Central Section as of January 1993. To receive a travel grant, the student must present a paper (oral or poster) of which he or she is the author or co-author at the meeting. Applications for travel assistance awards may be obtained by writing the General Chairman (Richard D. Hagni, Department of Geology and Geophysics, 125 McNutt Hall, University of Missouri—Rolla, Rolla, MO 65401, (314) 341-4616. Applications must be received by January 7, 1993.

PROJECTION EQUIPMENT

Two standard 35 mm carousel projectors and one overhead projector will be provided in each meeting room for 2" x 2" slides and transparencies. Please bring your own loaded carousel trays identified with your name, session, and speaker number. A speaker-ready room equipped with projectors will be available for review and practice.

BUSINESS MEETING

The GSA North-Central Section Management Board will hold its business meeting with breakfast in the Silver and Gold Room, University Center, UMR on March 29, 1993, at 7:00 a.m.

EXHIBITS

Exhibits of educational and commercial organizations will be on display in McNutt Hall in proximity to the symposia, theme, technical, and poster

sessions. Exhibit space must be reserved by January 7, 1993. For further information, contact: Kerry Grant, Local Arrangements Chair, Department of Geology and Geophysics, 125 McNutt Hall, University of Missouri—Rolla, Rolla, MO 65401, (314) 341-4616.

SOCIAL EVENTS

A welcoming reception will be held on the evening of Sunday, March 28, in the Miner Lounge, Centennial Hall, from 5:00 to 9:00 p.m. On Monday evening, March 29, the annual banquet of the North-Central Section will be held at the UMR Centennial Hall at 7:00 p.m., preceded by a social hour beginning at 6:00 p.m. in the Miner Lounge. USGS Director Dallas L. Peck will speak at the banquet on "Future Directions of the U.S. Geological Survey."

The Great Lakes Section of SEPM and the North-Central Section of the Paleontological Society will hold a joint luncheon on Monday, March 29, at 12:00 noon in the Meramec Room, Centennial Hall, UMR. On Tuesday, March 30, the National Association of Geology Teachers and the GSA North-Central Section Education Committee will hold a joint luncheon in the Silver and Gold Room, Centennial Hall, UMR, at 12:00 noon. The North-Central GSA Campus Representatives will hold a breakfast on Tuesday, March 30, in the Silver and Gold Room, Centennial Hall, UMR, at 7:00 a.m.

HOUSING

Motel rooms will be available in Rolla and nearby towns. Numerous restaurants within walking distance of McNutt Hall offer a variety of foods.

TRAVEL ARRANGEMENTS

Rolla and the University of Missouri—Rolla are easily accessible by automobile via Interstate 44 and Highway 63. McNutt Hall is located at the corner of Highway 63/72 and 14th Street at the northwest corner of the University of Missouri—Rolla. Motels are available along Interstate 44, Highway 63, City Route 44, and Martin Spring Drive. Rolla also can be reached by commercial airplane to the St. Louis Lambert Airport and then by Greyhound bus from the airport to Rolla, a distance of about 110 miles west.

DETAILED INFORMATION

All sessions, registration, and the banquet will be held at McNutt and Centennial Halls at UMR. Special arrangements can be made for luncheons and/or special meetings by contacting the Local Arrangements Chair, Kerry Grant, Department of Geology and Geophysics, 125 McNutt Hall, UMR, Rolla, MO 65401, (314) 341-4616. Information concerning registration, hotel accommodations, and other activities will appear in the December 1992 issue of *GSA Today* and in the North-Central Section *Abstracts with Programs* for 1993. Symposia and field trips listed for this meeting are in the planning stage, and further suggestions are welcome. Inquiries, additional information, requests, or suggestions should be directed to: Richard D. Hagni, General Chairman, Department of Geology and Geophysics, 125 McNutt Hall, University of Missouri—Rolla, Rolla, MO 65401, (314) 341-4616, fax 314-341-6935, E-mail on the BITNET 2 System: Geology2@-UMRVMB.UMR.EDU. ■

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1992 Honorary Fellows Named

Lee Gladish

The achievements of two internationally known geoscientists will be recognized at the 1992 GSA Annual Meeting in October. GSA Council members, at their meeting last May, voted to confer Honorary Fellowship upon the two, who represent two diverse disciplines of geology, who are from very different places, and who had to suspend their geological pursuits temporarily because of major political upheavals. They are Hans Füchtbauer, Bochum, Germany, and Yang Zun-yi (Tsun-yi), Beijing, Peoples Republic of China.

