ABSTRACT

Neo-Darwinian evolutionary theory argues that species and faunas are exquisitely adapted to their environment and should respond when their habitat changes. To test this hypothesis, the mammalian response to four of the largest climatic events of the Cenozoic (as documented by the marine record, oxygen isotopes, land plants, and other climatically sensitive organisms) are examined. These events occurred during the global cooling at the end of the middle Eocene (37 Ma), the cooling and drying event in the earliest Oligocene (33 Ma), the spread of C4 grasslands in the late Miocene (7 Ma), and the rapid climatic fluctuations of the Pliocene-Pleistocene (2.5 Ma to present). In each case, there is relatively little short-term response of the mammalian fauna. Typically, there is greater turnover millions of years before and after the time of climatic change than during the climatic event itself. This pattern suggests that the climatic control on mammalian evolution is much more complex than previously supposed, or that intrinsic biotic controls may be more important than extrinsic environmental controls.

INTRODUCTION

One of the central tenets of neo-Darwinian evolutionary theory is the idea that organisms are highly responsive to changes in their environment caused by climate, and readily adapt to environmental selection pressures. Evolutionary biologists have documented many elegant (but small-scale and short-term) examples of organisms responding to environmental selection (Weiner, 1994). One explicitly testable hypothesis related to this idea was Vrba’s (1985, 1993) “turnover pulse” hypothesis, which suggests that most evolutionary turnover events are correlated with episodes of major climatic change. The turnover pulse idea has appeared in many recent books that purport to explain human evolution as a response to climatic change and instability (Stanley, 1996; Potts, 1996; Boaz, 1997).

However, a growing body of data conflicts with the notion that all organisms are highly sensitive to climatic changes, and respond by adaptation to environmental selection pressures. One of the surprising outcomes of the punctuated equilibrium model of Eldredge and Gould (1972) has been recognition of the prevalence of stasis among species through millions of years and many episodes of climatic change (Eldredge, 1995, p. 64). This is not to say that most organisms are insensitive to climate. For some groups of organisms, such as microplankton or land plants, the response to environmental change is well established. However,
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the environmental sensitivity of other organisms (especially marine invertebrates and terrestrial vertebrates) is less obvious.

In recent years, the potential to document and evaluate such patterns with excellent, detailed fossil records of certain organisms has greatly improved. The development of high-resolution chronostatigraphy with integrated biostratigraphy, magnetostratigraphy, and 40Ar/39Ar dating has allowed paleontologists to directly date and correlate patterns of faunal response in both the marine and terrestrial realms at a very fine scale. It is now possible to test aspects of the “turnover pulse” hypothesis with a much better data base than was available only a decade ago.

We now can ask whether turnover pulses are typical of the history of mammals. Broad, long-term changes in mammalian faunas (spanning tens of millions of years) apparently correlate with the well-documented climatic changes of the Cenozoic (Webb, 1977; Webb and Opdyke, 1995; Janis, 1989, 1993), but do mammalian faunas respond to rapid, short-term climatic changes, as predicted by the turnover pulse model? Alroy (1995, 1997, 1998) showed that there was a very poor correlation between the turnover patterns of North American Cenozoic mammals and accepted proxies of climatic change, such as the global oxygen isotope record. Hill (1995) and Behrensmeyer et al. (1997) argued that the turnover pulses reported by Vrba (1985) for African Pliocene-Pleistocene mammals are not substantiated by the much larger database of Pliocene mammals from the Tugen Hills and Turkana Basin of Kenya. Thus, even the original data set that led to the turnover pulse hypothesis is under question.

In Memoriam

Thomas F. Bates
State College, Pennsylvania
June 19, 1999

William F. Jenkins
Newburyport, Massachusetts
March 18, 1999

Sheldon Judson
Princeton, New Jersey
May 28, 1999

Charles J. Orth
Los Alamos, New Mexico
October 6, 1994

John D. Ridge
Charlottesville, Virginia

Richard C. Thompson
San Francisco, California
June 27, 1999

Robert T. White
Lafayette, Louisiana
July 2, 1999

Please contact the GSA Foundation for information on contributing to the Memorial Fund.

Did You Remember To Vote?

The GSA ballots to elect officers for 2000 and councilors for the term 2000-2002 are due September 13, 1999.

Don’t forget to vote!

Please note, for the ballot you received, this updated information on Council: Position 3 Nominee Mary P. Anderson. PROF. EXP.: PROF. HYDROGEOLOGY, UNIV. WISCONSIN-MADISON, 97-99.
As new chief executive officer of GSA, I’m thrilled to have this opportunity each month to talk to the Society’s members and friends. As good as it is, however, GSA Today is a one-way medium. By itself, it can’t give us the open, immediate and interactive communication we need as a scientific society on the verge of a new millennium.

There’s Lots to Talk About

GSA’s Strategic Plan, approved by Council in 1998, set the stage for sweeping change, while preserving and building on our 111-year heritage. The inspiring vision on which the plan is based reads, “GSA will be a broad unifying scientific society: fostering the human quest for understanding Earth, planets, and life; catalyzing new scientific ways of thinking about natural systems; and applying geoscience knowledge and insight to human needs and aspirations and stewardship of the Earth.”

It’s my job to lead the headquarters staff in implementing the Strategic Plan on your behalf. But we have a mutual responsibility to discuss and debate the issues that arise from our individual interpretations of the vision. In that spirit, here’s a brief overview of what you can expect to see in the months ahead.

GSA’s main focus will continue to be the science on which the Society was founded. We’ll pursue our mission of advancing the geosciences and the professional growth of our members through our traditional disciplines and Divisions. At the same time, we’ll aggressively pursue integrated science that crosses disciplines within our field and with allied sciences.

In the coming months, you’ll also see GSA’s intrinsic values take their place alongside the science. We’ll explore the concept of stewardship and our role as stewards of earth science knowledge and of Earth itself. We’ll strive to de-politicize this term, exploring its meaning for both the environmentalists and natural resource professionals among us. If GSA is to grow into its vision of a broad, unifying scientific society, unification must begin here at home. As a Society, we intend to model for others the kind of discourse that makes this possible.

We’ll better articulate the role of service at GSA—service to our members, to the geoscience education community, and to society as a whole. We intend to encourage and support geoscientists in offering their services in whatever ways are most rewarding and meaningful to them.

You’ll also be hearing about the “globalization” of GSA. This may seem like a departure from how we’ve thought of ourselves in the past, but in fact, it’s an acknowledgement of trends already well underway.

Ways to Get in Touch and Stay in Touch

I’m looking forward to lively exchange of ideas on these and other subjects. You can call me at my office here at headquarters (303-447-2020, ext. 139) or send e-mail to ceo@geosociety.org. You can post questions to me on the GSA Web site, www.geosociety.org, by going to “How to Contact Us” and clicking on “Ask Sara Foland.”

We’re also considering a series of interactive chat room sessions on topics of interest. Watch for details on the Web site and here in GSA Today.

I hope to meet as many of you as possible at next month’s Annual Meeting in Denver. Watch for notices in Down to Earth, the daily meeting newsletter, about locations where you can stop by and say hello. We’ll be joined, at various times, by GSA President Gail Ashley, Vice President Mary Lou Zoback, and 1999 Annual Program Committee Chair Sharon Mosher.

I’m excited about working with you all as we move this venerable organization forward. We are GSA. Let’s stay in touch.

TESTING THE HYPOTHESIS

What is the mammalian response to the major climatic events of the past 50 m.y.? The highly detailed climatic history now available for much of the Cenozoic allows us to pinpoint certain episodes of major environmental change (as recognized in marine faunas, oxygen isotopes, land plants, and other climatically sensitive organisms). With improved dating and correlation, we can examine any mammalian response to each of these global climatic events. If the turnover pulse hypothesis is generally valid for Cenozoic mammals, there should be similar responses to the other great climatic crises of the Cenozoic. Four major climatic events stand out (see below). This study excludes turnover events such as those at the Paleocene-Eocene boundary, or the Grande Coupure in the European Oligocene, because those episodes include significant immigrational turnover, which complicates the picture of in situ change.

Test 1—Middle Eocene Event

The first major step in the climate change of the Cretaceous through middle Eocene “greenhouse world” was the profound cooling event at the end of the middle Eocene, dated at 37.0 Ma (Berggren and Prothero, 1992; Berggren et al., 1995) (Fig. 1). Oxygen isotope records from benthic foraminifera show that the oceans cooled by about 4–5 °C at this time (Miller et al., 1987). Boersma et al. (1987) argued that there was a major cooling of oceanic bottom waters, which became decoupled from surface waters. In response to this rapid cooling and oceanographic change, there was a major extinction in the warm-water foraminifera (Boersma et al., 1987), a major extinction of many long-lived tropical nannoplankton (Aubry, 1992), and extinctions in the bivalves (84% of species) and gastropods (89% of species) in the Gulf Coastal Plain (Hansen, 1987, 1992). By any standard, the end of the middle Eocene was a dramatic cooling and extinction event, especially in the marine realm.

The terrestrial paleoclimatic record of the middle-late Eocene transition is rather limited, but there are some important clues. Land plants from Alaska to the Gulf Coast indicate dense tropical forests with more than 1 m of annual rainfall, while those of the overlying upper Eocene Chadron Formation received between 500 and 1000 mm and were less densely forested (Retallack, 1983).

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How did land mammals respond to these climatic changes? The middle-late Eocene boundary at 37.0 Ma is now correlated with the boundary between the Duchesnean and Chadronian North American land mammal “ages” (Prothero, 1995; Prothero and Emry, 1996). Most mammalian faunas can be correlated with this interval through a combination of magnetic stratigraphy and 40Ar/39Ar dates. In west Texas, the Duchesnean-Chadronian transition can be directly calibrated between 40Ar/39Ar dates of 36.7 ± 0.07 and 37.8 ± 0.15 Ma, and by correlation with other faunas, the overall pattern in North America can be determined.

All recent studies of this interval conclude that there was very little change in mammalian faunas between the Duchesnean and Chadronian. Large-scale compilations of species and generic diversity and turnover (Stucky, 1990, 1992; Alroy, 1998) show no significant diversity changes or unusual turnover rates between the late Duchesnean and early Chadronian; there was a stable equilibrium value of between 72 and 84 genera throughout this 5 m.y. (40–35 Ma) interval (Fig. 2). Turnover rates are about average for the late Paleogene. In fact, Emry (1981) and Wilson (1984, 1986) argued that the Duchesnean could be considered a “sub-age” of the Chadronian, because the differences were so slight. A much greater faunal change (Fig. 2) occurred between the early Duchesnean and the late Duchesnean (Wilson, 1986; Lucas, 1992). This turnover occurred at 39 Ma, 2 m.y. before the climatic change in the oceanic realm (Prothero and Emry, 1996).

Test 2—Early Oligocene Event

On the basis of the oxygen isotope curve (Miller et al., 1987) or the land floras (Wolfe, 1978, 1994), the most significant climatic event in this interval was the first significant Antarctic glaciers, and about 5–6 °C of global cooling (Miller et al., 1987; Miller, 1992). The cooling was as drastic as that at the end of the middle Eocene, and extinctions in the marine realm were almost as severe. There were major extinctions in the calcareous nannoplankton (Aubry, 1992), diatoms (Baldauf, 1992), and benthic foraminifera (Gaskell, 1991). Gulf Coast molluscs were decimated again; 97% of gastropod species and 89% of bivalve species disappeared after their late Eocene recovery (Hansen, 1987, 1992). Echinoids dropped 50% in species diversity at this time (McKinney et al., 1992). Planktonic foraminifera underwent a minor extinction; most surviving early Oligocene species were small, low in diversity, and cold adapted (Boersma et al., 1987).

Numerous climatic indicators show that the earliest Oligocene was a time of rapid (less than a few thousand years) change in terrestrial habitats. Land plants from the Gulf Coast to Alaska indicate a decrease of 13 °C in mean annual temperature, a great increase in seasonality (mean annual range of temperatures increased dramatically from about 5 °C to almost 25 °C), and much drier climates (Wolfe, 1978, 1994). Floras indicate that most of North America changed from paratropical forests (like those of tropical Central America) to broad-leaved deciduous forests (like those of New England) in a very short period of time. Paleosols from the Big Badlands of South Dakota show that late Eocene forests, which received more than 1 m of rainfall, were replaced in the early Oligocene by open scrublands with less than 500 mm of annual precipitation (Retallack, 1983, 1992). In Douglas, Wyoming (Fig. 1), flood-plain deposits were replaced by eolian deposits, indicating even greater trends toward aridity (Evanoff et al., 1992). Late Chadronian land snails are large forms adapted to wet, subtropical habitats (like those of modern central Mexico). In the early Orellan they were replaced by smaller taxa with restricted apertures, typical of drier climates, like those of modern Baja California (Evanoff et al., 1992). Late Chadronian reptiles and amphibians were pre-dominantly aquatic taxa, such as crocodilians, pond turtles, and salamanders, but only dry land tortoises are common in the Orellan (Hutchison, 1982, 1992).

How did land mammals respond to this dramatic change in their environment? As Prothero and Heaton (1996) have shown, there was almost no response (Fig. 2). The earliest Oligocene climatic event (middle early Orellan, Chron C13n) was almost ignored by land mammals. Of 70 species known from the earliest Orellan, 62 persisted unchanged into the late Orellan. Most of the modest faunal responses during the Chadronian-Orellan transition had already taken place more than 250 k.y. before the climatic crash of the early Orellan. But even these changes were unimpressive: A few archaic groups from the Chadronian, such as the brontotheres, oromerycid artiodactyls, and cylindrodon rodents disappeared, and the oreodont Miniochoerus underwent slight dwarfing, but most mammalian lineages showed no changes worth documenting. Compared to the 177 species now documented for this interval, this is a remarkably mild response to what all the other evidence indicates was a major climatic and floral change. This lack of change cannot be dismissed as an artifact of sampling or preservation, because the White River Group in eastern Wyoming is densely fossiliferous through all of the relevant interval (Prothero and Heaton, 1996; Evanoff et al., 1992).
Test 3—Late Miocene Carbon Isotopes and Grasslands

One of the classic cases of evolutionary response to climate is the well-known story of how some herbivorous mammals acquired high-crowned teeth for eating gritty grasses in the Miocene. This is most often noted in the evolution of horses, but it also occurred in camels, bovids, pronghorns, rhinoceroses, and other groups (Webb, 1983). Scientists have long pointed to this as a clear example of an evolutionary response to a climatic and vegetational change. There is a major problem with this scenario: the timing is all wrong. Hypsodont horses, camels, rhinos, and bovids all first developed their high-crowned teeth in the middle Miocene (about 15–16 Ma), but geological evidence of extensive C4 grasslands (the grasses that now dominate most temperate and tropical latitudes) did not become widespread until the late Miocene (8–7 Ma), at least 7 m.y. later (Quade et al., 1989; Cerling, 1992; Cerling et al., 1997). Retallack (1997) has argued that there must have been an expansion of C3 grasslands in the middle Miocene, but if this is so, we have no modern analogues for such a vegetation (Wang et al., 1994).

Regardless of how one tries to explain this mismatch between teeth and vegetation, the C4 carbon isotope signal, which marks the great expansion of tropical and temperate grasslands and savannas at 8–7 Ma, produces another climatic-evolutionary enigma (Cerling et al., 1997). The carbon isotopic records of several areas (in North America, South America, East Africa, Pakistan) indicate a dramatic and abrupt global isotopic event at 7 Ma. C4 grasslands must have rapidly taken over huge areas in lower and middle latitudes at this time (Fig. 3).

Such a dramatic vegetational change should have led to drastic changes in the mammalian faunas that ate the grasses, especially in their abundance, extinction, and diversification. Yet, a detailed examination of the mammalian record does not support this. In North America, the 7 Ma isotope event falls at the early-late Hemphillian boundary (Woodburne and Swisher, 1995). The change in carbon isotope values at this time was dramatic (Cerling et al., 1997). Before 7 Ma, the values range between ~7‰ and ~14‰ (all C3 plants), but after 7 Ma, there are numerous values above ~7‰ and some as high as ~15‰ (mostly C4 plants). At the end of the early Hemphillian, there was some extinction in the horses, browsing camels, and pronghorns (Webb, 1983; Webb et al., 1995), for a total of 9 genera of large ungulates, and 27 genera overall (Stucky, 1990). But only 33 new genera (Stucky, 1990) appeared as the grasslands expanded in the late Hemphillian, and there was no great increase in grazing taxa. No new grazing ungulate genera were added, and the percentage of grazing taxa actually declines from 87% in the late Clarendonian-early Hemphillian to 80% in the late Hemphillian Coffee Ranch Quarry, Texas (Webb, 1983). Janis et al. (1999) found no increases in grazing ungulate taxa in this interval.

In addition, much greater turnover (45 new early Hemphillian genera, 36 Clarendonian genera extinct) marked the beginning of the Hemphillian (9.0 Ma), which was 2 million years before the C4 grasslands appeared. The most significant turnover event (37 new genera, 63 genera extinct) of the entire Miocene occurred 2.5 million years later, at the end of the Hemphillian (4.5 Ma), when most of the savanna fauna of North America (especially among the horses, camels, pronghorns, protoceratids, dromomerycids, rhinoceroses, gomphotheres, and mylaluidas) disappeared (Webb, 1983).

In Asia, isotopic data (Cerling et al., 1997) show an abrupt and dramatic increase in grasslands at 7 Ma (Fig. 3). Before 7 Ma, the δ13C values are between ~5 and ~14 ‰, but after 7 Ma, the values range from 0 to ~25 ‰. Barry (1995) showed the detailed history of faunal change (mostly bovids and rodents) in the well-studied Siwalik deposits of Pakistan. There was a major turnover event between 9.0 and 8.5 Ma, but none at 7 Ma (Fig. 3). In fact, turnover rates (both first and last occurrences) declined dramatically after 8.0 Ma (Barry, 1995). Cerling et al. (1997) suggested that there were some faunal replacement events between 8 and 7 Ma, but this change in dominance is not reflected in the overall taxonomic turnover. In addition, there are many pulses of turnover throughout the Miocene of Pakistan that do not seem to be correlated with any known climatic event. Researchers have argued that these data are evidence of climatically driven turnover, but much of the turnover has no apparent climatic explanation (Barry et al., 1985). Even if higher-resolution studies should show more turnover at 7 Ma, the salient fact remains that turnover was higher before and after the C4 event.

In western Europe, the pattern is similar. Köhler et al. (1998) showed that there were two major faunal turnover events in the Neogene mammals of Spain, one at 10-9 Ma, and the other at 6.5 Ma, but none at 7.0-7.5 Ma. This is consistent with the episodes of maximum turnover in Pakistan. Köhler et al. (1998) suggested that the synchronous turnover across Western Eurasia uncorrelated with the C4 grasslands (which developed in Pakistan but not in Spain) supports a model of protracted faunal change that is caused by more complex forcing factors than a single climatic change.

