Vol. 7, No. 12 December 1997

GSA TODAY

A Publication of the Geological Society of America

INSIDE

Holocene Sea-Level Change and Early Human Utilization of Deltas

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ABSTRACT

Thirty-four documented archaeological sites, dated >5000 yr B.P. and located in and adjacent to marine deltas, are identified to evaluate early occupation of Holocene deltas worldwide. Modern marine deltas began to form from ~8500 to 6500 yr B.P., and our survey distinguishes at least 16 archaeological sites dated to ≥7000 yr B.P., which indicates that these resource-rich ecosystems were used by humans soon after their development. The model presented here links deceleration in rate of Holocene sea-level rise with the near-synchronous development of deltas and human occupation of these fertile plains. The integrated geological and archaeological database shows that conditions in and around deltas (accumulation of fertile soil, reliable water supply, perennial aquatic food sources, ease of travel and trade) were attractive to human immigration and settlement. Currently, rising sea level and land subsidence are principal natural phenomena affecting use of deltas, and humans remain vulnerable to these factors as well as to extensive ecological degradation caused by increased population pressures. The integrated geoarchaeological approach serves to refine long-term rates of change in delta evolution and thereby gauge human impact on these depocenters. Moreover, the model presented here provides insight into environmental conditions during the early to mid-Holocene transition from hunter-gatherers to sedentary communities, a major turning point in human history.

INTRODUCTION

During most of the past four million years, hominids sustained themselves by gathering wild plants and hunting and

Deltas *continued on p. 2*

Background photo: Wax Lake (left) and Atchafalaya (right), nascent deltas of the Mississippi River prograding into Atchafalaya Bay, Gulf of Mexico. Image shows characteristic features of newly formed deltas, which would have been typical during the early Holocene, including low-lying islands isolated by channels. During early phases of delta occupation, humans would have had to overcome challenges such as isolation and periodic inundation in this setting. This color infrared image was taken in February 1980 (courtesy of I. van Heerden, Louisiana State University).

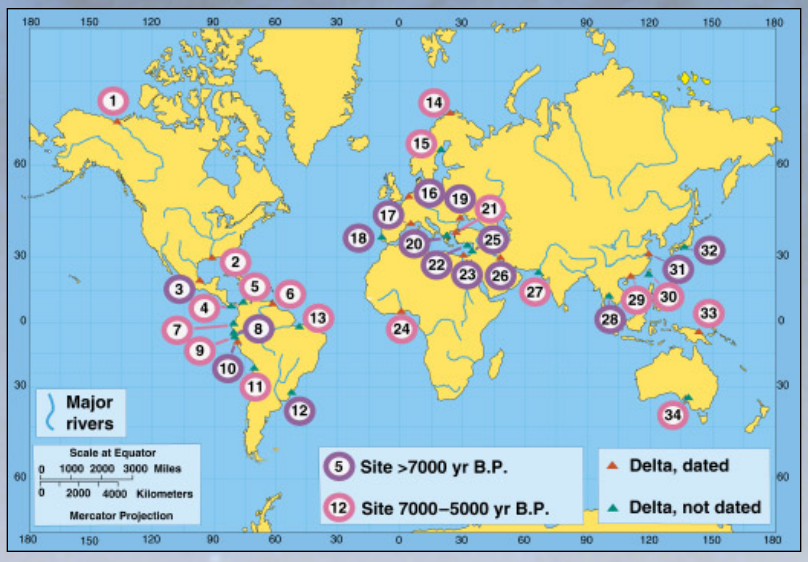

Figure 1. Documented archaeological sites, dated from >7000 to ~5000 yr B.P., on and adjacent to 34 delta sequences compiled in this preliminary survey (Table 1). Sixteen of the 34 delta sequences have been dated (Table 1). Of note are eight sites >7000 yr B.P. (purple circle) positioned on deltas that are dated to >7000 yr B.P. (red triangle), indicating early occupation of these depocenters.

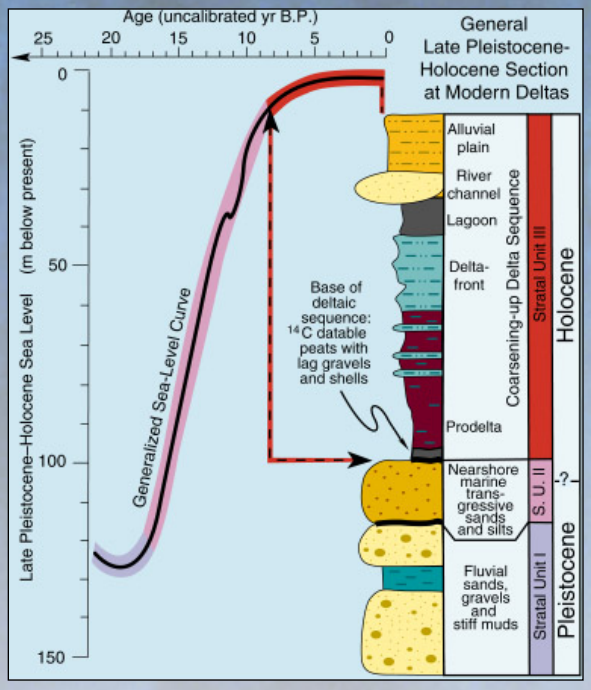

Figure 2. Generalized stratigraphic section depicting the late Pleistocene to Holocene subsurface geology at diverse marine delta localities (no thickness scale shown or implied). Particular focus in this study is on stratal unit III, characteristically a coarsening-up delta sequence comprising diverse lithofacies dated from ~8500 yr B.P. to present. The start of deltaic sequence formation in the early Holocene was fundamentally controlled by the decelerating rate of sea-level rise, as noted on the generalized world sea-level curve (after Warne and Stanley, 1995).

GSA TODAY

December 1997

Vol. 7, No. 12

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

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Printed in U.S.A., using pure soy inks and recyclable paper.

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CORRECTION

The U.S. Geological Survey and the National Science Foundation were among the sponsors of the 1997 GSA Presidential Conference "Ethics in the Geosciences" ("Conferees Tackle Ethics Questions," October *GSA Today*, v. 7, no. 10, p. 18).

Deltas *continued from p. 1*

fishing, typically in small mobile groups (Gebauer and Price, 1992; Feibel, 1997). The latest Pleistocene to mid-Holocene transition from hunting and gathering to a more settled way of life, referred to by some as the Neolithic Revolution, is a turning point in human history and has long been a keystone to archaeological research and debate. The change from foraging to sedentariness, and in some cases agriculture, which took place from about 10,000 to 5000 years ago, apparently occurred independently in different parts of the world.

Archaeologists generally attribute this widespread modification in human behavior to one or more of three principal factors: population pressure, altered social behavior, and/or climatic and environmental change (Price and Gebauer, 1995). Even though there have been extensive discussions during the past century regarding the relative importance of these three factors, there remain widely differing explanations for the remarkable transition from foraging to farming. However, most archaeologists agree that there is a close link between environment and human activity. Proponents of the climatic and environmental impetus have typically emphasized meteorological changes, especially transitions from cool to hot and wet to dry during the late Pleistocene and early Holocene (e.g., Childe's [1928] propinquity or desiccation theory). Associated with amelioration of climate in late stages of deglaciation (~8000 to 5000 yr B.P. [before present; herein all dates are uncalibrated]) are changes in vegetation communities worldwide (Adams and Faure, 1997).

In studies paralleling but generally independent of archaeological research, earth scientists are involved in identifying and measuring late Quaternary environmental changes, including those induced by anthropogenic activity. In this article, we present a new thesis that assimilates both the observed worldwide change in human settlement and subsistence behavior and near-synchronous environmental changes associated with a global deceleration in rate of sea-level rise that occurred between ~8500 and 6500 yr B.P. We propose that delta development, inextricably linked to deceleration in rate of sea-level rise (Stanley and Warne, 1994), provided newly formed, resource-rich environments conducive to occupation and subsequent development of sedentary human cultures worldwide (Fig. 1).

Deltas *continued on p. 3*

Deltas *continued from p. 2*

EARLY HOLOCENE INITIATION OF MARINE DELTAS WORLDWIDE

This study focuses specifically on deltas, although we recognize that other coastal environments, such as barrier islands that formed in the early to mid-Holocene, were extensively exploited by humans. Herein, the term delta is used in a broad sense and includes alluvial tracts of land deposited at or near the mouth of rivers near the sea. These depocenters include settings such as fan-, cuspate-, and bird-foot–shaped silty plains, coarse fan deltas, and river mouth alluvial plains located at heads of estuarine, bay, and fjord systems.

Radiocarbon-dated late Pleistocene to Holocene sections beneath modern delta plains typically contain three distinct stratigraphic units (Fig. 2). From base to top these units comprise: stratal unit I, late Pleistocene fluvial deposits (to as young as ~11,000 yr B.P.); stratal unit II, late Pleistocene to early Holocene shallow marine transgressive deposits (~18,000 to 8000 yr B.P.); and stratal unit III, Holocene deltaic deposits of variable lithologies (~8000 yr B.P. to present). Deltaic unit III, the focus of this article, is typically a coarsening-upward, prograding sequence with datable peats, shells, and lag gravels at its base. To determine the timing of initiation of world deltas, we identified the oldest radiocarbon age available at or near the dated base of documented Holocene deltaic sequences (Fig. 2).

Global survey of radiocarbon-dated sedimentary sequences in modern marine deltas reveals that many (>50) of these depocenters began to develop during the period ~8500 to 6500 yr B.P. in a variety of geographic and geologic settings on coastal margins of world oceans (Stanley and Warne, 1994; Warne and Stanley, 1995; additional dated delta sites available from the authors). Having considered all major controls (including climate, tectonic setting, isostasy, coastal hydrodynamics, fluvial and sediment discharge, and sediment accumulation rates), we conclude that sea-level change is the only process that could bring about the coeval worldwide initiation of Holocene deltas. Surveys of sea-level histories from diverse settings (cf. Pirazzoli, 1991) indicate a marked deceleration in sea-level rise at ~8000 to 7000 yr B.P. (Fig. 2). Recent investigations attribute this deceleration to abrupt changes in early Holocene atmospheric circulation (Alley et al., 1997; Stager and Mayewski, 1997). Holocene deltaic sequences began to accumulate as former incised river valleys filled with sediment to the point that the rate of fluvial sediment input exceeded the declining rate of sea-level rise along coasts. This threshold, from marine transgression and coastal erosion to sediment accretion and progradation at the mouth of rivers, took place on a worldwide basis within a span of ~2000 yr.

TABLE 1. EARLY TO MIDDLE HOLOCENE ARCHAEOLOGICAL SITES IN AND ADJACENT TO MARINE DELTAS

Delta seq. (Fig. 1)	Delta or lower plain*	Age (yr B.P.)	Dating method†	Reference
North and Central America				
1	*Mackenzie*	~5000	4	Clark (1991)
2	*Mississippi*	6220–5345	1	Russo (1996)
3	*Tecolutla, Veracruz*	7600	3A	Wilkerson (1980)
4	Santa Maria	6810	1	Ranere and Hansell (1978)
South America				
5	Magdalena	5050	1	Meggers (1979)
6	*Orinoco system*	~6000	1, 3A	Sanoja (1989)
7	Valdivia	5800	1, 3A	Stothert (1985)
8	Las Vegas	8250–6600	1, 3A	Stothert (1985)
9	Huaca Prieta	~5000	1	Quilter (1991)
10	Santa	~7000	4	Wells (1992)
11	Camiña	~6000	1	Martinez (1979)
12	Porto Alegre plain	~7000	1	Rodríguez (1992)
13	Near Amazon coast	5045	1, 3B	Meggers (1979)
Europe				
14	*Alta*	~5600	1, 3A	Nygaard (1989)
15	Ume	~5500	3A	Ramqvist et al. (1985)
16	*Rhine-Maas*	~7000	3A	Whittle (1996)
17	*Rhône*	8000–7000	4	Whittle (1996)
18	Tagus	~7000	4	Whittle (1996)
19	*Danube*	~7000	3C	Whittle (1996)
20	Dimini Bay–Seskolitis	8000–6400	1	Zangger (1991)
21	*Troy Bay–Scamander plain*	6800–6500	1	Kayan (1995)
22	Zyyi	8000–7000	3A	Ronen (1995)
Africa				
23	*Nile*	~7000	1, 3B	Stanley and Warne (1993)
24	*Niger*	~5000	4	Devisse and Vernet (1993)
Asia				
25	Oren	~8100–7500	1, 3A	Galili et al. (1993)
26	*Tigris-Euphrates*	7600–7000	1	Sanlaville (1992)
27	Indus	~5600	1	Mughal (1990)
28	Bang Pakong	~8000–7000	2, 3C	Higham (1989)
29	*Zhu Jiang (Pearl)*	6000	4	Lo (1990)
30	Peinan	~5600	3C	Lien (1993)
31	*Han Jiang (Yangtze)*	~7500	1	Stanley and Chen (1996)
32	Tokyo Bay	9450	4	Chard (1974)
33	*Ramu*	~5600	3B	Gorecki (1993)
Australia				
34	Murray	6020	1	Mulvaney (1969)

*Italics indicate deltas that have been radiocarbon dated.
† 1—Standard ^{14}C radiocarbon; 2—accelerator mass spectrometer (AMS); 3—artifact type: lithic = A, ceramic = B, other = C; 4—undefined.

DOCUMENTING EARLY HUMAN OCCUPATION OF DELTAS

Studies of the Nile and Yangtze deltas, where evidence for occupation extends to as early as ~7500 yr ago (Stanley and Warne, 1993; Stanley and Chen, 1996), were the catalyst for the present geoarchaeologic investigation. Findings from these two systems demonstrate that humans expanded onto the two depocenters within 500 yr of their development as fertile plains. We reviewed archaeological literature to identify and document prehistoric sites in and adjacent to these depocenters. Our aim was to determine if there is a worldwide correlation between early development of modern marine deltas (~8500–6500 yr B.P.) and human exploitation of these resource-rich environments shortly after their formation.

The focus of this survey is to determine timing of earliest recorded occupation, rather than the specific nature of human activity (foraging, sedentariness, plant cultivation, domestication, pottery-making, etc.) at the 34 identified sites. Thus, we do not discuss specific cultures, typologies, or other archaeological designations. To evaluate the timing of human occupation of deltas shortly after development of these new ecosystems, we selected sites for this study on the basis of the following: (1) only those with material older than 5000 yr B.P. (Table 1); and (2) availability of radiocarbon-dated material, such as charcoal, plant, and bone (20 sites),

Deltas *continued on p. 4*

Deltas *continued from p. 3*

and/or dated artifacts (lithic, ceramic) assigned a numeric age (14 sites). In this preliminary evaluation of the timing of early occupation of deltas, data are subdivided into two temporal categories (Fig. 1): sites known to be older than 7000 yr B.P., or shortly after delta development (n = 16); and those somewhat younger, between 7000 and 5000 yr B.P. (n = 18).

This preliminary survey, which is representative but not comprehensive, shows that sites we identified occur in a wide range of latitudes (Fig. 1). However, most are within tropic and northern temperate latitudes, primarily in northern South America, the circum-Mediterranean, and eastern-southeastern Asia. Our database records a near-equal number of sites dated >7000 and <7000 yr B.P., older sites being concentrated in European and Mediterranean areas. Sites occur on all continents except those at highest latitudes, and we found few documented early delta sites (>5000 yr B.P.) in North America (Coastal Environments, Inc., 1977), southern South America and Africa, Eurasia, and Australia. Also, our research did not identify documented early Holocene sites on some major world deltas, such as the Congo, Ganges, and Yellow, and those of northern Russian rivers.

LIMITATIONS OF CURRENT DATABASE

By early Holocene time, humans were widely dispersed in temperate and tropic regions. The majority of prehistoric sites are recorded on inland and upland landscapes rather than on the coast (Price and Gebauer, 1995). Current distributions of documented early settlement sites appear in marked contrast to modern demographics, where almost 80% of the world's population lives within 100 km of the coast. Thus, one might expect a larger number of sites positioned on or close to delta plains and submerged offshore (Stright, 1990) than are currently recorded.

There are several possible explanations for the relatively small number of recorded prehistoric sites on deltas. In many instances, artifacts and sites have been buried and obscured by thick sequences of Holocene deposits resulting from successive floods and generally high rates of deposition near river mouths (to 10 cm/yr). Land subsidence, which typically affects deltas (Stanley, 1997), would also lower early sites below present land surface and water table. Moreover, rise of sea level during this period submerged some coastal sites, such as the Neolithic settlement on the Oren delta (Fig. 1; Table 1), Israel (Galili et al., 1993). Hence, many deltaic sites are obscured and inherently difficult to discover and excavate (cf. Stright, 1990), and evidence of human occupation is most commonly found along more stable and somewhat higher margins and apices of these depocenters. In addition, subsequent anthropogenic activity may have further modified and obscured prehistoric sites.

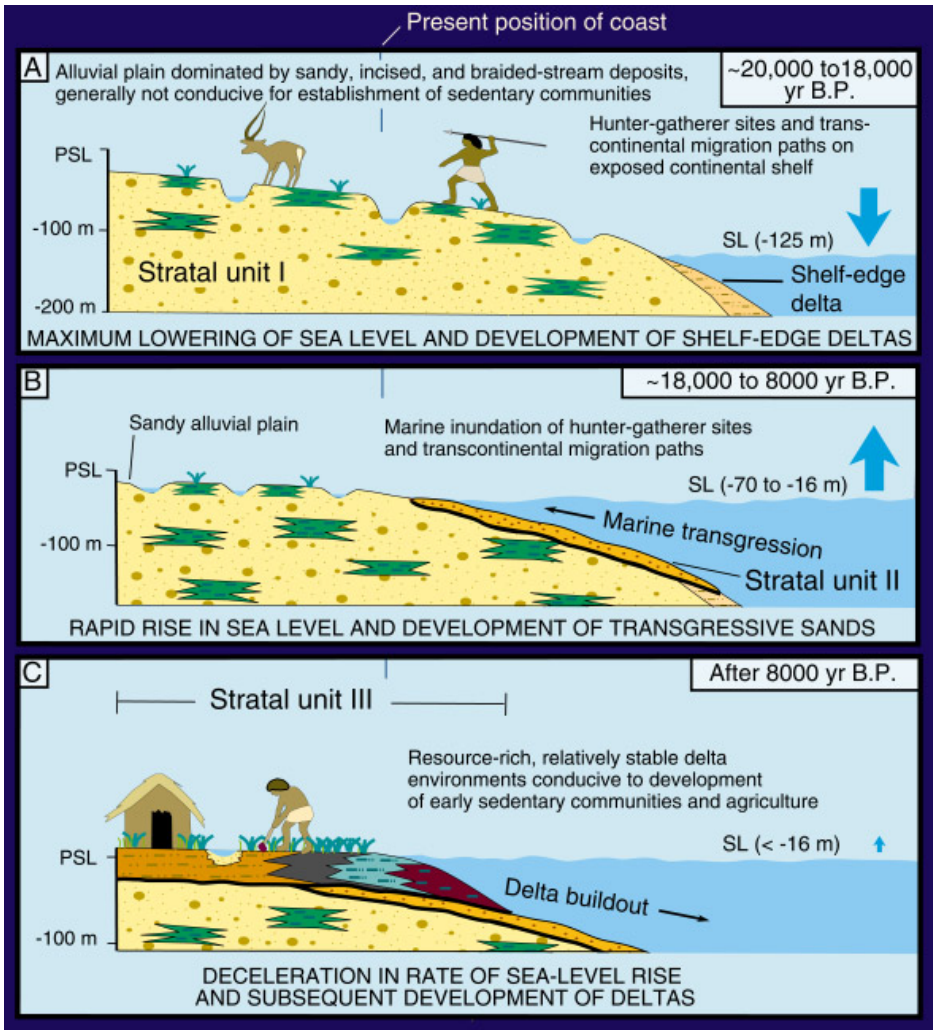

Figure 3. Integrated geological-archaeological model depicting the relations among late Pleistocene to Holocene sea-level change, coastal development near river mouths, and human migration and occupation. Formation of modern marine deltas and occupation of these fertile plains (part C) are inextricably linked to deceleration in the rate of sea-level rise. Facies correspond to those depicted in Figure 2.