GSA Honorary Fellowships are awarded to outstanding geologists who have distinguished themselves internationally through their geological work or have rendered special service to the Society. Most Honorary Fellows live outside North America.

Hans Füchtbauer

Rumor has it that Füchtbauer was hired in 1949 by a small German oil company while mopping his brow immediately following the defense of his Ph.D. thesis at Göttingen. More likely it was the next day that he accepted a position with *Gewerkschaft Elwerath*, the beginning of a challenging period of research and production that would last for nearly 20 years. According to Füchtbauer it was "the diverse, multi-faceted, scientifically stimulating, and unrestrained activity in this company" that shaped him as a scientist. A small team, at arm's length from big research centers and their often overheated working climate, permitted him to work unhindered on important scientific problems, ranging from classical sedimentological studies, such as of the alpine molasse, to diagenesis, sedimentary geochemistry, and energy-related problems. In each of these subfields, he made significant

and lasting contributions. In his work on authigenic feldspars, he was the first European sedimentologist to observe and understand the intimate relations between precursor phases, solution chemistry, and the nature of authigenic feldspar.

The culmination of his period with industry research was the publication of landmark papers on two major sedimentary basins, the Zechstein and the Molasse. His work on clastic diagenesis during that period still has an impact, known by some as the "Füchtbauer



effect"—the inhibition of sandstone cementation by hydrocarbon migration into primary or secondary pore space.

Füchtbauer began his formal academic studies in 1939 with Hans Cloos in Bonn and completed them, after the interruption of World War II, in 1949 with Carl Correns in Göttingen. Following his employment with *Gerwerk-*

schaft Elwerath, he accepted in 1967 the chair in sedimentary geology at Ruhr University, Bochum, and for nearly two decades headed one of Germany's leading groups in sedimentary geology. He served as dean of the geoscience faculty and as vice president for research of the Ruhr Universität. He was the founder of the International Association of Sedimentologists and served as both its president and the editor of its journal. Füchtbauer edited the 1970 textbook *Sediments and Sedimentary Rocks*; his own contribution constituted more than half of the 1100 pages.

Yang Zun-yi (Tsun-yi)

In 1939, with his brand-new Ph.D. from Yale University, Yang Zun-yi (given name in most records is Tsun-yi; new pinyin is Zun-yi) returned to his native China at the height of the second Sino-Japanese war and entered government service as a professor and director of two provincial geological surveys. His former Yale classmates heard excellent things about his progress until 1949 when the "Bamboo Curtain" descended. Then his classmates dared not write to him for fear of exacerbating suspicions about an American-educated geologist in a country in the throes of political revolution. Finally, in 1979 it was learned that Yang had been busy teaching and writing papers, even though interrupted during World War II when he served as Secretary of the British Military Mission to China for two years and during China's Cultural Revolution when he spent several years relegated to menial farm labor under brutal conditions.

Yang's chief interests are stratigraphy, especially the Permian-Triassic sequence, and invertebrate paleontology of China, as correlated with the rest of the world. Many of these studies have involved less-explored and relatively unknown parts of China.

While doing geologic mapping and collecting in many of the source areas for his research material, he taught field geology to his students. From 1947 to 1956, he mapped in and

around the Western Hills of Peking and Choukoutien, the Kaiping Basin in eastern Hopeh, parts of Chechiang, and northern Shansi and Shantung. From 1959 to 1961, he supervised 1:200,000 quadrangle mapping of Kansu, Kweichou, Hunan, Chechiang,



and Changhsi and in 1962 made detailed stratigraphic studies of various Carboniferous and Permian coalfields in Shantung. When relations with China improved after the "Gang-of-Four" years, it was suggested that Yang prepare a monograph on the geology of China. The book appeared in the early 1980s and is now a standard reference on the geology of that country, covering a record of the work that went on during the 30 years China was closed to outsiders.