Isotopic studies from East Africa (Cerling et al., 1997) document a significant carbon isotope event between 9 and 7 Ma. Yet Hill (1987, 1995) argued that the faunas of East Africa show little evidence of grassland dominance until Pleistocene time. Leakey et al. (1996) also found little faunal change in the 9-7 Ma interval. South America also shows the 7 Ma carbon isotope event (MacFadden et al., 1994, 1996; Cerling et al., 1997; Latorre et al., 1995).

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1997), yet there was no obvious response in turnover or hyp- sodonty of South American mammals (MacFadden et al., 1994, 1996).

Test 4—Pleistocene Climatic Changes
The most rapid climatic fluctuations of the entire Cenozoic have occurred in the past 2 m.y.a. when climate has been con- trolled by 120 ka glacial-interglacial cycles. In the classic neo-Darwinian model that postulates species adapting to each cli- matic change, we would expect that such climatic variability would trigger much adaptation and speciation in Pleistocene mammals. Yet Barnosky (1987, 1994) and Barnosky et al. (1996) have shown that the response is much more complicated than this. Most Pleistocene mammals persist through many climatic cycles. They usually respond to climate change not by evolving
new adaptations and producing new species, but simply by
migrating north or south as climatic belts shift in latitude. Rela-

tively few evolutionary changes (other than size changes) can be
directly attributed to climatic change. The same evolutionary sta-
dard has been documented in Pleistocene reptiles and amphib-

CONCLUSIONS
Palaeontologists and evolutionary biologists have long sought to explain the excellent fossil record of land mammals, with its many dramatic faunal changes, and examples of adaptations (such as high-crowned teeth or long limbs) in terms of the Ceno-

zoic changes in vegetation and climate. As our understanding of the fossil record of mammals improves, and the dating of the rel-

dent deposits reaches higher levels of resolution and precision, it is possible to test hypotheses of climatic causes for evolutionary changes in much greater detail. In each of these four examples of independently established climatic change (as documented by
the marine record, terrestrial isotopes, and terrestrial soils, plants, and climatically sensitive organisms), there are very few instances of direct response of the mammalian fauna to a specific, tempo-
rally limited climatic stimulus. Instead, the striking feature of each of these abrupt climatic changes is the lack of response of land mammals, even though in each example, it is clear that land plants and other elements of the terrestrial biota are responding. Clearly, the response of mammalian faunas to climatic stimuli is
much more complicated than we have previously suspected. As
previous studies of species and faunal stasis have shown, many
organisms are much more stable in face of environmental change than classic neo-Darwinian models have previously supposed.

In past studies of excellent faunal records through long peri-

do"es of time, scientists tried to explain each pulse of turnover by a

specific external environmental event. Yet as the quality of the
dating and of external records of climate improves, the emerging
picture is not one of each pulse of turnover having a direct cli-

matic cause. Instead, we are finding that many faunal events occur with no obvious extrinsic trigger, and many other climatic changes seem to cause no mammalian faunal change. On the
longer-term scale, this is similar to the conclusions reached by
Alroy (1995, 1997, 1998), who found that few of the major
global climatic events (as represented by changes in marine oxygen iso-
topes) were correlated with peaks of mammalian turnover in
North America, and vice versa. This noncorrelation seems to
reveal an inherent bias toward focusing on possible instances of climatic causation of faunal change, and ignoring all the other unexplained turnover events. Instead, an objective (and statistically
valid; Alroy, 1998) view of the mammalian faunal record in the
Cenozoic leads to the conclusion that few turnover events can be directly tied to specific climatic changes.

This suggests that scientists should be more skeptical and more rigorous when they wish to suggest a cause-and-effect rela-
tionship between short-term climatic and faunal change. Such

relationships may exist, but scientists must establish correlation on a very highly resolved chronostratigraphic basis before these hypotheses can be evaluated. To date, when such detailed correla-

tions have been established between global climatic signals and
terrestrial faunal change, the response has been contrary to expectations.

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Manuscript received March 12, 1999; accepted July 8, 1999.
While scientists know that human actions have global implications, recent research has shown that human impact on Earth is considerably more complex than first thought (see, for example, Houghton et al., 1996). Although this knowledge renders public consciousness of geoscience issues increasingly more important, the public has not had sufficient access to scientific facts or thought processes to allow them to make educated decisions on lifestyle and resource allocation. This has led to the creation of a society that often makes short-term, reactive decisions based on little—or, worse, incorrect—scientific data. However, recent public interest in geoscience issues presents each and every geoscientist with an exciting opportunity to participate in creating a discriminating, educated society committed to the responsible use of Earth and its resources. GSA urges each of you to set aside at least one day during Earth Science Week to reach out to your community.

Creating a public that respects and utilizes appropriate scientific research requires a commitment from the scientific community to improve science literacy. GSA members are uniquely equipped to assist in this effort by using the language of the public to communicate: (1) critical thinking skills with which the public can effectively separate accurate scientific data from pseudo-scientific propaganda, and (2) factual geoscience information directly related to the quality of human life. Teaching these basic skills and knowledge to the public helps citizens make more informed decisions not only about geoscience issues, but also...
about other aspects of their lives. Making better decisions improves the quality of people’s lives, which, in turn, benefits each of you as geoscientists, because the public only allocates resources to support projects and skills that it views as valuable to society.

Tips and Resources for Successful Earth Science Week Experiences

There are many ways individual scientists can contribute unique skills, knowledge, and time toward enhancing science literacy. The type of activity you choose to pursue depends on your skills and interests. Some geoscientists prefer to talk to students about geoscience careers, geology in the movies, or the local geologic setting. Others lead local officials on natural hazard field trips, work with policy makers on geoscience legislation, or encourage local bookstores to create a special display of geoscience books during Earth Science Week. No matter what your interest, the following tips and resources can greatly increase the success of your outreach experience:

◆ Examine how your research relates to the quality of human life. If you plan to discuss your research with the public, spend some time examining how your research relates to the lives of your audience. This gives both you and your audience a sense of the value of your work, and encourages your audience to view scientists as approachable and interesting.
◆ Work on your project with a local teacher. For many geoscientists, language simplification is the greatest barrier to effective communication. According to Partners for Education Program (PEP) member Bill Houston, “There’s a big gap between the public and the scientific community. If scientists can learn to convey the simplest science in a way the public can understand, people get a lot more out of it.” One effective way to enhance your ability to communicate with the public is to work on your project with a local geoscience teacher. Teachers are masters at translating scientific lingo into language the public understands. One place to find geoscience teacher partners is at your children’s school or at the education department of your local museum. Alternatively, consider joining PEP for help connecting with a teacher in your area. PEP provides partnering tips, project ideas, and access to a national database of scientists and educators engaged in outreach. For more information on PEP, visit our Web site at www.geosociety.org/educate/pep.htm.
◆ If appropriate, involve the media. Involving the media is an easy way to increase the size of the audience you reach during Earth Science Week. Invite the press if you plan to host an open house at your research institute, lead a public field trip, or assist with a geoscience fair at a local school.
◆ Utilize existing Earth Science Week resources for project ideas. Both GSA and AGI provide resources for Earth Science Week projects. GSA offers a list of project ideas, a list of geoscience books recommended by GSA, links to useful Web sites for information and ideas, and a stamp design and directions for those of you who would like to ask your local post office to set up a special cancellation booth during your Earth Science Week activities. These resources are available via GSA’s Earth Science Week Web site at www.geosociety.org/educate/earthweek.htm. AGI offers free Earth Science Week kits, which contain project ideas, classroom activities, extensive tips for a successful Earth Science Week experience, posters (one of which you received in the July issue of GSA Today), and bookmarks. To order a kit, or to access most of this information on-line, visit AGI’s Earth Science Week Web site, at www.earthsciweek.org.

The geoscience community has received a public mandate to participate in the development of a conscientious society that values geoscience research and respects Earth’s resources. However, the success of Earth Science Week depends entirely on each individual’s contribution to this effort. Start thinking now about how you can use Earth Science Week to reach out to your community. This is a mandate we cannot afford to ignore.

Reference Cited
WASHINGTON REPORT

Bruce F. Molnia, bmolina@erols.com

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

Meet Charles Groat, Director of the U.S. Geological Survey (Part 2)

Last month, GSA Today published the first half of an interview with Charles G. Groat, new Director of the U.S. Geological Survey (USGS). This month’s Washington Report concludes the interview.

GSA Today: Are there any customer groups that the USGS should deal with that might allow it to come closer to becoming a household word?

Groat: On every street corner, in every house, and in every business, there are people affected by our programs and products. Most of them don’t know it. Every effort we make to increase our visibility can strike a resonant chord with almost everybody. Somebody once said to me that when they came out to USGS headquarters and saw all of the interesting things we do, they thought, “The Discovery Channel is right here.” People come to our open houses and see all of these things that they are curious about, or find exciting. They identify them with us, and all of a sudden, we are more visible, and people start to think about us.

GSA Today: Several years ago, a DOI Assistant Secretary said that she found Water Supply Papers and many products of the Water Resources Division very useful, but she had yet to see a Geologic Division product that made any sense to her. Is there a need for a much more concerted effort to put the output of the USGS into words that can be understood by the general public?

Groat: We need to use effective means of communication such as the World Wide Web and TV-based approaches. In addition to the general public, there is a whole group of professionals who could apply our products on a big scale, but we don’t reach them because we are so traditional. Our practice of writing things for a very technical audience, whether it’s a Professional Paper, a Water Supply Paper, or a Bulletin, served us well in communicating with technical people. But if we are targeting decision-makers, policy people in industry, government, or the private sector, we must have products for them. “Decision-support system” is a generic term for what we need to master, a way of getting that technical stuff into an intelligible and rational format that is not “talking down” but that isn’t so caught up in jargon. It goes back to the importance of starting out with your customers, your clients, and your partners as you design something. The next step is how we get this information to the customer so they can use it. Almost every science program needs a communications strategy as an integral part of it. With the customers and clients, you tailor the product so they can use it. The nice thing about maps and reports on demand is that you can do that; one format doesn’t have to fit all. We can use the flexibility that information technology gives us to meet specific needs.

GSA Today: Some federal agencies have used Madison Avenue-type marketing strategies. About 15 years ago NASA launched its “Mission to Planet Earth” project with well-prepared, broadly distributed graphics and press kits. They spent money to saturate every potential market, especially on Capitol Hill, with an attractive, understandable brochure. The USGS, on the other hand, has relied on its scientific merits and its laurels and has never gone that commercial, outreach route. Is this a necessity in the changing world that we live in?

Groat: NASA has an appealing product and an exciting mission that almost everybody is interested in. The posters, the graphics, the school programs, the Earth system science materials have been very effective. We need to make everybody aware of us, but we can’t afford to do it the way NASA does. I don’t necessarily think that we would ever come together with NASA, but a close partnership with NASA could be a marriage made in heaven. The danger is that they are so big, so influential, and so PR conscious that they could just gobble you up. On the other hand, they provide a technology that has never been exploited to its potential, because that isn’t a part of their mission. But they are recognizing, more and more, that unless they do demonstrate applications, they will have problems with support for their programs. The USGS, an earth science and life science organization that has a multitude of applications for good technology, provides a natural opportunity to work together. If we can ever do it on the basis of mutual benefit it could work well. I think there is a case where we would ride the tail of their great public identity by having our logo next to theirs in some of these things that do reach everyone, from the kids in kindergarten to the people planning giant construction projects and resource management projects. This is a case where, through partnering with people who are already very visible, we can do great science and increase our visibility.

GSA Today: You joined the USGS from an academic background. Do you see stronger cooperative ties developing with academic institutions?

Groat: Being able to partner and collocate with universities gives us reasonably priced facilities and a supply of fresh, young minds, in the form of graduate students and undergraduates, that can help our science. It gives us faculty collaborators who bring compatible interest in science to the table. It’s a way of building our capabilities and our support in the least costly and most flexible sort of way, because it can be done on a project basis or a program basis. It’s also a way of adding to our capabilities. If there are fields that are important to us and, because of budget and position limitations, we can’t plunge into them, we can build that capability through university partners. Whether it’s social science or economics, partnering with universities also provides new opportunities for them. Because they have a funding agency on their campus, they have ways to support their graduate students and their faculty...
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GSA Today: There have been very few new geological positions at the USGS. Do you have any thoughts about how the USGS might acquire some “new blood”?

Great: Cooperating with universities is one way. Term appointments, details back and forth, and IPAs (Intergovernmental Personnel Act—formal exchanges of staff) are other mechanisms. The tragedy that we must avoid as a bureau is what the 1995 Geologic Division reduction in force (RIF) was, in a microcosm. We must avoid being in a position where the maturity of our scientists and staff consumes our available funding to the point where we don’t have any program money and when someone retires we can’t replace them because we need their salary to operate. One answer to that is program limitations, cutting back on what we are trying to do, and using that money to support people. The second is budget growth, more than what just covers cost of living increases for existing people and programs. That is part of our push with the Secretary of the Interior right now. The only way we will get to do that is because you don’t have the people to do the programs, then you have lost your identity as a science organization. We can’t afford to do that. I really see that maintaining our scientific staff and its ability for it to grow as the most overwhelming challenge that we face.

GSA Today: The 1995 Geologic Division RIF resulted in the loss of more than 500 positions. Do you see any future resizing of the USGS needed to meet White House directives?

Great: I hope that if we do our business well, are serious about meeting our customers’ needs, serious about outreach, and serious about identity and raising our profile, no one will have any reason to consider severe cuts to the USGS budget. If we let that happen again, it is our own fault. I don’t see anything, other than an extremely conservative President or Administration, in the midst of a major budget crisis, having any reason to force us to do that.

GSA Today: The 1995 RIF coincided with several large buyouts (retirements with a cash incentive). More individuals retired and took buyouts (more than 1,000) than were lost in the RIF (about 530). Do you believe that the USGS has recovered from the buyouts and the downsizing of the past few years?

Great: I think that there are still some scars and negative feelings about the loss of colleagues and their expertise. Losing senior people through buyouts is a concern in terms of continuity and institutional memory. We have not been able to hire a lot of new young people to replace those lost in the buyouts and in the RIF. We haven’t accomplished an objective of building long-term replacements through hiring young people needed to feed the system.

GSA Today: A major interest of President Clinton and Vice-President Gore is “reinventing government,” making government do more at less cost. If USGS were asked to do more with less, how would you respond?

Great: I don’t think that we can do more with less, frankly. The expectation that we can just keep heaping unfunded mandates on people and they will produce has reached its limits. This increases the frustrations that come from not being able to get more or new people. People can get excited about things but not feel that they have enough hours left in the day to take on more and more if they are still being expected to continue existing work. We have been accused of never wanting to stop anything, but we have ended programs. A lot of stratigraphy and paleontology programs, for example, aren’t around anymore, and we aren’t doing much ore-genesis work. If our planning and our program processes are right, consistent with our strategic plan, we won’t be doing things that are irrelevant.

GSA Today: What mix do you want to see between applied (need-driven) research and basic (curiosity-driven) research?

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GSA SECTION MEETINGS — 2000

Northeastern Section
March 13-15, 2000,
New Brunswick, New Jersey
Submit completed abstracts to: Kenneth G. Miller, Dept. of Geological Sciences, Wright Lab, Rutgers University, 610 Taylor Rd., Piscataway, NJ 08854-8066, (732) 445-3622, kmg@rci.rutgers.edu.
Abstract deadline: November 29, 1999

Southeastern Section
March 23-24, 2000,
Charleston, South Carolina
Submit completed abstracts to: June E. Mirecki, Dept. of Geology, College of Charleston, Charleston, SC 29424-0001, (803) 953-8278, mireckij@cofc.edu.
Abstract deadline: December 8, 1999

South-Central Section
April 3-4, 2000,
Fayetteville, Arkansas
Submit completed abstracts to: John Van Brahan, Department of Geology, University of Arkansas, Ozark Hall 118, Fayetteville, AR 72701-1201, (501) 575-2570, jbrahanajungle.uark.edu.
Abstract deadline: December 8, 1999

North-Central Section
April 6-7, 2000,
Indianapolis, Indiana
Submit completed abstracts to: Robert D. Hall, Dept. of Geology, Indiana University--Purdue University, 723 W. Michigan St., Indianapolis, IN 46202-5132, (317) 274-7484, rhaljipui.edu.
Abstract deadline: December 20, 1999

Rocky Mountain Section
April 17-18, 2000,
Missoula, Montana
Submit completed abstracts to: Marc Hendrix, Dept. of Geology, University of Montana, Missoula, MT 59812-1019, (406) 243-5278, marc@selway.umt.edu.
Abstract deadline: January 13, 2000

Cordilleran Section
April 27-29, 2000,
Vancouver, British Columbia
Submit completed abstracts to: Peter Mustard, Dept. of Earth Sciences, Simon Fraser University, Burnaby, BC, V5A 1S5 Canada, (604) 291-5389, pmustard@sfu.ca.
Abstract deadline: January 10, 2000
Washington Report continued from p. 11

Groat: If basic means purely curiosity-driven, without any feel for what direction it’s headed, there is probably less opportunity for that in this organization than there might have been in the past. If basic means contributing to a field of knowledge that’s important, for some application that may be way down the road, then I think that is still important to the USGS. The relevance issue is important for us, but not to the point where we simply apply other people’s processes to societal problems. That’s not where our strengths lie or our role is. We stress the development of scientific understanding for use by others in making decisions about resources and environmental issues. Some people who consider themselves to be basic researchers feel that “applied” automatically means a compromise in quality, effectiveness, and stature. I don’t believe there is any stigma or value loss to scientists in having their efforts address real-world needs.

GSA Today: What is your feeling about the role for monitoring long-term earth science observations studies? The USGS is one of the few organizations in the federal government that conducts monitoring. NSF doesn’t support monitoring studies. How does monitoring fit into this research mix?

Groat: The great interest today is in processing, displaying, and using information. The greatest appeal of information management systems, GIS, decision-support systems, and Web projects, is, unfortunately, accompanied by a growing lack of appreciation for the need to gather data and for investing in the effort to gather it. One of the most important ways that we gather information is by monitoring. Whether it’s a stream-gauging network or the seismic monitoring system or water quality, we are seeing a drop-off in the quality of our systems because we are falling behind technologically. We are not putting in new stations. We are not adding to the network, and we are not adding to the technical sophistication consistent with the technology that is available. There seems to be an interest in providing funds for this only when there is a major hazard or natural catastrophe. Overall, the government is less willing to invest in technology and the observing systems that we need to gather data. This is occurring at the same time we are talking about adaptive management of natural systems, which depends on monitoring the behavior of those systems as management measures are implemented. Adaptive management without monitoring as a key part is a farce. If we cannot maintain and expand the support for our basic monitoring function, and the technology to do it effectively and efficiently, then our science will be compromised, as will other scientists and managers who depend on our data. Meeting this need is one of the things that we are trying to convince the Secretary of the Interior to support.

GSA Today: The USGS has a long history of international cooperation, involving more than 75 countries. What do you see as its role in international activities under your directorship?