It is possible that the irregular distribution of documented early delta sites is influenced by other factors, such as uneven intensity of archaeological exploration and access to literature and records. Other explanations for the uneven distribution of sites include increased logistical difficulty of exploration in areas such as densely vegetated tropics, climatically isolated (polar) regions, and submarine settings.

Additional challenges associated with the systematic worldwide survey of early and mid-Holocene archaeological sites on deltas pertain to dating. In some regions, sites are dated typologically—that is, by identifying characteristic lithic and ceramic manufacture method and/or style and correlating with sites elsewhere that contain similar artifacts that have been radiocarbon dated. Materials are now commonly dated by the standard radiocarbon method, but ages cited in the literature vary in format—e.g., in yr B.P., uncalibrated or calibrated, or in yr B.C.E. At this time, material at only a few delta sites has been dated using the accelerator mass spectrometer (AMS) method, and none that we reviewed in the literature incorporate reservoir corrections (cf. Stuiver and Brazunias, 1993).

INCIPIENT SETTLEMENT OF RESOURCE-RICH DELTA PLAINS

Humans occupied a broad spectrum of environments by the end of the Pleistocene, and the transition to agriculture was under way in widely different regions of the world between that time and the mid-Holocene. By identifying 34 delta sites occupied by at least 5000 yr B.P., our database suggests that delta environments

may have been a component in this transition. Eight documented sites are dated to 7000 yr B.P. or earlier and are positioned on or adjacent to deltas that are known to have begun at least 7000 yr ago. These include (Table 1): Tecolutla (Mexico), Santa (Peru), Rhine-Maas (Netherlands), Rhône (France), Danube (Romania), Nile (Egypt), Tigris-Euphrates (Iraq, Kuwait), and Yangtze (China). These sites are in diverse geologic, geographic, and climatic settings along the lower stretches of rivers characterized by variable flow and sediment load. These localities, nevertheless, have the following common features: a generally prograding shoreline and increasing land area, permanent freshwater sources, high water table, aquatic habitats (fresh, brackish, marine), well-developed and relatively stable system of distributary channels, and fertile silt-rich soil.

Archaeological research indicates that sedentariness occurred in diverse geographic and climatic settings, but essential to site location was availability of a reliable water supply such that risks of drought were minimized. Other advantages associated with proximity to water sources include perennially available protein and other aquatic food sources and ease of regional travel and trade.

INTEGRATED GEOLOGICAL-ARCHAEOLOGICAL DELTA MODEL

A delta model that incorporates the geological and archaeological records emphasizes the near-synchronous development of resource-rich deltaic environments, which offered soil and water resources conducive to human immigration and settlement (Fig. 3). Although climate is the fundamental driving force for late Pleistocene and Holocene sea-level oscillations, as well as regional environmental and associated vegetation changes, our model identifies sea level as the principal worldwide mechanism that directly controls delta formation and early human occupation of these coastal environments.

From ~20,000 to 18,000 yr B.P. (Fig. 3A), when sea level was at least 120 m below present level (Fairbanks, 1989), river gradients were greater than those of today, braided-river systems incised preexisting coastal plains, and deltas formed seaward of present shorelines, near the present shelf edge. Late Pleistocene alluvial plain deposits on the subaerially exposed continental shelf (Fig. 2) served as habitat as well as land bridges between continents for forager groups.

From ~18,000 to 8000 yr B.P. (Fig. 3B), sea level rose rapidly (to as much as 1 cm/yr), while shelf-edge deltas and continental shelves were concurrently submerged. Coastlines retreated landward, and shelf sediments were extensively reworked by nearshore waves and currents forming widely distributed, shelly sand (transgressive) deposits (Fig. 2). Coastal processes associated with this marine transgression altered or destroyed coastal sites that had previously been located on the exposed shelf. Fluvial systems remained predominantly incised and braided. Although groups of hunter-gatherers continued to occupy alluvial plains near river mouths, these still-incised, rapidly shifting, sandy, braided-river environments were not conducive to long-term settlement.

From ~8500 to 6500 yr B.P. (Fig. 3C), the rate of sea-level rise decreased markedly (to as little as 1 mm/yr), yet landward displacement of most coastlines continued. However, decelerating sea-level rise induced infilling of incised river valleys and a change from marine erosion to fluvial deposition at river mouths, with accompanying accretion and progradation of silty, nutrient-rich delta plain deposits (Fig. 2). Moreover, as river gradients decreased there was a widespread change from ephemeral braided to more stable meandering river systems.

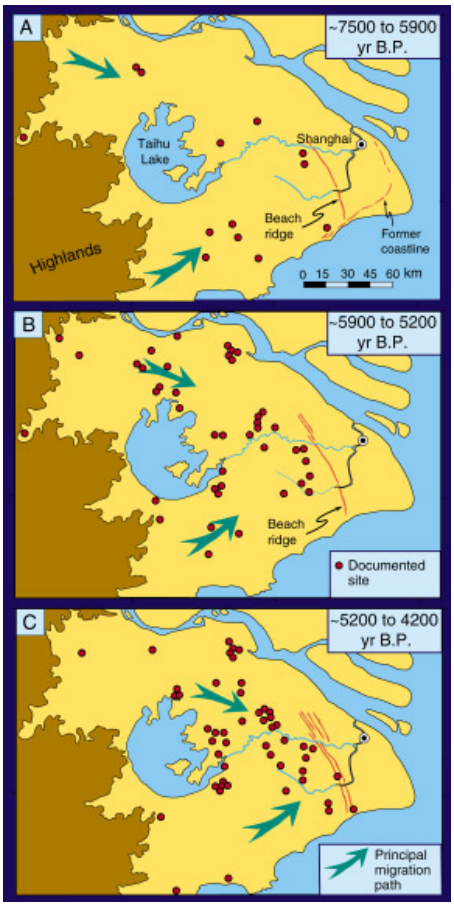

Figure 4. Yangtze delta of China, which contains the largest number of documented early sites (sedentary Neolithic cultures), provides evidence of human occupation shortly after delta-plain formation. Eastward migration through time is primarily related to the effects of early to middle Holocene sea-level rise on delta landform development (after Stanley and Chen, 1996).

During initial stages of development, the seaward parts of deltas generally comprise a series of ephemeral lowlands and islands isolated by shallow distributaries (van Heerden and Roberts, 1980), as illustrated by the nascent Atchafalaya delta (see background photo). These frequently inundated lowlands compelled humans to overcome difficulties associated with isolation on islands, periodic inundation, and forced migration (Büdel, 1966). Technological advances during the early and middle Holocene enabled some humans to exploit these evolving coastal lowland environments. Abundant freshwater resources and access to inland settlements via rivers made deltas more attractive than other coastal areas to some prehistoric groups. In some deltas, such as the Nile and Yangtze, increasing technology and human manipulation eventually gave rise to well-developed hydraulic civilizations (Butzer, 1976).

The Yangtze in eastern China (Fig. 4) is the most extensively documented example that demonstrates the close relation between sea-level change and early human occupation of deltas. By integrating archaeological information and petrologic and radiocarbon data derived from cores, it has been shown that this depocenter was occupied by ~7500 yr B.P. or within five centuries of the beginning of delta formation (Stanley and Chen, 1996). Geoarchaeological studies reveal that positions of Neolithic settlements are related to geography (selection of topographic highs, which are less vulnerable to inundation) and advancing techniques in adapting to wetland occupancy, and that their distributions changed systematically through time in direct response to sea-level rise. The integrated record indicates a progressive eastward expansion of settlements as sea-level rise inundated former topographic lows, inducing relocation toward higher elevations associated with coastal ridges that served as protective barriers (Fig. 4).

RAMIFICATIONS OF THE INTEGRATED STUDY

This integrated geological and archaeological investigation of early to middle Holocene deltas can serve to refine the archaeological record for deltas and other coastal settings and to foster development of effective, long-term coastal protection strategies.

Systematic geological analyses of continuous borings in deltas and their lateral correlation define three-dimensional lithofacies distributions and associated environments of deposition. Such analyses provide a context for interpreting both

Deltas *continued on p. 6*

Deltas *continued from p. 5*

regional paleogeography and site-specific environmental settings. These paleoenvironmental reconstructions refine measurements of relative sea-level change that take into account land motion relative to sea level. Detailed study of the history of relative sea level enhances understanding of coastal landscape evolution and its influence on human migration, subsistence, and settlement patterns.

Augmenting the geologic record with dated artifacts and associated cultural material can help us establish a more accurate chronostratigraphic framework, allowing us to reconstruct delta environments and evaluate rates of change through time (Warne and Stanley, 1993). Geoarchaeological research incorporating nonintrusive subsurface exploration methods refines the relation among sea level, nearshore environments, and early occupation of deltas by humans. Enhanced use of remote sensing methods, such as ground penetrating radar (GPR), may be useful in identifying buried sites. Analysis of closely spaced cores by both geologists and archaeologists provides the most effective means to evaluate these buried sites (cf. Kayan, 1995).

Since the mid-Holocene, humans have increasingly exploited and altered deltaic environments. Yet most low-elevation delta-plain surfaces continue to be subject to natural factors, primarily rising sea level (Milliman et al., 1989) and subsidence (Stanley, 1997). These phenomena induce coastal erosion, salt-water incursion, and loss of habitable delta-plain surfaces; thus, humans remain vulnerable to sea-level rise (cf. French et al., 1995). The impact of sea-level rise on deltas is a critical concern because world population is projected to exceed 10 billion by 2060 (Rosenzweig and Parry, 1994). Humans are increasingly dependent on deltas as vital food resources. Moreover, the increasing population pressures are causing serious and extensive degradation of these environmentally sensitive regions.

The integrated geoarchaeological record provides the means to interpret deltaic conditions for the period prior to major human modification and thereby to establish a baseline to differentiate from anthropogenic activity long-term changes in delta environments induced by natural factors. By evaluating long-term delta changes, this interdisciplinary approach can be used to measure environmental change through time and formulate effective, long-term coastal protection strategies.

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ACKNOWLEDGMENTS

We thank J. M. Coleman, A. N. Ellis, J. C. Kraft, B. J. Meggers, M. F. Miller, K. K. Schepis, B. D. Smith, L. D. Wakeley, and an anonymous reviewer for helpful discussions and constructive suggestions, and the Smithsonian Institution, National Museum of Natural History, and National Geographic Committee for Research and Exploration for financial support. Permission was granted by the Chief of Engineers to publish this information.

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Manuscript received July 15, 1997; revision received August 30, 1997; accepted September 5, 1997 ■

Louisiana Transfers from Southeastern Section to South-Central Section

The management boards of the Southeastern and South-Central Sections of the Geological Society of America recommended in summer 1997 that GSA member affiliation in Louisiana be transferred from the Southeastern to the South-Central Section. The GSA Council approved the transfer pending member input, and in August, GSA solicited the opinion of members in Louisiana. An overwhelming majority of those who responded approved of the transfer, which will bring the South-Central Section population into proportion with that of other sections. In addition, professional geologists in Louisiana are generally more aligned with the activities of the South-Central Section than with those of the Southeastern Section.

Effective immediately, GSA members in the state of Louisiana will be affiliated with the South-Central Section, *unless they indicate otherwise.* **Please note that GSA members may choose to maintain affiliation with any GSA section, regardless of their residential area. However, members may affiliate with only one GSA section at a time.** Any member who wishes to affiliate with a GSA section outside of his or her residential area should specify this on his or her dues statement or contact Membership Services at (303) 447-2020 or member@geosociety.org.

The members of the GSA South-Central Section wish to welcome our new affiliates. We remind you that we have an active program of student support, including travel grants to meetings and research awards at both the undergraduate and graduate levels. Our section meetings will be in Norman, Oklahoma (1998), Lubbock, Texas (1999), and Fayetteville, Arkansas (2000). Plan to attend these and get to know us!

—Elizabeth Anthony, Chair, South-Central Section

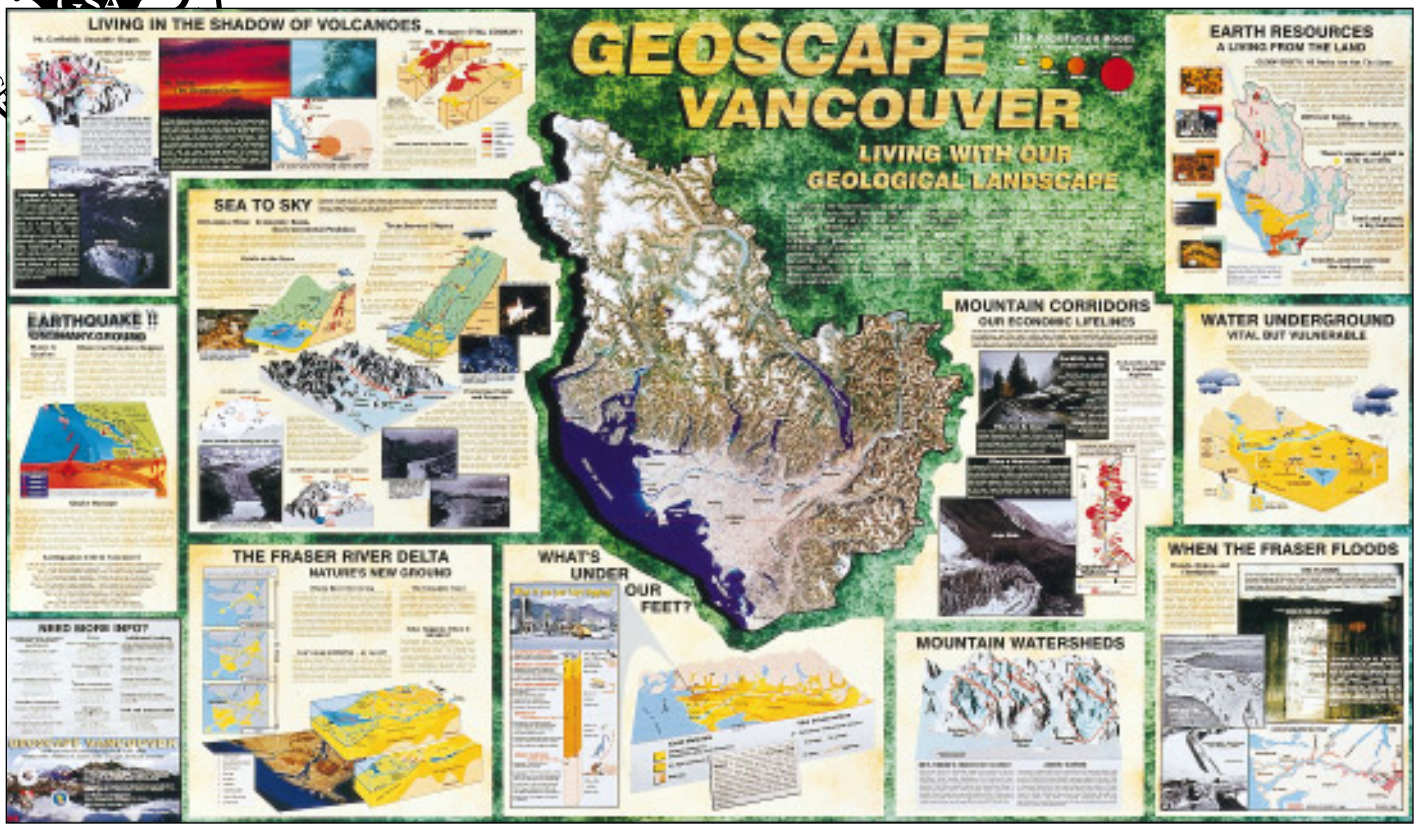

Figure 1. Geoscape Vancouver poster (published poster is 90 × 150 cm).

Raising Community Geoliteracy—The GEOSCAPE Vancouver Story

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OVERVIEW

The Geological Survey of Canada has recently launched a geoliteracy initiative in the Vancouver metropolitan region. Our first product is *Geoscape Vancouver*, a colorful, jargon-free, graphics-rich poster dealing with local geological issues. This poster has proven to be a powerful vehicle for educating the public, and we hope, through this article, to encourage the production of similar posters for other cities in North America.

THE LOCAL OPPORTUNITY

A great challenge facing geoscientists is to ensure that relevant earth science information is clearly communicated to the public, and through them to society's decision makers. To get people's attention, we must talk about what directly affects their lives. In large part that means explaining geological issues relevant to the places where people live and work. People are concerned with local geological hazards and are aware of land use debates in their community. They value understandable information on important issues such as quality of drinking water and resource development. They know best their own local landscape and are curious about what they have observed or experienced, be it flood or fossil, rockfall, or river stone.

Unfortunately, most geological information is highly technical, full of jargon, and therefore inaccessible to the public. What is produced specifically for the public is often aimed at a state, provincial, or national audience and is therefore rather generic. Excellent information is available for the geological "show pieces" of North America (e.g., Grand Canyon, Mount St. Helens, Niagara Falls), but rarely is there anything to explain the geology of a local watershed or ground-water supply, or nearby mountains or shorelines.

A deterrent to producing such locally oriented geological information is the possibility that the audience for such a product is so limited that the effort is difficult to justify. Large metropolitan centers, however, are ideal places for providing local geological information: A large population shares a small landscape; the large population places complex demands on earth and water resources, and any geological hazards affect many people. In addition, the geological database for most urban areas is large; thus the geoscientist can draw on a wealth of information. Further, metropolitan school systems can be important users and distributors of the geological product that is critical to its success. These circumstances provided the context for the development of the *Geoscape Vancouver* poster.

THE POSTER

Geoscape Vancouver is a large (90 × 150 cm), full-color, jargon-free, graphics-rich poster (Fig. 1). A central satellite image of the Vancouver area is surrounded by 10 panels, each of which discusses an important local geological issue: earthquakes; volcanoes;

floods; the Fraser River delta; geologic substrates of the city; an old mine, debris flows, and the Pleistocene history along a major highway; drinking water from mountain watersheds; groundwater resources; landslides and other slope hazards; and local earth resources (Turner et al., 1996a). We coined the word "geoscape" as a contraction of "geologic landscape," reflecting our belief that it is through the landscape that people meet geology.

Getting Started

In 1995, the Vancouver office of the Geological Survey of Canada faced a challenge: With diminishing resources, how could we make a significant impact on public awareness of geological issues in British Columbia and Yukon, our mandate area? Our strategy was to focus on the Vancouver area because, with 1.8 million people, it is home to half of British Columbia's population. A variety of issues make geoscience information vital to this fast-growing area: earthquakes, landslides, floods, and surface and underground water supplies. Local geologic events frequently make the news. Could we capitalize on this attention to present the science behind the geological issues?

We started by reviewing the situation. Although a large geoscience information base exists for the Vancouver area, almost all of it is contained in technical documents and maps that effectively cannot be used by people untrained in geology. Our task was to distill the essence of these data, and to repackage them in an accessible format.

We knew we had the in-house expertise to produce a series of good products. What concerned us was our ability to ensure that what we produced was widely used outside the geoscience community. Part of our philosophy was to target educators as the primary users; we had to make something that high school, college, and university teachers would find of value. What they wanted, they told us, was material that would allow them to teach about local geological issues.

Our next step was to invite a group of geoscientists to a brainstorming session to discuss geological issues in the Vancouver area. That meeting produced a long list of issues and examples. Our working group took that list and pared it down. At the outset, we intended to make a geologic map showing the distribution of surface sediments and rocks, hazards, and resources. However, it quickly became apparent that we needed explanatory text and graphics to communicate the science behind the geologic phenomena. As we worked, the explanatory component of the map grew, while the map component shrank—the map evolved into a poster.

The poster idea appealed to us. A successful poster can be highly visible within a community. It can also be loaded with information, most of it contained in figures, yet presented in small, easy-to-digest thematic components. We envisioned a poster that would take the reader many visits to complete, but just a five-minute visit to cover a particular theme. Once created, the poster contents and layout could be transferred to the World Wide Web, a medium with its own advantages.