Yang has taught and done research for more than 50 years as professor and head of departments at Sun Yat-sen University, Qinghai University, Peking Institute of Geology and Geological Exploration, and Wahan College of Geology. He continues to direct the studies of graduate students, at the University of Geosciences, and to pursue his research interests. ■

About People

GSA Member **Thomas Ahrens**, California Institute of Technology, has been elected a member of the National Academy of Sciences. Fellow **Carlton Brett** has received the University of Rochester's Edward Curtiss Peck Award for Excellence in Teaching. Fellow **Emery T. Cleaves** has been appointed State Geologist and Director of the Department of Natural Resources for the Maryland Geological Survey.

Recently elected officers of SEPM include GSA Member **Harry E. Cook**, USGS, Menlo Park (president); Member **Sherwood W. Wise, Jr.**, Florida State University (president-elect); and Member **Emily L. Stouft**, Texaco Exploration and Production, Houston (secretary-treasurer); Fellow **S. J. Mazzulo**, Wichita State University, was elected councilor for research activities.

GSA Member **Lucy E. Edwards**, USGS, Reston, was recently elected chair of the North American Commission on Stratigraphic Nomenclature, and Member **Donald E. Owen**, Lamar University, Beaumont, Texas, is the new vice-chair. Fellow **Gerald M. Friedman**, Brooklyn College and City University of New York, Graduate School, was recently awarded honorary membership in the Geological Society of Israel. Fellow **Seymour S. Greenberg** has retired from the Department of Geology and Astronomy at West Chester [Pennsylvania] University. Fellow **Paul R. Krutak** has been appointed chair of the Department of Geosciences at Fort Hays State University, Hays, Kansas, where he plans to reinstate micropaleontology as part of the curriculum. Member **Barney Lewis** has been

named the new chief of the Wyoming District of the USGS Water Resources Division, in Cheyenne.

American Geophysical Union awardees for 1992 include GSA Fellow **Alfred O.C. Nier**, University of Minnesota, the William Bowie Medal, and Fellow **Luna B. Leopold**, University of California, Berkeley, the Robert E. Horton Medal.

GSA Member **Michael J. Passow**, White Plains [New York] Middle School, has received one of the first four regional Catalyst awards from Chemical Manufacturers Association, for excellence in teaching middle school science. Fellow **John W. Rold** has retired as state geologist and director of the Colorado Geological Survey.

SEPM has awarded its William H. Twenhofel Medal to GSA Fellow **Peter R. Vail**, Rice University; honorary membership to Fellows **Raymond L. Ethington**, University of Missouri, Columbia, and **Orrin H. Pilkey**, Duke University; and the Raymond C. Moore Medal to Fellow **Raymond C. Gutschick**, University of Rochester.

GSA Fellow **Donald E. White**, Menlo Park, California, was one of two honorees of the International Association of Geochemistry and Cosmochemistry at a special symposium in July. Fellow and GSA President **E-an Zen** has been awarded the Major John Sacheverell A'Deane Coke Medal by the Geological Society of London. ■

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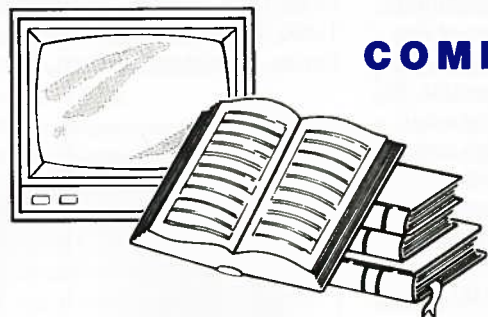
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GSA Penrose Conferences

September 1992

Origin and Emplacement of Low-K Silicic Magmas in Subduction Settings, September 25-30, 1992, Chelan, Washington. Information: James S. Beard, Virginia Museum of Natural History, Martinsville, VA 24112, (703) 666-8611, fax 703-632-6487; George W. Bergantz, Dept. of Geological Sciences, University of Washington, Seattle, WA 98195, (206) 545-4972; Marc J. Defant, Dept. of Geology, University of South Florida, Tampa, FL 33620, (813) 974-2238, fax 813-974-2668; Mark S. Drummond, Dept. of Geology, University of Alabama, Birmingham, AL 35294, (205) 934-8130.

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 to 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, B.C. V6B 1R8, Canada.