Groat: I was a bit surprised to learn, given the history, that we are at our lowest level of international involvement. This may be the product of a couple of things. In the past, when we were involved in so many countries, there were external (reimbursable) sources of funding, and many of these are no longer available. Also, the role of science as a tool of foreign diplomacy for the United States has declined. I’ve read a couple of interesting things recently, chastising the federal government for not using U.S. science capabilities more effectively. Unlike the British and others, whose geological surveys are very aggressive and active in other countries, in part as a mechanism for economic influence in the world, the U.S. has not emphasized this approach. There is probably not, particularly with this Congress, a real will for us to use appropriated dollars to do international things. But in the face of the growing globalization of society, if we are truly serious about the frontiers that we can attack as scientists understanding systems that don’t honor political boundaries, we need to bring the international dimension. Add to this the fact that geology is an experiential science, and the more experience people get the better scientists they are. We can’t get all of our experience in our own backyard. We can assist in capacity building by working in countries that are developing geological surveys. There will be more and more internationalization of scientific cooperation, as there is in the private sector, and in the universities. Given our tradition of international cooperation and capabilities, we are in a better position than almost anybody else to do it. The old fundamental question is, How do you pay for it? International activity depends on building relationships. We may have to wait out current domestic attitudes and use that time to build relationships that have access to funds that are nontraditional to us, such as the World Bank. I hope that sometime soon we can make a serious effort to develop a strategy, because that is a great opportunity for growth for us.

GSA Today: Several years ago at the International Conference on Geological Surveys, many national surveys reported that in order to maintain the viability of their organizations, they had to contract out their services, either to government or to private industry. Do you see the USGS going this route?

Groat: I can see us contracting our services to other organizations. I don’t see any conflict there as long as what we offer is appropriate for a government agency to do. I doubt that we would ever become like the British and provide major services through contracts, with a large part of our business being with the private sector.

GSA Today: Geologic mapping was among the first activities of the original USGS. Considering the Geologic Mapping Act of 1992, which called for closer cooperation with the states but didn’t fully appropriate funds to make it happen, what do you see as the future relationship between the state surveys and the USGS?

Groat: When the state surveys generated the Mapping Act, there was the feeling that the USGS really didn’t care. In fact, the USGS saw it as a distraction from the scientific direction that it was headed and didn’t want to make mapping a priority. Now, the situation is the opposite, and we are very supportive of geologic mapping. The funding level has increased to $27 million. Congress is about to reauthorize the Mapping Act, and the process of preparing for this was a cooperative one.

GSA Today: Where do you think the USGS will fit into the U.S. government of the year 2010 and beyond?

Groat: I see growing limits on what kinds of science the government will actually pursue. When the USGS was part of the Department of the Interior, the Interior Department was one of the biggest customers for USGS products, but those days may be over. The USGS is now a separate entity within the U.S. government. We need to diversify our customers, and we need to do that on a financial basis as well as a philosophical one. We need to build relationships. We may have to find opportunities for greater financial flexibility in the way that we operate.

European scientific endeavor is as variable in its approach and methodology as the cultural mosaic from which it has evolved. The European Commission recognized the value of integrating empiricists, theoreticians, and romantics from numerous countries, and targeting broad scientific problems. Thus, from 1992 to 1995, the Integrated Basin Studies Project (IBS), part of which focused on the foreland basins of western Europe, was funded. The intentions of the project were to “study the interplay, at different scales, between tectonics and sedimentation during the construction of an orogen, and also to study how control is exerted on the basin-fill down to the scale of the depositional sequence.” This book records the main results of the project.

The book comprises four sections, the first three based on regions and the last devoted to numerical modeling. The basins studied are the Guadalquivir basin, north of the Betic orogen, southern Spain; the Ebro Basin of the southern Pyrenees; and the northern and western foreland basin of the Alps in France, Switzerland, and Germany. Why these basins were chosen above others is an important question that was not addressed. Given the similarity in their paleogeography, do these basins share a commonality of controlling parameters that may differ significantly from other systems worldwide? I believe they do, and that this should be borne in mind when making comparisons.

A common strength in this book is the high quality of data presented, particularly from the Pyrenees and French Alps. Many colored foldouts provide superb images that would be invaluable for field studies. My only disappointment is the level of integration of theory and observation in the regional studies; the variability of scientific approach has remained distinct. Essentially, the regional basis of the book dominates, with too many descriptive papers finishing with unconstrained interpretations of underlying controls. Without a thorough understanding of the possible controlling parameters on a system, it is hard to draw out general implications for other foreland basins of different ages and settings. This aspect should have been improved by a more non-European component to the review panel. Although there are exceptions, notably from the Utrecht research group who generate stimulating predictive models of growth strata associated with fault-bend folding. However, as an example of the lack of integration of researchers, it is curious that these predictive models were not compared to the stunning field examples shown from the Pyrenees earlier in the book.

Overall, the quality and presentation of data in this volume are of a very high standard, and at least 50% of the contributions represent significant modifications in our understanding of the basins discussed. I encourage researchers interested in the complex dynamics of foreland basin systems to take time to increase their knowledge of these important European examples with this worthwhile purchase.

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This edited volume provides a review and evaluation of the IPCC’s Second Assessment Report on the Economic and Social

**BOOK REVIEWS continued on p. 14**
**Book Reviews** continued from p. 13

Dimensions of Climate Change, (Intergovernmental Panel on Climate Change, Climate Change 1995: Economic and Social Dimensions of Climate Change, Cambridge University Press, Cambridge, UK, 1996). The authors are of high scholarly distinction. Solicited comments on thisambivalence is a major concern of this set of papers.

One point of view, expressed most forcefully in a chapter by Paul Portney, is that standard economic tools provide a rigorous and necessary framework for rational decision-making. Although uncertainties concerning the costs and benefits of climate change pose problems for empirical analysis, Portney argues that these problems are no worse in the case of climate change than in other policy domains where cost-benefit analysis is routinely employed. Tom Kram and John Weyant offer well-grounded chapters on the problems of abatement of greenhouse gas emissions, while Robert Mendelsohn reviews the more speculative literature on climate change damage assessment. Given the potential for human adaptation to altered climatic conditions, Mendelsohn questions the IPCC's conclusion that a doubling of atmospheric greenhouse gas concentrations would impose costs commensurate to 1.5%-2.0% of world economic output. Climate change, Mendelsohn argues, would likely have benign or perhaps beneficial effects on ecological systems.

Charles Kolstad discusses the literature on so-called “integrated assessment” models, which employ cost-benefit analysis to identify “optimal” climate change policies. Under conventional assumptions, such models suggest that comparatively low rates of abatement of greenhouse gas emissions are justified in the coming decades. In this perspective, it is better to bear the costs of climate change than to impose large short-term costs on the global economy.

Contributions by Granger Morgan, Robert Lind, and Richard Schuler express skepticism regarding the use of standard economic tools in climate change policy analysis. According to Morgan, climate change involves questions of long time horizons and fundamental uncertainty that substantially diminish the power of cost-benefit analysis and related decision-making aids. Lind and Schuler argue that cost-benefit analysis, in which the future costs of climate change are discounted relative to the present to account for the presumed impatience or time preference of decision-makers, is difficult to reconcile with conventional notions of intergenerational equity. More pointedly, they assert that there is no unique approach to identifying “optimal” policy choices for a problem such as climate change that imposes uneven burdens and benefits on generations and world regions. Economic analysis, they argue, should be carefully linked to the ethical and political aspects of climate change policy.

A final chapter by Richard Schmalensee explores the challenges involved in developing the institutional aspects of climate change response strategies. Economists, Schmalensee argues, have stressed the development of global optimization models while underemphasizing the mechanics of policy implementation. He outlines a research strategy for addressing this gap in the literature. Overall, this volume presents an accessible overview of the IPCC’s work on the economics of climate change that is balanced and appropriately critical. For the most part, the authors give the IPCC credit for providing an in-depth description of a truly voluminous literature. Their criticisms reflect the state of the science as opposed to deficiencies in the synthesis report itself.

Viewed in its own terms, the book offers a readable survey that is aimed at a broad, interdisciplinary audience. The contributing authors are of high scholarly distinction. Solicited comments on each chapter provide a sense of the diversity of opinion that prevails in this field.

Richard B. Howarth Environmental Studies Program Dartmouth College Hanover, NH 03755


Lyell in America presents an important new study of one of the most important natural philosophers of the 19th century. Much has been written about the work of Charles Lyell in Europe, but little has been written about his impact on American science. Working with the archives of the American Philosophical Society, Wilson provides a detailed analysis of Lyell's influence in America. He traces Lyell's influence in the American scientific community, his impact on American geology, and his influence on American thought more generally. Wilson's book is a valuable contribution to the study of the history of science in America.

The parallels in Lyell's social and political views to his scientific philosophy are striking. Lyell held to values intermediate between the two extremes of the abolitionists and the advocates of slavery. His descriptions of the slow, gradual growth of the Mississippi delta parallel his analysis of the slow, gradual progress of the Negro slave under the more enlightened planters of Georgia. The rash urge to cataclysmic political change by the northern abolitionists was abhorrent to Lyell, just as the improper treatment of slaves in the frontier areas of Mississippi was anathema. That Lyell goes to great length to document circumstances in which slaves were well treated reveals his thorough-going commitment to gradualism.

Charles Lyell was accorded superstar status on his trips to America. Thousands paid the substantial admission fees to attend his many lectures in Boston, New York, and Philadelphia. He met with Daniel Webster, John Quincy Adams, and Presidents Pierce and Tyler. The most prominent American geologists shared their extensive data with him, and he provided a kind of scientific stature to their efforts. In general, his influence was positive in promoting American geology. Back in England, Lyell became so known as an expert on America that he was consulted by William Gladstone and Prince Albert, among others.

This book contains many fascinating insights, including Lyell's thoughts on university educational reform, his contacts with amateur naturalists in remote parts of America, and his efforts to fund science prior to government grants and university science departments. Wilson is such a sympathetic biographer that Lyell's point of view is always championed over those of adversaries. But this is a minor distraction, given the wealth of historical detail provided.

Victor Baker University of Arizona Tucson, AZ 85721-0011
GSA Names New Congressional Science Fellow

Melody Brown Burkins, Dartmouth College, is the 1999–2000 GSA Congressional Science Fellow.

Burkins is an adjunct assistant professor of Environmental Studies at Dartmouth, where she teaches environmental science and mentors undergraduates in Dartmouth’s Women in Science Project. Her research interests include analysis of community-scale environmental science issues and policies and links among geology, climate, and ecological systems in the dry valleys of Antarctica. As part of her community-focused research, Burkins recently guided students in a pilot environmental indicator project, assessing the long-term environmental issues facing Dartmouth College. In the Antarctic, she continues her doctoral work, using stable isotopes to elucidate the origin, distribution, and cycling of soil organic material in polar deserts. She works collaboratively with the NSF-supported McMurdo Region Long Term Ecological Research (MCM-LTER) program. Burkins has also been involved in ore geochemistry studies in south-central Ireland and central Mexico, glacier studies in southeast Alaska, and marine geochemistry research in the Bering Sea. As a graduate student at Dartmouth, she served as president of the Graduate Student Council and won the Hannah Croasdale Prize for Excellence in Graduate Research and Teaching. Burkins received her B.S. in geology from Yale University. She has been a member of GSA since 1997.

Burkins’s broad interests in science and policy include the issues of global climate change, ecosystem health, and standards for air, water, and soil quality. She is keenly interested in the growing communication among scientists, communities, business, and policy-makers surrounding environmental legislation. She is an active advocate for earth and ecosystem science literacy, speaking in community venues such as the Vermont Law School, Dartmouth’s Women in Technology program, and local public school classrooms. To further encourage young earth scientists, she spent the fall of 1998 teaching geology and field methods to 10th grade students in Zermatt, Switzerland.

Burkins says she is extremely pleased to have the opportunity to work on science and policy issues in Washington, D.C. She is working with GSA to develop an interactive Web site for the GSA-USGS Congressional Science Fellow, and she will continue the fellows’ tradition of publishing perspective articles in GSA Today.

Shaping Tomorrow

The Congressional Science Fellowship is a unique opportunity to apply scientific expertise to a wide range of policy issues as a staff member in a congressional or committee office. Fellows can and do directly impact public awareness of earth science and related issues.

Funded by GSA and the U.S. Geological Survey, the fellowship illustrates the value of institutional cooperation toward involving the earth science community in the public policy arena. The program places highly qualified scientists in the offices of individual members of Congress and congressional committees for a one-year to 15-month appointment. Fellows are directly involved in varied legislative, oversight, and investigative activities as sources of expertise. While fellows explicitly do not represent special interests, they do play a professional role for GSA during their appointment by bringing issues and perspectives to the attention of headquarters staff and our members and by expanding our network of contacts “inside the beltway.” The GSA-USGS fellow, as part of the cohort of appointees from other geoscience societies and along with the AGI Government Affairs Program, are our community’s finger on the pulse of national political activities that impact our profession and that provide us opportunities to affect public policy. Following appointment, the GSA-USGS Congressional Science Fellow serves a two-year term on GSA’s Geology and Public Policy Committee. In this capacity, fellows continue to provide an invaluable service by lending their one-of-a-kind experience to the work of the committee.

In alignment with GSA’s Strategic Plan, the Institute for Earth Science and the Environment (IEE) administers the Congressional Science Fellow program and supports our members’ activities and interests in public policy. Please see Science & Society on the GSA Web site for additional information on this program and other science and policy topics. Watch for our new Virtual Congressional Science Fellow Hall of Fame. We are proud to recognize the service of current and former GSA-USGS fellows.

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2000–2001 CROSSING DIVIDES: Congressional Science Fellowship

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The millennial Congressional Science Fellow will be selected from among top competitors early in 2000. If you are an experienced earth scientist with a broad geologic background, experience in applying scientific knowledge to societal challenges, and a passion for helping shape the future of the geoscience profession, GSA invites your application. To learn more about the Fellowship experience, contact David Verardo, 1997–1998 GSA Congressional Science Fellow, at (202) 314-2234 or dverardo@usgcrp.gov. For application information on this year's program, watch www.geosociety.org/science/scifello.htm or contact Cathleen May, Director for Science & Outreach, at GSA Headquarters, (303) 447-2020, ext. 195, or cmay@geosociety.org. The deadline for applications is February 1, 2000.

Shape Tomorrow—Today!
Tuesday Morning
K04 Geoscientists in the Legal System: The Challenge for the Next Century
GSA Hydrogeology Division; National Ground Water Association. E. Scott Bair, Ohio State University, Columbus; Steve Wheatcraft, University of Nevada, Reno; David Stephenson, S.S. Papadopulos & Associates, Jackson, Wyoming. ORAL
Keynote speaker Jerry Facher will describe his observations on the effectiveness of the scientific testimony presented at the Woburn toxics trial. A judge, attorneys, and expert geoscience witnesses will present their opinions on the role of science in our legal system and how to be an effective and ethical expert witness. A panel discussion and a question-and-answer period will conclude the session.

Tuesday Afternoon
K01 Impact Events: Environmental Consequences and Their Influence on the Origin and Evolution of Life
GSA Planetary Geology Division; Paleontological Society. David A. Kring, Lunar and Planetary Laboratory, University of Arizona, Tucson. ORAL
Largely because of Cretaceous-Tertiary boundary studies, impact cratering is now widely recognized as an important geologic process.

K05 Low-Latitude Precambrian Glaciation: Geochemical, Climatic, and Biological Effects of the Snowball Earth
Joseph L. Kirschvink, California Institute of Technology, Pasadena; Paul F. Hoffman, Harvard University, Cambridge, Massachusetts. ORAL
Precambrian glacial deposits have long been recognized as peculiar, because of climatic indicators of sea-level ice within the tropics. This symposium will explore geological, geophysical, climatic, and geochemical constraints on these putative low-latitude glaciations, and some of the biological implications of “Snowball Earth” conditions produced when the oceans freeze over completely.

See previous issues of GSA Today for more details on the other Pardee Keynote Symposia below.
GSA thanks the 1999 Annual Meeting Hosts and Sponsors for their generous contributions to make the Denver meeting a success.

### Graduate School Information Forum

Colorado Convention Center, Hall A, Sunday, Oct. 24, 5:00 to 7:30 p.m. and Monday, Oct. 25 through Wednesday, Oct. 27, 9:00 a.m. to 5:30 p.m. Enhance your search for the right graduate school by coming to the GSA Annual Meeting in Denver. Meet with representatives from universities across the nation without spending travel time and money to go to each school. The schools participating (as of June 28) are listed below. To receive a complete list of schools, with the contact person and telephone number, contact Tammy White, GSA Exhibits Manager, twhite@geosociety.org.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Sun</th>
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<td>Arizona State University</td>
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<td>University of North Carolina, Chapel Hill</td>
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Overview of the 1999 GSA Annual Meeting Program

217 Technical Sessions—2,924 Poster and Oral Presentations!

Create Your Own Personal Schedule for the Meeting with the GeoTimer

GSA Technical Sessions on the Web

This year’s technical program is the largest in GSA’s history! You can create your own personal Annual Meeting schedule and daily calendar with the Web-based GeoTimer. This basic search and sorting software contains session, event, exhibit, field trip, and course information.

TECHNICAL SESSION PROGRAM CALENDAR — 1999

Titles and Authors Database: http://www.geosociety.org/meetings/99/config

ALL SESSIONS LOCATED AT THE COLORADO CONVENTION CENTER

Sessions are oral unless poster is indicated. See www.geosociety.org/meetings/99/index for detailed listings and abstracts.