Choosing the Area

Several considerations determined our choice of the boundaries of the Vancouver area. We wanted to emphasize the city's links to its landscape and so needed to include a significant hinterland beyond the metropolitan area. It was important that the area contain features and sites well known to residents, including major highway routes into the city and important recreational areas. We also wanted to use a drainage basin boundary to underscore the importance of stream basins as natural subdivisions of the landscape. We chose the drainage basins of the lower Fraser River and nearby Howe Sound, an area of about 40,000 km^2. The central satellite image on the poster was trimmed to the shape of this area.

Keep It Relevant, Keep It Familiar

The rapid growth of Vancouver is emphasized in a graphic below the poster title. Our message to the reader is clear: Understanding the geologic landscape is a prerequisite for wise choices about where growth takes place and how resources are managed.

Early on we received some sage advice from a member of our advisory group: To get people's attention, we should talk about things that directly affect their lives. The poster thus emphasizes hazards. It also focuses on that most important of resources—water. The stories behind both the city's mountain watersheds and ground-water supplies are told. In each case the poster emphasizes the natural workings of the landscape and puts the hazard or resource into a landscape context.

The poster interprets the icons of the local landscape: the local mountain skyline, Mount Baker volcano, the big Fraser River, the Fraser River delta, and steep-walled Howe Sound fjord. We give people a new look at "old friends."

Telling the Story with Pictures

We knew we had to use strong images to tell our stories; thus, we made a special effort to find photographs that graphically illustrate geologic processes. Photos of a village before and just after a devastating flood dramatically show the damaging power of flood waters (Fig. 2). A picture of a multitude of past Fraser flood-level marks hand-painted on a barn conveys the recurrent nature of flooding.

We employ block diagrams to explain local geologic features and processes: acid drainage at an abandoned mine (Fig. 3); geothermal resources and hot springs near a local volcano; river processes that have built the Fraser River delta; and ground-water in the Fraser Valley.

Most people cannot read topographic contour maps. For this reason, we present map information on relief maps that look like the local landscape (Fig. 4).

GEOSCAPE *continued on p. 10*

Figure 2. Telling the story with pictures: Britannia village before and after a devastating flood in 1921.

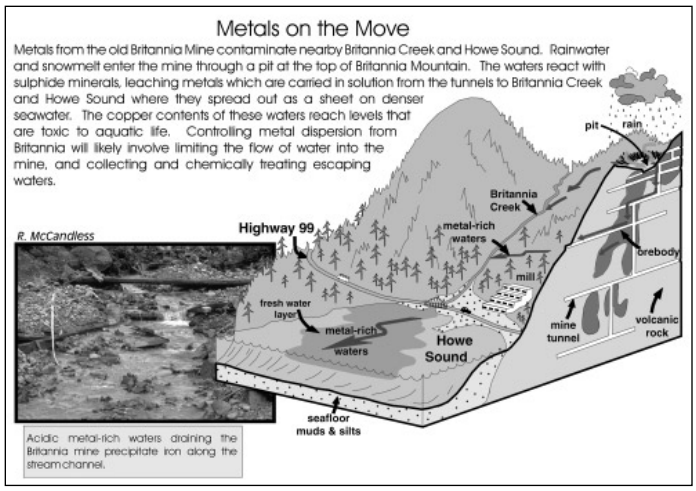

Figure 3. Using block diagrams to tell geological stories: the Britannia mine, its orebodies, and how acid mine drainage is generated.

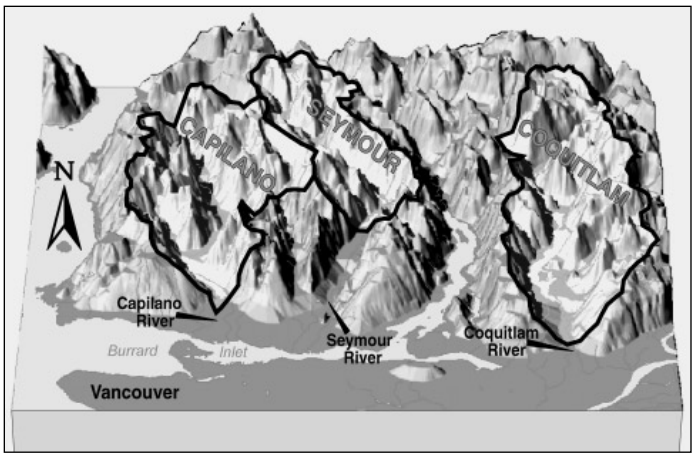

Figure 4. Making maps come alive: a perspective view of mountain watersheds that supply Vancouver's water.

GEOSCAPE *continued from p. 9*

IN THE CLASSROOM

We have had a positive response to the poster, particularly from local educators teaching geography and earth science classes at the high school and introductory university levels. At their urging, we produced two companion products. One is a set of 10 poster enlargements of *Geoscape* theme panels that allow teachers to focus on particular geological issues (Turner et al., 1996b). The second product is a set of 20 overhead transparencies of the best *Geoscape* images (Turner et al., 1996c).

Several school districts have organized workshops with us to introduce the content of the *Geoscape* poster to teachers. These sessions have provided us with feedback on the poster and ideas on other useful products.

RESOURCES

The poster took 18 months to complete, including production of a French-language version. The project required research staff to establish content and produce draft figures and text (four months), a computer draftsperson to produce the final figures (one month), a geologist-graphics designer to design and produce the poster (three months), and a digital cartographer to prepare the poster for printing (one month). Scientific contributions were made by a large group of geoscientists from the Geological Survey of Canada, British Columbia Geological Survey Branch, and Simon Fraser University. A draft version was reviewed by a group of educators, geotechnical engineers, and environmental consultants. The poster was assembled in CorelDraw (version 6). Three thousand copies of the poster were printed on high-quality paper at a cost of about Canadian $5000, and we currently sell the poster for Canadian $15. Copies of the poster can be obtained from Sales and Publications, Geological Survey of Canada, 101-605 Robson St., Vancouver, BC V6B 5J3, Canada, (604) 666-0271; fax 604-666-1337; gscvan@gsc.nrcan.gc.ca.

The poster contents are also available on the Web at http://sts.gsc.nrcan.gc.ca/page1/urban/geoscape/geoscape.htm.

WHAT'S NEXT?

The *Geoscape Vancouver* project introduced us to educators, environmental professionals, and land-use planners in the Vancouver area. These contacts encouraged us to prepare other products that push the boundaries of traditional geoscience. The next step was to produce the geological map for nongeoscientists that had been our initial idea. Our objective was to provide useful spatial geoscience information to regional planners, environmental consultants, emergency preparedness personnel, and educators. We have just completed this map, *GeoMap Vancouver* (Turner et al., 1997; see Clague et al., 1997 for a description). We are assembling a set of slides on local geologic features for teachers, and in 1998 we will start work on a book amplifying the material in both *Geoscape* and *GeoMap*.

OTHER GEOSCAPE POSTERS?

Our hope is to see similar posters produced for major metropolitan areas across Canada, in the United States, and elsewhere. We can think of no better way to raise geoliteracy than to provide educators with access to geological stories behind their own local landscapes. Teaching local geology has tremendous advantages: Students are more interested in the familiar; local field trips provide students with hands-on experience; and local media coverage provides the human interest side of the geological issues.

"We could do that!" is a comment we received from geoscientists in a number of cities across Canada. The Geological Survey of Canada is currently considering what role it can play in encouraging production of such posters. And the idea has already jumped the border; Curt Pederson of Portland State University is planning such a poster for the Portland area. We encourage other local geological groups to consider producing such a geoscience poster for their community.

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To Order the Poster ...

Sales and Publications, Geological Survey of Canada, 101-605 Robson St., Vancouver, BC V6B 5J3, Canada, (604) 666-0271; fax 604-666-1337; gscvan@gsc.nrcan.gc.ca.

The Climate Change Debate Is Heating Up

Tamara Nameroff, 1996–1997 GSA Congressional Science Fellow

The climate change debate in Washington is heating up as nations of the world consider setting binding global limits on emissions of greenhouse gases. At the heart of the debate are questions about the significance of the large increase in concentrations of atmospheric climate-forcing gases since pre-industrial times, and the economic impacts of a climate treaty.

As geologists, we recognize that Earth's climate has changed over time in response to natural variations. When dinosaurs roamed the planet 100 million years ago, the planet's mean global surface temperature may have been as much as 6–8 °C above that of today. During the Last Glacial Maximum—about 15,000 to 23,000 years ago—mean surface temperatures were significantly cooler. Atmospheric greenhouse gas levels have waxed and waned in tandem with changes in the climate. Climate models suggest that, during the steamy days of the dinosaur, atmospheric concentrations of carbon dioxide likely were considerably higher than they are today. In contrast, ice-core records show that during cold, dry periods like the last Ice Age, the concentrations of atmospheric CO_2, CH_4, and N_2O were dramatically lower.

Earth science collides with economics and politics when the more recent climate record is considered. Observational evidence, such as the worldwide retreat of glaciers and rise in sea level, indicates that the surface of the planet has warmed over the last century. Whether these changes are the result of human emissions of greenhouse gases or are attributable to natural variability has been the subject of one of the most intensive research efforts—and political debates—of the past 20 years.

Because of the enormous complexity of the climate system, the fingerprints of human activity on the climate have been difficult to isolate. Nevertheless, after an extensive process that evaluated both empirical and theoretical studies, the Intergovernmental Panel on Climate Change— a group of expert scientists from around the world—concluded in 1995 that the warming trend observed in the past 100 years "is unlikely to be entirely natural in origin," and "the balance of evidence suggests a discernible human influence on the climate." The IPCC predicts that mean surface temperatures could rise 1–3.5 °C by the year 2100 if we do nothing to limit anthropogenic emissions of greenhouse gases.

Those who challenge the IPCC's predictions point to the number of assumptions that must be made about the climate system in the computer models used to develop projections of future climate. For example, the skeptics point to the models' failure to capture decade-scale climate variations as an indication that the projections for future warming are flawed. The skeptics also highlight the uncertainties of the IPCC's projections regarding the magnitude, location, and timing of the predicted warming.

The two-part question that legislators must answer when faced with an incomplete scientific understanding of the climate system is whether the science presents a sufficiently compelling reason to put limits on greenhouse gas emissions, and if it does, what the best way of moving forward might be. Formulating a reasonable climate policy is made difficult by the fact that great uncertainty exists about the benefits (the damages avoided) of reducing greenhouse gas emissions, in addition to great uncertainties about the costs of attaining those reductions—modeling the world's economy is no less challenging a task than modeling the world's climate system. Although the Clinton Administration has accepted the conclusions of the IPCC, many members of Congress have not. This has led to a fundamental disagreement regarding the urgency and nature of the steps needed

Climate Change *continued on p. 12*

WASHINGTON REPORT

Bruce F. Molnia

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.

New Federal-State Cooperation in Watershed Protection

> *"While we begin this effort in Maryland, we believe it is a model that can apply to other states as well. Clean water is not a regional issue. It is a national issue."*
>
> —Vice President Al Gore, Centerville, Maryland, October 20, 1997

In late October, the White House announced that the state of Maryland and the U.S. Department of Agriculture (USDA) have joined together in a new initiative to help protect the Chesapeake Bay and its tributaries. It is their hope that this agreement will serve as a model for other cooperative water-quality efforts nationwide. This new federal-state partnership expands an existing USDA program, the Conservation Reserve Program (CRP) that protects millions of acres of American topsoil from erosion. According to the USDA, by reducing water runoff and sedimentation, it protects ground water and helps improve thousands of lakes, rivers, ponds, streams, and other water bodies. All of these acres are planted to vegetative cover or other forms of wildlife habitat.

This new joint program will attempt to have as many as 100,000 environmentally sensitive acres of land along Maryland streams and rivers set aside and maintained to protect water quality. The new component of this partnership, the State Enhancement Program, is designed to build on the broad foundation of the CRP. It permits the USDA to work in partnership with states, link resources, and share costs to meet conservation and environmental objectives. Nationally, about 27.8 million acres are enrolled in the CRP; only about 20,000 acres are in Maryland. Full enrollment in the Maryland program could provide buffers along 5,000 miles of streams by the year 2002. This would put a buffer between every permanent stream in the state and its adjacent farmland, as well as a buffer along many seasonal streams.

The new State Enhancement Program follows on the heels of USDA efforts to reinvigorate the CRP, which has a relatively long and rocky history. The nearly 28 million acres enrolled today is down from nearly 37 million acres enrolled in

Washington Report *continued on p. 13*

Climate Change *continued from p. 11*

to address climate change in the future. While acknowledging our lack of precise scientific information, the Administration believes that the risks posed by climate change are sufficiently serious that action must be taken now, and that costs of the climate treaty can be mitigated with flexible implementation policies. In contrast, many members of Congress see the risks of climate change as too uncertain and are convinced that the costs of reducing emissions would be too high to warrant any kind of action. They would prefer a wait-and-see policy or, at most, a limited expenditure on emission reductions.

The debate in Washington is fueled by the fact that international negotiations on a binding agreement to limit emissions of greenhouse gases are scheduled to conclude in December in Kyoto, Japan. It is widely expected that the treaty will set binding limits on emissions for industrialized nations. While developing nations likely will commit to strengthen their existing voluntary commitments to reduce emissions, it is unlikely that they would also be subject to binding limits in the agreement. The rationale for this approach is that developing nations bear little historic responsibility for the buildup of greenhouse gases above pre-industrial levels in the atmosphere, and have relatively low per-capita emissions compared to industrialized countries.

A 95–0 vote in the Senate on a resolution sponsored by Robert Byrd (D—WV) and Chuck Hagel (R—NE) illustrates growing concerns in the Congress about this approach. The resolution states that the United States should not agree to limit emissions unless developing countries also adopt binding targets. As indicated by floor statements made during debate on the nonbinding measure, some senators do not believe that climate change is a serious problem, and therefore a treaty would harm the economy for no good reason. Other senators feel that by leaving developing countries off the hook at Kyoto, the treaty could harm the U.S. economy for no environmental benefit. These senators believe that if emissions reductions covered only industrialized nations, industries would move overseas to countries that have no emissions limits. A third group of senators endorsed the sentiment of the resolution—that developing countries ought to do more to reduce emissions—but disagreed with the substance of the bill.

Given this potential impasse between the President and the Senate, the Administration has tried to steer a middle course. President Clinton announced in October that the United States would seek to reduce greenhouse-gas emissions to 1990 levels in the 2008–2012 time period. This is a relatively modest goal compared to proposals from some nations that would require industrialized nations to cut emissions by 2010 to 20% below 1990 levels. To try to address concerns about the economic impact of such a reduction, the President will propose a $5 billion package of tax cuts and R&D for new energy technologies. The Administration also has redoubled its efforts to gain additional commitments from developing countries in the treaty, and the President has stated that the United States will not adopt binding obligations without the participation of developing countries. Whether any compromise will be adequate to satisfy Congressional critics remains to be seen. Judging by the range of concerns expressed on the Senate floor during debate on the Byrd-Hagel resolution, the 67 votes necessary to ratify a climate treaty will be difficult to secure. ■

Tamara Nameroff is the 1996–1997 GSA Congressional Science Fellow. *The one-year fellowship is supported by GSA and by the U.S. Geological Survey, Department of the Interior, under Assistance Award 1434-HQ-96-GR-02768. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government or GSA.*

Washington Report *continued from p. 12*

1995. During the CRP's early years, 1986–1989, the USDA accepted about 33.9 million acres of cropland into the CRP. This acreage was enrolled in nine separate signups under authority of the Food Security Act of 1985. CRP enrollment was extended through 1995 with passage of the Food, Agriculture, Conservation, and Trade Act of 1990. Three additional signup periods were held in 1991 and 1992, and about 2.5 million additional acres were enrolled under significantly revised program rules. No CRP funds were appropriated for growth in fiscal years 1993–1995, and many contracts have expired.

Earlier this year, Dallas Smith, USDA Acting Under Secretary for Farm and Foreign Agricultural Services, told a congressional agriculture subcommittee, "The CRP is an effective, voluntary approach to improving the nation's natural resource base." Landowners enter into contracts with USDA to place erodible and other environmentally sensitive cropland in long-term conservation practices. In exchange, the landowners receive annual rental payments for the land and cost-share assistance for establishing those practices. "We are very eager to move forward and enroll land under the new contracts to set the stage for conservation in the 21st century," Smith said. "The new CRP will provide wonderful conservation opportunities to thousands of farmers and landowners who had land in the program before and thousands more who have never enrolled land in the CRP. Under the new CRP, the taxpayers get a better deal and landowners and farmers have a potent, flexible conservation tool." According to a 1990 nationwide survey conducted by the Soil and Water Conservation Society, the average CRP contract holder is 57 years old, has a high school education, is owner-operator of 323 acres, put 93 acres into CRP, and obtains less that 50% of the household income from farming.

Maryland is the first state to participate in a State Enhancement Program. Maryland will provide technical support to all applicants and also may purchase permanent conservation easements to protect riparian areas. The enhancement agreement establishes a voluntary, $200 million incentive program, under which Maryland's landowners may enroll up to 100,000 acres of cropland in the Conservation Reserve Program to restore wetlands and to establish forest and grass buffers between farms and fragile waterways. Under this program, through the enhancement program, the USDA will make annual rental payments to participating farmers through 15-year contracts, and Maryland will fund permanent conservation easements on 20,000 acres of enrolled lands. This includes cost-share assistance, and technical assistance to encourage landowners to devote environmentally sensitive farmland or marginal pasture-land adjacent to streams, rivers, or other water bodies to long-term resource conservation practices. Participating landowners will receive 87.5% of the cost of planting buffer strips, restoring wetlands, or implementing other measures to protect water quality.

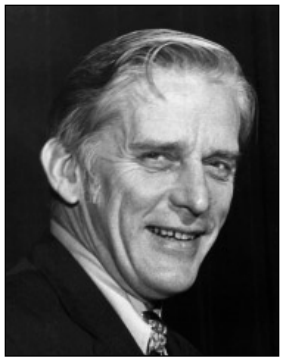
The philosophy behind this program is that wetlands play a vital role in filtering pollutants and restoring water quality. The goal is to develop "riparian buffer areas." These are strips of land along stream and river banks, that, if properly planted with protective vegetation, can be used to reduce the amount of sediment and nutrients reaching streams or rivers by as much as 90%. To encourage applicants to protect these environmentally sensitive lands, USDA will make annual incentive payments. USDA and Maryland also will help pay for the cost of planting long-term resource-conserving vegetation and for restoring wetlands. These conservation measures are essential to combating soil erosion as well as to protecting Chesapeake Bay tributaries and other Maryland waters from runoff of phosphorus, nitrogen, and other pollutants that impair water quality. Polluted runoff from agriculture and a range of other sources such as sewage and urban runoff is known to contribute to the proliferation of harmful marine organisms in Chesapeake Bay. This State Enhancement Program agreement is directly linked to President Clinton's initiative, announced in Kalamazoo, Michigan, in August 1996, to target federal farm programs to protect water quality and to create stronger incentives for farmers to help reduce agricultural runoff. Illinois and Minnesota have already submitted participation proposals to the USDA.

On October 20, Vice President Al Gore stated, "This new partnership will further protect the water resources of Maryland and the Chesapeake Bay.... This agreement means cleaner water, healthier fish, and a stronger environment for every family in Maryland. By protecting the lands adjacent to the tributaries of the Bay and by restoring wetlands, we can significantly reduce the amount of nutrients, sediment, and pesticides that reach the waters of the Bay." Gore was joined by DOA Secretary Dan Glickman and Maryland Governor Perris Glendening. "This new initiative reflects the Clinton Administration's commitment to voluntary, cost-effective conservation programs," Glickman said. He continued, "Problems associated with run-off from agricultural lands, as well as from urban areas, are real and must be addressed. Working with farmers, ranchers and other landowners through these kinds of state and federal partnerships will go a long way to addressing water quality problems." ■

GSAF UPDATE

Valerie G. Brown, *Director of Development, GSA Foundation*

Fund to Honor Chuck Drake



With Chuck Drake's death last July, GSA lost a respected scientist and good friend. In more than 40 years of membership, Chuck's generous commitment of time and talent were reflected in many aspects of GSA's governance and activities. Consequently, we are truly proud that Chuck's contributions and achievements will be permanently honored by a memorial fund carrying his name and dedicated to a purpose he cherished.