MESOZOIC AND EARLY CENOZOIC DEVELOPMENT OF THE GULF OF MEXICO AND CARIBBEAN REGION
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Gulf Coast Section Society Of Economic Paleontologists and Mineralogists Foundation Thirteenth Annual Research Conference
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TECHNICAL PROGRAM

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Preliminary List of Speakers and Topics

- S.T. Algar and J.L. Pindell Relationship between pre-Middle Miocene Sedimentation and Tectonics in Trinidad
- Hans G. Ave Lallemand and V.B. Sisson Caribbean-South American Plate Interactions: Constraints from the Cordillera de la Costa Belt, Venezuela
- Peter Bartok Pre-breakup Geology of the Gulf of Mexico-Caribbean: Its Relation to Triassic and Jurassic Rift Systems of the Region
- Mark R. Bitter Provenance of the Chicotepec Sandstones and Implications for Uplift of the Sierra Madre Oriental and Teziutlan Massif
- Richard T. Buffler, D.A. DeBalko and L.M. Dobson Middle Jurassic through Early Cretaceous Evolution of the Northeast Gulf of Mexico
- S. Cao, K. Petersen, I. Lerche and A. Lowrie (1) Cretaceous and Tertiary Structural History in Northern Louisiana (2) Basement Motion and Sediment Loading: A Quantitative Study in the Northern Louisiana, Gulf of Mexico
- Andrew J. Davidoff Deep Basement Structure and Sedimentary Fill of Central East Texas: Tectonic Implications
- Johan P. Erikson Aptian-Albian Stratigraphy in NE Venezuela and Implications for Lateral Variations in Passive Margin Sedimentation
- J.C. Fiduk and D.S. Hamilton Identifying Potential Field Extensions by Integrated Reservoir Characterization and Seismic Analysis: Eocene Strata of Duval County, South Texas
- David J. Hall and B. E. Bowen Mesozoic and Early Cenozoic Development of Texas Rifted Continental Margin: A New Integrated Cross-Section from the Cretaceous Shelf Edge to the Perdido Folded Belt
- Stuart A. Hall, I. Najmuddin and R. Buffler Constraints on the tectonic development of the Gulf of Mexico provided by magnetic anomaly data
- Mark R. Hempton and J.A. Barros Cuba-Bahamas Arc-Margin Collision: Constraints on Timing of Suturing
- Mark R. Hempton and J.A. Barros Mesozoic Stratigraphy of Cuba: Depositional Architecture of a SE-Facing Continental Margin
- Garry D. Karner, J.L. Pindell and U. Mello Geological Development of Overpressuring in the Gulf of Mexico and the Generation of Hydrocarbons
- David T. King Paleogeography of Paralic and Shelfal Facies, Upper Santonian to Uppermost Maastrichtian Coastal-onlap Stratigraphy, Alabama Gulf Coastal Plain
- Hemin Koyl Centrifuge Modeling of Segmentation and Emplacement of Salt Sheets
- Hemin Koyl and Kenneth Petersen Basement Faulting: A Complementary Triggering Mechanism for Diapirism
- Maria E. Lara Tertiary Tectonic Evolution of the Belize Southern Lagoon
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GSA Journals on Compact Disc Coming for 1993

Jim Clark, GSA Production & Marketing Manager

Subscribers to GSA journals and *GSA Today* are being offered a new option for the 1993 subscription year—*GSA Journals on Compact Disc*. The "CD" option is being offered as an annual version in ISO 9660 format CD-ROM, to be supplied at the end of each subscription year.

The first CD will contain all 1993 issues of *GSA Bulletin*, *Geology*, and *GSA Today*, plus the complete 1993 *GSA Data Repository*. As an introductory bonus, this edition also will contain all 1992 issues of the same publications, plus the 1991 issues of *GSA Today*. That's two full years of both journals and the *Data Repository* and three full years—all issues published—of *GSA Today*.

Future annual volumes of the CD will contain the current year of each of the above publications, plus titles, authors, and abstracts for all articles from some range of years prior to 1992. How large that range ultimately will be, and how quickly we can recapture those data will depend to a large extent upon the response to this new

offering from our members and library subscribers.

The sidebar article provides detailed technical information on the CD and equipment requirements. Briefly, however, the disc will be usable on most IBM-compatible AT-class PCs or Macintosh computers equipped with hard drives and CD-ROM drives. With a PCL-capable laser printer, printing will also be possible. With that basic equipment, users will be able to browse issues, view page images and text in detail, and print complete pages. High-resolution, gray-scale images will be provided of all photographs in the issue, and all color illustrations will be included as VGA-quality color images.