T = Theme Session, K = Keynote Session

SUNDAY, OCTOBER 24, 1999

<table>
<thead>
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<th>Session Number</th>
<th>Title</th>
<th>Time</th>
<th>Room</th>
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<tr>
<td>2</td>
<td>T102. Perspectives on Our Ancestors: Old World and New World Human Populations I (Organic Geochemistry Division of the Geochemical Society)</td>
<td>8:05 AM–12:00 PM</td>
<td>A101–103</td>
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<tr>
<td>4</td>
<td>T100. The Sustainability Challenge II: Water and Human Sustainability (Institute for Earth Science and the Environment; GSA Committee on Critical Issues)</td>
<td>1:30 PM–5:30 PM</td>
<td>A102-104–106</td>
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<tr>
<td>5</td>
<td>T102. Perspectives on Our Ancestors: Old World and New World Human Populations II (Organic Geochemistry Division of the Geochemical Society)</td>
<td>1:30 PM–5:30 PM</td>
<td>A101–103</td>
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MONDAY, OCTOBER 25, 1999

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<th>Session Number</th>
<th>Title</th>
<th>Time</th>
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<tr>
<td>6</td>
<td>Aqueous Geochemistry I</td>
<td>8:00 AM–12:00 PM</td>
<td>C201</td>
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<tr>
<td>7</td>
<td>Coal Geology I: Energy Mix of the Future</td>
<td>8:00 AM–10:00 AM</td>
<td>C109</td>
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<tr>
<td>8</td>
<td>Economic Geology I: Radiometric Dating, Pb Isotopes, Geochemical Exploration, Metamorphic Au, and PGE in Layered Igneous Complexes</td>
<td>8:00 AM–2:00 PM</td>
<td>A101-103</td>
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<tr>
<td>9</td>
<td>Engineering Geology (Posters)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>10</td>
<td>Environmental Geoscience I: Geochemistry of Surfaces, Sediments, and Waters</td>
<td>10:00 AM–12:00 PM</td>
<td>A111</td>
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<tr>
<td>11</td>
<td>Geology Education I</td>
<td>8:00 AM–12:00 PM</td>
<td>A207-209</td>
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<tr>
<td>12</td>
<td>Geoscience Information (Posters)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>13</td>
<td>History of Geology (Posters)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>14</td>
<td>Metamorphic Petrology I</td>
<td>8:00 AM–12:00 PM</td>
<td>A205</td>
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<tr>
<td>15</td>
<td>Paleontology I: Phylogeny and Functional Morphology</td>
<td>8:00 AM–12:00 PM</td>
<td>A108-110</td>
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<tr>
<td>16</td>
<td>Planetary Geology</td>
<td>8:00 AM–12:00 PM</td>
<td>C101-103</td>
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<tr>
<td>17</td>
<td>Quaternary Geology (Posters)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<td>18</td>
<td>Structure I: Deformation Mechanisms, Fabrics, and Strain</td>
<td>8:00 AM–12:00 PM</td>
<td>C102-104–106</td>
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<tr>
<td>19</td>
<td>K3. Maintaining a Livable Earth: Conversations Among Concerned Geologists (GSA Committee on Critical Issues; Institute for Earth Science and the Environment)</td>
<td>8:00 AM–12:00 PM</td>
<td>Ballroom 4</td>
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<tr>
<td>21</td>
<td>T5. Effects of Impact Events in the Sedimentary Record I (GSA Planetary Geology Division; European Science Foundation [ESF] Impact Program)</td>
<td>8:00 AM–12:00 PM</td>
<td>C108-110–112</td>
</tr>
<tr>
<td>22</td>
<td>T9. Origin of Orogenic Plateaus: Interactions of Plate Convergence, Mantle Processes, and Surficial Processes in Continental Tectonics I (GSA Structural Geology and Tectonics Division)</td>
<td>8:00 AM–12:00 PM</td>
<td>C105-107</td>
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<tr>
<td>Session Number</td>
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<td>23</td>
<td>T16. Uranium: Minerals, Chemistry, and the Environment I (Mineralogical Society of America)</td>
<td>8:00 AM–12:00 PM</td>
<td>C205</td>
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<tr>
<td>24</td>
<td>T18. Application of Advanced Geochemical Modeling to Mining-Related Environmental Issues (Geochemical Society; Mineralogical Society of America)</td>
<td>8:00 AM–10:00 AM</td>
<td>A111</td>
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<tr>
<td>25</td>
<td>T43. The Hell Creek Formation and the Cretaceous-Tertiary Boundary in the Northern Great Plains: An Integrated Continental Record of the End of the Cretaceous (Paleontological Society)</td>
<td>8:00 AM–12:00 PM</td>
<td>A105–107</td>
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<tr>
<td>26</td>
<td>T50. North Atlantic Crossroads: Terrestrial and Marine Environmental Records of Iceland (Posters)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<td>27</td>
<td>T53. Shallow Subsurface Mapping: Using Geophysics for Geological, Groundwater Resource, and Continuation Studies (Posters) (GSA Quaternary Geology and Geomorphology Division; GSA Geophysics Division; GSA Hydrogeology Division)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>28</td>
<td>T55. Surficial Three-Dimensional Geologic Mapping: Basic Map Products and Applications (Posters) (GSA Quaternary Geology and Geomorphology Division; Association of American State Geologists and U.S. Geological Survey National Cooperative Geologic Mapping Program)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>29</td>
<td>T70. Teaching Earth Science with Art</td>
<td>8:00 AM–12:00 PM</td>
<td>A201</td>
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<td>30</td>
<td>T78. Calibration, Inversion, and Uncertainty of Groundwater Models (GSA Hydrogeology Division; International Ground Water Modeling Center, Colorado School of Mines; U.S. Geological Survey, Denver)</td>
<td>8:00 AM–12:00 PM</td>
<td>C209</td>
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<tr>
<td>31</td>
<td>T87. Measurement Techniques and Modeling of Spatial and Temporal Variability in Groundwater Recharge in Response to Past, Present, and Future Climates I (GSA Hydrogeology Division)</td>
<td>8:00 AM–12:00 PM</td>
<td>C207</td>
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<tr>
<td>32</td>
<td>T92. Sediments in Karst Systems: Processes, Mechanisms, Interpretation (GSA Hydrogeology Division; Karst Waters Institute; GSA Quaternary Geology and Geomorphology Division)</td>
<td>8:00 AM–12:00 PM</td>
<td>A102–104–106</td>
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<tr>
<td>33</td>
<td>Coal Geology II</td>
<td>4:15 PM–5:30 PM</td>
<td>C207</td>
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<td>34</td>
<td>Economic Geology II: Porphyry Cu-Mo-Au, Epithermal and Carlin-type Deposits</td>
<td>1:30 PM–5:30 PM</td>
<td>A101–103</td>
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<td>35</td>
<td>Geochemistry I</td>
<td>1:30 PM–5:30 PM</td>
<td>C209</td>
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<tr>
<td>36</td>
<td>Geophysics: Magnetics, Lower Crustal Reflectivity, Seismic Stratigraphy (Posters)</td>
<td>1:30 PM–5:30 PM</td>
<td>Poster Hall</td>
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<td>37</td>
<td>Hydrogeology I: Fate and Transport of Contaminants in Groundwater</td>
<td>1:30 PM–5:30 PM</td>
<td>C101–103</td>
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<td>38</td>
<td>Metamorphic Petrology II</td>
<td>1:30 PM–5:30 PM</td>
<td>A205</td>
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<td>39</td>
<td>Paleontology II: Paleocology</td>
<td>1:30 PM–5:30 PM</td>
<td>A108–110</td>
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<td>40</td>
<td>Precambrian Geology: Proterozoic History of Western Laurentia, plus Precambrian Sedimentology, Tectonics, and Geochronology</td>
<td>1:30 PM–5:30 PM</td>
<td>A105-107</td>
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<td>41</td>
<td>Structural Geology (Posters)</td>
<td>1:30 PM–5:30 PM</td>
<td>Poster Hall</td>
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<td>42</td>
<td>Tectonics (Posters)</td>
<td>1:30 PM–5:30 PM</td>
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<td>43</td>
<td>K6. Globally Warm Climates of the Early Cenozoic: Evidence, Causes, and Biotic Consequences (Paleontological Society)</td>
<td>1:30 PM–5:30 PM</td>
<td>Ballroom 4</td>
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<td>44</td>
<td>T5. Effects of Impact Events in the Sedimentary Record II</td>
<td>1:30 PM–5:30 PM</td>
<td>C108–110–112</td>
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<td>45</td>
<td>T6. Faulting and Folding: Crossing the Divide Between 2-D and 3-D (Posters) (GSA Structural Geology and Tectonics Division)</td>
<td>1:30 PM–5:30 PM</td>
<td>Poster Hall</td>
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<td>46</td>
<td>T8. Active Faulting and Earthquake Behavior in Complex Orogens: A Multidisciplinary Approach (Posters) (GSA Structural Geology and Tectonics Division)</td>
<td>1:30 PM–5:30 PM</td>
<td>Poster Hall</td>
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<td>48</td>
<td>T10. Cenozoic Tectonics of the Southern Rocky Mountains in Colorado and New Mexico: Connections with Global Processes (Posters)</td>
<td>1:30 PM–5:30 PM</td>
<td>Poster Hall</td>
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<td>50</td>
<td>T16. Uranium: Minerals, Chemistry, and the Environment II (Mineralogical Society of America)</td>
<td>1:30 PM–5:30 PM</td>
<td>C205</td>
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<td>51</td>
<td>T32. Geoscience Ethics Guidelines: A Discussion of Their Development, Utility, and Implementation (American Institute of Professional Geologists)</td>
<td>1:30 PM–3:30 PM</td>
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<td>52</td>
<td>T35. Environmental Justice: Geocological, Social, and Philosophical Perspectives (GSA Committee on Critical Issues; Institute for Earth Science and the Environment)</td>
<td>3:30 PM-5:30 PM</td>
<td>A111</td>
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<td>53</td>
<td>T45. Beyond Phylogeny Reconstruction: Tree-Based Analyses in Paleontology (Paleontological Society)</td>
<td>1:30 PM-5:30 PM</td>
<td>A102-104-106</td>
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<tr>
<td>54</td>
<td>T49. Glaciation and Reorganization of Asia's Network of Drainage: The Effects on Late Quaternary Global Change (GSA Quaternary Geology and Geomorphology Division; International Geological Correlation Program [IGCP])</td>
<td>1:30 PM-5:30 PM</td>
<td>A207-209</td>
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<tr>
<td>56</td>
<td>T63. Linking Science Research and Education to Improve Undergraduate Geoscience Programs and K-12 Earth Science Teacher Preparation (American Geophysical Union; National Earth Science Teachers Association; National Association of Geoscience Teachers; SAGE)</td>
<td>1:30 PM-5:30 PM</td>
<td>A201</td>
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<td>57</td>
<td>T80. Measurement and Description of Flow and Transport in Highly Heterogeneous Aquifers (GSA Hydrogeology Division)</td>
<td>1:30 PM-5:30 PM</td>
<td>C105-107</td>
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<tr>
<td>58</td>
<td>T87. Measurement Techniques and Modeling of Spatial and Temporal Variability in Groundwater Recharge in Response to Past, Present, and Future Climates II (GSA Hydrogeology Division)</td>
<td>1:30 PM-5:30 PM</td>
<td>C207</td>
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<tr>
<td>59</td>
<td>T92. Sediments in Karst Systems: Processes, Mechanisms, Interpretation (Posters) (GSA Hydrogeology Division; Karst Waters Institute, GSA Quaternary Geology and Geomorphology Division)</td>
<td>1:30 PM-5:30 PM</td>
<td>Poster Hall</td>
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<td>60</td>
<td>T93. Impacts of Urbanization on Groundwater Quantity and Quality (GSA Hydrogeology Division)</td>
<td>1:30 PM-5:30 PM</td>
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**TUESDAY, OCTOBER 26, 1999**

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<tr>
<td>61</td>
<td>Clastic Sedimentology I: Interpreting Environment, Provenance, and Burial History</td>
<td>8:00 AM-12:00 PM</td>
<td>A105-107</td>
</tr>
<tr>
<td>62</td>
<td>Economic Geology III: Skarns, Stratiform Cu, Massive Sulfides, and Fluid Flow</td>
<td>8:00 AM-10:00 AM</td>
<td>A102-104-106</td>
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<td>64</td>
<td>Experimental Petrology (Posters)</td>
<td>8:00 AM-12:00 PM</td>
<td>Poster Hall</td>
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<td>65</td>
<td>Geoscience Information</td>
<td>10:00 AM-12:00 PM</td>
<td>A111</td>
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<td>66</td>
<td>Igneous Petrology (Posters)</td>
<td>8:00 AM-12:00 PM</td>
<td>Poster Hall</td>
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<td>67</td>
<td>Metamorphic Geology (Posters)</td>
<td>8:00 AM-12:00 PM</td>
<td>Poster Hall</td>
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<td>68</td>
<td>Mineralogy (Posters)</td>
<td>8:00 AM-12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>69</td>
<td>Paleontology III: Paleobiological Trends</td>
<td>8:00 AM-12:00 PM</td>
<td>A207-20</td>
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<tr>
<td>70</td>
<td>Planetary Geology (Posters)</td>
<td>8:00 AM-12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>71</td>
<td>Precambrian Geology (Posters)</td>
<td>8:00 AM-12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>72</td>
<td>Volcanology (Posters)</td>
<td>8:00 AM-12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>73</td>
<td>K4. Geoscientists in the Legal System: The Challenge for the Next Century (GSA Hydrogeology Division; National Ground Water Association)</td>
<td>8:00 AM-12:00 PM</td>
<td>Ballroom 2 &amp; 3</td>
</tr>
<tr>
<td>74</td>
<td>T3. Alloformations, Synthems, and Sequences (North American Commission on Stratigraphic Nomenclature)</td>
<td>8:00 AM-12:00 PM</td>
<td>C105-107</td>
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<td>75</td>
<td>T6. Faulting and Folding: Crossing the Divide Between 2-D nd 3-D I (GSA Structural Geology and Tectonics Division)</td>
<td>8:00 AM-12:00 PM</td>
<td>C102-104-106</td>
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<td>76</td>
<td>T10. Cenozoic Tectonics of the Southern Rocky Mountains in Colorado and New Mexico: Connections with Global Processes I (GSA Geophysics Division; GSA Structural Geology and Tectonics Division)</td>
<td>8:00 AM-12:00 PM</td>
<td>C108-110-112</td>
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<td>77</td>
<td>T12. The International Space Station: New Opportunities for Earth Science Research and Education (NASA/Johnson Space Center Office of Earth Sciences; GSA Planetary Geology Division; GSA International Division; GSA Geoscience Education Division; SAGE)</td>
<td>8:00 AM-12:00 PM</td>
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<td>78</td>
<td>T16. Uranium: Minerals, Chemistry, and the Environment (Posters) (Mineralogical Society of America)</td>
<td>8:00 AM-12:00 PM</td>
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<td>79</td>
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<td>80</td>
<td>T28. Geologic Hazard Mapping: The State of the Art (GSA Engineering Geology Division; Association of Engineering Geologists)</td>
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<td>81</td>
<td>T31. Communication Divides: Perspectives on Supporting Information Bridges in the Geosciences (Geoscience Information Society)</td>
<td>8:00 AM–10:00</td>
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<td>82</td>
<td>T34. Mission-Driven Geology: Meeting Global Challenges and Society’s Needs (Posters) (GSA International Division; U.S. Geological Survey; Geological Survey of Canada; Association of American State Geologists)</td>
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<td>84</td>
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<td>85</td>
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<td>86</td>
<td>T57. Granite Systems and Proterozoic Lithospheric Processes (Posters) (International Geological Correlation Program Project #426 [IGCP-426])</td>
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<td>87</td>
<td>T59. Multidisciplinary Studies in Volcanology, Planetary Geology, and Economic Geology: A Tribute to 50 Years of Research by Professor Wolfgang Elston, University of New Mexico (Posters)</td>
<td>8:00 AM–12:00 PM</td>
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<td>88</td>
<td>T60. Building the Quantitative Skills of Non-Majors and Majors in Geoscience Courses (National Association of Geoscience Teachers)</td>
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<td>89</td>
<td>T67. Teaching Science By Example: Real Problems, Real Data, All Classes, Every Day (National Association of Geoscience Teachers)</td>
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<td>T81. Investigations into the Effect of Measurement Scale on Determining Hydraulic Conductivity: Field and Modeling Studies (GSA Hydrogeology Division)</td>
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<td>91</td>
<td>T91. Low-Recharge Groundwater Systems</td>
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<td>92</td>
<td>T96. Subsurface Transport, Fate, and Remediation of Nonaqueous Phase Liquid Contaminants in Multicomponent Biogeochemical Systems (GSA Hydrogeology Division)</td>
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<td>93</td>
<td>T98. Sources, Transport, Fate, and Toxicology of Trace Elements in the Environment: A Tribute to Jerome Nriagu (International Association of Geochemistry and Cosmochemistry)</td>
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<td>97</td>
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<td>99</td>
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<td>100</td>
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<td>102</td>
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<td>103</td>
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<td>104</td>
<td>K1. Impact Events: Environmental Consequences and Their Influence on the Origin and Evolution of Life (GSA Planetary Geology Division; Paleontological Society)</td>
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<td>105</td>
<td>T1. Origins of Carbonate Mounds: Crossing the Divides of Sedimentology, Diagenesis, and Paleontology (Society for Sedimentary Geology [SEPM])</td>
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<td>106</td>
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<td>107</td>
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<td>109</td>
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<td>110</td>
<td>T25. Engineering/Environmental Geology: State Geological Surveys and Academic Communities (GSA Engineering Geology Division)</td>
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<td>112</td>
<td>T40. The Tropics Compared: Icehouse and Greenhouse States</td>
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<td>113</td>
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<td>114</td>
<td>T51. Landscape Erosion and Sedimentation Modeling (U.S. Army Research Office)</td>
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<td>115</td>
<td>T54. Subglacial Processes and the Behavior of Ice Sheets II (GSA Quaternary Geology and Geomorphology Division)</td>
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<td>T60. Building the Quantitative Skills of Non-Majors and Majors in Geoscience Courses (Posters) (National Association of Geoscience Teachers)</td>
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<td>119</td>
<td>T62. Student Research (Posters) (Sigma Gamma Epsilon)</td>
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<td>120</td>
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<td>T72. Teaching Geology to the Disabled (Posters) (National Association of Geoscience Teachers)</td>
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<td>122</td>
<td>T74. Isotopic Records of Microbially Mediated Processes in Natural Environments (Geochanical Society)</td>
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**WEDNESDAY, OCTOBER 27, 1999**