At Bruce Hanshaw's recommendation, the Operating Committee of the 28th International Geological Congress (of which Chuck was president), has donated $50,000 to establish the Charles Lum Drake Travel Grant Program. The fund will be used to provide assistance to young foreign geoscientists, enabling them to attend GSA's Annual Meetings. Following the initial gift, other memorial donations have already been added to the fund.

In facilitating such an important gift, Hanshaw commented: "As we all know, young people were very special to Chuck, who was always seeking ways to enhance their careers. What better way to do so than to set up an award that will help these young folks get into the mainstream of geoscientific thinking at a major meeting in North America. The more the award fund grows, the greater will be the opportunity to realize Chuck's ideas about helping young scientists from around the world achieve their fullest potential."

Contributions to the Charles Lum Drake Travel Grant Fund may be sent to the GSA Foundation. ■

Donors to the Foundation, September 1997

(Please note: All contributions, both annual and Second Century Fund, are included under the fund designated by the donor.)

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continued on p. 15

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Digging Up the Past

Most memorable geologic experience:

In 1951, as a neophyte mapping alone in remote Navajo country, I was having lunch when a man carrying a rifle approached. I became frightened, especially when he demanded to know what I was doing. I told him and invited him to share my lunch, which he did. We talked about geology and the land, and I found we had much in common.

—Arthur Mirsky

STUDENT NEWS AND VIEWS

Brian Exton, *University of Texas at Austin*

Student News and Views provides GSA membership with commentary on matters relating to undergraduate and graduate students in the geosciences. The Correspondent for Student News and Views welcomes comments and suggestions, sent to stumatts@geosociety.org.

Credit Where Credit Is Due

What better way to start off a column for students than by saving them money! Last summer, while many of us were pounding on rocks at research sites and field camps, Congress was hammering out the details of a new tax bill. The House version of the bill, however, threatened to eliminate Section 117(d) of the tax code, which would have required graduate teaching and research assistants to pay taxes on their tuition waivers. The alarm was sounded, rallying students and scientists alike to a last-minute lobbying effort. GSA President George A. Thompson wrote an exemplary letter to the House Ways and Means Committee (see Legislative Alert, August 1997 *GSA Today*, p. 3), and when the dust finally settled, Section 117(d) remained intact. In addition, the Taxpayer Relief Act of 1997 contains several new and important provisions, including two substantial tax credits for undergraduate and graduate students.

Students will use the first credit, dubbed the "HOPE Scholarship," during their first two years of postsecondary education. Beginning with expenses paid after December 31, 1997, freshmen and sophomores enrolled at least half-time may claim 100% of the first $1,000 and 50% of the second $1,000 spent on tuition and academic fees each year, but excluding costs for books, nonacademic fees, and room and board. If you are a typical student in the 15% tax bracket (income less than $24,000), this translates into a maximum savings of $225 per year. With the money you'll save you can buy a decent mountain bike, or if you have already declared yourself a geology major, that gold-plated Estwing hammer you always wanted. If your parents still claim you as a dependent, send them a copy of this column and earn brownie points for financial savvy and responsibility. They'll also want to know that they can claim this credit for each student.

Most GSA Student Associates and Members are juniors, seniors, or graduate students. The Lifetime Learning Credit, which applies to expenses paid after June 30, 1998, establishes a second tax credit for juniors and seniors, graduate students, professional students, and adults pursuing a continuing education *regardless of the number of hours taken,* and *for an unlimited number of years* (pending future legislation, of course). This credit entitles you to claim 20% of the first $5,000 of qualified tuition and related expenses each year through the year 2002. At that time, that amount will be increased to 20% of the first $10,000. Once again, if you are in the 15% tax bracket, you will deny the IRS—an equally satisfying way of thinking of it—a maximum of $1,000 per year per family. My advice to you: Save this column and file it away with your tax forms. I'll leave word with the next Student Correspondent to remind you about it.

The Taxpayer Relief Act of 1997 contains many other provisions related to educational expenses, including interest deductions on educational loans, educational IRAs, and more. To learn about these and other tax code changes and how they might affect you, visit the following Web sites: http://www.finaid.org/finaid/documents/hr2014-summary.html; http://www.ed.gov/offices/ope/ppi/97918tax.html; and http://www.nagps.org/StudentAid/105th/97TaxReconciliation.html. ■

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continued from p. 14

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CALL FOR NOMINATIONS REMINDERS

Penrose and Day Medals, and Honorary Fellowship

Nominations for 1998 Penrose and Day Medals and for Honorary Fellowship in the Society are due by **FEBRUARY 2, 1998.**

Young Scientist Award (Donath Medal)

The Young Scientist Award was established in 1988 to be awarded to a young scientist (35 or younger during the year in which the award is to be presented) for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences. The award, consisting of a gold medal called the Donath Medal and a cash prize of $15,000, was endowed by Dr. and Mrs. Fred A. Donath.

For the year 1998, only those candidates born on or after January 1, 1963, are eligible for consideration. In choosing candidates for the Young Scientist Award, scientific achievement and age will be the sole criteria. Nominations for the 1998 award must include

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

Deadline for nominations for 1998 is **FEBRUARY 2, 1998.**

Officers and Councilors

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

Deadline for nominations for 1999 service is **FEBRUARY 18, 1998.**

Distinguished Service Award

The GSA Distinguished Service Award was established by Council in 1988 to recognize individuals for their exceptional service to the Society. GSA Members, Fellows, Associates, or, in exceptional circumstances, GSA employees may be nominated for consideration. Any GSA member or employee may make a nomination for the award. Awardees will be selected by the Executive Committee, and all selections must be ratified by the Council. Awards may be made annually, or less frequently, at the discretion of Council. This award will be presented during the annual meeting of the Society. Deadline for nominations for 1998 is **MARCH 2, 1998.**

John C. Frye Environmental Geology Award

In cooperation with the Association of American State Geologists (AASG), GSA makes an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys. The award is a $1000 cash prize from the endowment income of the GSA Foundation's John C. Frye Memorial Fund. The 1998 award will be presented at the autumn AASG meeting to be held during the GSA Annual Meeting in Toronto.

Nominations can be made by anyone, based on the following criteria: (1) paper must be selected from GSA or state geological survey publications, (2) paper must be selected from those published during the preceding three full calendar years, (3) nomination must include a paragraph stating the pertinence of the paper.

Nominated papers must establish an environmental problem or need, provide substantive information on the basic geology or geologic process pertinent to the problem, relate the geology to the problem or need, suggest solutions or provide appropriate land-use recommendations based on the geology, present the information in a manner that is understandable and directly usable by geologists, and address the environmental need or resolve the problem. It is preferred that the paper be directly applicable by informed laypersons (e.g., planners, engineers). Deadline for nominations for 1998 is **MARCH 30, 1998.**

National Awards

The deadline is **April 30, 1998,** for submitting nominations for these four awards: William T. Pecora Award, National Medal of Science, Vannevar Bush Award, Alan T. Waterman Award.

Coal Division Offers Medlin Award

The Coal Geology Division of the Geological Society of America announces the availability of the Antoinette Lierman Medlin Scholarship in Coal Geology for the 1998–1999 academic year. The scholarships provide full-time students who are involved in research in coal geology (origin, occurrence, geologic characteristics, or economic implications of coal and associated rocks) with financial support for their project for one year.

Scholarship funding can be used for field or laboratory expenses, sample analyses, instrumentation, supplies, or other expenses essential to the successful completion of the research project. Approximately $2000 will be available for the 1998–1999 scholarship award. In addition, the recipient of the scholarship may be provided with a stipend of up to $750 to present results of the research at the 1999 GSA Annual Meeting. For the academic year 1998–1999, the Coal Geology Division is also offering a field study award of $1500. The recipient of this award will also be eligible to receive travel funds to present results of their study at the GSA Annual Meeting.

Proposals for the scholarship and the field study award will be evaluated by a panel of coal geoscientists. Applicants may apply for the scholarship award, the field study award, or both; however, only one award will be made to a successful applicant.

Interested students should submit five copies of the following: (1) a covering letter indicating which award(s) is (are) sought; (2) a concise statement of objectives and methods, and a statement of how the scholarship funds will be used to enhance the project. The proposal would be no more than five (5) double-spaced pages in length, including references; (3) a letter of recommendation from the student's immediate advisor which includes a statement of financial need and the amount and nature of other available funding for the research project.

Send the material to: **Peter D. Warwick**, Chairman, A. Lierman Medlin Scholarship Committee, U.S. Geological Survey, MS 956, National Center, Reston, VA 22092, (703) 648-6469, E-mail: pwarwick@usgs.gov.

The proposal and letter of recommendation must arrive no later than **February 15, 1998.** Applicants will be notified of the Scholarship Committee's decision by April 1, 1998.

The scholarship was established as a memorial to Antoinette "Toni" Medlin, who for many years worked toward the advancement of coal geoscience and encouraged students in coal geology. Monies for the scholarships are derived from the annual interest income from the scholarship fund.

Final Announcement

NORTH-CENTRAL SECTION, GSA 32nd Annual Meeting

Columbus, Ohio
March 19–20, 1998

The Department of Geological Sciences, The Ohio State University, in conjunction with the College of Mathematical and Physical Sciences, the Byrd Polar Research Center, the Division of Geological Survey of the Ohio Department of Natural Resources, and the U.S. Geological Survey Water Resources Division will host the 32nd Annual Meeting of the North-Central Section of the Geological Society of America. The meeting will be in the Ohio Union, Orton Hall, Mendenhall Laboratories, and the Faculty Club on the Ohio State University campus. Societies and organizations meeting with the North-Central Section include the Association for Women Geoscientists, the East-Central Section of the National Association of Geoscience Teachers, the Geology Division of the Council on Undergraduate Research, the Great Lakes Section of SEPM, the North-Central Section of the Paleontological Society, and the Pander Society. These organizations join in extending a warm invitation to meet with them in Columbus for pre- and postmeeting field trips and two full days of scientific interchange.

SETTING

Columbus, Ohio's capital and largest city, is situated in the center of of the state at the confluence of the Scioto and Olentangy Rivers and the intersection of U.S. Interstate Highways 70 and 71. Columbus lies just a few miles west of the edge of the Allegheny Plateau, which is underlain by flat-lying Carboniferous bedrock and sprawls over some 400 square miles of drift-covered Devonian bedrock, mostly black shale. Columbus is home to an array of fine cultural organizations, including the Columbus Symphony, Ballet Met, Opera Columbus, the Contemporary American Theater Company, the Columbus Museum of Art, and the Center for Science and Industry. Scattered through Columbus are numerous fine restaurants and shopping malls. Central Ohio is home to a large number of institutions of higher education, including The Ohio State University and Columbus State University in Columbus, Capitol University in Bexley, Otterbein College in Westerville, Denison University in Granville, and Ohio Wesleyan University in Delaware.

REGISTRATION

Registration is required for all who participate in any event at the meeting, including technical sessions, symposia, workshops, field trips, exhibits, and planned social events.

Preregistration Deadline:
February 13, 1998

Preregistration is encouraged to aid local committees in making final plans for the meeting. A discount is available to those who preregister by using the form provided in this announcement. Preregistration is **required** for field trips. **Preregistration may be accomplished by completing the enclosed registration form and sending it with full payment by check or credit card to the Geological Society of America North-Central Meeting, P.O. Box 9140, Boulder, CO 80301-9140.** Full payment MUST accompany registration. Please preregister only one professional, one student, or one K–12 educator per form. Guests registering for the meeting may register on the same form. A confirmation letter from GSA will be your receipt. Preregistration forms received after February 13, 1998, will be charged the on-site rate.

Registration badges must be worn for access to all activities. Guest registration is required for attendance at the welcoming party, annual dinner, scheduled luncheons, and field trips; however, guests who do not wish to attend these functions need not register and may find it of interest to visit the numerous local museums, galleries, historical monuments, and shops on their own.

A current student ID is required to obtain student registration rates. Students who cannot produce a current student ID when they pick up their registration materials will be charged the full professional registration fee.

REGISTRATION FEES

	Full Meeting	One Day
Professional Member	$65	$40
Professional Nonmember	$70	$45
Student Member	$30	$15
Student Nonmember	$35	$30
K–12 Professional	$35	NA
Guest or Spouse	$ 5	NA

Access. GSA's North-Central Section is committed to making all events at the 1998 meeting accessible to all people interested in attending. The Ohio Union complies with all ADA requirements. If you have special requirements, please indicate this on the registration form or call William I. Ausich at (614) 292-0069. We will be happy to make whatever arrangements we can to enable full participation in the meeting. If possible, let us know by the preregistration deadline so that we will have time to make any necessary arrangements.

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for registration additions, changes, and cancellations must be made in writing and received by February 20, 1998. Faxes (303-447-0648 or 303-447-1133) will be accepted. Advance registrations will be refunded for all such cancellations. NO REFUNDS WILL BE MADE ON CANCELLATION NOTICES RECEIVED AFTER FEBRUARY 20, 1998. Refunds paid by credit card will be credited according to the card number on the preregistration form. NO refunds will be given for on-site registration or ticket sales.

ON-SITE REGISTRATION SCHEDULE

Registration will be held in the West Ballroom, on the first floor of the Ohio Union. Registration hours are:
Wed., March 18, 4:30 p.m. to 9:00 p.m.
Thur., March 19, 7:30 a.m. to 4:30 p.m.
Fri., March 20, 7:30 a.m. to 12:00 noon

STUDENT PAPER AWARDS AND TRAVEL ASSISTANCE GRANTS

The North-Central Section will award $100 for up to eight papers judged to be the best in their respective technical sessions and whose author and presenter is a graduate or undergraduate student. Abstracts of papers submitted for consideration for these awards should be so identified on the abstract form.

Grants for travel assistance of up to $200 (exclusive of field trips) may be made to student members and associates. These grants will be offered on a first-come, first-served basis. If funds are limited, priority will be given to students who are also presenting oral or poster papers. To be eligible for travel assistance grants, students must be currently enrolled in an academic department and certify their student membership in GSA. Applications for travel assistance grants may be obtained by writing to William I. Ausich, General Chairman GSA North-Central Section, Dept. Geological Sciences, The Ohio State University, 125 So. Oval Mall, Columbus,

North-Central *continued on p. 18*

North-Central *continued from p. 17*

OH 43210. Applications for travel assistance must be received on or before Friday, **February 6, 1998.**

TECHNICAL PROGRAM

Questions regarding the technical program should be addressed to David Elliot, Program Coordinator, NC-GSA, Dept. Geological Sciences, The Ohio State University, 125 So. Oval Mall, Columbus, OH 43210, fax 614-292-7688, elliot.1@osu.edu. Technical sessions will begin at 8:00 a.m. on Thursday, March 19, 1998, and will conclude at 5:00 p.m. on Friday, March 20, 1998.

SYMPOSIA

1. **Ecology and Evolution of Encrusting and Boring Organisms.** *(Sponsored by North-Central Section, Paleontological Society.)* Halard Lescinsky, Dept. Life and Earth Sciences, Otterbein College, Westerville, OH 43081, (614) 823-1565, fax 614-823-3042, hlescinsky@otterbein.edu.
2. **Spreading the Good Word. The Importance of Outreach Programs in Geoscience Education.** *(Sponsored by Central Section, National Association of Geoscience Teachers.)* David H. Malone, Dept. Geography-Geology, Illinois State University, Campus Box 4400, Normal, IL 61790-4400, (309) 438-2692, fax 309-438-5310, dhmalon@ilstu.edu; and G. G. Anderson, Dept. Earth Sciences, St. Cloud State University, St. Cloud, MN 56301-4498.
3. **Hot Topics in Conodont Biochronology.** *(Sponsored by the Pander Society.)* Mark Kleffner, Dept. Geological Sciences, OSU at Lima, 4240 Campus Dr., Lima, OH 45804-3576, (419) 221-1641, ext. 208, fax 419-221-1658, kleffner.1@osu.edu; and Walter C. Sweet, Dept. Geological Sciences, OSU, 155 So. Oval Mall, Columbus, OH 43210, (614) 292-2326; fax 614-292-1496, sweet.2@osu.edu.
4. **Conodont Evidence for Impacts and Extinctions.** *(Sponsored by the Pander Society.)* Charles A. Sandberg, U.S. Geological Survey, Box 25046, MS 940, Federal Center, Denver, CO 80225, (303) 236-5763, fax 303-236-0459, sandberg@usgs.gov.
5. **Geology of Ohio.** *(Sponsored by Geological Survey Division, Ohio Department of Natural Resources.)* Thomas Berg, State Geologist and Chief, Geological Survey Division, ODNR, Fountain Square, Bldg. B, Columbus, OH 43224, (614) 265-6988, fax 614-268-3669, thomas.berg@dnr.state.oh.us.
6. **The Contribution of Bedrock and Glacial Debris to the Quality of Life in the Midwest.** E. Scott Bair, Dept. Geological Sciences, OSU, 125 So. Oval Mall, Columbus, OH 43210, (614) 292-6197, fax 614-292-7688, esbair@hydro.mps.ohio-state.edu.
7. **Global Change and Natural Climate Variability Recorded in Mountain Glaciers.** Lonnie G. Thompson, Dept. Geological Sciences, OSU, 125 So. Oval Mall, Columbus, OH 43210, (614) 292-2616, fax 614-292-7688; and Byrd Polar Research Center, 082C Scott Hall, 1090 Carmack Rd., Columbus, OH 43210, (614) 292-6652, fax 614-292-4697, thompson.3@osu.edu.
8. **Sedimentologic and Paleoecologic Approaches to Interpreting Sea-Level Changes and Sequence Stratigraphy.** *(Sponsored by Great Lakes Section, SEPM.)* Brian Witzke, Iowa Geological Survey, 109 Trowbridge Hall, University of Iowa, Iowa City, IA, 52242-1319, (319) 335-1590, fax 319-335-2754, brian-witzke@uiowa.edu.
9. **R. L. Bates Symposium on Industrial Minerals.** D. E. Pride, Dept. Geological Sciences, OSU, 125 So. Oval Mall, Columbus, OH 43210, (614) 292-9523, fax 614-292-7688, pride.1@osu.edu; and R. O. Utgard, Dept. Geological Sciences, OSU, 125 So. Oval Mall, Columbus, OH 43210, (614) 292-0138, fax 614-292-7688, rutgard@summit.bor.ohio.gov.
10. **Geophysics for Shallow-Depth Site Characterization.** Paul Wolfe, Dept. Physics and Geological Sciences, Wright State Univ., Dayton, OH 45435, (937) 775-2990, fax 937-775-3462, paul@taurus.gl.wright.edu; and Jeffrey J. Daniels, Dept. Geological Sciences, OSU, 125 So. Oval Mall, Columbus, OH 43210, (614) 292-4295, fax 614-292-7688, jdaniels@geols.mps.ohio-state.edu.
11. **The Midwest Response of Physical Systems to Abrupt Climate Change.** Tom Lowell, Dept. Geology, University of Cincinnati, Cincinnati, OH 45226-0013, (513) 556-4165 or (513) 556-3732, fax 513-556-6931, Thomas.Lowell@uc.edu; and Donald Pair, Dept. Geology, University of Dayton, Dayton, OH 45469-2364, (937) 229-2936, fax 937-229-2889, pair@neelix.udayton.edu.
12. **Appalachian Cyclothems.** Elizabeth Gierlowski-Kardesch, Department of Geological Sciences, Ohio University, Athens, Ohio 45701-2979, (614) 593-1898, gierlows@ohiou.edu; and David L. Kidder, kidder@ohiou.edu.

PROJECTION EQUIPMENT

Each meeting room will have two standard 35 mm carousel projectors for 2″ × 2″ slides and two viewing screens. Overhead projectors for transparencies will be available upon request. A speaker-ready room will be available for review of slides and overheads and for speaker preparation. Each carousel to be used in an oral presentation should be clearly identified with the speaker's name, session number, and speaker number. Carousels must be turned in to the projectionists at the beginning of the appropriate technical session.

Authors are encouraged to load slides in their own carousels. A few carousels will be available for loan to those unable to supply their own, but these will be loaned out on a first-come, first-served basis and **must** be returned to the speaker-ready room immediately following the technical session in which they are used.