When working with the CD, you will be able to switch between the graphic mode and a window containing the complete, searchable ASCII* text of all articles in *GSA Bulletin* and *Geology*, and of the science articles in *GSA Today*.

All data in the science articles, letters, opinions, and comment/discussion and reply sections are arranged in fields: titles, authors, abstracts, article text, and references, plus an "all text" field. This arrangement makes it possible to make computer searches of any specific field, or of all fields, for names, words, or phrases.

The search function of the retrieval software is extremely powerful, creating a "virtual index" of all ASCII text in all science articles. There is almost no limit, therefore, to what you will be able to search for—any word or any phrase in any field—or all fields! Locating earlier references will become fast, easy, and sure as our data base grows.

A copy of *GSA Journals on Compact Disc* is the same size and shape as an ordinary audio compact disc (CD), 4¾" in diameter (its "jewel case" holder is 5" square by ½" thick). Compare the shelf space needed for the two discs in the

introductory package to the space needed for the equivalent 24 issues of *GSA Bulletin*, 24 issues of *Geology*, two complete issues of *GSA Data Repository*, and 36 issues of *GSA Today*—more than 7,000 pages!

Price of the first edition of *GSA Journals on Compact Disc—1993* to a GSA member or student associate is \$99 if you also subscribe to the paper or microfiche format of either or both journals; it is \$120 to a member or student associate who does not. Price for nonmembers is \$125 for those who subscribe to either or both journals in paper or microfiche; it is \$175 for those who do not.

The *GSA Journals on Compact Disc* will be demonstrated at GSA's 1992 Annual Meeting in Cincinnati, at booth 562, next to the GSA Bookstore.

An archival CD containing all three years of *GSA Today* only (1991, 1992, and 1993—all published issues) is also being offered. However, because these same issues are included at no extra cost on the *GSA Journals on Compact Disc*, this item will be of interest primarily to libraries. It will be available to members, nevertheless.

A descriptive brochure on the new CDs was mailed in August with members' dues statements and with *pro forma* subscription invoices to libraries and others. If you did not receive a copy and would like one, just write or call the GSA marketing department.

Will the compact disc replace printed copies? Not for a long while, if ever. But it *does* provide an extremely powerful new tool for locating and retrieving data quickly and a new, economical approach to archiving journals. For these reasons, it holds immense promise for the future of scientific research.

Members of GSA's Publications Committee voted unanimously to support the startup of this project. Considerable interest also was expressed in the recapture of the titles, authors, and abstracts of previous-year articles, mentioned above.

We welcome opinions and suggestions from the membership on the usefulness of this new tool, and on the prospect of recapturing those earlier data. Write to J. Clark, GSA Marketing Manager, P.O. Box 9140, Boulder, CO 80301-9140. ■

The basics on CDs

Using GSA's new CDs

Jim Clark, GSA Production & Marketing Manager

You can use GSA's new compact discs on most modern personal computers: either an AT-class IBM-compatible PC or an Apple Macintosh. Be sure to specify which when ordering.

Users of AT PCs will need DOS 3.0 operating system, or later; a minimum of 480 KB of free RAM (random access memory); a hard disk drive with at least 2 MB free for loading the retrieval software; and a CD-ROM drive in ISO 9660 for-

mat—the "standard" format for personal computers.

Macintosh users will need an Apple "Mac Plus" or higher, with Operating System 6 or later. You will need the same hard-drive space and the same type of CD-ROM drive as the AT PC.

To print from either computer, you will need a PCL-capable laser printer. "PCL" is the print language of the HP LaserJet series, which also is emulated by several other laser printers. Print accelerator cards are supported by the access software.

Although any CD-ROM drive in the ISO 9660 format will work, the speed of the search and data retrieval functions is primarily a function of the speed of the drive, so the faster the drive, the faster the search/retrieve. Drive speed is expressed as "average access time," and should be in the range of 350 for best results.

Technically, GSA's compact discs are CD-ROMs (Compact Disc-Read Only

Memory), identical to the familiar audio CDs. Like magnetic computer disks, they store data for retrieval through a personal computer, but the similarity ends there.