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<td>Clastic Sedimentology: Perspectives from Mineralogy, Sedimentology, and Stratigraphy (Posters)</td>
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<td>Engineering Geology I/Dams, Landslides, and the Richard H. Jahns Distinguished Lecturer</td>
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<td>Hydrogeology II: Groundwater Modeling and Parameter Estimation</td>
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<td>127</td>
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<td>128</td>
<td>Tectonics II: North America, from Mexico to Alaska</td>
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<td>129</td>
<td>K7. The Case for Steady-State Mountain Belts: Observations, Models, and Implications for Global Tectonics (GSA Quaternary Geology and Geomorphology Division)</td>
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<td>130</td>
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<td>131</td>
<td>T7. Dates of Faults and Rates of Deformation (GSA Structural Geology and Tectonics Division)</td>
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<td>132</td>
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<td>133</td>
<td>T15. Beryllium: Mineralogy, Petrology, and Geochemistry (Mineralogical Society of America)</td>
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<td>134</td>
<td>T33. Crossing the Greatest Divide: The Earth Sciences, the Humanities, and the Needs of Society (Institute for Earth Science and the Environment; International Association for Environmental Philosophy [IAEP])</td>
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<td>135</td>
<td>T41. From Icehouse to Icehouse: The Marine Eocene-Oligocene Transition</td>
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<td>136</td>
<td>T46. Fire and Geology: Surface Processes and Stratigraphic Records (GSA Quaternary Geology and Geomorphology Division)</td>
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<td>T58. Role of Supercontinents in Earth History: Assembly and Dispersal</td>
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<td>of the Rodinian Supercontinent (1300–750? Ma), and Impacts on</td>
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<td>Evolution of the Proterozoic Biosphere, Hydrosphere, and Crust-Mantle</td>
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<td>System (GSA Structural Geology and Tectonics Division)</td>
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<td>139</td>
<td>T61. Undergraduate Research: Strategies for Success I (National</td>
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<td>T66. Successes in Creating Multimedia-Assisted Learning Environments:</td>
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<td>Divide to Cross I (National Association of Geoscience Teachers;</td>
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<td>T75. Geomicrobiology and Biogeochemistry (Posters)</td>
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<td>T82. Field Scale Hydrodynamic and Geochemical Interactions at the</td>
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<td>T86. Hydrochemistry of Springs (GSA Hydrogeology Division)</td>
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<td>Systems at Reclaimed Mine Sites (GSA Hydrogeology Division)</td>
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<td>T103. Biological Diversity in the Phanerozoic I: In Memory of Jack</td>
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<td>K5. Low-Latitude Precambrian Glaciation: Geochemical, Climatic, and</td>
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<td>Biological Effects of the Snowball Earth</td>
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<td>Multidisciplinary Approach (GSA Structural Geology and Tectonics</td>
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<td>163</td>
<td>T17. New Insights into the Giant Butte Hydrothermal Deposit</td>
<td>1:30 PM–5:30 PM</td>
<td>C102–104–106</td>
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<td>164</td>
<td>T30. Coastal Geologic Risk: Mapping the Hazards and Influencing Public</td>
<td>1:30 PM–5:30 PM</td>
<td>C205</td>
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<td>165</td>
<td>T42. A Multidisciplinary Study of Coalbed Methane in the Ferron Coals,</td>
<td>1:30 PM–5:30 PM</td>
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<td></td>
<td>Utah: An Unusual Resource with Potential for Global Environmental</td>
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<td></td>
<td>Impact (GSA Coal Geology Division)</td>
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<td>166</td>
<td>T61. Undergraduate Research: Strategies for Success II (National</td>
<td>1:30 PM–3:30 PM</td>
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<td></td>
<td>Association of Geoscience Teachers; Council on Undergraduate Research,</td>
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<td>Keck Geology Consortium)</td>
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<td>The Sage on the Stage Versus the Guide on the Side—Yet Another</td>
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<td>Divide to Cross II (National Association of Geoscience Teachers;</td>
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<td>American Geological Institute)</td>
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<td>168</td>
<td>T71. Teaching Geologic Time: Methods and Relevance (National</td>
<td>3:00 PM–5:30 PM</td>
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<td>Association of Geoscience Teachers)</td>
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<td>169</td>
<td>T74. Isotopic Records of Microbially Mediated Processes in Natural</td>
<td>1:30 PM–5:30 PM</td>
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<td></td>
<td>Environments (Posters) (Geochemical Society)</td>
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<tr>
<td>170</td>
<td>T75. Geomicrobiology and Biogeochemistry I (Geochemical Society)</td>
<td>1:30 PM–5:30 PM</td>
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<td>Session Number</td>
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<tr>
<td>171</td>
<td>T85. From Atrazine to Hypoxia to Antibiotics: Occurrence and Fate of</td>
<td>1:30 PM–5:30 PM</td>
<td>Poster Hall</td>
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<td></td>
<td>Agrichemicals in the Hydrologic System (Posters) (GSA Hydrogeology Division)</td>
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<td>172</td>
<td>T86. Hydrochemistry of Springs (Posters) (GSA Hydrogeology Division)</td>
<td>1:30 PM–5:30 PM</td>
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<td>173</td>
<td>T103. Biological Diversity in the Phanerozoic II: In Memory of Jack Sepkoski (Paleontological Society)</td>
<td>1:30 PM–5:30 PM</td>
<td>A207-209</td>
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**THURSDAY, OCTOBER 28, 1999**

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<tr>
<th>Session Number</th>
<th>Title</th>
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<tr>
<td>174</td>
<td>Archaeology (Posters)</td>
<td>8:00 AM–12:00 PM</td>
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<tr>
<td>175</td>
<td>Coal Geology (Posters)</td>
<td>8:00 AM–12:00 PM</td>
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<td>176</td>
<td>Economic Geology (Posters)</td>
<td>8:00 AM–12:00 PM</td>
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<td>177</td>
<td>Environmental Geology (Posters)</td>
<td>8:00 AM–12:00 PM</td>
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<tr>
<td>178</td>
<td>Geology Education II: Successful Assessment in the Geoscience Classroom</td>
<td>10:15 AM–12:00 PM</td>
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<td>179</td>
<td>Hydrogeology III: Geological Controls on Groundwater Flow and Biogeochemistry</td>
<td>8:00 AM–12:00 PM</td>
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<tr>
<td>180</td>
<td>Igneous Petrology II</td>
<td>8:00 AM–12:00 PM</td>
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<td>181</td>
<td>Paleoclimatology/Paleoceanography II: Causes, Chronologies, and Modeling</td>
<td>8:00 AM–12:00 PM</td>
<td>A102-104-106</td>
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<td>182</td>
<td>Paleontology VI: Taphonomy and the Fossil Record</td>
<td>8:00 AM–12:00 PM</td>
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<td>183</td>
<td>Quaternary Geology III: Fluvial and Coastal Geomorphology</td>
<td>8:00 AM–12:00 PM</td>
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<td>184</td>
<td>Stratigraphy II: Sequence Stratigraphy and Basin Analysis</td>
<td>8:00 AM–12:00 PM</td>
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<td>185</td>
<td>Structure III: Fractures, Faults, and Fluid Flow</td>
<td>8:00 AM–12:00 PM</td>
<td>C102-104-106</td>
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<tr>
<td>186</td>
<td>Tectonics IV: Igneous, Metamorphic, and Geochronologic Perspectives on Continental Assembly and Breakup</td>
<td>8:00 AM–12:00 PM</td>
<td>C101-103</td>
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<tr>
<td>187</td>
<td>K8. New Insights on Organic Metamorphism in the Earth (Group Exploring Organic Processes in Geochemistry)</td>
<td>8:00 AM–12:00 PM</td>
<td>Ballroom 2 &amp; 3</td>
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<td>188</td>
<td>T14. Morphological and Mineralogical Biomarkers for Mars Exploration III</td>
<td>8:00 AM–12:00 PM</td>
<td>Ballroom 4</td>
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<tr>
<td>189</td>
<td>T27. Geologic Input to Public Decision-Making: The Need for Greater Predictive Capability (GSA Engineering Geology Division; Institute for Earth Science and the Environment)</td>
<td>8:00 AM–12:00 PM</td>
<td>A108-110</td>
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<tr>
<td>190</td>
<td>T42. A Multidisciplinary Study of Coalbed Methane in the Ferron Coals, Utah: An Unusual Resource with Potential for Global Environmental Impact (Posters) (GSA Coal Geology Division)</td>
<td>8:00 AM–12:00 PM</td>
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<td>191</td>
<td>T44. High-Resolution Stratigraphic Approaches in Paleontology (Paleontological Society)</td>
<td>8:00 AM–12:00 PM</td>
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<td>192</td>
<td>T46. Fire and Geology: Surface Processes and Stratigraphic Records (Posters) (GSA Quaternary Geology and Geomorphology Division)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>193</td>
<td>T48. Integrated Landscapes: The Colorado Front Range (GSA Quaternary Geology and Geomorphology Division)</td>
<td>8:00 AM–12:00 PM</td>
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<tr>
<td>194</td>
<td>T52. Geologic and Biologic Evidence for Late Cenozoic Drainage Rearrangements in North America: Implications for Aquatic Biogeography (GSA Quaternary Geology and Geomorphology Division; Smithsonian Institution)</td>
<td>8:00 AM–12:00 PM</td>
<td>C105-107</td>
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<tr>
<td>195</td>
<td>T56. The Case for Steady-State Mountain Belts: Observations, Models, and Implications for Global Tectonics (Posters) (GSA Quaternary Geology and Geomorphology Division)</td>
<td>8:00 AM–12:00 PM</td>
<td>Poster Hall</td>
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<tr>
<td>196</td>
<td>T65. Evaluation and Assessment of Multimedia Computer-Assisted Geoscience Education: A Hard Look at What Works and Why (Center for Research and Evaluation for Advanced Technologies in Education)</td>
<td>8:00 AM–10:00 AM</td>
<td>A201</td>
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<tr>
<td>197</td>
<td>T75. Geomicrobiology and Biogeochemistry II (Geochemical Society)</td>
<td>8:00 AM–12:00 PM</td>
<td>C108-110-112</td>
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<tr>
<td>198</td>
<td>T79. Dynamics of Mass Transport in Fractured Rocks and Fine-Grained Sediments: Contributions from Laboratory and Field Analyses to Conceptual and Mathematical Modeling I</td>
<td>8:00 AM–12:00 PM</td>
<td>C209</td>
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<tr>
<td>199</td>
<td>T83. From Atrazine to Antibiotics: The Occurrence and Fate of Agricultural Chemicals in the Hydrologic System (GSA Hydrogeology Division)</td>
<td>8:00 AM–12:00 PM</td>
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<tr>
<td>200</td>
<td>T90. Hydrologic Resources of Synorogenic Strata (Denver Museum of Natural History)</td>
<td>8:00 AM–12:00 PM</td>
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<tr>
<td>201</td>
<td>Clastic Sedimentology II: Structural and Tectonic Applications/Carbonate Sedimentology: Deposition and Diagenesis</td>
<td>1:30 PM–5:30 PM</td>
<td>A102-104-106</td>
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### GSA Short Courses at 1999 Annual Meeting

Registration information and course descriptions were published in the June issue of GSA Today. For additional information, contact Edna Collis, GSA headquarters; (303) 447-2020, ext. 134, ecollis@geosociety.org, or see GSA's Web site, www.geosociety.org.

**Preregistration deadline September 17**

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<td>202</td>
<td>Engineering Geology II/Expansive Soils, Road Salts, and General</td>
<td>1:30 PM–5:30 PM</td>
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<td></td>
<td>Engineering Geology</td>
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<td>203</td>
<td>Marine Geology (Posters)</td>
<td>1:30 PM–5:30 PM</td>
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<tr>
<td>204</td>
<td>Paleoecology/Paleoceanography (Posters)</td>
<td>1:30 PM–5:30 PM</td>
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<td>205</td>
<td>Paleontology/Paleobotany (Posters)</td>
<td>1:30 PM–5:30 PM</td>
<td>Poster Hall</td>
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<tr>
<td>206</td>
<td>Paleontology VII: Extinctions, Recoveries, and Paleobiogeography</td>
<td>1:30 PM–5:30 PM</td>
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<tr>
<td>207</td>
<td>Quaternary Geology IV: Quaternary Tectonics and Weathering</td>
<td>1:45 PM–5:30 PM</td>
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<td>208</td>
<td>Tectonics V: Laurentian/Gondwanan Correlations and Appalachian Geology</td>
<td>1:30 PM–5:30 PM</td>
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<tr>
<td>209</td>
<td>Volcanology</td>
<td>1:30 PM–5:30 PM</td>
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<td>210</td>
<td>K2. Human Transformation of the Physical Landscape (GSA Archaeological</td>
<td>1:30 PM–5:30 PM</td>
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<td>Geology Division)</td>
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<td>211</td>
<td>T11. Making Crustal Souffles: High Mountains and Thin Crust in the</td>
<td>1:30 PM–5:30 PM</td>
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<td>Sierra Nevada</td>
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<td>212</td>
<td>T20. Geology: The Bedrock of the Ecosystem; Biological Uses of Geologic</td>
<td>1:30 PM–5:30 PM</td>
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<td>Data (U.S. National Park Service, Geologic Resources Division; U.S.</td>
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<td>Geological Survey, Biological Resources Division; Institute for Earth</td>
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<td>Science and the Environment)</td>
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<td>Testing the Snowball Earth Hypothesis (Posters)</td>
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<td>214</td>
<td>T75. Geomicrobiology and Biogeochemistry III (Geochemical Society)</td>
<td>1:30 PM–5:30 PM</td>
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<tr>
<td>215</td>
<td>T79. Dynamics of Mass Transport in Fractured Rocks and Fine-Grained</td>
<td>1:30 PM–5:30 PM</td>
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<td></td>
<td>Sediments: Contributions from Laboratory and Field Analyses to Conceptual and Mathematical Modeling II</td>
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<td>216</td>
<td>T89. Sustainability of Water Resources in the High Plains (GSA Hydrogeology Division)</td>
<td>1:30 PM–5:30 PM</td>
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<td>217</td>
<td>T95. Wetland Hydrology and Geochemistry: The State of the Science (GSA Hydrogeology Division)</td>
<td>1:30 PM–5:30 PM</td>
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1. **Practical Methods in Applied Contaminant Geochemistry: From Characterization to Remediation**
   - **Saturday**, October 23, 8:00 a.m. to 5:00 p.m. both days.
   - Colorado Convention Center. Cosponsored by GSA Hydrogeology Division. **Faculty**: Evan R. Anderman, ERA Ground-Water Modeling, LLC; Denver; Ph.D.; Colorado School of Mines; James O. Rumbaugh, Environmental Simulations, Denver. **Limit**: 40. Fee: $385, students $365; includes course manual and lunches. CEUs: 1.6.

2. **Applied Inverse Ground Water Modeling: Why Use Anything Less?**
   - **Saturday–Sunday**, October 23–24, 8:00 a.m. to 5:00 p.m. both days.
   - Colorado Convention Center. Cosponsored by GSA Hydrogeology Division. **Faculty**: Kent Nielsen, Dept. of Geosciences, University of Texas at Dallas; Ph.D., University of British Columbia; Carlos Aiken, Dept. of Geosciences, University of Texas at Dallas; Ph.D., University of Arizona; Xuming Xu, Dept. of Geosciences, University of Texas at Dallas; M.S., Chinese Academy of Science. **Limit**: 25. Fee: $385, students $365; includes course manual and lunches. CEUs: 1.6.

3. **Digital Mapping Methods: Accurate Digital Data Capture and Analysis for the Field Scientist**
   - **Saturday–Sunday**, October 23–24, 8:00 a.m. **to** 5:00 p.m. both days.
   - Colorado Convention Center. **Faculty**: Kent Nielsen, Dept. of Geosciences, University of Texas at Dallas; Ph.D., University of British Columbia; Carlos Aiken, Dept. of Geosciences, University of Texas at Dallas; Ph.D., University of Arizona; Xuming Xu, Dept. of Geosciences, University of Texas at Dallas; M.S., Chinese Academy of Science. **Limit**: 40. Fee: $385, students $365; includes course manual, lunches, and field trip transportation. CEUs: 1.6.

4. **Introduction to Remote Sensing for Geologic Applications**
   - **Saturday–Sunday**, October 23–24, 8:00 a.m. **to** 5:00 p.m. both days.
   - Colorado Convention Center. Cosponsored by GSA Planetary Geology Division. **Faculty**: Andrea Gallagher, Research Systems, Boulder, Colorado; B.S., Colorado School of Mines; Rebecca Dodge, University of Texas at El Paso; Ph.D., Colorado School of Mines; K. Eric Livo, U.S. Geological Survey, Denver; M.S., Colorado School of Mines. **Limit**: 30. Fee: $325, students $305; includes course manual and lunches. CEUs: 1.6.

5. **Modern Salt Tectonics**
   - **Saturday–Sunday**, October 23–24, 8:00 a.m. **to** 5:00 p.m. both days.
   - Colorado Convention Center. Cosponsored by GSA Sedimentary Geology Division. **Faculty**: Mark G. Rowan, Rowan Structural Consulting, Boulder, Colorado; Ph.D., University of Colorado, Boulder. **Limit**: 50. Fee: $265, students $245; includes course manual and lunches. CEUs: 1.6.

6. **Three-Dimensional Seismic Interpretation: A Primer for Geologists**
   - **Saturday–Sunday**, October 23–24, 8:00 a.m. **to** 5:00 p.m. both days.
   - Colorado Convention Center. Cosponsored by GSA Structural Geology and Tectonics Division. **Faculty**: Bruce S. Hart, New Mexico Bureau of Mines and Mineral Resources; Ph.D., University of Western Ontario. **Limit**: 40. Fee: $280, students $260; includes course manual and lunches. CEUs: 1.6.

7. **Applications of Environmental Isotopes to Watershed Hydrology and Biogeochemistry**
   - **Saturday**, October 24, 8:00 a.m. **to** 5:00 p.m.
   - Colorado Convention Center. Cosponsored by GSA Hydrogeology Division. **Faculty**: Carol Kendali, Water Resources Division, U.S. Geological Survey, Menlo Park, California; Ph.D., University of Maryland; Thomas D. Bullen, Water Resources Division, U.S. Geological Survey, Menlo Park, California; Ph.D., University of California, Santa Cruz. **Limit**: 40. Fee: $275, students $255; includes course manual and lunch. CEUs: 0.8.

   - **Sunday**, October 24, 8:00 a.m. **to** 5:00 p.m.
   - Colorado Convention Center. **Faculty**: Christopher R. Scotese, Dept. of Geology, University of Texas at Arlington; Ph.D., University of Chicago. **Limit**: 30. Fee: $175, students $155; includes course manual, CD-ROM, software, and lunch. CEUs: 0.8.
NEW AND NOTEWORTHY

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The Remote Sensing Data Book
Gareth Rees
This volume contains over 700 alphabetically arranged and cross-referenced entries on how remote sensing works, what kinds of data are available, and the large number of satellites and instruments from which the information is obtained. As well as short technical definitions, the book also includes longer essays and reviews to give a complete overview of the subject.
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Robert Mendelsohn and James E. Neumann, Editors
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—Times Literary Supplement
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Preliminary Announcement and Call for Papers

SOUTH-CENTRAL SECTION, GSA
34th Annual Meeting
Fayetteville, Arkansas
April 3–4, 2000

The Department of Geosciences of the University of Arkansas at Fayetteville in conjunction with the Arkansas Water Resource Center, University of Arkansas at Fayetteville, Department of Earth Science of the University of Arkansas at Little Rock, Department of Physical Science-Geology of Arkansas Tech University, Arkansas Geological Commission, and Fort Smith Geological Society will host the 2000 annual meeting of the South-Central Section of the Geological Society of America. Meeting dates will be Sunday evening, April 2, through Tuesday, April 4, at the Continuing Education Center in Fayetteville, Arkansas. The meeting will be held in association with the Pander Society, the South-Central Section of the Paleontological Society, and the Midcontinent Section of the Society for Sedimentary Geology. A more detailed description of the meeting arrangements is on the GSA Web site at http://www.geosociety.org.

CALL FOR PAPERS

Papers are invited for presentation in oral sessions, symposia, and poster sessions. Volunteered abstracts not included in symposia will be scheduled for regular technical sessions. Anyone wishing to organize a symposium should contact Doy Zachry, Dept. of Geosciences, University of Arkansas, Fayetteville, AR 72701, 501-575-2785, fax 501-575-3177, dzachry@comp.uark.edu.

ABSTRACTS

Abstract Deadline: December 8, 1999

Abstracts for all sessions must be submitted camera-ready on official 2000 GSA section meeting abstract forms. The forms are available from the GSA Abstracts Coordinator, P.O. Box 9140, Boulder, CO 80301, or ncarlson@geosociety.org. A downloadable PDF version will be available on the GSA Web site. Submit completed abstracts to Van Brahana, Dept. of Geosciences, University of Arkansas, Fayetteville, AR 72701, 501-575-2785, fax 501-575-3177, jbrahana@jungle.uark.edu.