POSTER SESSIONS

Students and professional geologists are encouraged to take advantage of this effective means of presentation. Please indicate *Poster Session* on the GSA abstract form. Each poster booth will contain two areas, 4′ × 4′ each, arranged at table height. Poster sessions will be in the exhibit area in the West Ballroom of the Ohio Union. Posters will be available for viewing for four hours during each session, and authors should arrange to be present for the full four hours during which their poster is on display.

Poster Session for Undergraduate Research. *(Sponsored by the Geology Division of the Council on Undergraduate Research.)* Undergraduates are encouraged to submit posters to this special-topic poster session. Additional information may be obtained from the convener, Karen H. Fryer, Dept. Geology and Geography, Ohio Wesleyan University, Delaware, OH 43015, (614) 368-3618, fax 614-368-3999, khfryer@owu.edu.

WORKSHOPS

The following workshops are scheduled. There will be no charge for participation, but preregistration is encouraged so that organizers may prepare adequate numbers of printed materials. Additional information may be obtained from the organizers, whose names and addresses are given below.

1. **Learning from the Fossil Record.** *(Sponsored by the North-Central Section, Paleontological Society.)* Halard Lescinsky, Dept. Life and Earth Sciences, Otterbein College, Westerville, OH 43081, (614) 823-1565, fax 614-823-3042, hlescinsky@otterbein.edu. Friday, March 20; location to be announced in NC-GSA *Abstracts with Programs* volume.
2. **ESSTEP Workshop for High School and College Earth Science Teachers: Effective Use of Computer-Based Technologies in the Classroom.** *(Earth and Space Science Technological Education Project, Sponsored by Central Section, National Association of Geoscience Teachers.)* David H. Malone, Dept. Geography-Geology, Campus Box 4400, Illinois State University, Campus Box 4400, Normal, IL 61790-4400, (309) 438-2692, fax 309-438-5310, dhmalon@ilstu.edu; and Fred Siewers, Dept. Physical Science, Rock Valley College, 3301 N. Mulford Rd., Rockford, IL 61114, (815) 654-4385, faps3fs@rvcux1.rvc.cc.il.us. Saturday,

March 21; location to be announced in NC-GSA *Abstracts with Programs* volume.
3. **Workshop on Effective and Innovative Techniques for Teaching Geoscience.** *(Sponsored by National Association of Geoscience Teachers.)* Heather Macdonald, Dept. Geology, College of William and Mary, Williamsburg, VA 23187, (757) 221-2443, fax 757-221 2093, rhmacd@facstaff.wm.edu. Saturday, March 21, 8 a.m. to 5 p.m.; location to be announced in NC-GSA *Abstracts with Programs* volume. This workshop, sponsored by NAGT and funded partially by NSF's Division of Undergraduate Education, is designed to give participants specific strategies for more effective teaching. Workshop will emphasize innovative techniques for actively engaging students in the classroom, lab, and field. Workshop is aimed toward college and university teachers and graduate students interested in teaching careers. Saturday, March 21, 8 a.m. to 5 p.m., no charge. Space is limited; prospective participants must register in advance. Refreshments provided. Presenters are Barbara Tewksbury (Hamilton College) and Jeffrey Niemitz (Dickinson College).

FIELD TRIPS

Field trip coordinators are Douglas E. Pride, Dept. Geological Sciences, The Ohio State University, 125 So. Oval Mall, Columbus, OH 43210, (614) 292-9523, fax 614-292-7688, pride.1@osu.edu; and Thomas Berg, State Geologist and Chief, Geological Survey Division, ODNR, Fountain Square, Bldg. B, Columbus, OH 43224, (614) 265-6988, fax 614-268-3669, thomas.berg@dnr.state.oh.us. All inquiries about field trip arrangements should be directed to Douglas Pride. Trip charge includes transportation, lunch, and guidebook. All trips begin and end on the west side of the Ohio Union on College Road.

Premeeting

1. **Field Excursion to a Longwall Coal Mine.** Douglas L. Crowell, Head Coal Geologist, Geological Survey Division, Ohio Department of Natural Resources, 44383 Fountain Square Dr., Columbus, OH 43224-1362, (614) 265-6594, doug.crowell@dnr.state.oh.us.

This trip will be the opportunity of a lifetime for anyone who has never been inside an operating underground coal mine. Located in the rugged hill country of southeastern Ohio, the Southern Ohio Coal Company will open its mine doors to a limited number of people to see the mining of coal by longwall technology, an efficient method of mining that leaves very little waste. The technology is fascinating and the machinery is astoundng. Participants will visit either the Meigs #31 mine or the Meigs #2 mine. Only 10 people will be taken into either mine, so the trip is limited to 20 participants who will be registered on a first-come, first-served basis. On-site training in the use of self-rescue and mine safety equipment will be provided. March 18. Cost: $53.

2. **Field Excursion to an Underground Salt Mine.** Thomas M. Berg, State Geologist and Chief, Geological Survey Division, Ohio Department of Natural Resources, 4383 Fountain Square Dr., Columbus, OH 43224-1362, (614) 265-6988, fax 614-268-3669, thomas.berg@dnr.state.oh.us.

This excursion will take participants to northeastern Ohio in the vicinity of Cleveland. The glaciated terrain and the wide expanse of Lake Erie will be left behind as field trippers descend a nearly 2,000-ft elevator shaft into salt beds of the Silurian Salina Group. Participants will travel within the mine to as much as a mile horizontally beneath Lake Erie. Mining methods will be explained, and the sedimentology and small-scale structural features of the salt beds will be discussed. The trip is limited to 12 participants who will be registered on a first-come, first-served basis. On-site training in the use of self-rescue and mine safety equipment will be provided. There will be opportunities to collect large, clear halite crystals from some of the resolution channels in the salt beds. March 18. Cost: $80.

Postmeeting

3. **Hydrogeology Tour of Acid Mine Drainage in Southeast Ohio.** Dina Lopez and Mary Stoertz, Dept. Geological Sciences, Ohio University, 316 Clippinger Laboratories, Athens, OH 45701-2979, (614) 593-9435, fax 614-593-0486, lopezd@oak.cats.ohiou.edu.

Highly acid waters generated in coal spoil piles and underground mine workings in southeast Ohio contaminate streams and affect aquatic life. Studies of acid mine drainage in abandoned coal mines in southeast Ohio indicate that seasonal variations in the volume of water discharged from the mines dominate the contaminant loads (Fe, Al, Mn, sulfate, etc.) discharged to streams. Higher flows during late winter and early spring discharge loads tens to hundreds of times greater than those of summer and fall, when evapotranspiration is higher and less water infiltrates the overburden. During this trip we will observe environmental degradation at three sites, which represent typical sources of acid mine drainage in the region: Rock Run, a coal spoil pile; the Esco No. 40; and the Majestic underground coal mines. March 21. Cost: $40.

4. **Quaternary Geology along the Eastern Margin of the Scioto Lobe.** John Szabo, Dept. Geology, University of Akron, Akron, OH 44325-4101, (330) 972-7630, fax 330-972-7611, jpszabo@uakron.edu; and Tod A. Frolking, Dept. Geology and Geography, Denison University, Granville, OH 43023, frolking@cc.denison. edu.

Participants will examine the geomorphology and Quaternary stratigraphy of Licking County east of Columbus. This area was glaciated by the Scioto Lobe, which flowed eastward over the Allegheny Escarpment onto the Allegheny Plateau. We will examine multiple Wisconsinan and Illinoisan units at the classical Gahanna cut and at a stream cut near Alexandria, Ohio. Near the glacial boundary at Newark, we will visit outcrops of Illinoisan outwash cemented by pedogenic carbonate and cryoturbation features in a mixed zone of loess and Illinoisan outwash. Valley morphology, stratigraphy, and reversals of the Licking River system and their relationship to Black Hand Gorge will be discussed in the field. March 21. Cost: $40.

5. **Sedimentology and Provenance of the Permo-Carboniferous of Athens County, southeastern Ohio.** Elizabeth Gierlowski-Kordesch, Joseph P. Smith, and Gregory C. Nadon, Dept. Geological Sciences, Ohio University, 316 Clippinger Laboratories, Athens, OH 45701-2979, (614) 593-1101, fax 614-593-0486, gierlowsk@ohiou.edu.

Participants will view selected outcrops of Pennsylvanian (Pottsville-Monongahela) and Permian (Washington) sandstones, shales, and limestones (cyclothems). Variations in provenance and depositional environments will be discussed within the context of the Alleghenian Orogen. March 21. Cost: $40.

6. **Geology Along the Towpath: Stones of the Ohio & Erie and Miami & Erie Canals.** Joe Hannibal, Invertebrate Paleontology Dept., Cleveland Museum of Natural History, 1 Wade Oval Dr., University Circle, Cleveland, OH 44106-1767, (216) 231-4600, fax 216-0231-5919, jhanniba@cmnh.org.

Two great canals, the Ohio & Erie Canal, and the Miami & Erie Canal, were constructed in the 1800s to link Lake Erie with the Ohio River. Participants on this trip will examine sites along both of these canals. Emphasis will be on stone used for locks and other structures, but we will also discuss the historical aspects of the canals and their effect on the stone industry. March 21. Cost: $40.

BUSINESS MEETINGS AND SOCIAL EVENTS

A **Welcoming Reception** will be held in the Ohio Union from 6 to 9 p.m., on Wednesday evening, March 18, 1998. Access to this event will be limited to registered participants identified by their name badges.

The **GSA North-Central Section Management Board** will hold its business meeting with breakfast on Thursday, March 19, 1998, between 7 and 11 a.m. in the Ohio Union. No charge. Exact location will be given in the *Abstracts with Programs* volume.

North-Central *continued on p. 20*

North-Central *continued from p. 19*

The **North-Central Section of the Paleontological Society,** the **Pander Society,** and the **Great Lakes Section of SEPM** will meet jointly for lunch at noon on Thursday, March 19, 1998, in a private dining room on the second floor of the Ohio Union. Please register in advance for this luncheon. Cost: $11.

The **Annual Banquet** will take place in the Faculty Club on Thursday evening, March 19, 1998, preceded by a social hour beginning at 5:30 p.m. Please register in advance. Cost: $26.

A **special address** will follow the Annual Banquet at 8 p.m. in the Mendenhall Laboratories auditorium, a few steps east of the Faculty Club and accessible to those who do not attend the banquet. There is no charge for attendance at this event.

Breakfast meetings are also scheduled on Friday, March 20, for **GSA Campus Representatives** (no cost) and the **Association for Women Geoscientists** (cost: $11). See the *Abstracts with Programs* volume for the location of these events in the Ohio Union. Preregistration is required for both.

A luncheon will also be scheduled on Friday for the **National Association of Geoscience Teachers.** Location will be printed in the *Abstracts with Programs* volume. Please register in advance. Cost: $11.

SPECIAL ACTIVITIES AND EVENTS

Alternative opportunities for registrants and guests will be available during the meeting, including informally organized and hosted trips to museums, government buildings, and other sites of interest in Columbus. Registration is not required for these ad hoc events, but those who might be interested should indicate their interests and leave their local address and telephone number at the Registration Desk in the West Ballroom of the Ohio Union.

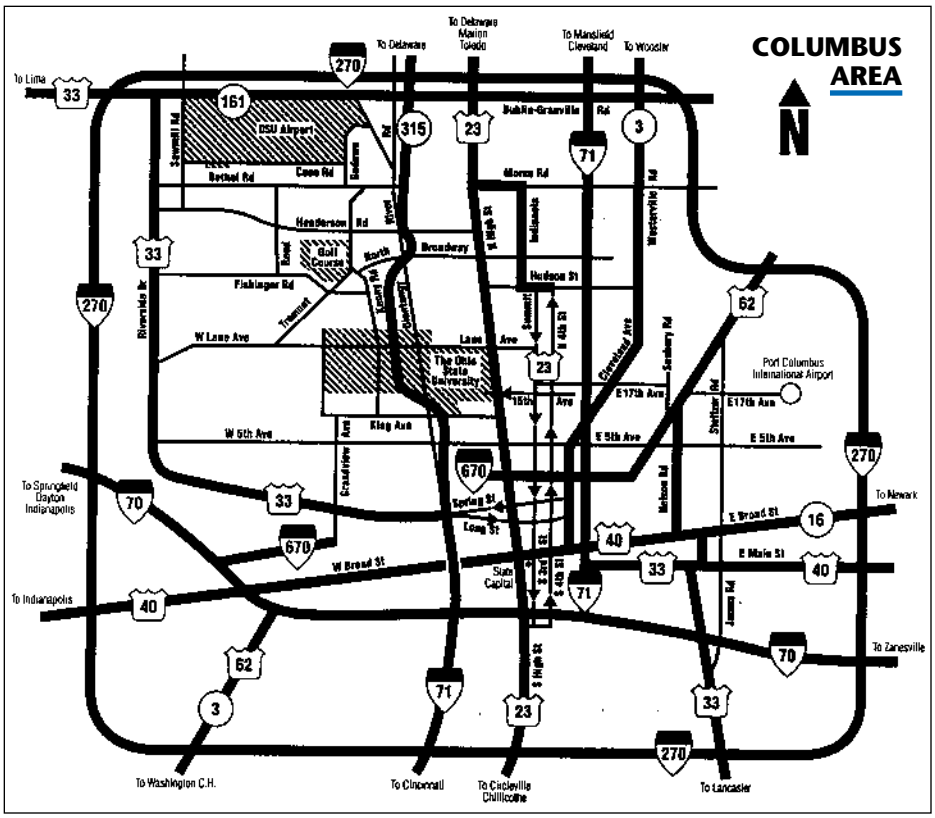
HOUSING

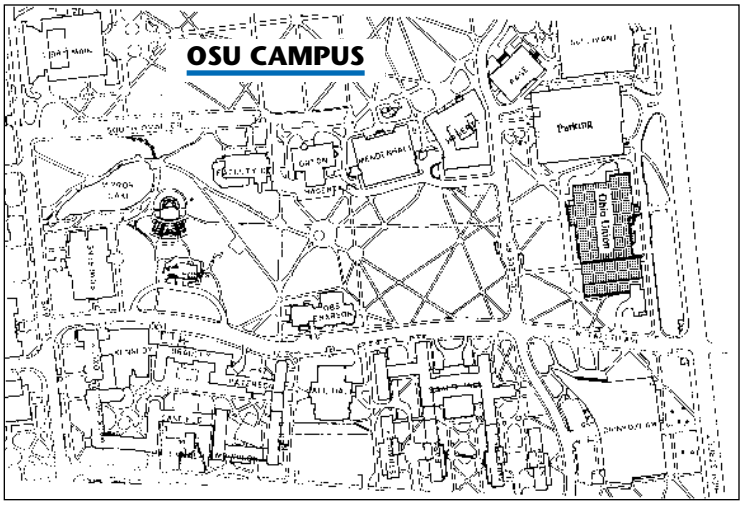
We have reserved blocks of rooms in several motels one to three miles north of the University (check the map) but readily accessible by car or bus. Please indicate that you are registering for the NC-GSA meeting. These motels are:

Ramada University Hotel and Conference Center, (614) 267-7461, 3110 Olentangy River Rd. (State Rte. 315). One mile north of OSU. Single or double room $71.

Clarion Hotel Worthington, (614) 436-0700, I-270 at State Rte. 23 (7007 N. High St.). About three miles north of OSU on COTA bus line. Single or double room $80.

AmeriSuites (Columbus/Worthington), (614) 846-4355, I-270 at State Rte. 23 (7490 Vantage Dr.). About three miles north of OSU on COTA bus line. Single or double room $88.





Holiday Inn—Worthington, (614) 885-4355, I-270 at State Rte. 23 (175 Hutchinson Ave.). About three miles north of OSU on COTA bus line. Single or double room $86.

The 1998 NC-GSA meetings will coincide with Winter Quarter Commencement at OSU as well as the State High School Basketball Tournament, which is held on the OSU campus; hence motels and hotels close to campus will be completely booked well in advance of our meetings and are understandably reluctant to reserve blocks of rooms for us. However, if you will book your rooms promptly upon receipt of this announcement, chances are good that you will find a space in one of the following motels, which are all on State Route 315 (Olentangy River Road), south of W. North Broadway and 1–1½ miles north of the OSU campus (see Columbus area map). It would be difficult to walk from any of these motels to the Ohio Union, but there is COTA bus service along Olentangy River Road (=State Rte. 315), and it is easy to reach the campus by car from any of them:

Days Inn—University, (800) 325-2525 or (614) 261-8523, 3160 Olentangy River Rd.

Parke University Hotel, (614) 267-1111, 3025 Olentangy River Rd.

Red Roof Inn—University, (614) 267-9941 or (800) THE ROOF. Olentangy River Rd. at Ackerman Rd.

Cross Country Inn (OSU North), (614) 267-4646, 3264 Olentangy River Rd.

Best Western University Inn, (614) 261-7141 or (800) 528-1234, 3232 Olentangy River Rd.

Holiday Inn—OSU area, (614) 294-4848, 328 W. Lane Ave. (Just across the street from the north edge of the OSU campus and within easy

North-Central *continued on p. 22*

PREREGISTRATION FORM

GSA North-Central Section **Columbus, Ohio, March 19–20, 1998**

Please print clearly • THIS AREA IS FOR YOUR BADGE

Name as it should appear on your badge (last name first)

Employer/University Affiliation

City State or Country

Mailing Address (use two lines if necessary)

City State

ZIP Code Country (if other than USA)

Circle member affiliation (to qualify for registration member discount):

(A) GSA (B) AWG (C) CUR (D) NAGT (E) PS (F) Pander Society (G) SEPM

GUEST INFORMATION • Please print clearly • This area is for badge

Name as it should appear on your guest's badge

City State or Country

Please inform us by February 13, 1998, of any special considerations that you or your guest require.

☐ I will need special considerations.

( ) - **Business Phone**

( ) - **fax**

( ) - Home Phone

Preregistration Deadline: February 13
Cancellation Deadline: February 20

MAIL TO:
GSA NORTH-CENTRAL SECTION MEETING, P.O. BOX 9140, BOULDER, CO 80301
FAX: 303-447-0648 *(credit cards only)*

Remit in U.S. funds payable to: 1998 GSA North-Central Section Meeting
(All preregistrations must be prepaid.
Purchase Orders not accepted.)

Payment by (check one): ☐ Check ☐ American Express ☐ VISA ☐ MasterCard

Card Number

Signature Expires

PREREGISTRATION FEES

	Full Meeting	One Day	Qty.	Amount
Professional Member*	(10) $65 ☐	(11) $40 ☐	1	$
Professional Nonmember	(14) $70 ☐	(15) $45 ☐	1	$
Student Member*	(30) $30 ☐	(31) $15 ☐	1	$
Student Nonmember	(32) $35 ☐	(33) $30 ☐	1	$
K–12 Professional	(60) $35 ☐	NA	1	$
Guest or Spouse	(90) $ 5 ☐	NA	1	$

*Member fee applies to any current Professional OR Student Member of GSA or Associated Societies listed at left. Discount does not apply to guest registrants.

SPECIAL EVENTS

1. GSA N-C Section Management Board Breakfast	March 19	(301) FREE	1	$
2. Paleo/SEPM/Pander Luncheon	March 19	(302) $11	__	$
3. Annual Banquet	March 19	(303) $26	__	$
4. AWG Breakfast	March 20	(304) $11	__	$
5. GSA N-C Campus Reps Breakfast	March 20	(305) FREE	1	$
6. NAGT Luncheon	March 20	(306) $11	__	$

WORKSHOPS

1. Learning from the Fossil Record	March 20	(601) FREE	1	$
2. ESSTEP—Computer-Based Technologies	March 21	(602) FREE	1	$
3. NAGT Workshop on Geoscience Teaching	March 21	(603) FREE	1	$

FIELD TRIPS

1. Field Excursion to a Longwall Coal Mine	March 18	(401) $ 53	1	$
2. Field Excursion to an Underground Salt Mine	March 18	(402) $ 80	1	$
3. Hydrogeology of Acid Mine Drainage	March 21	(403) $ 40	1	$
4. Quaternary Geology, E. Margin of Scioto Lobe	March 21	(404) $ 40	1	$
5. Permo-Carboniferous of Athens County	March 21	(405) $ 40	1	$
6. Geology along the Towpath: Stones of the Canals	March 21	(406) $ 40	1	$

FOR OFFICE USE

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TOTAL FEES $_____

North-Central *continued from p. 20*

walking distance of the Ohio Union. Also the largest motel of the group listed—and the one that is likely to fill up first with parents, families, and basketball fans!)