As their name implies, the discs can only be read (by a computer); a user cannot change the data on them. Another difference is the immense amount of data stored on CDs, up to 675 megabytes. This translates to about 5000 or so pages of searchable text and graphical page images on our discs.

Wordkeeper® data-retrieval software is provided with the *GSA Journals on Compact Disc*, along with an operator's manual and the scientific data. The software loads quickly and easily, and is very intuitive in use. Pull-down menus are always available, and in several test loadings no difficulties have been encountered. However, registered users will be entitled to use a special "help hotline" telephone number in case they encounter any problems. ■

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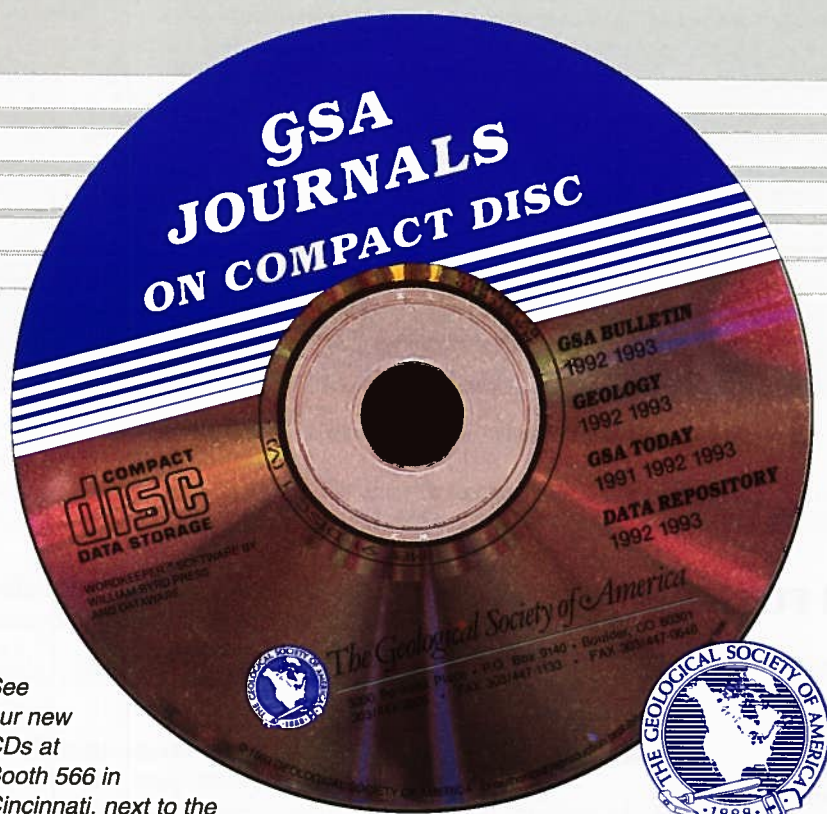
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The Geological Society of America
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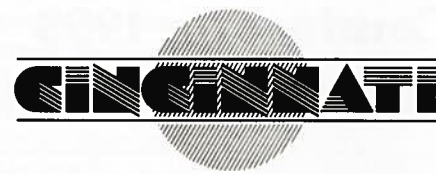
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GSA ANNUAL MEETINGS

1992

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



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

Field trip chairmen: Thomas Berg and John Rupp

Technical Program chairmen: Nicholas Rast and Roy Kepferle

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

Student Travel Grants

The Northeastern, Southeastern, and South-Central Sections of GSA are offering financial assistance to GSA Student Associates who are enrolled in institutions within these sections for travel to the 1992 Annual Meeting in Cincinnati in October. Application forms and additional information may be obtained from the section secretaries:

Northeastern Section: Kenneth N. Weaver, (410) 554-5559;
deadline: September 20.

Southeastern Section: Michael J. Neilson, (205) 934-5102;
deadline: October 1.

South-Central Section: Rena M. Bonem, (817) 755-2361;
deadline: October 1.

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 1993 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 8 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.

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The current Dean, Don L. Warner, has announced his retirement. The Dean of the School of Mines and Metallurgy reports to the Chancellor and is responsible for the administration of the School through its departments and centers. Academic training, professional experience and achievements, and demonstrated success in administration will be considered in the selection process.