SYMPOSIA

1. Alkalic Rocks of North America. Don F. Parker, Dept. of Geology, Baylor University, Waco, TX 76798, don_parker@baylor.edu; Daniel S. Barker, Dept. of Geosciences, University of Texas, Austin, TX 78712, danbarker@mail.utexas.edu; J. Michael Howard, Arkansas Geological Commission, 3815 W. Roosevelt Rd., Little Rock, AR 72204, Mike.Howard@mail.state.ar.us.

2. Advances in Structural Geology. John M. Spang, Dept. of Geology and Geophysics, Texas A & M University, College Station, TX 77843-3115, J.Spang@tamu.edu; Jeffrey Connelly, Dept. of Earth Science, University of Arkansas, Little Rock, AR 72204-1099, jbcronnelly@uark.edu.

3. Atokan Series: A Centennial Re-examination. (Sponsored by Paleontological Society South-Central Section.) Walter L. Manger, Dept. of Geosciences, University of Arkansas, Fayetteville, AR 72701, wmanger@comp.uark.edu.

4. Hydrogeology of Mantled Karst. Van Brahana, Dept. of Geosciences, University of Arkansas, Fayetteville, AR 72701, jbrahana@uingle.uark.edu.

5. General Hydrogeology. Ralph K. Davis, Dept. of Geosciences, University of Arkansas, Fayetteville, AR 72701, ralphd@comp.uark.edu.


8. Pander Society Symposium. James Barrick, Dept. of Geosciences, Texas Tech University, Lubbock, TX 79409-1053, ghjeb@ttu.edu.

FIELD TRIPS

Premeeting
1. Peralkalic Rhyolite of the Davis Mountains. Don F. Parker, Dept. of Geology, Baylor University, Waco, TX 76798, don_parker@baylor.edu; Daniel S. Barker, Dept. of Geosciences, University of Texas, Austin, TX 78712, danbarker@mail.utexas.edu.


Postmeeting
5. Alkalic Rocks of Central Arkansas. J. Michael Howard, Arkansas Geological Commission, 3815 W. Roosevelt Road, Little Rock, AR 72204, Mike Howard @mail.state.ar.us.

EXHIBITS

Booths and table space will be available in a ballroom near the poster sessions. Contact Stephen K. Boss, Dept. of Geosciences, University of Arkansas, Fayetteville, AR 72701, (501) 575-7134, sboss@comp.uark.edu for details.

UNDERGRADUATE RESEARCH POSTER SESSION

Sponsored by Geology Division of Council on Undergraduate Research. Designed to showcase senior theses and other undergraduate research projects. For more information, contact Diane Smith, Dept. of Geosciences, Trinity University, (210) 999-7656, dsmith@trinity.edu, or visit the GSA Web site (www.geosociety.org).

REGISTRATION

P preregistration deadline February 18, 2000. The preregistration form will be available in December 1999.

HOUSING

A block of rooms is reserved at the Hilton Hotel in Fayetteville. The hotel is physically connected to the Center for Continuing Education, where the meetings will be held, and is convenient to restaurants on and around the Fayetteville Square. Rooms for students at a lower cost will be available at a dormitory on the University of Arkansas campus. Buses routinely travel between the dormitories and the Continuing Education Center at convenient intervals and at no cost.

ADDITIONAL DETAILS

Details about social events, business meetings and student travel support and awards will be published in the December 1999 issue of GSA Today. See the GSA Web site (www.geosociety.org) for more information. Request a printout of the announcement from GSA Meetings, P.O. Box 9140, Boulder, CO 80301-9140 or (303) 447-2020, ext. 113.
Preliminary Announcement and Call for Papers

NORTHEASTERN SECTION, GSA
35th Annual Meeting
New Brunswick, New Jersey
March 13-15, 2000

REGISTRATION
Preregistration Deadline: February 4, 2000
The preregistration form will be available in December 1999 GSA Today.

ABSTRACTS
Abstract Due: February 4, 2000
Preregistration Deadline: March 13-15, 2000
New Brunswick, New Jersey

SYMPOSIA
Prospective authors should contact the conveners directly. Symposium Co-chairs are: Kenneth G. Miller, Technical Program Chairperson, Dept. of Geological Sciences, Wright Labs, Rutgers University, 610 Taylor Rd., Piscataway, NJ 08854-8066. Request forms from GSA Abstracts Coordinator, P.O. Box 9140, Boulder, CO 80301-9140, or ncarnson@geosociety.org.


3. Influence of Urbanization on River Form and Process. Jim Pizzuto, Dept. of Geology, University of Delaware, Newark, DE 19716, (302) 831-2910, pizzuto@udel.edu; W. Cully Hession, (610) 566-5414, hession@acmatsi.org.


5. Coastal Hazards and Management in the Mid-Atlantic Bight. Susan Halsey, New Jersey Dept. of Environmental Protection, Trenton, NJ 08625, (609) 292-9762, shalsey@dep.state.nj.us; Nicholas Coch, (212) 642-2202.

6. Evidence for the Assembly and Breakup of Rodinia in the Appalachians. Alec E. Gates, Dept. of Geological Sciences, Rutgers University, 195 University Ave., Room 411, Newark, NJ 07102, (973) 353-5034, agates@andromeda.rutgers.edu; Richard Volkert, (609) 292-2576, richv@njs.dep.state.nj.us.

7. Effectiveness of K–16 Collaboration in Geoscience Education. (Sponsored by NAGT) Richard F. Yuretich, Dept. of Geosciences, University of Massachusetts, Amherst, MA 01003, (413) 545-0538, yuretich@geo.umass.edu; Richard D. Little, (413) 757-1445, little@gcc.mass.edu.

8. Appalachian Basin Stratigraphy: Sequences in an Active Tectonic Basin. (Sponsored by Northeastern Section of SEPM.) Chuck Mitchell, Dept. of Geology, SUNY Buffalo, Buffalo, NY 14260-3050, (716) 645-6800, ext. 3991, cem@ns.m.buffalo.edu; Robert Jacobi, (716) 645-6800, rjacobl@acsu.buffalo.edu.

9. Environmental Geophysics (Poster). Samuel Peavy, Dept. of Geological Sciences, Boyden Hall, Rutgers University, Newark, NJ 07102, (973) 353-1851, peavy@andromeda.rutgers.edu.

THEMES
Theme session papers are volunteered. Prospective authors should contact the conveners directly. For general information, contact Gail M. Ashley or Peter Rona (see Symposia).


2. Late Cretaceous to Cenozoic Sea Level, Sequences, and the U.S. Atlantic Margin. Gregory S. Mountain, Lamont-Doherty Earth Observatory, Palisades, NY 10964, (914) 365-8077, mountain@deo.columbia.edu; Kenneth G. Miller, (732) 445-3374, kmg@rci.rutgers.edu.

3. East Coast Rift Basins and Late Triassic–Early Jurassic Paleoclimate. Dennis V. Kent, Dept. of Geological Sciences, Wright Labs, Rutgers University, 610 Taylor Rd., Piscataway, NJ 08854-8066, (732) 445-6974, dkvc@rci.rutgers.edu; Paul E. Olsen, (914) 365-849, polsen@deo.columbia.edu.

4. Filling the Rift: Modern and Ancient Sedimentary Systems in Rift Valleys. (Sponsored by SEPM Northeastern Section.) Craig S. Feibl, Dept. of Anthropology, Rutgers University, 131 George St., New Brunswick, NJ 08901-1412, (732) 932-8853, feibl@rci.rutgers.edu; Gay M. Ashley, (732) 445-2221, gmashley@rci.rutgers.edu.


7. Value of Geologic Research in Public Lands. Jack B. Epstein, U.S. Geological Survey, MS926A, National Center, Reston, VA 20192, (703) 648-6944, jepstein@usgs.gov; Donald Monteverde, (609) 984-7929, donnm@njs.dep.state.nj.us.

8. Taphonomy: Case Studies in the History of Fossils From Death Until Discovery. (Sponsored by Paleontological Society.) Cindy Fisher, Dept. of Geology and Astronomy, West Chester University, West Chester, PA 19383, (610) 436-2108, cfisher@wcupa.edu; Christopher McRoberts, (607) 753-2925, mcroroberts@cornell.edu.


10. Appalachian Basin Stratigraphy: Sequences in an Active Tectonic Basin. (Sponsored by SEPM Northeastern Section.) Chuck Mitchell, Dept. of Geology, SUNY Buffalo, Buffalo, NY 14260-3050, (716) 645-6800, ext. 3991, cem@ns.m.buffalo.edu; Robert Jacobi, (716) 645-6800, rjacobl@acsu.buffalo.edu.

11. Undergraduate Research. (Sponsored by the Council on Undergraduate Research Geology Division.) David G. Bailey, Dept. of Geology, Hamilton College, Clinton, NY 13323 (315) 859-4142, dbailey@hamilton.edu. Poster only.

SHORT COURSE
Preliminary Announcement and Call for Papers

SOUTHEASTERN SECTION, GSA
49th Annual Meeting

Charleston, South Carolina
March 22-24, 2000

Please see the full announcement of this meeting at the following Web sites:
http://www.geosociety.org/
http://www.cofc.edu/~geology/SEGSA/
http://www.geo.ua.edu/segsa/

REGISTRATION
Meeting Preregistration and Hotel Accommodation Deadline: February 11, 2000

Please preregister to qualify for lower registration fees, and to assist the local committee in planning. Field trip participants must preregister for the meeting. Preregistration by mail will be handled by the GSA Registration Coordinator, P.O. Box 9140, Boulder, CO 80301-9140. Pre-registration forms will be available in December 1999. The local committee encourages preregistration because accommodations are scarce in Charleston during the spring months.

ACCOMMODATIONS
The conference will be held at the Westin Francis Marion Hotel, 387 King St., Charleston, SC 29403, (800) 937-8461. Rooms will range from $99 to $129. Other accommodations are available; see www.geosociety.org.

ABSTRACTS
Abstract Deadline: December 8, 1999

Abstracts for all sessions must be submitted camera-ready on official 2000 GSA Section meeting abstract forms. These forms are available from the Abstracts Coordinator, GSA, P.O. Box 9140, Boulder, CO 80301, (303) 447-2020, ext. 161, ncarlson@geosociety.org, or the Technical Committee Co-Chair, June Mirecki, College of Charleston, mireckij@cofc.edu. A downloadable PDF version will be available on the GSA Web site. An original and five copies of all abstracts should be sent to June Mirecki, Dept. of Geology, College of Charleston, Charleston, SC 29424. Late abstract submissions will be returned. Abstracts sent by e-mail or fax will not be accepted.

FIELD TRIPS
For general questions concerning field trips please contact Christopher Abate, field trip coordinator, abatec@cofc.edu, (843) 953-1802.

Field Trips—Tentative
1. Paleoliquefaction Effects of the 1886 Charleston Earthquake. Pradeep Talwani, University of South Carolina, Columbia, talwani@prithvi.seis.sc.edu, (803) 777-6449.
2. Charleston Earthquake Damage Walking Tour. (Sponsored by NAGT Southeastern Section.) William A. Smith, Earthquake Education Center, Charleston Southern University, wsmith@csuniv.edu, (843) 863-8085.
3. Neotectonic Features of the Lower Coastal Plain of Georgia and South Carolina. Jerry Bartholomew, ESRI, University of South Carolina, Columbia, jbarth@esri.sc.edu, (843) 953-8278.
4. Newberry Eclogite: Structural Setting and Style of Occurrence. Allen J. Dennis, University of South Carolina, Aiken, dennis@sc.edu, or (803) 641-3396; John Shervais; Don Secor.
5. Folly Beach: Tomorrow’s Coastal Problems, Today. Gered Lennon, College of Charleston, lennon@cofc.edu, (843) 953-3193.
7. Depositional History and Coastal Processes at Cape Romain. Walter J. (Jerry) Sexton, Athena Technologies, Inc., Columbia, athena@netside.com, (803) 790-4483; Tim Kana, tkana@aol.com, (803) 799-8949.
8. Paleontology and Biostratigraphy of the Coastal Plain. David Campbell, University of North Carolina, Chapel Hill, bivalve@mailserv0.isis.unc.edu, (919) 966-4516.
9. Sapelo Island Coastal Geology and Paleontology. Susan J. Goldstein, goldst02@ualu.uga.edu, (706) 542-2397; John Garbsch, jgarbsch@peachnet. campususw.net.

SYMPOSIA
If you have a suggestion for an additional symposium, please contact June Mirecki, College of Charleston, Charleston, South Carolina, mireckij@cofc.edu, (843) 953-8278.

1. Role of Geology in Coastal Restoration. Richard A. (Skip) Davis, Jr., University of South Florida, Tampa, rdavis@chuma.cas.usf.edu, (813) 974-2773; Orrin H. Pilkey, pilkey@geo.duke.edu, (919) 684-5847. Oral and poster.
2. The Bald Head Island Conferences on Coastal Plain Geology Revisited; A Memorial to Victor A. Zullo. W. Burleigh (Bill) Harris, harrisw@uncwil.edu, (910) 962-3492, University of North Carolina, Wilmington; Tricia Kelley, kelleyp@uncwil.edu, (910) 962-3490; Richard A. Laws, laws@uncwil.edu, (910) 962-3490. Oral and Poster.

Southeastern continued on p. 30

Northeastern continued from p. 28
Massachusetts Institute of Technology, Cambridge, MA 02139, (617) 253-2127, Southard@MIT.edu.

FIELD TRIPS
The field trip coordinator is Roy Mueller, Environmental Studies, Stockton College, Pomona, NY 08240, (609) 652-4209, Ray.Mueller@stockton.edu.

DETAILED INFORMATION
For more information, contact the general chair, Robert E. Sheridan, Dept. of Geological Sciences, Rutgers University, 610 Taylor Rd., Piscataway, NJ 08854-8066, (732) 445-2015, rsheridin@rci.rutgers.edu, or see the GSA Web site, www.geosociety.org. Request a printout of the announcement from GSA Meetings, P.O. Box 9140, Boulder, CO 80301-9140 or (303) 447-2020, ext. 113.
GSAF UPDATE

Donna L. Russell, Director of Annual Giving

Foundation Appoints Eaton as Trustee

The GSA Foundation Board of Trustees is pleased to announce the appointment of Gordon P. Eaton as a Foundation Trustee. He will complete the term of Hugo Dummett, who has resigned. Eaton is also a current member of the Foundation’s Board Development Committee.

Eaton, who lives in Coupeville, Washington, brings a wide variety of experience and leadership to the Board.

He graduated from Wesleyan University with high honors and a B.A. in geology. He received an M.S. in geology as well as a Ph.D. in geology and geophysics from the California Institute of Technology. In 1994, he became the 12th Director of the U.S. Geological Survey. Eaton held a variety of positions with the U.S. Geological Survey during his career there, including Associate Chief Geologist in Reston, Virginia; Scientist-in-Charge at the Hawaiian Volcano Observatory in Hawaii; Project Chief of Geothermal Geophysics and Project Chief of the Southwestern Geophysics Project both in Denver, Colorado; and Deputy Chief of the Office of Geochemistry and Geophysics in Washington, D.C. and Reston, Virginia.

He also served as the Director of Lamont-Doherty Earth Observatory of Columbia University in Palisades, New York for four years, and was President of Iowa State University in Ames, Iowa for four years. Earlier, Eaton was Dean of the College of Geosciences, then Vice President for Academic Affairs at Texas A&M University.

Eaton has received many honors during his career, including the American Geological Institute’s Ian Campbell Medal in 1995, as well as the California Institute of Technology Distinguished Alumnus Award in 1995. He is currently a member of the Earth Sciences Advisory Board at Stanford University and the External Advisory Board of the Geoscience and Environment Center at Sandia National Laboratories. Morris “Brud” Leighton, Chair of the GSA Foundation Board commented, “I am very pleased that Gordon has accepted a position as Trustee on the Board. Gordon brings many talents to our Board and is well known among the geologic community.”

El-Baz Award Fund Growing

The recent announcement by GSA and Boston University that the Farouk El-Baz Award for Desert Research will be naming its first recipient at the GSA Annual Meeting in Denver has generated a plethora of contributions to the Foundation. In June alone, over $71,000 was received for the El-Baz award fund, bringing the endowment balance to $91,945.

El-Baz, research professor and director of the Center for Remote Sensing at Boston University, intends for this award to encourage young scientists to strive for excellence in desert research. According to El-Baz, deserts have not received as much attention by geologists as other types of landforms, and that is why we need to encourage and reward arid-land studies. The El-Baz award will be managed by the Quaternary Geology & Geomorphology Division of GSA.

El-Baz is well known for his work on the Apollo missions and the use of remote sensing techniques in nondestructive archaeology and exploration for groundwater in arid lands. He is currently working on a project for the Sultanate of Oman. El-Baz’s scientific contributions have made a remarkable legacy for future generations.

Bryce Hand Award for 2000

To honor the retirement of Bryce Hand from 30 years of service at the University of Syracuse, several friends and associates made contributions to the GSA Foundation’s Research Grants Fund. Hand, whose specialty is in sedimentation, joined the geology department at Syracuse as an associate professor in 1969.

All donations received in honor of Bryce Hand will be given to the GSA Committee on Research Grants in the spring of 2000 for a one-time Bryce Hand Award.

Southeastern continued from p. 29

3. New Strategies for Interpreting the Coastal Plain of South Carolina; A Memorial to Donald J. Colquhoun. David C. Prowell, U.S. Geological Survey, Atlanta, dprowell@usgs.gov, (770) 903-9100; Karen E. Waters, waters@water.dnr.state.sc.us, (803) 737-0800; Joseph A. Gellici, gellici@water.dnr.state.sc.us. Oral.


5. Planetary Geology in the Southeastern Section. Harry A. (Hap) McSween, University of Tennessee, Knoxville, mcsween@utk.edu, (423) 974-9805. Oral.

6. Geoarchaeology—Blackbeard’s Flagship Queen Anne’s Revenge Returns to Charleston. John E. Callahan, Appalachian State University, Boone, North Carolina, callahn@Appstate.edu, (828) 262-2746; Mark Wilde-Ramsing, mramsing@ncsl.dcr.state.nc.us, (901) 458-9042. Oral.

7. Structure and Tectonics Symposium in Honor of Donald T. Secor, Jr. Allen J. Dennis, University of South Carolina, Aiken, dennis@sc.edu, (803) 641-3396; John W. Shervais, shervais@sc.edu, (803) 777-2669. Oral.

8. Structural Geology, Metamorphism, and Geochronology Along the Eastern-Western Blue Ridge Contact. Charles H. Trupe, Georgia Southern University, Statesboro, ctrupe@gsaix2.cc.gasou.edu, (912) 681-0337; Kevin G. Stewart, kgstewar@email.unc.edu, (919) 966-4519. Oral.

9. Shoreline and Shoreface Geology of the Carolinas: Recent Advances. William J. Cleary, University of North Carolina at Wilmington, clearyw@uncwil.edu, (910) 256-3721, ext. 251; Stanley R. Riggs, riggsms@mail.ecu.edu, (252) 328-6379. Oral.