Registrants are responsible for making their own housing arrangements.

MEALS

There are many fine restaurants in Columbus and nearby suburbs, and a variety of small, ethnic eating facilities in the university area. Downtown restaurants are reached easily by COTA bus, which loads on the High Street (east) side of the Ohio Union. A list of restaurants will be available at the Registration Desk.

Lunch is readily available in the Ohio Union, which includes a selection of franchise facilities. In addition, there are many fast-food establishments along High Street, which parallels the Ohio Union on the east.

GETTING TO COLUMBUS

The Ohio State University campus is approximately three miles north of the center of Columbus, which can be reached from both east and west by U.S. Interstate Highway 70 and from the northeast and southwest by U.S. Interstate Highway 71. Port Columbus International Airport, several miles east of the University, is served by most major airlines and is the eastern hub of America West Airlines. Local bus service along High Street will deliver participants to the door of the Ohio Union from either the north or south parts of Columbus.

Those who drive to the university may park in the Ohio Union ramp, which is directly north of the Union. Passes that will enable you to park in the Union ramp will be available at the Registration Desk for $4.50 a day. Visitors are cautioned to avoid parking in spaces elsewhere on campus that are restricted (by sign) to staff, students, or faculty. Parking at meters in certain areas of the campus, or along High Street, is possible, but charges and time limits may prove prohibitive. Some motels and hotels will provide shuttle service to and from the campus.

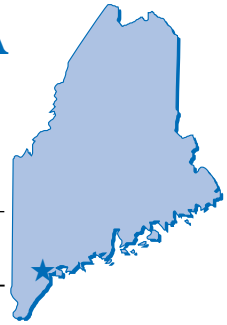
EXHIBITS

Exhibits by educational and commercial organizations will be displayed in the West Ballroom of the Ohio Union from 6 to 9 p.m. on Wednesday, March 18; from 8 a.m. to 5 p.m. on Thursday, March 19; and from 8 a.m. to 3 p.m. on Friday, March 20. Exhibit space must be reserved by *February 13, 1998*. For further information, contact Jim Collinson, Dept. Geological Sciences, The Ohio State University, 155 So. Oval Mall, Columbus, OH 43210, fax 614-292-1496, collinso@mps.ohio-state.edu. ■

Final Announcement

NORTHEASTERN SECTION, GSA 33rd Annual Meeting

Portland, Maine
March 19–21, 1998



The hosts for the 1998 meeting of the Geological Society of America Northeastern Section are geologists from the University of Southern Maine, the Maine Geological Survey of the Natural Resources Information and Mapping Center (Maine Department of Conservation), the University of Maine at Farmington, Bates and Bowdoin Colleges, and Lepage Environmental Services, Inc.

Meeting in conjunction with the GSA Northeastern Section will be the Eastern Section of SEPM, Northeast Section of the Paleontological Society, Eastern and New England Sections of the National Association of Geoscience Teachers, Association for Women Geoscientists, and Council on Undergraduate Research Geology Division.

The meeting will be held at the Holiday Inn by the Bay, 88 Spring Street, Portland, Maine.

REGISTRATION

Preregistration discounts are given to members of GSA and the associated societies listed on the preregistration form. Please indicate your affiliation(s) to register using the member rates. Students and K–12 teachers must show a CURRENT ID in order to obtain these rates. Students or teachers not having a current ID when registering on site will have to pay the professional fee. Preregistration forms must be received at GSA no later than February 13, 1998. Please register only one professional or student per form and retain a copy for your records.

By Mail: Northeastern Section GSA Annual Meeting, P.O. Box 9140, Boulder, CO 80301-9140.

By Fax 303-447-0648 or 303-447-1133—credit card use only. Fax line is open 24 hours. Do not send another copy in the mail.

If you preregister, you will not have to wait in long registration lines to pick up badges in the registration area, because they will be mailed to you two weeks prior to the meeting. Save yourself time and money—preregister today. Advance registration is required for many of the special activities because of participation limits. Use the preregistration form provided in this announcement.

Registration will not be processed unless full payment is received. Unpaid purchase orders are NOT accepted as valid registration. Charge cards are accepted as indicated on the preregistration form. If using a charge card, please recheck the card number given. Errors will delay your registration. The confirmation sent to you by GSA will be your only receipt.

Badges are needed for access to all activities, from 8 a.m. Wednesday through noon Saturday. Guest registration is required for those attending guest activities, technical sessions, or the exhibit hall. Guest registrants MUST be accompanied by a registered professional, a student, or a K–12 teacher. A guest is defined as a nongeologist spouse or friend of a professional, student, or K–12 teacher registrant.

All registrations received after February 13, 1998, will be considered on-site registrations and charged accordingly. Absolutely no registrations should be mailed or faxed after February 21. All forms received after February 13, regardless of when postmarked, will be held for on-site processing. Delegates who will attend only a short course or workshop must pay at least the one-day registration fee. Registration fees do not include provi-

Northeastern *continued on p. 23*

REGISTRATION FEES

	Advance *(by 2/13/98)*		On Site *(after 2/13/98)*	
	Full Meeting	One Day	Full Meeting	One Day
Professional Member	$65	$40	$80	$50
Professional Nonmember	$80	$45	$95	$55
Student Member	$25	$20	$30	$25
Student Nonmember	$35	$30	$40	$35
K–12 Professional	$30	$15	$40	$20
Guest or Spouse	$15	NA	$20	NA

Northeastern *continued from p. 22*

sions for insurance of participants against theft or property damage. Participants and accompanying guests are advised to take out whatever insurance they consider necessary.

Cancellations, Changes, and Refunds

All requests for additions, changes, and cancellations must be made in writing and received by February 20, 1998. NO REFUNDS OR CREDITS WILL BE MADE ON CANCELLATION NOTICES RECEIVED AFTER THIS DATE. Refunds for fees paid by credit card will be credited according to the card number on the preregistration form. There will be NO refunds for on-site registration, *Abstracts with Programs,* and ticket sales.

ON-SITE REGISTRATION SCHEDULE

Holiday Inn by the Bay

Wed., March 18 . . . 7:00 p.m. to 9:00 p.m.
Thurs., March 19 . . 7:00 a.m. to 4:30 p.m.
Fri., March 20 . . . . 7:00 a.m. to 4:30 p.m.
Sat., March 21 . . . . 7:30 a.m. to 10:00 a.m.

ACCESSIBILITY FOR REGISTRANTS WITH SPECIAL NEEDS

The GSA Northeastern Section is committed to making every event at its 1998 meeting accessible to all people interested in attending. If you have special requirements (such as an interpreter or wheelchair accessibility) indicate this on the meeting registration form or contact Stephen Pollock, Department of Geosciences, University of Southern Maine, Gorham, ME 04038, (207) 780-5353, fax 207-780-5167, pollock@usm.maine.edu. *Please let us know of your needs by February 15, 1998.*

WEATHER

Portland weather during March varies. Mid-March temperatures range from upper 20s to 60s °F. Clear weather, rain, sleet, snow, or a combination of these are all possible.

LOCATION AND DIRECTIONS

Meeting registration, technical sessions, poster sessions, and exhibits will be in the Holiday Inn by the Bay, 88 Spring Street, Portland, Maine. For those arriving by air, the Holiday Inn by the Bay operates a shuttle to and from the Portland Jet Port. Those arriving by automobile from the south should use exit 6A of the Maine Turnpike (I-95), and proceed toward Portland on Route I-295. From I-295, take the Forest Avenue South exit. From there, take the first right onto State Street. Follow State Street to Spring Street. Turn left onto Spring Street and proceed to the Holiday Inn by the Bay.

Those arriving from the north on Route I-295 should also take the Forest Avenue South Exit and proceed following the directions given above. Those arriving from the north on the Maine Turnpike should use exit 8. From exit 8 turn left, and proceed to Brighton Avenue (Route 25). Turn left on Brighton (Route 25) and proceed to Congress Street. Turn left onto Congress and then turn right onto State Street. From State Street turn left onto Spring Street.

TECHNICAL PROGRAM

The technical program will begin at 8 a.m., Thursday, March 19, and end at noon on Saturday, March 21. Oral sessions will normally include 15 minutes for presentation and 5 minutes for questions and discussion. Two 35 mm carousel slide projectors, two screens, and one overhead projector will be provided for each oral session. Speakers are encouraged to bring their slides already loaded into carousel trays. A speaker-ready room will be available for previewing slides. Additional carousel trays may be signed out from the speaker-ready room.

Additional computer technology or Internet access will be provided at direct additional cost to the presenter(s). Those individuals desiring these services must make their own arrangements. For those wishing additional technical services, please contact: David Coffin, Headlight Audio–Visual, 874 Brighton Ave., P.O. Box 1316, Portland, ME 04104-1316, (207) 774-5998 or 1-800-247-0504, fax 207-874-7803.

Poster sessions will allow at least three hours of display time; the authors must be present for two hours. Three 4-ft by 8-ft tack boards will be provided for each U-shaped booth. Access to electrical outlets and furniture for poster sessions must be requested well in advance.

General questions on format of sessions should be addressed to Technical Program Co-Chair Marc Loiselle, Maine Geological Survey, 22 State House Station, Augusta, ME 04333, (207) 287-2801, fax 207-287-2353, marc.c.loiselle@state.me.us. For general questions on equipment, contact Stephen Pollock, Dept. of Geosciences, University of Southern Maine, Gorham, ME 04038, (207) 780-5353, fax 207-780-5167, pollock@usm.maine.edu.

In addition to general technical sessions organized by discipline, the following symposia, theme sessions, and special poster sessions are planned.

Symposia

S1. **Tectonic History of the Eastern Margin of the Appalachians: New England and Atlantic Canada.** Dave West, Dept. of Geology, Earlham College, Richmond, IN 47374, (765) 983-1231, westd@earlham.edu; Sandra Barr, Acadia University, sandra.barr@acadiau.ca.

S2. **Coastal Geology and Public Issues.** *(Sponsored by the GSA Geology and Public Policy Committee)* Robert Marvinney, Maine Geological Survey, 22 State House Station, Augusta, ME 04333, (207) 287-2804, fax 207-287-2353, robert.g.marvinney@state.me.us; Sue Halsey, New Jersey Department of Environmental Protection, shalsey@dep.state.nj.us.

S3. **Two Decades of Progress in Maine Geology.** Robert Marvinney, Maine Geological Survey, 22 State House Station, Augusta, ME 04333, (207) 287-2804, fax 207-287-2353, robert.g.marvinney@state.me.us.

S4. **The Sebago Batholith.** John Creasy, Dept. of Geology, Bates College, Lewiston, ME 04240, (207) 786-6153, jcreasy@abacus.bates.edu; David Gibson, University of Maine, dgibson@maine.maine.edu; Henry Berry, Maine Geological Survey, henry.n.berry@state.me.us.

S5. **Late Quaternary Paleohydrology of Northeastern North America.** Heather Almquist-Jacobson, Dept. of Geological Sciences and Institute for Quaternary Studies, University of Maine, Orono, ME 04469, (207) 581-1502, almquist@maine.maine.edu.

S6. **Deglacial History and Relative Sea-Level Changes, Northern New England and Adjacent Canada.** Thomas K. Weddle, Maine Geological Survey, 22 State House Station, Augusta, ME 04333, (207) 287-7170, fax 207- 287-2353, thomas.k.weddle@state.me.us; Michael J. Retelle, Bates College, mretelle@abacus.bates.edu.

S7. **Evolution of Tidal and Nontidal Wetlands.** *(Sponsored by Eastern Section of SEPM.)* Jim Pizzuto, Dept. of Geology, University of Delaware, Newark, DE 19716, (302) 831-2710, fax 302-831-4158, pizzuto@udel.edu.

S8. **Educating the Public about Earth Scientists: How We Can Put OURSELVES in the Limelight.** R. Laurence (Larry) Davis, Dept. of Biology and Environmental Sciences, University of New Haven, 300 Orange Ave., West Haven, CT 06516, (203) 932-7108, fax 203-931-6097, rldavis@charger.newhaven.edu.

S9. **The Contributions of Marland Billings and Katherine Fowler-Billings to Understanding the Geology of New England.** Peter Robinson, Dept. of Geosciences, University of Massachusetts, Amherst, MA 01003, (413) 545-2593 or 2286, probinson@geo.umass.edu; Dykstra Eusden, Bates College, deusden@abacus.bates.edu.

Northeastern *continued on p. 24*

Northeastern *continued from p. 23*

Theme Sessions

T1. **The Role of Hydrogeologists in the 21st Century.** Grover Emrich, Emrich and Associates, 1488 Hancock Lane, Wayne, PA 19087, (610) 296-5068, emrichc@aol.com.

T2. **Fractured Rock Hydrology and Contaminant Transport.** Andrews Tolman, Gerber-Jacques Whitford, 174 South Freeport Rd., Freeport, ME 04032, (207) 865-6138, atolman@jacqueswhitford.com.

T3. **Geoarchaeology: Using Geological Techniques to Model Past Environments.** Alice R. Kelley, Dept. of Geological Sciences, University of Maine, Orono, ME 04469, (207) 581-2056, akelley@maine.maine.edu; David Sanger, University of Maine, sanger@maine.maine.edu.

T4. **Evolution of the New England Coast.** *(Sponsored by Eastern Section of SEPM.)* Daniel F. Belknap, Dept. of Geological Sciences, University of Maine, Orono, ME 04469-5711, (207) 581-2159, belknap@maine.maine.edu; Duncan FitzGerald, Boston University, dunc@crsa.bu.edu.

T5. **Evidence and Impacts of Storms in Shallow Marine Environments.** *(Sponsored by Eastern Section of SEPM.)* Carrie Kievman, Dept. of Geology & Meteorology, Kean College of New Jersey, Union, NJ 07083, (908) 527-2515, ckievman@turbo.kean.edu.

T6. **Economic Mineral Deposits of Northeastern North America.** William Kelly, New York State Geological Survey, 3140 CEC, Albany, NY 12230, (518) 474-7559, fax 518-486-3696, wkelly@museum.nysed.gov; Robert Altamura, University of Pittsburgh, altamura+@pitt.edu.

T7. **Teaching with Fossils.** *(Sponsored by the Paleontological Society.)* Steve Good, Dept. of Geology & Astronomy, West Chester University, West Chester, PA 19383, (610) 436-2203, sgood@wcupa.edu.

T8. **Paleontology as a Tool for Interpreting Ancient Depositional Environments.** *(Sponsored by the Paleontological Society.)* Steve Good, Dept. of Geology & Astronomy, West Chester University, West Chester, PA 19383, (610) 436-2203, sgood@wcupa.edu.

T9. **Environmental and Engineering Geophysics.** David Lesmes, Dept. of Geology and Geophysics, Boston College, Chestnut Hill, MA 02167, (617) 552-0839, lesmes@bc.edu.

T10. **Archaeological Stone Artifacts: Contributions to Sources, Petrology and Distribution.** O. Don Hermes, Dept. of Geology, University of Rhode Island, Kingston, RI 02881, (401) 874-2192, fax 401-874-2190, dhermes@uriacc.uri.edu; Stephen Pollock, University of Southern Maine, pollock@usm.maine.edu; Nathan Hamilton, University of Southern Maine, casco@usm.maine.edu.

T11. **Internet Applications in Introductory Geoscience Courses.** Willis Hayes, Dept. of Geosciences, University of Southern Maine, Gorham, ME 04038, (207) 780-5890, fax 207-780-5167, hayes@usm.maine.edu.

Special Poster Sessions

P1. **Results from FEDMAP, STATEMAP, EDMAP, and NATMAP: National Cooperative Geologic Mapping Programs in the USA and Canada (POSTER ONLY).** Peter Lyttle, U.S. Geological Survey, Mail Stop 908, Reston, VA 20192, (703) 648-6943, fax 703-648-6937, plyttle@usgs.gov; Michael Cherry, Geological Survey of Canada, mcherry@gsc.nrcan.gc.ca.

P2. **Undergraduate Research (POSTER ONLY).** *(Sponsored by the Council on Undergraduate Research Geology Division.)* Students must be listed as the authors and must have been the major preparer of the poster. Topics may vary but must be the result of the student's own participation in undergraduate research programs. Larry Malinconico, Dept. of Geology, Lafayette College, Easton, PA 18042, (610) 250-5193, fax 610-252-3904, malincol@lafayette.edu.

STUDENT AWARDS AND TRAVEL ASSISTANCE

Awards will be given by the Northeastern Section of GSA for the best oral paper and best poster session presented by students. Although the faculty mentor may appear as the junior author, a major part of the paper or poster session must represent work by the student author. NOTE: Only those papers designated as student author on the abstract form are considered for awards.

The Northeastern Section of GSA will award travel grants to students who give papers (oral or poster) of which she or he is the presenter and author or coauthor at the meeting. In addition, the Northeastern Section will award student research grants to undergraduates in 1998.

Applications for travel assistance and guidelines for student research may be obtained from Kenneth N. Weaver, Secretary-Treasurer, Northeastern Section, GSA, c/o Maryland Geological Survey, 2300 St. Paul Street, Baltimore, MD 21821-5210, (410) 554-5532, fax 410-554-5502.

ROY G. SHLEMON MENTORS PROGRAM

The Roy G. Shlemon Mentors Program in Applied Geology sponsored by the GSA Institute for Environmental Education (IEE) is a new program developed to present workshops for upper-level undergraduates and graduate-level geoscience students who will soon be entering the job market. The Shlemon Mentors Program, led by environmental consultants Russ Slayback (Leggette, Brashears & Graham, Inc.) and Allison Kozak (HKS Environmental, Inc.), will consist of presentations and interactive dialogue about the environmental hydrogeology consulting field. Participants will gain a better understanding of what environmental consultants look for in employment candidates and what to expect from their initial years of employment in the field. The six-hour program will cover the full range of consulting work opportunities for environmental hydrogeologists and how best to prepare for a career as a consultant.

Wednesday, March 18, 9 a.m.–4 p.m. Cost: Free. Preregistration required. Morning and afternoon beverages will be provided; lunch is not provided.

SHORT COURSES

1. **Environmental Geophysics.** *(Sponsored by an award from the U.S. Department of Energy/Maine Science and Technology Foundation Experimental Program to Stimulate Competitive Research [EPSCoR].)* Wednesday, March 18. Stewart Sandberg, Dept. of Geosciences, University of Southern Maine, Gorham, ME 04038, (207) 780-5154, sandberg@usm.maine.edu; Lee Slater, University of Southern Maine, lslater@usm.maine.edu.

This one-day course is an introduction to the application of geophysical methods in environmental investigations, including monitoring of remediation, supplementing hydrogeological evaluations, and site characterization. The course will be appropriate for those with little to no experience with near-surface geophysics. The aim is to provide enough information so that participants are at least familiar with many of the capabilities and limitations of geophysical methods in the environmental setting. Limit: 75. Cost: $75 professional; $30 student. Cost includes lunch and morning and afternoon refreshments.

2. **Hydrology and Ecology of Wetlands.** Wednesday, March 18. Instructors: Andrew Reeve, Dept. of Geological Sciences, University of Maine, Orono, ME 04469, (207) 581-2353, asreeve@maine.maine.edu; Aram Calhoun, University of Maine.

Topics will include an introduction to the hydrologic and ecologic principles relevant to wetland systems. We will discuss the monitoring methods in wetlands and identification of linkages between ecology and hydrology. Vernal pools and peatlands will be used to showcase the principles presented in the class. A field trip to these wetland systems will be included. Limit: 14. Cost: $37, includes lunch, morning and afternoon refreshments, and field trip.

3. **Environmental Hydrogeology.** *(Sponsored by Eastern Section of SEPM; SEPM*

Short Course #32.) Saturday, March 21. Instructor: Eric Eslinger, Alpha Earth, Inc., Glenmont, New York. For details contact Kathy Browne, Dept. of Geological and Marine Sciences, 2083 Lawrenceville Rd., Rider University, Lawrenceville, NJ 08648-3099, (609) 895-5408, browne@enigma.rider.edu.