Applications and nominations for the position should be submitted to: C. Dale Elifrits, Chairman, Search Committee for the Dean of the School of Mines and Metallurgy, Rm 206 Parker Hall, Univ. of Missouri-Rolla, Rolla, MO 65401. It is requested that dossiers be submitted to be received before October 5, 1992, when the selection process will begin. University of Rolla is an Equal Opportunity Institution.

GSA SECTION MEETINGS

South-Central Section, Texas Christian University, Fort Worth, Texas, March 15-16, 1993

Richard E. Hanson, 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

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

David J. Furbish, Department of Geology, Florida State University, Tallahassee, FL 32306-3029, (904) 644-5892. *Abstract Deadline: December 7, 1992*

Cordilleran and Rocky Mountain Sections, 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. *Abstract Deadline: January 26, 1993*

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 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.

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University of Texas at Austin, Institute for Geophysics, Ewing/Worzel Fellowship in Marine Geology/Geophysics, Seismic Processing, Seismology, Neotectonics, and Regional Tectonics. Graduate Fellowships are available from the Institute for Geophysics of the University of Texas at Austin. The Ewing/Worzel Fellowship Fund was established by Palisades Geophysical Institute in 1987 and is named after Maurice Ewing and J. Lamar Worzel, two former directors of the geophysical laboratory. Candidates are expected to have a bachelors or masters degree in geology, geophysics, physics, computing, mathematics, electrical engineering or other related field and must be accepted in a graduate program of one of the University academic departments.

The Institute for Geophysics is an organized research unit of the University of Texas and employs approximately 25 full-time researchers. Fellows are expected to ally themselves with a member of the Institute for Geophysics research staff and either generate an original research project or join an existing project during their first year.

The Fellowship amount is \$12,000 per nine month academic year, which is intended to provide for tuition and fees, as well as a generous stipend. Fellowship recipients are eligible for in-state tuition. Additional support, including summer support, may be awarded after the first year, depending on the research performance of the individual.

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Questions about the fellowship program, and requests to be considered for a Fellowship should be directed to Dr. Paul Mann, Chairman, UTIG Fellowship Committee, 8701 N. MoPac Expressway, Austin, Texas, 78759 (tel. 512-471-6156). Application materials for admission as a graduate student may be obtained from the Graduate Studies Office of the appropriate academic department of The University of Texas at Austin. The Dept. of Geological Sciences application materials may be obtained and submitted through Ms. Ann Page, Dept. of Geological Sciences, The University of Texas, Austin, Texas 78731 (tel. 512-471-6098).

The Spring 1993 deadline for completed applications for admission as a graduate student and for requests to be considered for a fellowship is October 1, 1992. The Fall 1993 deadline is February 1, 1993.

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).

Doctoral Studentship in Quaternary Paleolimnology. The Geology Institute of the ETH has a studentship available beginning October, 1992 for the study of Quaternary lake environments in the Swiss Alps. 2 years of initial funding have been secured, with good expectations of renewal. The work involves field studies and lake sampling in the upper Engadin region (near St. Moritz), and laboratory studies of microfossils and sediments.

The student will work under the supervision of Drs. Barbara Mohr and David Lazarus, and together with an interdisciplinary team of Quaternary micro-paleontologists, sedimentologists, and geochemists. Candidates should have completed their Diplom (German speaking countries), Masters (US/Canada), or equivalent degree in earth or environmental sciences. Knowledge of German helpful but not required. A stipend of SFr 25,000/yr (~\$US 17,000), plus benefits, is included. Applicants should send a curriculum vitae, and the names and full addresses of 3 references to: Dr. David Lazarus, Geologisches Institut, ETH-Zentrum, CH-8092 Zürich, Switzerland. Telephone: 041-1-256-5695 or -3714, fax 041-1-252-0819 or -7008. Bitnet Addresses: GONZO@ERDZ.ETHZ.CH (EARN Network).

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).

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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@cfvrm.bitnet.

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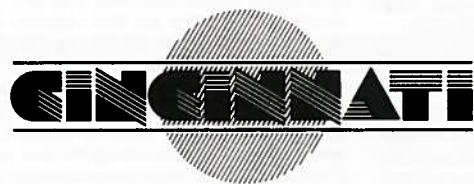
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1992

**GSA ANNUAL MEETING
OCTOBER 26-29**



For Technical Program Information
see page 198 in this issue.