THEME SESSIONS

If you have a suggestion for a theme session, please contact June Mirecki, mireckij@cofc.edu, (843) 953-8278.

1. Hydrology at the Land’s Edge: Sea-Water Intrusion, Submarine Discharges, and Groundwater Geochemical Fluxes. W. Berry Lyons, University of Alabama, Tuscaloosa,
Birdsall Award
Philip C. Bennett
George H. Davis

John T. Dillon Alaska Scholarship Award
Catherine L. Hanks

Shirley Dreiss Memorial
Maryellen Cameron*

Engineering Geology Award
Phyllis Wormington

Farouk El-Baz Fund
Mohammed Al Qassimi**
Moataz Al-Alfi**
American Research Center in Egypt**

Kathryn A. Bard*
Samuel W. Bodman**
Paul Rich Dinsmore**
H. E. Dregne**
Donald C. Fraser*
Friends of the Libraries*
Shanti Golden*
Patricia C. Grodzki*
George Hatsopoulos*
Jennifer A. Inzana*
Timothy M. Kusky*
Samira Omar**
Cordula Robinson*
Barbara Ross*
Priscilla L. Strain*
Qaboos bin Said Sultan of Oman**
Noel Sweetzer**

Howard R. & Marilyn B. Gould Student Research Grant
Howard R. & Marilyn B. Gould**

History of Geology Award
Michele L. Aldrich*

Institute for Earth Sciences & the Environment National Science Foundation**
E-an Zen*

J. Hoover Mackin Award
Bruce H. Bryant

Antoinette Lierman Medlin Scholarship Award
Richard F. Meyer
John F. Murphy

Meetings Support
M. Lee Allison

Minority Fund
R. Ernest Anderson

Northeastern Section Endowment
Robert W. Metsger*

Penrose Conferences
R. Ernest Anderson

Oregon Department of Geology & Mineral Industries*

Research Grants
Jean M. Bahr
Charles E. Bartberger in honor of Bryce Hand
Marion E. Bickford, Jr.*
in honor of Bryce Hand
Deborah A. Bondi- Ellison in honor of Bryce Hand
James C. Brower in honor of Bryce Hand
Carol Cavalluzzi in honor of Bryce Hand
John L. Davis in honor of Bryce Hand
Vita Demarchi in honor of Bryce Hand
Susan M. Dugolinsky in honor of Bryce Hand

Christine Gilmore in honor of Bryce Hand
Jane A. Gilotti
Daniel Howe in honor of Bryce Hand
Linda C. Ivany* in honor of Bryce Hand
George C. Kelley in honor of Bryce Hand
Ruth H. Major in honor of Bryce Hand
Leslie D. McFadden
Annie Merriam in honor of Bryce Hand
David Lachlan Meyer*
Helen M. Michaels in honor of Bryce Hand
Ernest H. Muller in honor of Bryce Hand
Henry T. Mullins in honor of Bryce Hand

National Science Foundation**
Stephen Norwich
Beverly H. O'Brien in honor of Bryce Hand
Douglas G. Patchen in honor of Bryce Hand
John J. Prucha in honor of Bryce Hand
Kenneth B. Ranlet in honor of Bryce Hand
Joanne L. Ranz in honor of Bryce Hand
Joseph E. Robinson in honor of Bryce Hand

Christopher A. Scholz in honor of Bryce Hand

Donors to the Foundation, June 1999

Digging Up the Past
Most memorable early geologic experience:

“In 1951, I was a neophyte mapping alone in remote Navajo country; an Indian carrying a rifle approached. To my east-coast eyes he looked mean. I became frightened, especially when he demanded to know what I was doing on his land. I told him (with some anxiety) and invited him to share my lunch, which he did. We talked about geology and the land, and I learned that we had many interests in common, despite our different cultures.”

—Arthur Mirsky

blyons@wgs.geo.ua.edu, (205) 348-0583; Anne E. Carey, acarey@coe.eng.ua.edu, (205) 348-4008. Oral.

2. From the Mountains to the Sea: The Biogeochemistry of Surface Waters in the Southeast. C. Brannon Anderson, Furman University, Greenville, cbrannon.anderson@furman.edu. (864) 294-3366; William B. (Brian) Hughes, U.S. Geological Survey—Water Resources Division, wbhughes@usgs.gov, (803) 750-6106. Oral.

3. Innovative Applications of GIS Technology to Geologic Research. (Sponsored by Sigma Gamma Epsilon.) Douglas W. Haywick, University of South Alabama, Mobile, dhaywick@aguar1.usouthal.edu, (334) 460-6381, David T. Allison, dallison@aguar1.usouthal.edu. Poster and oral.

4. The Geologist as Informant: Assessing Geohazard Risks and Raising Public Awareness. (Sponsored by the GSA Committee for Geology and Public Policy.) Peter J. Lemiszki, Tennessee Division of Geology, Knoxville, pleniszki@mail.ustn.us, (423) 994-5598; Earl A. Shapiro, earl_shapiro@mail.dnr.state.ga.us, (404) 656-2833. Oral.

5. Geology and Military History. (Sponsored by the Southeastern Sections GSA Education Committee and NAGT.) Robert C. Whisnant, Radford University, Virginia, rwhisona@unet.edu, (540) 831-5224; Roger J. Cuffey, cuffey@ems.psu.edu, (814) 865-1293. Oral.


8. Undergraduate Research. (Sponsored by the Council for Undergraduate Research.) C. Brannon Anderson, Furman University, Greenville, cbrannon.anderson@furman.edu, (864) 294-3366; Joel B. Thompson, thompsjb@eckerd.edu, (813) 864-8991. Poster.

Request a printout of the announcement from GSA Meetings, P.O. Box 9140, Boulder, CO 80301-9140 or (303) 447-2020, ext. 113.
GSA's 1999 Research Grant Awards

Leah Carter, Research Grants Administrator

The GSA Committee on Research Grants met in Boulder, Colorado, on April 16-17, 1999, and awarded $395,235 to 212 graduate student applicants, and $20,000 for the Gladys W. Cole and W. Storr's Cole Awards to two postdoctoral applicants. Committee members for 1999 are Paul M. Myrow (Chair), James N. Connelly, Duncan M. FitzGerald, James G. Schmitt, Allen F. Glazner, Brian G. Katz, Jim E. O'Connor, Russell C. Kelz (National Science Foundation Conference).

COLE AWARDS FOR POSTDOCTORAL RESEARCH

Grant A. Meyer, Middlebury College, Vermont, was awarded the Gladys W. Cole Memorial Research Award for 1999 to support his project "Postglacial Climate and Alluvial System Processes in the Arid Bighorn Basin, Wyoming: Insights through Comparison to Adjacent High-Elevation Systems." This award is restricted to support research for the investigation of the geomorphology of semi-arid and arid terrains in the United States and Mexico.

The W. Storr's Cole Memorial Research Award, which is restricted to support research in invertebrate micropaleontology, was presented this year to T. Markham Puckett, University of Alabama, for his project "The Use of Ostracodes in Sequence Stratigraphy."

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

STUDENT AWARDS

This year, proposals were received from 468 students, of which 212 (45%) were awarded grants. Of these recipients, 92 are master's candidates, and 120 are doctoral candidates. Proposal requests totaled $952,603 for an average of $2,035. The average award was $1,865.

Twenty alternate candidates were selected by the committee in the event that some of the grantees return all or part of their grant funds due to their having changed their research project or receiving funds from another source.

The Committee's budget included $170,000 from the Petroleum Endowment and the Pardee Memorial, $130,000 from the National Science Foundation, $8,500 from the Harold T. Stearns Award Fund, the Geophysics Division, the Sedimentary Geology Division, and the Structural Geology and Tectonics Division, and $3,814 from funds returned too late in 1998 and early in 1999 to be re-awarded. The budget also included $83,600 from the GSA Foundation which included $27,000 from the Research Fund (including $2,000 from Mobil Oil), $46,785 from GEOSTAR and Unrestricted funds, $1,000 from the Second Century Fund (donations by the Lipman Research Fund), and $2,100 from the Engineering Geology and Hydrogeology Divisions.

The recipients of student research grants awarded by GSA divisions and sections will be announced in the October issue of GSA Today.

OUTSTANDING MENTION

The Committee on Research Grants specially recognized 32 of the proposals as being of exceptionally high merit in conception and presentation:

Wade Lee Aubin, Washington State University, "Magma Mingle in Ignimbrites of the Deschutes Formation, Northern-Central Oregon: Implications for Magma Genesis in the High Cascades."

Mengesha Assefa Beyene, University of Nevada—Las Vegas, "Timing and Kinematics of Pinto Shear Zone, New York Mountains, Northeastern Mojave Desert, California."

Donors continued from p. 31

Bette S. Siegel in honor of Bryce Hand
C. Brian Trask in honor of Bryce Hand
Craig A. Webb in honor of Bryce Hand

Rocky Mountain Section Endowment
Robert M. Weidman*

SAGE
National Science Foundation*
Kenneth H. Noble*
E-an Zen*

Shoemaker Memorial Fund for Crater Studies
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Charles E. Seedorff*
Holly J. Stein
Jing Tao
J. Cotter Tharin
Robert M. Weidman*
Edmund G. Wermund, Jr.
Manfred P. Wolff
Phyllis Wormington

*Century Plus Roster (gifts of $150 or more).
**Second Century Fund.
Peter A. Buscemi, University of Massachusetts, “The Petrologic and Tectonic Significance of Proterozoic Ultramafic Rocks in the Upper Granite Gorge, Grand Canyon, Arizona.”

Donna D. Carlson, University of Cincinnati, “Bivalve Epibiont Armor: The Evolution of an Anti-Predatory Strategy.”

Amy Carter, University of Nebraska-Lincoln, “Mid-Late Holocene Sea Level Change—Optically Stimulated Luminescence Dating of Coastal Sands from the Texas Gulf Coastal Plain.”


Mark Clementz, University of California—Santa Cruz, “Stable Isotopes as Indicators of Dietary Preferences and Niche Partitioning within Sirensians.”

Luke Copland, University of Alberta, “Relationship Between Short-Term Velocity Patterns and Subglacial Hydrology on a Polythermal Glacier.”

Catherine Duke, University of New Mexico, “Aqueous Alteration of Carbonaceous Chondrites: Experimental Low-Temperature Hydrothermal Alteration of Allende.”

Rebecca Marie Flowers, University of Utah, “Structural and Geochronological Investigation of a Mid-Crustal Discontinuity Exposed in the Vredefort Impact Structure, South Africa.”

Duane G. Froese, University of Calgary, “Ground Penetrating Radar and Resistivity Imaging of Valley-Fill Geometry: A New Method to Quantify Grade and Neotectonic Effects on Rivers.”

Rebecca R. Ghent, Southern Methodist University, “Numerical Modeling of Folds and Ribbons in Venusian Crustal Plateaus.”

Galen Pippa Halverson, Harvard University, “Dating Cap Dolomites in Svalbard: An Attempt to Constrain the Number of Neoproterozoic Glaciations.”

Ulrike Maria Huber, University of Colorado, “Linkages between Past Climate, Vegetation and Fire Regimes in Southernmost Patagonia and Tierra del Fuego.”

Marcia L. Jensen, University of New Mexico, “Evaluating Dinosaur Metabolism Using Stable Isotope Geochemistry.”

Ganqing Jiang, Columbia University, “Integrated Sequence and Chronostratigraphy of the Neoproterozoic Yangtze Platform of South China.”


Nancy E. Leawood, Memorial University of Newfoundland, “Distribution and Transport of Toxic Heavy Metals in a Heavily Polluted Estuarine Harbour.”

Kevin M. Middleton, Brown University, “Morphological and Functional Evolution of the Hallux (Digit I) in Mesozoic Birds.”

Christopher M. Moy, Syracuse University, “Holocene El Niño Events Preserved in Lacustrine Sediment Cores from the Southern Ecuadorian Andes.”

Radu Popa, University of Cincinnati, “Biogenic Origin of Framboidal Pyrite Via an Energy-Yielding Fe$^{2+}$/S$^{2-}$.”

Joshua H. Ring, Stanford University, “Geochronology and Petrology at Mammoth Mountain in the Western Moat of Long Valley Caldera, California: Recurrence Intervals and Possible Eruption Triggers at a Potentially Active Volcano.”

Meredith S. Robertson, University of Southern California, “Paleoseismic Investigations of the San Andreas and Garlock Faults, Southern California: Implications for Fault Interactions.”

Jennifer C. Russel, Dalhousie University, “Taphonomy and Microevolution of the Cape Phillips Formation Graptolite Fauna, Cornwallis Island, Arctic Canada.”

Jennifer Rebecca Smith, University of Pennsylvania, “A History of Quaternary Climate Change and Human Occupation in the Western Desert, Egypt.”

Laryn Micaela Smith, University of Colorado, “Holocene Paleoenography of the East Greenland and Northwest Icecontinental Margins of the Denmark Strait.”

Kristin Polizzotto Tausch, Cornell University, “Evidence of Environmental Effects on the Fossil Gastrodiscus Turritella cooperi and T. jewettii: Marks of Predation and Stable Isotope Analysis.”

Douglas Keith Tinkham, University of Alabama, “High-Temperature Tectono-thermochronology Along the Wasatchehe Block, Cascade Crystalline Core, Washington: Metamorphic Phase Equilibria and Garnet Sm-Nd Chronology.”

Asuka Tsuji, University of Alberta, “Chemical Weathering in Glacial Environments: Establishing Links between the Himalayan Mountains, CO$_2$ Levels and 813 Isotopic Oceanography.”

Jorge A. Vazquez, University of California—Los Angeles, “Chronology of Magma Chamber Processes in the Yellowstone Caldera System using Ion Microprobe Analysis.”


**STUDENT RECIPIENTS OF SPECIAL AWARDS IN 1999**

**Gretchen L. Blechschmidt Research Award.** This award supports research for women interested in achieving a Ph.D. in the geological sciences and a career in academic research. This year’s recipient is Laryn Micaela Smith, University of Colorado, for her project “Holocene Paleoenography of the East Greenland and Northwest Icecontinental Margins of the Denmark Strait.”

**John T. Dillon Alaska Research Award.** John T. Dillon was 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 recipient of this award is Jeffrey David Manusza, Purdue University, for “Development of a Sedimentologic and Structural Model for Collisional Basins: A Case Study of the Nutzotin Basin, Alaska.”

**Robert K. Fahnstock Award.** This award honors the memory of Ken Fahnstock, who was a member of the Committee on Research Grants. It is awarded to the applicant with the best proposal in sediment transport or related aspects of fluvial geomorphology. The 1999 recipient is Simon Brocklehurst, Massachusetts Institute of Technology, for “Effects of Glacial Erosion on Relief in the Eastern Sierra Nevada.”

**Lipman Research Award.** The Lipman Research Fund is supported by gifts from the Howard and Jean Lipman Foundation to promote and support student research grants in volcanology and petrology. Peter W. Lipman, president of the Lipman Foundation, was the recipient of a GSA research grant in 1965. The 1999 Lipman Award recipient is Jorge A. Vazquez, University of California—Los Angeles, for “Chronology of Magma Chamber Processes in the Yellowstone Caldera System using Ion Microprobe Analysis.”

**Bruce L. “Biff” Reed Scholarship Award.** The Bruce L. “Biff” Reed Scholarship Award was established in Reed’s memory to provide grants to graduate students pursuing studies in the tectonic and magmatic evolution of Alaska primarily, and also can fund other geologic work in Alaska. This year’s recipient is Rebecca Marie Flowers, University of Utah, for “Structural and Geochronological Investigation of a Mid-Crustal Discontinuity Exposed in the Vredefort Impact Structure, South Africa.”

**Alexander Sisson Research Award.** Family members of Alexander Sisson established a fund in his memory to promote and support research for students pursuing studies in Alaska and the Caribbean. The recipient of the award this year is Jonathan G. Wynn, University of Oregon, for “Neogene Paleosols of the Middle Tanana Basin, South-Central Alaska.”

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Other Successful Applicants

Other applicants recommended for funding are the following:

Nancy K. Adams
Lee Amoroso
C. Fred T. Andrus
Katherine Ault
Ellen Avery
David L. Barbeau, Jr.
Susan L. Barbour
April Ann Barnes
Scott Barnes
Monica L. Becker
Michael Begbie
Matthias Bernet
Anand Erik Boice
Steve D. Bowman
Alexander P. Bump
William Matthew Burns
Robert A. Burrows
Illya V. Buynevich
Eric Cannon
Colin D. Card
Brian R. Cellura
Ryan D. Christensen
Julia Allison Clarke
Monika Coginini
Sean R. Cornell
Samuel J. Coyner

William Crump
Kristina A. Curry
Dyanna Czek
Julia F. Daly
Patricia Allison Dean
Carol Merritt Dehler
Rahwan F. Denniston
Arie J. Doets
André Ellis
Rachel Ellisor
Michael Emilio
Annette Summers Engel
Gregory M. Etter
Matthew J. Evans
Cadassia R. Fenton
Eric J. Ferrmann
Patricia A. Foglesong
Margaret Fraser
JingFang Fu
Lisa S. Gardiner
Geoffrey Garrison
Jennifer M. Garrison
Carmina N. Garzione
David Scott Gerwe
D. A. Grau
Lea Greenwood
Michael Guidry
Paula Gural
Britta Gustavson
Laura B. Hagan
Yoshie Hagiwara
Jenney M. Hall
Brian Hampton
Eric V. Hargrave
Garret L. Hart
Ross David Hartleb
Carolyn L. Hartwick
Nicholas W. Hayman
Elizabeth A. Haynes
Jason S. Herrin
Mark A. Hespenheide
Matthew D. Hildreth
Barbara M. Hill
Glenn S. Jaechs
Elizabeth R. James
Christopher L. Johnson
James V. Jones III
Pedro J. Jugo
Thomas J. Kakalay
Sharon L. Kanfoush
Stuart Knoop
Michele N. Koppes
Matthew Kosnik
Joseph R. Krieg
Lori Krikorian
Thomas R. Kulp
Suman K. Kumar
Melissa Lautreniere
Tori Larson
Peter B. Laak
Windy Faye Lawdewil
Timothy J. Lee
Amy E. Lesen
Cynthia M. Liutkus
Caroline M. Loop
Christina M. Luke
Kari Anne Lundeen
Eugene W. MacDonald
Julie Annette Malburg
Cindy Michelle Martin
Christopher R.M.
McFarlane
Margaret E. McMillan
Nadine McQuarrie
Liz McVay
Sean P. Motvier
Brian A. Michaels
Heather A. Moffat
Jessica D. Moore
Amy Elnor Myrbo
Anne I. Nelson
Catherine M. O'Reilly
German Y. Ojeda
Ann E. Olesen
Alyssa Olson
Nathan Washburn Onderdonk
Mutlu Ozdogan
Heather L. Petcovic
Eric W. Peterson
William T. Phelps
Preston Lee Phillips, Jr.
Geoffrey S. Pignotta
Christopher J. Pihlar
Michael Patrick Poland
Julie Ann Pollard
Vera Pospenova
Michael E. Potter
John A. Rayburn
Mark Elliott Reinhold
Michael W. Ressel
Matthew K. Zimmerman

Events preserved in Lacustrine Sediment Cores from the Southern Ecuadorian Andes.”