A one-day introduction to practical environmental hydrogeology for geologists with little first-hand experience in environmental consulting. This course covers basic principles of subsurface hydrology, the environmental regulatory framework, and Phase 1, 2, and 3 assessments. Limit: 80. Cost: $100 for SEPM or GSA professional; $115 for nonmember professional; $60 for SEPM or GSA student; $75 for nonmember student. Cost includes course materials and morning and afternoon refreshments. Lunch not provided.

4. **Introduction to Seismic Stratigraphy.** *(Sponsored by Eastern Section of SEPM.)* Saturday, March 21. Instructor: John Armentrout, Mobil Research and Development, Dallas, Texas. For details contact Kathy Browne, Dept. of Geological and Marine Sciences, 2083 Lawrenceville Rd., Rider University, Lawrenceville, NJ 08648-3099, (609) 895-5408, browne@enigma.rider.edu.

A one-day introduction to the fundamentals of seismic-based stratigraphic analysis using examples and exercises. Prior coursework in stratigraphy and sedimentology needed. Limit: 30. Cost: $90 for SEPM or GSA professional; $105 for nonmember professional; $65 for SEPM or GSA student; $80 for nonmember student. Cost includes course materials and morning and afternoon refreshments. Lunch not provided.

EXHIBITS

Companies or organizations wishing to sell or display publications, scientific equipment, or other products, services, or public relations materials may rent a display area for the duration of the meeting. The exhibit area will be adjacent to the poster area. Morning and afternoon beverage service will be in the immediate vicinity of the exhibit area. The 10 ft × 10 ft booths framed with 8-ft-high rear and 3-ft-high side drapes are $300 for commercial exhibitors, and $200 for educational, government, and nonprofit organizations. A table, two chairs, and a sign will be provided for each booth. A limited number of unsecured table-top exhibit spaces at reduced rates will be available at the rear of the exhibit area. Exhibits will be open from 8 a.m. to 5 p.m. on Thursday and Friday, March 19 and 20. Application deadline for space is March 1, 1998. For information contact Irwin Novak, Dept. of Geosciences, University of Southern Maine, Gorham, ME 04038, (207) 780-5350, fax 207-780-5167, novak@usm.maine.edu. Space will be allocated on a first-come, first-served basis.

HOUSING FORM — *Holiday Inn by the Bay, Portland, Maine*

Northeastern Section, Geological Society of America
Wednesday, March 18–Saturday, March 21

Arrival Date _____ Departure Date _____

PERSON REQUESTING HOUSING (type or print)

_____
Last Name First

_____
Institution or Firm

_____
Address or P.O. Box

_____
City State/Province ZIP Code

Phone: ( ) _____ ( ) _____
Work Home

Place reservation in name of: _____

Name of all other occupants:

_____ _____

_____ _____

RATES PER ROOM* *(price does not include 7% Maine room-use tax).*
Single or Double Occupancy $95
Check-in time is 3:00 p.m. Check-out time is noon.

SPECIAL NEEDS ☐ Smoking Room ☐ Nonsmoking Room ☐ Special Room
☐ Special Room Requirements _____

*Enclose check or money order (for amount of one night's lodging) payable to Holiday Inn by the Bay or major credit card number and date of expiration. No cancellations accepted within 72 hours of arrival.

Reservations must be received prior to February 18, 1998; reservations received after that date will be accepted on a space-available basis only and the group rate will not be guaranteed. Telephone reservations accepted: (207) 775-2311; (800) 345-5050; fax 207-761-8224.

_____
Type of Card Card Number

_____
Name as it appears on the credit card

_____
Exp. Date Signature

SEND THIS FORM AND REMITTANCE OR CREDIT CARD INFORMATION TO:
Holiday Inn by the Bay, 88 Spring Street, Portland, ME 04101-3924.

FIELD TRIPS AND GUEST ACTIVITIES

Geology of the Portland Waterfront by Narrow Gauge Railroad. Lunch hour Thursday through Saturday. Professor of geology (Bowdoin College) and engineer Arthur Hussey will lead daily excursions via original narrow gauge railway equipment owned by the Maine Narrow Gauge Railroad and Museum. The trip will make periodic stops along the Portland waterfront to discuss the geology of outcrops and views. A small fee will be required for this trip, payable upon arrival at the Narrow Gauge Railroad.

Poland Spring Bottling Company Tour. Saturday, March 21. Kristin Tardiff, Northeast Natural Resource manager, will lead a tour of the Poland Spring sources and bottling plant. The trip will include a discussion of site geology and water-quality monitoring. A bus will leave the Holiday Inn by the Bay at 1 p.m. and return at 5 p.m. There is no charge for the trip, but space is limited, so please preregister.

Self-Guided Trips. The local committee will provide descriptions of interesting geologic sites so that meeting participants may use them for self-guided field trips within the greater Portland area. Each self-guided trip will take between 90

Northeastern *continued on p. 26*

Northeastern *continued from p. 25*

minutes and 3 hours, depending upon the distance from the Holiday Inn by the Bay.

The Holiday Inn by the Bay is centrally located and within walking distance of the Portland Museum of Art and the shopping district located in the Old Port section of Portland.

ACCOMMODATIONS

The GSA Northeastern Section has reserved a block of 190 rooms at the Holiday Inn by the Bay. These will be assigned on a first-come, first-served basis. After the block is filled, and regardless of the cut-off date, preregistrants will be given the option of a comparable, nearby hotel that has been selected to serve as an overflow facility. For meeting planning purposes, and to ensure the guaranteed room rates, it is imperative that you reserve your room(s) by February 18, 1998. When making reservations by phone, you must state that you are attending the Geological Society of America Northeastern Section meeting. Mail the housing form (p. 25) directly to the Holiday Inn by the Bay.

PARKING

Parking for guests registered at the Holiday Inn by the Bay is free. For those registrants not staying at the Holiday Inn, parking is available at several nearby commercial parking facilities.

SPECIAL EVENTS

GSA Northeastern Section Management Board Meeting. Wednesday, March 18, 7–9 p.m. Holiday Inn by the Bay, York Room.

Welcoming Reception. Wednesday, March 18, 7:30–9:30 p.m. Holiday Inn by the Bay, Ballroom. Nonalcoholic beverages and hors d'oeuvres will be served. A cash bar will be available for beer, wine, and mixed drinks.

Eastern Section of NAGT Luncheon and Business Meeting. Thursday, March 19, 12 noon to 1:30 p.m. Cost: $15; $11 for students. Preregistration required.

SEPM Eastern Section Business Meeting and Reception. Thursday, March 19, 4:30 to 6:30 p.m. Guest speaker: Lee Krystinik, president-elect of SEPM, "Synsedimentary Tectonic Controls on Sequence Stratigraphic Architecture." Refreshments will be served. The meeting is open to all SEPM members.

Map Blast. Thursday, March 19. This special, informal evening session is for the display and discussion of newly published, unpublished, or in-progress geologic maps of any sort. Maps should have a title and stand-alone explanation. This is not a poster session, and abstracts are not required and will not be published. Authors must be present. Display space is ample but finite. Refreshments available. Before the meeting, interested contributors should contact Tom Weddle (thomas.k.weddle@state.me.us) or Henry Berry (henry.n.berry@state.me.us), Maine Geological Survey, 22 State House Station, Augusta, ME 04333-0022, (207) 287-2801, fax 207-287-2353.

Fun Run. Friday, March 20. Weather permitting, this will be an approximate 3.75 mile run around the scenic path that borders Back Cove in Portland. Van transportation will leave the reception area of the Holiday Inn by the Bay at 6:15 a.m.

Association for Women Geoscientists Breakfast. Friday, March 20, 6:45–8:30 a.m. Cost: $13 for professionals, $8 for students. Preregistration required.

Northeast Section of the Paleontological Society Luncheon. Friday, March 20, 12 noon to 1:30 p.m. Cost: $15 for professionals, $11 for students. Preregistration required.

Annual GSA Northeastern Section Reception and Banquet. Friday, March 20, 7–9 p.m., Holiday Inn by the Bay, Ballroom. Cost: $28 or $25 for professionals; $15 for students. Preregistration required. A very limited number of banquet tickets will be available for sale on Wednesday evening only.

Bird Walk. Saturday, March 21, 6:30 a.m. until 8:30 a.m. Cost: Free. Limit: 13. Preregistration required. March in Maine is typically a time between the departure of wintering bird populations and return of early spring migrants. This informal walk will be to two or three locations in the greater Portland area. Trip leader will be Linda Woodard. Van transportation will leave the reception area of the Holiday Inn by the Bay at 6:15 a.m.

NEWS ROOM

The Northeastern Section News Room staff will coordinate and assemble information on topics for release to the news media. Please let them know of material that is newsworthy for the science or general and local press. Members of the press may receive complimentary meeting registration with appropriate press credentials by contacting Robert Caswell or Susan Swain, University of Southern Maine, Media and Community Relations, 209 Deering Ave., Portland, ME 04101, (207) 780-4200, caswell@usm.maine.edu; seswain@usm.maine.edu.

CHILD CARE

Child care arrangements for the period March 19 through noon March 21 will be coordinated by Linda L. Pollock, Dept. of Geosciences, University of Southern Maine, Gorham, ME 04038, (207) 780-5353; fax 207-780-5167, pollock@usm.maine.edu. *Deadline: February 18, 1998.* ■

Receive Duplicate Mailings from GSA?

Did you receive more than one copy of the new GSA Publications catalog? Or have you, in the past, received duplicates of other pieces from GSA? We understand your frustration in receiving duplications. Here are some of the reasons why this sometimes occurs.

GSA purchases commercial mailing lists to use in many mailings, along with our own lists. This usually is where the duplication comes from, and it is virtually correction-proof given our present level of mailing-list technology.

Even GSA's own internal lists sometimes produce duplicates because they are not yet organized in ways that make it practical to do "merge and purge" operations. We're working on a consolidated "client" mail list now, to include all members and nonmembers who deal with GSA. When that consolidation is ready sometime in 1998, we hope to be able to avoid most address duplications.

A related problem is that people frequently and regularly identify themselves to GSA under different names. For example, we'll often have the same person as J. Smith, John Smith, and John R. Smith on different lists because that's the way they have provided their information on various forms such as membership forms, meeting registrations, abstract submissions, publication orders, etc. Frequently one or more of these iterations are at different addresses (office and/or home), further frustrating efforts to identify duplicates—last names, ZIP codes, and phone numbers are the common data used for that purpose.

Knowing all this, we usually put notices on all mailing faces suggesting: "Get two copies? Share one with an associate." We apologize for overlooking this step on this year's catalog. But, *please do pass one along* if you've received more than one copy.

PREREGISTRATION FORM

GSA Northeastern Section **Portland, Maine, March 19–21, 1998**

Please print clearly • THIS AREA IS FOR YOUR BADGE

Name as it should appear on your badge (last name first)

Employer/University Affiliation

City State or Country

Mailing Address (use two lines if necessary)

City State

ZIP Code Country (if other than USA)

Circle member affiliation (to qualify for registration member discount):

(A) GSA (B) AWG (C) CUR (D) NAGT (E) PS (F) SEPM

GUEST INFORMATION • Please print clearly • This area is for badge

Name as it should appear on your guest's badge

City State or Country

Please inform us by February 15 of any special considerations that you or your guest require.

☐ I will need special considerations.

( ) - **Business Phone**

( ) - **fax**

( ) - Home Phone

Preregistration Deadline: February 13
Cancellation Deadline: February 20

MAIL TO: GSA NORTHEASTERN SECTION MEETING, P.O. BOX 9140, BOULDER, CO 80301, FAX 303-447-0648

Remit in U.S. funds payable to:
1998 GSA Northeastern Section Meeting
(All preregistrations must be prepaid. Purchase Orders not accepted.)

Payment by (check one):

☐ Check ☐ American Express ☐ VISA ☐ MasterCard

Card Number

Signature Expires

FOR OFFICE USE

A _____ V _____ M _____

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PREREGISTRATION FEES

	Full Meeting	One Day	Qty.	Amount
Professional Member*	(10) $65	(11) $40	1	$
Professional Nonmember	(14) $80	(15) $45	1	$
Student Member*	(30) $25	(31) $20	1	$
Student Nonmember	(32) $35	(33) $30	1	$
K–12 Professional	(60) $30	(61) $15	1	$
Guest or Spouse	(90) $15	N/A	1	$

*Member fee applies to any current Professional OR Student Member of GSA or Associated Societies listed at left. Discount does not apply to guest registrants.

SPECIAL EVENTS

1. NAGT Luncheon, March 19	Professional	(301) $15	__	$
	Student	(301) $11	__	$
2. AWG Breakfast, March 20	Professional	(302) $13	__	$
	Student	(302) $ 8	__	$
3. Paleontological Society Luncheon, March 20	Professional	(303) $15	__	$
	Student	(303) $11	__	$

4. Annual Banquet, March 20

	Prime Rib (304)	Vegetarian (305)		
Professional	$28	$25	__	$
Student	$15	$15	__	$

WORKSHOP

1. Roy G. Shlemon Mentors Program	March 18	(601) FREE	1	$

SHORT COURSES

1. Environmental Geophysics, March 18	Professional	(501) $ 75	__	$
	Student	(501) $ 30	__	$
2. Hydrology and Ecology of Wetlands, March 18		(502) $ 37	__	$
3. Environmental Hydrogeology, March 21	Professional Member	(503) $100	__	$
	Student Member	(503) $ 60	__	$
	Professional Nonmember	(504) $115	__	$
	Student Nonmember	(504) $ 75	__	$
4. Seismic Stratigraphy, March 21	Professional Member	(505) $ 90	__	$
	Student Member	(505) $ 65	__	$
	Professional Nonmember	(506) $105	__	$
	Student Nonmember	(506) $ 80	__	$

FIELD TRIPS AND GUEST ACTIVITIES

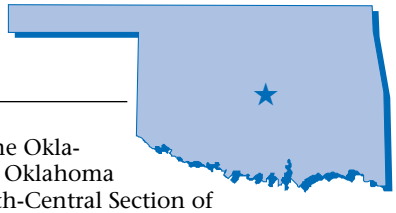
1. Geology of Portland Waterfront & Narrow Gauge Rail (*circle one*)	March 19	(401) TBD	1	$
	March 20	(402) FREE	1	$
	March 21	(403) FREE	1	$
2. Poland Spring Bottling Company Tour	March 21	(404) FREE	1	$
3. Bird Walk	March 21	(405) FREE	1	$

TOTAL FEES REMITTED $_____

Final Announcement

SOUTH-CENTRAL SECTION, GSA 32nd Annual Meeting

Norman, Oklahoma
March 23–24, 1998



The School of Geology and Geophysics and the Oklahoma Geological Survey at the University of Oklahoma invite you to the annual meeting of the South-Central Section of the Geological Society of America. Technical Sessions will be held Monday, March 23, and Tuesday, March 24, on the University of Oklahoma campus: The technical meetings will be held at the Oklahoma Center for Continuing Education (OCCE), with opening activities and Sunday sessions at the Sarkeys Energy Center.

LOCATION

Norman, located in central Oklahoma, is ~25 minutes from the Will Rogers World Airport (Oklahoma City) via Interstates 240 and 35.

Norman was born in the historic Land Run of 1889. Norman's prominence as the education capital of Oklahoma was assured with the founding of the University of Oklahoma the following year. Norman offers diverse cultural, educational, and recreational opportunities.

REGISTRATION

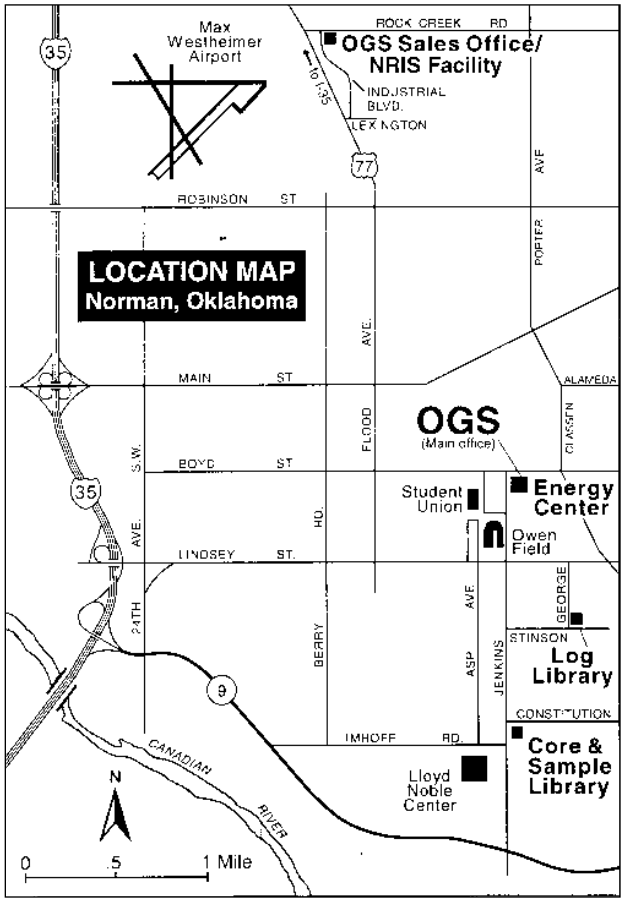
Preregistration deadline:
February 6, 1998

Anyone wishing to attend the technical sessions, exhibits, or field trips must register for the meeting. Return the preregistration form included here with payment no later than February 6, 1998.

On-site registration

For those who cannot preregister, on-site registration will be available Sunday, March 22 from noon to 8 p.m. at the Sarkeys Energy Center; Monday, March 23, from 8 a.m. to 4 p.m.; and Tuesday, March 24, from 8 a.m. to 11:30 a.m. at OCCE. Credit cards will not be accepted for on-site registration.

Attendees are encouraged to order an abstract book either with their GSA annual dues or from GSA Publication Sales. There will be only a limited number of abstract books available for purchase on-site.



Cancellations, Changes, and Refunds

All requests for registration additions, changes, and cancellations must be made in writing and received by Sara Moody, University of Oklahoma, 100 E. Boyd St., Suite 810, Norman, OK 73019-0628, by February 13, 1998. Faxes will be accepted.

NO REFUNDS WILL BE MADE AFTER FEBRUARY 13, 1998. Refunds will be mailed after the meeting, and fees paid by credit cards will be credited accordingly to the card number on the preregistration form. NO refunds will be given for on-site registration and ticket sales.

REGISTRATION FEES

Professional Member	$50
Professional Nonmember	$60
Student Member	$25
Student Nonmember	$30

STUDENT PAPER AWARDS AND TRAVEL GRANTS

Awards will be presented for the Best Oral Student Paper and Best Student Poster at the meeting. Awards will be based on quality of research and effectiveness of presentation. To be eligible, the abstract must list only student authors and must be identified clearly as a student paper.

STUDENT POSTER SESSION

The Geology Division of the Council on Undergraduate Research will sponsor a student poster session to showcase senior theses and other undergraduate research projects. First authors must be undergraduate students and responsible for the bulk of the research, preparation of the poster, and presentation of the results. Please indicate submission to this special session on the GSA abstract form.

For more information contact Diane Smith, Dept. of Geosciences, Trinity University, 715 Stadium Dr., San Antonio, TX 78212, (210) 736-7656, fax 210-736-8264, dsmith@trinity.edu.

TECHNICAL PROGRAM

Papers are invited from students and professionals for presentation at both symposia and in general sessions in oral or poster format. Oral presentations will be 15–20 minutes. Poster sessions will be set up for at least four hours, and authors will be available for two hours.

Volunteered abstracts not included in symposia will be scheduled for regular technical sessions.

Symposia

1. **Innovative Ideas for College-level Field Trips and Labs.** Mike Soreghan, OU School of Geology and Geophysics, msoreg@ou.edu; Neil Suneson, Oklahoma Geological Survey.
2. **Application of Trace Elements and Isotopes to Igneous and Sedimentary Systems.** Barry Weaver, OU School of Geology and Geophysics, bweaver@ou.edu.
3. **Geologic Mapping (STATEMAP).** Ken Johnson, Oklahoma Geological Survey, ksjohnson@ou.edu.
4. **Climatic Signals in Paleozoic Strata of the Mid-Continent.** R. Douglas Elmore, OU School of Geology and Geophysics, delmore@ou.edu; Gerilyn Soreghan, lsoreg@ou.edu.