For Registration and Housing Information
see the August issue of *GSA Today*.

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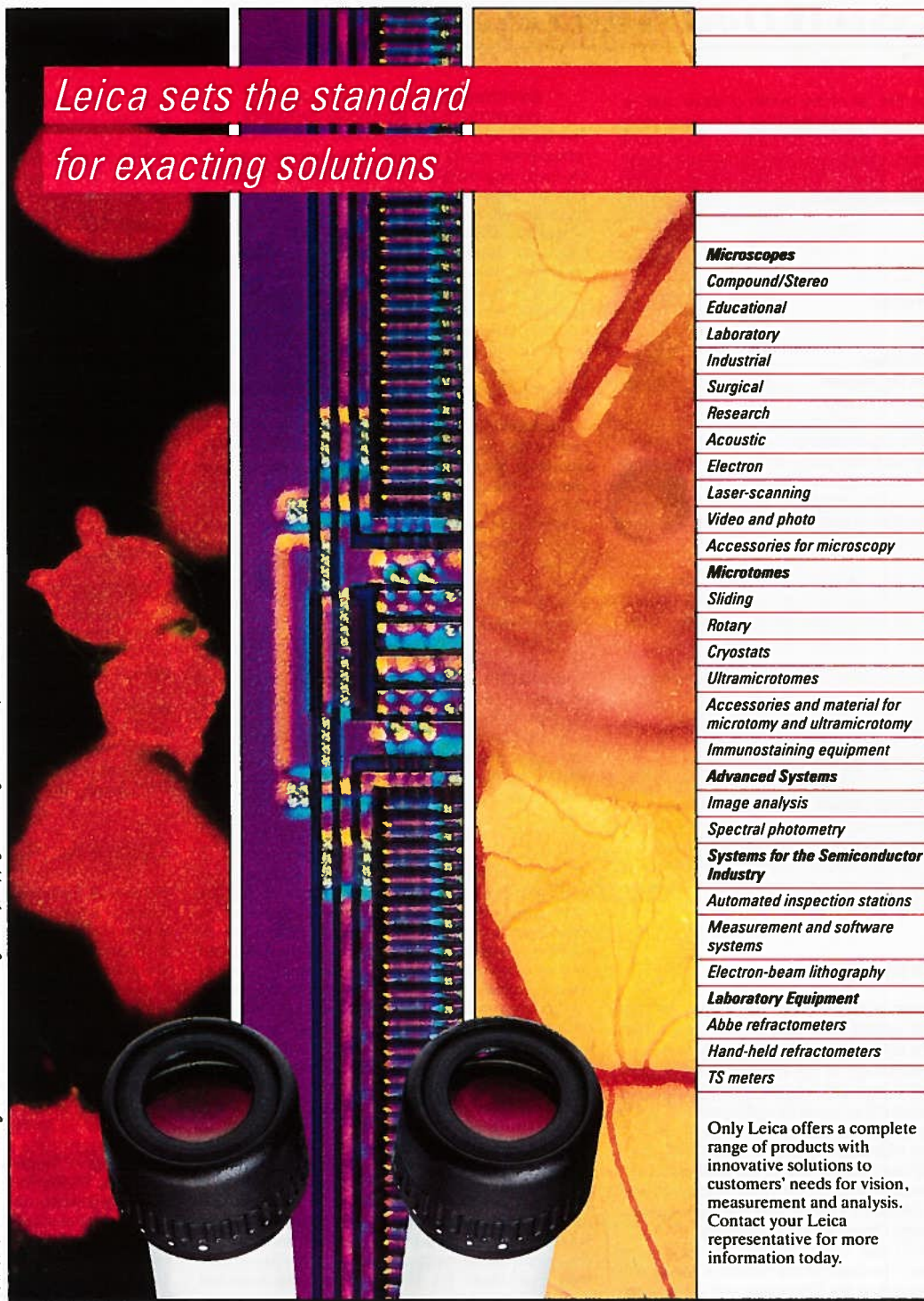
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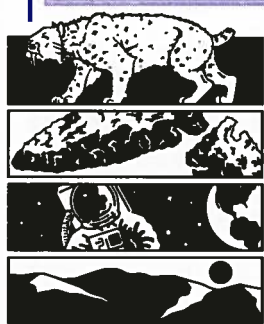
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