Industrial Donations and Awards. Industrial donations this year amounted to $2,000 from Mobil Oil Corporation. The 1999 recipients are: Matthew Hackworth, Louisiana State University, for “Effects of Gas Hydrates on Authigenic Carbonate Precipitation in Hydrocarbon Seep Sediments; Louisiana Continental Slope, Deepwater Gulf of Mexico,” and Kaveh Khorzad, University of Texas at Austin, for “Land Subsidence Along the Texas Gulf Coast Due to Oil and Gas Withdrawal.”

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Harold T. Stearns Fellowship Award. Harold Stearns established the Harold T. Stearns Fellowship Award in 1973 for student research on aspects of the geology of the Pacific Islands and the circum-pacific region. The 1999 recipients are: Ulrike Maria Huber, University of Colorado, for “Linkages Between Past Climate, Vegetation and Fire Regimes in Southernmost Patagonia and Tierra del Fuego,” Matthew Lachniet, Syracuse University, for “Late Quaternary Glaciation and Climate of Costa Rica,” and Christopher M. Moy, Syracuse University, for “Holocene El Niño
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Information About Earth Sciences at UCR is available on the Web at http://oceans.earthsci.ucr.edu. Applications, including a vita, statement of teaching and research interests, and full contact information of three referees should be sent by November 1, 1999, to Dr. Mary Droser, Chair, Global Sedimentary Systems Search, Department of Earth Sciences, University of California, Riverside, California 92521. E-mail contact: mary.droser@ucr.edu. The University of California is an equal opportunity employer.

Positions Open
DARTMOUTH COLLEGE
LOW TEMPERATURE GEOCHEMIST
The Department of Earth Sciences expects to fill a tenure-track position in low temperature geochemistry at the assistant professor level. The successful candidate will be expected to demonstrate excellence in both teaching and research, develop a vigorous externally funded research program, advise student research at both undergraduate and graduate levels in earth sciences. The Earth Sciences department has a VG Sector Mass Spectrometer, High Resolution ICP-MS, and a clean laboratory. Candidates with expertise in radiogenic isotope geochemistry are particularly encouraged to apply.
A current vitae, list of publications, description of proposed teaching and research goals, and the names, addresses, and fax numbers of at least three references should be sent to: Chair, Faculty Search Committee, Department of Earth Sciences, Dartmouth College, 6105 Fairchild Hall, Hanover, NH 03755 (email: earth.sciences@dartmouth.edu).

Bucknell University
DEPARTMENT OF GEOLOGY
The Department of Geology at Bucknell University invites applications for three assistant professor positions in Hydrogeology, Mineralogy/Petrology, and Sedimentology to be filled at the entry level beginning Fall semester, 2000. A Ph.D. with some prior teaching experience is strongly preferred; ABD considered. Two of these positions are reserved for new PhD graduates and/or postdocs, with a possibility of continuing for an expansion of our program. The Department of Geology anticipates that it will be housed in a new building to be occupied by Fall of 2001. Bucknell is a selective liberal arts university with an engineering program. The Department of Geology offers B.A. and B.S degrees in both Geology and Environmental Geology. Department members value teaching in both fundamental and applied geology. For all three positions, we seek broadly trained teacher-scholars who are equally comfortable in the field and in the laboratory, and who complement the strengths of our undergraduate faculty (aqueous geochemistry, geomorphology, and structural geology). Given our exceptional location, we expect candidates to incorporate fieldwork into the teaching of most courses. Opportunities exist for teaching and research collaboration with other departments on campus. Those who are interested in teaching in courses which include laboratory sections. The ability to contribute to departmental and university environmental programs will be particularly encouraged.

department and university environmental programs will strengthen an application.

Sedimentologist. The candidate will teach upper-level courses in sedimentology and paleontology with laboratory sections. The ability to contribute to both departmental and university environmental programs will strengthen an application.

Hydrogeology/GIS. The candidate will teach upper-level courses in hydrogeology and geographic information systems (GIS) with laboratory sections. The person filling this position is expected to contribute to both departmental and university environmental programs. The candidate must have expertise in radiogenic isotope geochemistry are particularly encouraged to apply.

Applications should include a statement of teaching and research interests and experience, resume, and at least three letters of reference to the Chair, Department of Earth Sciences, Bucknell University, Lewisburg, PA 17837. Review of applications will begin September 1, 1999, and will continue until the positions are filled.

Useful links for those interested in teaching and research include a website at www.gsa.org for geoscience careers and the Global Sedimentary Systems Search, Department of Earth Sciences, University of California, Riverside, California 92521. E-mail contact: mary.droser@ucr.edu. The University of California is an equal opportunity employer.

Sedimentary Geologist
UNIVERSITY OF YALE
Applications are sought for a one-year research associate position (with the possibility of renewal for a second year) in sedimentology/stratigraphy beginning January, 2000, in the Department of Earth Sciences. Applicants should have a Ph.D. and a record of independent scholarly work. We seek a person who will complement and extend our research programs in paleoecology, paleoceanography, taphonomy, paleobiology, and macroevolution. Demonstrated ability and willingness to teach are desired. Please send curriculum vitae, a statement of interests, and the names, addresses (standard and electronic), and phone and fax numbers of at least three referees who can supply letters. Review of applications will begin on October 1, 1999. Address applications to: Susan Kidwell, Department of the Geophysical Sciences, University of Chicago, 5734 South Ellis Avenue, Chicago, IL 60637. University of Chicago is an Equal Opportunity/Affirmative Action Employer.

FACULTY POSITIONS IN ATMOSPHERE, OCEAN, CLIMATE DYNAMICS AT YALE UNIVERSITY
The Department of Geology and Geophysics at Yale University announces a search for several ladder faculty positions in the general areas of oceanography, climate and climate dynamics. We seek both junior and senior applicants with records of creative research in subject areas that improve understanding of modern atmospheric and oceanic processes and on the relevance of the earth’s climate on geologic time scales. Areas of special interest include atmosphere/ocean modeling; climate-system modeling, coupled air-sea interaction; dynamical meteorology and oceanic processes and/or the evolution of the earth’s climate. We seek both junior and senior applicants with records of creative research in subject areas that improve understanding of modern atmospheric and oceanic processes and on the relevance of the earth’s climate on geologic time scales. Areas of special interest include atmosphere/ocean modeling; climate-system modeling, coupled air-sea interaction; dynamical meteorology and oceanic processes and/or the evolution of the earth’s climate. We seek both junior and senior applicants with records of creative research in subject areas that improve understanding of modern atmospheric and oceanic processes and on the relevance of the earth’s climate on geologic time scales. Areas of special interest include atmosphere/ocean modeling; climate-system modeling, coupled air-sea interaction; dynamical meteorology and oceanic processes and/or the evolution of the earth’s climate. We seek both junior and senior applicants with records of creative research in subject areas that improve understanding of modern atmospheric and oceanic processes and on the relevance of the earth’s climate on geologic time scales. Areas of special interest include atmosphere/ocean modeling; climate-system modeling, coupled air-sea interaction; dynamical meteorology and oceanic processes and/or the evolution of the earth’s climate. We seek both junior and senior applicants with records of creative research in subject areas that improve understanding of modern atmospheric and oceanic processes and on the relevance of the earth’s climate on geologic time scales. Areas of special interest include atmosphere/ocean modeling; climate-system modeling, coupled air-sea interaction; dynamical meteorology and oceanic processes and/or the evolution of the earth’s climate.
Forty kilometers wide and perhaps 1200 km long, the dextral Norumbega fault system is one of the major structures of the northern Appalachians. Differential erosion provides a mid- through shallow-crustal profile of the Norumbega system, offering insight into the mechanics and evolution of modern faults such as the San Andreas.

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Four papers address possible tectonic roles of the system, placing it in context with other northern Appalachian faults and examining geochemical evidence for the Norumbega system being a major terrane boundary. Two papers detail the system’s 200-million-year multistage deformation history, and the final contribution examines the possibility that the Norumbega is active today.

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The Department of Geology and Geophysics at Yale University announces the opening of several visiting faculty positions, starting as early as September 1, 1999. Applicants from all areas of earth science and all career levels are welcome to apply. The visiting positions are part of a major hiring initiative in earth sciences at Yale focused on rebuilding the size and strength of the department. We are looking for individuals who would enjoy contributing and interacting in a broad multidisciplinary department that includes physical, chemical, and biological sciences, general geology, geodynamics, paleontology, and evolutionary theory; and tectonics. The successful applicant would be expected to conduct an active research program, to interact with students and faculty, and to teach one course or seminar per semester with the topic to be negotiated. The duration and scope of the visit are negotiable as well. Applications will be considered as they arrive.

We encourage applicants from historically disadvantaged ethnic, racial, and gender categories. Yale University is an equal opportunity/affirmative action employer. Applicants should send a curriculum vitae, a statement of objectives for the visit, and the names and addresses of three references to:

Paleontology Search Committee, c/o Professor Danny Rye, Chair, Department of Geology and Geophysics, Yale University, P.O. Box 208109, New Haven, CT 06520-8109.

DIRECTOR BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN

The University of Texas at Austin seeks a Director of its Bureau of Economic Geology, one of the largest research units of the university and which also serves as the State Geological Survey for the state of Texas. The director is a doctorate in geology or a closely related field with a record of substantial research, teaching, and professional service. The Bureau has a long and illustrious history of discovery, exploration, and resource management and serves Texas and the nation as a model for integrating research, extension, and education.

The Bureau has an estimated annual budget of approximately $40 million, with 91 scientists and professionals, 66 technical and clerical employees, and an ARC/INFO and ERDAS GIS laboratory. The Bureau is an equal opportunity/affirmative action employer and encourages applications from women and minorities.

Applicants should send a curriculum vitae, statement of research interests, and three letters of recommendation to:

Dr. Jerome Blechman, Search Committee Chair, Earth System Science Interdisciplinary Center, University of Maryland College Park, MD 20742-2465. Applicants should provide a letter of application, curriculum vitae, statement of interest and qualification for the position, and a list of publications. A Ph.D. in geology is required.

STATE UNIVERSITY OF NEW YORK COLLEGE AT ONEONTA — LECTURER

The Department of Earth Sciences at the State University of New York at Oneonta invites applications for a one-year Lecturer position beginning Fall 1999 pending budgetary approval. This is a full-time position in Surficial Geology/Hydrology. Required qualifications: Ph.D. or ABD; extensive knowledge and experience in environment, which will include instruction, student mentoring, and the application of instructional technology. Duties include teaching courses in Surficial Geology/Hydrology, Environmental Resources, and Environmental Science. To apply: send curriculum vitae, statement of interest and qualification for this position, and three current letters of recommendation to Dr. Jennifer J. Chair, Earth Sciences Department, Box G, SUNY Oneonta, Oneonta, NY 13820. Review of applications will begin immediately and will continue until the position is filled. Applications and any additional materials submitted by February 15 will be considered as they arrive.

PREFESSORSHIP IN PHYSICAL SEDIMENTARY GEOLOGY
INDIANA UNIVERSITY–PURDUE UNIVERSITY INDIANAPOLIS (IUPUI)

The Department of Geology at IUPUI invites applications for two tenure-track assistant professor positions, beginning in Fall 2000. We seek individuals interested in developing a strong, externally funded research program in a collaborative environment who are also committed to high quality teaching. A Ph.D. in geology is required.

Involvement in multidisciplinary research interfaces with geotechnical (e.g., slope stability and mass movements) and hydrogeological engineering questions is desirable.

Applications should submit a detailed curriculum vitae, a statement of research interests, a list of publications, and the names of three potential referees to the President of ETH Zurich, c/o Professor W. T. McCutchen, Chair of Search Committee, Department of Earth Sciences, ETH Zurich, University of Zurich, CH-8092 Zurich no later than November 15, 1999. Our schools specifically encourage female candidates to apply with a view towards increasing the proportion of female professors.
Interested individuals should send a resume, statement of research and teaching interests, and the names of three referees by December 1, 1999 to: Dr. Andrew Barth, Search and Screen Committee, Department of Geology, IUPUI, P.O. Box F0003, 202 Bowen, Eastern Michigan University, Ypsilanti, MI 48197. For information about the department and university visit http://www.emich.edu/public/geo/welcome.html. EMU is an affirmative action/equal opportunity employer.

**FACULTY POSITION**

**CALIFORNIA STATE UNIVERSITY, HAYWARD**

The Department of Geosciences at California State University, Hayward, seeks a dynamic faculty member with expertise in meteorology, planetary geology, GIS, remote sensing, or paleoclimatology. Pending administrative approval, a tenure-track position at the assistant professor level will be offered beginning September, 2000. The individual hired will be expected to have talents in undergraduate and graduate teaching for a diverse student population, and become part of the research program in geography or environmental science in GIS and spatial analysis is highly desirable, as is significant field experience. The department offers BA, BS and MS degrees in geography, and has active centers on campus, including the Byrd Polar Research Center and the Center for Mapping. Applicants who win the Ph.D. by September, 2000, should mail a curriculum vitae and three letters of recommendation to Dr. Nancy Frey, Search Chair, Department of Geosciences, California State University, Hayward, 25800 Carlos Bee Boulevard, Hayward, CA 94542-3088.

**THE OHIO STATE UNIVERSITY**

**ENVIRONMENTAL ISOTOPE GEOCHEMISTRY**

The Department of Geosciences invites applications for one tenure track assistant professor position at the assistant professor level, or higher, to begin as early as September, 2000 for a position in environmental isotope geochemistry. Evidence of strong teaching and research potential is essential. Preference will be given to candidates with secondary expertise in environmental geochemistry, geophysics, or paleoclimatology. A Ph.D. degree in environmental isotope geochemistry, geophysics, or paleoclimatology is required. Candidates should have a strong record of productive research, refereed publications, and the ability to work with colleagues in other areas of specialization. The successful candidate will be expected to develop an independent research program in paleoclimatic reconstructions, and is expected to participate in the Department's research programs. Evidence of strong research and teaching potential is required. Send letter of application, a vita, a succinct statement of research and teaching interests, and names of three referees to: Dr. Barbara Stocklin, Chair, Department of Geosciences, The Ohio State University, 1385 Neil Avenue, Columbus, OH 43210. The search committee will begin reviewing applications on January 1, 2000, and will continue until a suitable candidate is hired.

**THE OHIO STATE UNIVERSITY**

**GENETIC STRATIGRAPHER**

The Department of Geosciences at The Ohio State University invites applications for a tenure-track position at the assistant professor level, or higher, to begin as early as September 2000. The successful candidate will teach introductory geology courses at the assistant professor level, although a position at a higher rank will be considered and may begin as early as September 2000. Candidates with interests and demonstrated skills in interpreting the depositional architecture of sedimentary fill in basins are encouraged to apply. Particular areas of interest include outcrop and subsurface-based sequence stratigraphy, chemostratigraphy, and computer modeling of stratigraphic sequences. A Ph.D. in geosciences or a related field is required. Successful candidates will work closely with existing programs in sedimentology, biostratigraphy, paleobiology, Quaternary geology and global change, geophysics, and hydrogeology. The successful candidate will be expected to maintain an active funded research program, advise graduate students, and contribute to the teaching mission of the department at both the undergraduate and graduate levels. Send letter of application, a vita, a succinct statement of research and teaching interests, and names of three referees to: Search Chair, Department of Geosciences, The Ohio State University, 155 South Oval Mall, Columbus, OH 43210. The search committee will begin reviewing applications on January 5, 2000, and will continue until a suitable candidate is hired. The Ohio State University is an equal opportunity/affirmative action employer. Women, minorities, Vietnam-era veterans, disabled veterans, and individuals with disabilities are encouraged to apply.

**ENVIRONMENTAL GEOLOGY**

**DEPAUW UNIVERSITY**

The Department of Geology and Geography at DePauw University invites applications for a three-year term position in Environmental Geology at the rank of Assistant Professor (Instructor for ABD) beginning August 15, 2000. We desire a person who is broadly trained in the geosciences with expertise in geochemistry/hydrogeology. The successful candidate will teach a variety of courses for undergraduate students including Physical Geology, Physical Geography, Geochemistry, and Applied Hydrogeology, will develop research projects for undergraduate students; and will possess excellent field and/or computational skills. Applicants should send a letter describing their research and teaching interests, curriculum vitae, a vita, transcripts of all academic work, and three letters of recommendation to Dr. Frederick, M. Soster, Chair, Department of Geology and Geography, DePauw University, Green- castle, IN 46135. Review of applications will begin October 15 and will continue until the position is filled. We plan to conduct interviews of selected applicants at the 1999 GSA meeting in Denver. DePauw University is an affirmative action, equal opportunity employer. Women and minorities are especially encouraged to apply.

**Consultants**

Global Geoservices is experienced with geological consulting to domestic and foreign Engineering, Geotechnical, and Environmental projects. For information on services, contact by e-mail: globgeo@soil.com or fax: 209-735-9908.

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Geology and History of Geology. Used, out-of-print, and rare. Free catalog. Patricia L. Daniel, BS, MS, Geology, 618 W. Maple, Independence, KS 67301, ph: (316) 331-0725, fax: 316-331-0785. E-mail: pldaniel@horizon.hi.net. Web site: www.hi.net/~pldaniel

**Opportunities for Students**

Graduate Student Opportunities in Earth Sciences, Lehigh University. The Department of Earth and Environmental Sciences of Lehigh University has Graduate Student Fellowships for highly qualified individuals. The department has active research programs in tectonic studies (geochronology, stable isotope geochemistry, low temperature geochemistry, seismology, high resolution geophysics, structural geology, paleomagnetism) and surficial processes (low temperature geochemistry, fluvial and tectonic geomorphology, glacial geology, hydrology, and limnology). Please contact Prof. D. Morris, Dept. of Earth and Environmental Sciences (dmorris@lehigh.edu) or see our Web page for more details (http://www.ees.lehigh.edu).

Department of Geosciences, University of Arizona, announces the availability of Sloan Scholarships for minority Ph.D. students in the geosciences. The Alfred P. Sloan Foundation and the Department of Geosciences at the University of Arizona are committed to increasing the number of African-Americans, Hispanic-Americans, and Native Americans receiving Ph.D.s in the geosciences. Sloan scholars receive fellowship support; three summers of research support, a research allowance, and peer and faculty mentoring. Additional support through other fellowships and teaching or research assistantships are also available. Inquiries and requests for applications to: Graduate Program, Department of Geosciences, The University of Arizona, Tucson, AZ 85721. Or gradapps@geo.arizona.edu and http://www.geo.arizona.edu.
Tectonosomes and Olistostromes in the Argille Scaglioise of the Northern Apennines, Italy

Every geologist interested in melanges and in the evolution of orogenic belts will find this profusely illustrated volume valuable.

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