5. **Basinal Fluids.** David Deming, OU School of Geology and Geophysics, ddeming@ou.edu; Tom Dewers tdewers@ou.edu.
6. **Rock Deformation and Structure Style.** T. Gene Scott, OU Rock Mechanics Institute, gene@rmg.ou.edu.
7. **Mid-Continent Basement Character.** R. E. Denison, University of Texas at Dallas, denison@utdallas.edu; W. R. Van Schmus, University of Kansas.
8. **Taphonomy: New Looks at Fossilization.** Walter Manger, University of Arkansas; P. K. Sutherland, OU School of Geology and Geophysics.
9. **Geoscience Information.** Claren Kidd, Youngblood Geology Library, OU School of Geology and Geophysics, ckidd@ou.edu.
10. **Geology and Travel: Historical Perspective.** Ken Taylor, OU History of Science Department, ktaylor@ou.edu.
11. **Pennsylvanian-Permian Boundary—New Biostratigraphic and Sequence Stratigraphic Data.** J. Chaplin, Oklahoma Geological Survey.
12. **Geophysics at the Norman, Oklahoma Landfill.** Roger Young, OU School of Geology and Geophysics, ryoung@ou.edu.

WORKSHOP

Learning from the Fossil Record. This workshop for grades 6–12 teachers in Oklahoma will be presented by paleontologists and earth science teachers. The workshop will give teachers information on how scientists have used fossil evidence to reconstruct the past. It will also offer some ideas about how to cultivate and use students' interest in fossils to encourage them to be scientists themselves.

There will be a general session followed by break-out groups for further discussion and hands-on activities. Each activity or focus topic will be related to the National Standards for Science Education.

This event will be held Sunday, March 22, 1997, in Sarkeys Energy Center. Organized by Jim Chaplin, OGS. Instructors will include Rena Bonem, Baylor University.

FIELD TRIPS

All field trips will leave from and return to the parking lot south of the Sooner Hotel at the OCCE in Norman. Several trips can be joined in the field. For general questions on field-trip activities, contact Ken Johnson, Field-Trip Chair, Oklahoma Geological Survey, 100 E. Boyd, Rm. N-131, Norman, OK 73019, (405) 325-3031, fax 405-325-7069, ksjohnson@ou.edu. For detailed information on any specific trip, contact the field-trip leaders identified with each individual trip.

Preregistration for all trips is required. Participants will be accepted on a first-come, first-served basis. Complete the form provided with this announcement. If you register for a field trip only, you must pay a $25 nonregistrant fee in addition to the field-trip fee.

Premeeting Trips

1. **Basement Rocks of the Southern Oklahoma Aulacogen.** Friday, March 20 (1 p.m.), through Sunday, March 22 (3:30 p.m.). Rodger E. Denison, Geosciences, University of Texas at Dallas, Box 830688, Richardson, TX 75083, (972) 883-2453, fax 972-883-2537, denison@utdallas.edu; Ed G. Lidiak, University of Pittsburgh; John P. Hogan, University of Oklahoma, jhogan@ou.edu; M. Charles Gilbert, University of Oklahoma, mcgilbert@ou.edu.

This trip will examine the older 1.4 Ga basement, representing the edge of Neoproterozoic Laurentia, and the contrasting Early(?) Cambrian Southern Oklahoma aulacogen basement, both exposed in the Arbuckle Mountains. We also will see the full suite of basement lithologies of the aulacogen in the central and eastern Wichita Mountains and a beautiful exposure of Carlton Rhyolite against the Timbered Hills Group unconformity. Subjects to be highlighted include: crustal growth and evolution; tectonics, including Pennsylvanian overprints; magma evolution; and shallow igneous processes. Cost: $175 (2 lunches, 2 dinners, 2 nights hotel). Limit: 20.

2. **Biostratigraphy and Sequence Stratigraphy of the Pennsylvanian-Permian Boundary in Kansas and Oklahoma.** Friday, March 20 (8 a.m.), through Sunday, March 22 (3:30 p.m.). (You can start in Norman or join the trip Friday evening in Eldorado, Kansas, by flying into Wichita, Kansas.) Darwin Boardman II, School of Geology, Oklahoma State University, Stillwater, OK 74078, (405) 744-6358, fax 405-744-7841; Sal Mazzullo; Merlynd Nestell.

We will examine all the cyclothemic-scale depositional sequences of the Admire, Council Grove, and Chase Groups. An additional focus will be the correlation of the Lower Permian stage boundaries, including the Gzhelian-Asselian, Asselian-Sakmarian, and Sakmarian-Artinskian boundaries. Cost: $200 (3 lunches, 1 dinner, 2 nights hotel). Limit: 20.

3. **Sequence Stratigraphy of the Middle Carboniferous of the Southwestern Ozark Mountains.** Friday, March 20 (1:00 p.m.), through Sunday, March 22 (5:00 p.m.). (You can start in Norman or fly or drive to join trip Friday by 6:00 p.m. in Fayetteville, Arkansas. If you drive to Fayetteville, you must leave your car there, join vans, and return to Fayetteville in a van at the end of meeting on Tuesday or Wednesday.) Walter Manger, Dept. of Geology, University of Arkansas, Fayetteville, AR 72701, (501) 575-3370, fax 501-575-3846; Patrick Sutherland.

This trip, sponsored by the South-Central Section of the Paleontological Society, will examine the lithofacies changes and biostratigraphic relations within the Chesterian-Morrowan-Atokan interval in northwestern Arkansas and northeastern Oklahoma. Several new and important roadcuts are now available in the Fayetteville area. Cost: $150 (2 lunches, 2 nights hotel). Limit: 18.

Postmeeting Trip

4. **Stratigraphy and Depositional Environments of the Lower Permian, Oklahoma City Metro Area, Oklahoma.** Wednesday, March 25 (8 a.m. to 5 p.m.). Neil H. Suneson and LeRoy A. Hemish, Oklahoma Geological Survey, 100 E. Boyd, Room N-131, Norman, OK 73019, (405) 325-3031, fax 405-325-7069, ogs-ns@geosys.studies2.uoknor.edu.

We will examine stratigraphy and depositional environments of the Lower Permian red-bed units in the Oklahoma City metro area. Stops will focus on formation contacts and on the Garber and Wellington Formations (principal aquifers). Many of the units are correlated with, and are named for, units in Kansas, and we will evaluate these correlations and nomenclature. Cost: $25 (1 lunch). Limit: 20.

PROJECTION EQUIPMENT

Please bring your own loaded carousel trays. There will be two 35 mm projectors There are numerous other hotels in the Norman area at which meeting attendees may arrange their accommodations, including Residence Inn (405) 366-0900; Holiday Inn (405) 364-2882; and Hampton Inn (405) 366-2100.

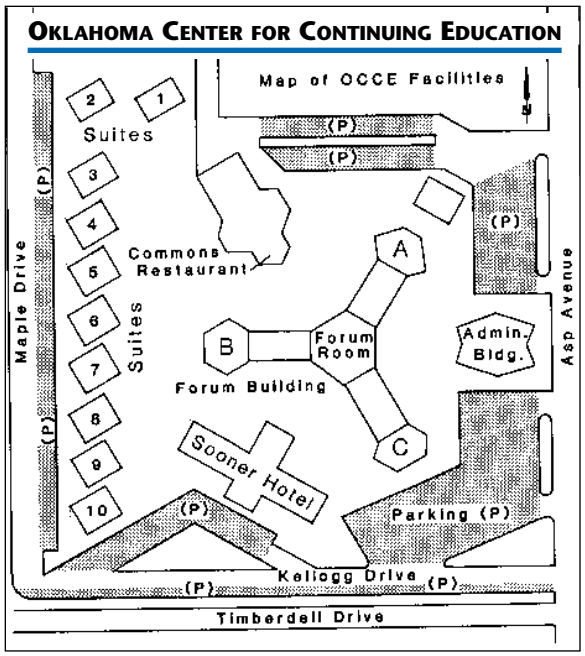
EXHIBITS

Exhibit facilities for business, educational, and governmental institutions will be available. Space rental is $175, which will include one complimentary registration. Exhibits will be open from 8 a.m. to 5 p.m. on Monday and Tuesday, March 23 and 24. Exhibitors should plan to set up on Sunday between 1 and 5 p.m. in Conference Room B. For information, contact Jane Weber, Oklahoma Geological Survey, 100 E. Boyd, Sarkeys Energy Center, Norman, OK 73019, (405) 325-3031, fax 405-325-7069.

ACCOMMODATIONS

We have reserved the Sooner Hotel, a hotel on the OU campus and adjacent to the OCCE Forum Building where the meeting is being held. The rate is $38 sin-

South-Central *continued on p. 30*



South-Central
continued from p. 29

gle and $42 double. Complimentary continental breakfast is included.

Also, separate cottages (suites) containing two bedrooms (each with one queen-sized bed) and living room, kitchen, and one private bath, are available. Rates are: $65 double, $70 triple, and $75 quad occupancy. Complimentary continental breakfast is included.

Please call (405) 329-2270 to make your own arrangements. **Cutoff date for reserving rooms at these rates is February 20, 1998.**

There are numerous other hotels in the Norman area at which meeting attendees may arrange their accommodations, including Residence Inn (405) 366-0900; Holiday Inn (405) 364-2882; and Hampton Inn (405) 366-2100.

PARKING AND MEALS

There is free parking available at the OCCE. Sunday parking at the Sarkeys Energy Center is also free.

There are a several restaurants within one to two miles of the OCCE. In addition, the conference center has a cafeteria that will be open for lunch.

SPECIAL EVENTS

Welcoming Party. Please plan to attend the Welcoming Party beginning at 5 p.m. and lasting until 8 p.m. on Sunday, March 22, in the West Atrium of the Sarkeys Energy Center. On-site registration will be available beginning at noon, and those who have preregistered may pick up their name badges, tickets for the Monday dinner, and programs. During the welcoming party plan to visit:

1. The Youngblood Energy Library, featuring displays of historic geologic maps and publications. This library, a branch of the university library system, contains 94,000 volumes, 140,000 maps, and 271,000 Oklahoma petroleum completion cards.
2. The Halliburton Rock Mechanics Laboratories and facilities of the Institute of Rock Mechanics of the Sarkeys Energy Center. Come by and listen to rocks crack!

GSA South-Central Section Management Board. Sunday, March 22, 4 p.m., Sarkeys Energy Center.

GSA South-Central Section Business Meeting. Sunday, March 22, 5:30 p.m., East Atrium of the Sarkeys Energy Center. After you check in, register, and join the Welcoming Party in the West Atrium, slip over to the East Atrium for an update on section affairs and elections for the coming year. You will not be far from the refreshments or the Welcoming Party.

Paleontological Society Luncheon. Monday, March 23, for PS members and other interested parties, OCCE Common Dining Room.

Section Special Dinner. Monday, March 23, on the campus of the University of Oklahoma; reception 6:30 p.m., dinner 7 p.m. Tickets ($20 per person) must be purchased in advance.

National Association of Geoscience Teachers (Texas Section) Luncheon. Tuesday, March 24, for NAGT members and other interested parties, OCCE Common Dining Room.

WEB SITE: http://hoth.gcn.ou.edu/~jahern/scgsa/index.html ■

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South-Central	3/23–3/24	$15		$
Southeastern	3/30–3/31	$15		$
Cordilleran	4/7–4/9	$15		$
Rocky Mountain	5/25–5/26	$15		$
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ON-SITE PURCHASES may be made in the registration area. Supplies are limited.

Preregistration Form

Preregistration deadline is February 6, 1998.

GSA South-Central Section

Norman, Oklahoma • March 23–24, 1998

Please print clearly • THIS AREA IS FOR YOUR BADGE

Name as it should appear on your badge (last name first)

Employer/Academic Affiliation

City State or Country

Please inform us by February 6, 1998, of any special considerations that you or your guest require.

☐ I will need special considerations. Please call me.

( ) - **Business Phone**

( ) - **fax**

( ) - **Home Phone**

Mailing Address (use two lines if necessary)

City State ZIP Code Country (if other than USA)

Circle member affiliation (to qualify for registration member discount*): (A) GSA (member #_____)
(B) NAGT (C) PS (D) Pander Society
(E) SEPM (F) SVP

PREREGISTRATION *Required for participating in all activities*		**Qty**	**Amount**
Professional Member* *(circle affiliation above)*	$50 ☐	1	$ _____
Professional Nonmember	$60 ☐	1	$ _____
Student Member* *(circle affiliation above)*	$25 ☐	1	$ _____
Student Nonmember	$30 ☐	1	$ _____

*Member fee applies to any Professional or Student Member of GSA or Associated Societies listed above.

SPECIAL EVENTS				
Banquet Dinner	March 23	$20	____	$ _____

FIELD TRIPS				
1. Basement Rocks of the Southern Oklahoma Aulacogen	March 20–22	$175	1	$ _____
2. Biostratigraphy and Sequence Stratigraphy of the Pennsylvanian-Permian Boundary in Kansas and Oklahoma	March 20–22	$200	1	$ _____
3. Sequence Stratigraphy of the Middle Carboniferous of the Southwestern Ozark Mountains	March 20–22	$150	1	$ _____
4. Stratigraphy and Depositional Environments of the Lower Permian, Oklahoma City Metro Area	March 25	$ 25	1	$ _____

TOTAL FEES ..... **$** _____

Remit in U.S. funds payable to: 1998 GSA South-Central Section Meeting
(All preregistrations must be prepaid. Purchase Orders not accepted.)

Payment by (check one): ☐ Check ☐ American Express ☐ VISA ☐ MasterCard

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MAIL TO: SCHOOL OF GEOLOGY AND GEOPHYSICS, UNIVERSITY OF OKLAHOMA, 100 E. BOYD ST., SUITE 810, NORMAN, OK 73019

Scholarship and Grant Opportunities

Society of Women Engineers Scholarship Program

The Society of Women Engineers is seeking qualified applicants for scholarships varying from $1,000 to $5,000. All SWE scholarships are open to women majoring in engineering (aerospace, chemical, mechanical, industrial, electrical, materials, or petroleum) or computer science in a college or university with an ABET-accredited program or in an SWE-approved school. Women in any year of undergraduate or graduate school are encouraged to apply. There are also awards for women who have been out of school and out of the engineering job market for a minimum of two years. These scholarships are to help recipients obtain the credentials necessary to reenter the job market in computer science or engineering.

Applications, which must be postmarked no later than *February 1, 1998,* may be obtained from SWE National Headquarters, 120 Wall Street, 11th Floor, New York, NY 10005-3902, (212) 509-9577, fax 212-509-0224, hq@swe.org.

Society of Economic Geologists Foundation Student Research Grants

Students of mineral resources throughout the world may apply for thesis research grants from the Society of Economic Geologists Foundation and the Society of Economic Geologists. Individual grants for 1998 will range from $500 to $3,000 and are intended to fund specific graduate thesis research expenses.

Grants from the Hugh E. McKinstry fund are awarded to support research with a substantial field component. The Hickok-Radford Fund awards grants for field projects in arctic, sub-arctic, or other challenging field areas. A third group of student research grants is funded in part by gifts from BHP Minerals. These grants provide funds for research in economic geology that focuses on new descriptive data on ore deposits, mining districts, and other topical subjects.

Application forms may be obtained from Chair, SEG Student Research Grants, 5808 South Rapp St., Suite 209, Littleton, CO 80120, (303) 797-0332, fax 303-797-0417, socecongeol@csn.net. Forms are also available on the Web at http://www.mines.utah.edu/~wmgg/SEG.html. *Applications must be postmarked by March 1, 1998,* and awards will be announced by May 1, 1998.

Smithsonian Research Fellowships

Smithsonian Fellowships are awarded to support independent research in residence at the Smithsonian Institution in association with the research staff. Under this program, senior, predoctoral, and postdoctoral fellowships of 3 to 12 months and graduate student fellowships of 10 weeks are awarded.

Proposals for research may be made in the earth sciences, including meteoritics, mineralogy, paleobiology, petrology, planetary geology, sedimentology, and volcanology, and in the history of science and technology, including air and space, computers, electrical technology, mathematics, social dimensions of science and technology, transportation, natural history, and physical sciences.

Awards are based on merit. For an application form, write the Smithsonian Institution, Office of Fellowships and Grants, 955 L'Enfant Plaza, Suite 7000, MRC 902, Washington, DC 20560, siofg@ofg.si.edu. The postmark deadline for applications is *January 15, 1998.*

In addition, the Smithsonian Minority Internship Program invites graduate and undergraduate students to participate in research and museum-related activities for periods of 10 weeks. The appointment carries a stipend of $300 per week, and may provide a travel allowance. *Deadline is February 15, 1998.* See address above for more information. ■

GSA Offers Awards in Geomorphology and Micropaleontology

Through the generosity of W. Storrs Cole, two awards for support of research are offered through GSA. The Gladys W. Cole Memorial Research Award provides support for the investigation of the geomorphology of semiarid and arid terrains in the United States and Mexico. It is to be given to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers on geomorphology. Funds cannot be used for work already accomplished, but recipients of a previous award may reapply if additional support is needed to complete their work. The amount of this award in 1998 will be $11,000.

The second award, the W. Storrs Cole Memorial Research Award, has been established to support research in invertebrate micropaleontology. This award will carry a stipend of $9,000 in 1998, and will be given to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers on micropaleontology.

Additional information and application forms may be obtained from the Research Grants Administrator, GSA, P.O. Box 9140, Boulder, CO 80301, jforstro@geosociety.org.

All applications must be postmarked on or before **February 1, 1998.** Actions taken by the Committee on Research Grants will be reported to each applicant in April.

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

CALENDAR

Only new or changed information is published in *GSA Today*. A complete listing can be found in the **Calendar** section on the Internet: **http://www.geosociety.org**.

1998 Penrose Conferences

May

May 14–18, **Linking Spatial and Temporal Scales in Paleoecology and Ecology,** Solomons, Maryland. Information: Andrew S. Cohen, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721, (520) 621-4691, fax 520-621-2672, acohen@geo.arizona.edu.

June

June 4–12, **Evolution of Ocean Island Volcanoes,** Galápagos Islands, Ecuador. Information: Dennis Geist, Dept. of Geology, University of Idaho, Moscow, ID 83844, (208) 885-6491, fax 208-885-5724, dgeist@uidaho.edu.

July

July 4–11, **Processes of Crustal Differentiation: Crust-Mantle Interactions, Melting, and Granite Migration Through the Crust,** Verbania, Italy. Information: Tracy Rushmer, Dept. of Geology, University of Vermont, Burlington, VT 05405, (802) 656-8136, fax 802-656-0045, trushmer@zoo.uvm.edu.

September

September 13–17, **Ophiolites and Oceanic Crust: New Insights from Field Studies and Ocean Drilling Program,** Marshall, California. Information: Yildirim Dilek, Dept. of Geology, Miami University, Oxford, OH 45056, (513) 529-2212, fax 513-529-1542, dileky@muohio.edu.

1998 Meetings

April

April 9–10, **Michigan Geological Survey Division 5th Symposium on the Geology of Michigan,** Lansing, Michigan. Information: Michigan Geological Survey Division, P.O. Box 30256, Lansing, MI 48909, Ray Vugrinovich, (517) 334-6937, fax 517-334-6919, vugrinov@state.mi.us.

April 17–19, **Mid-America Paleontology Society National Fossil Exposition,** Macomb, Illinois. Information: Tom Witherspoon, 6611 Miller Rd., Dearborn, MI 48126-1915.

June

June 8–10, **Integrated Technical Approaches to Site Characterization,** Chicago, Illinois. Information: Lorraine M. LaFreniere, Argonne National Laboratory, 9700 South Cass Ave., Bldg. 203, Argonne, IL 60439-4843, (630) 252-7969, fax 630-252-5747, ITASC@anl.gov, http://www.anl.gov/ITASC. *(Abstract deadline: January 2, 1998.)*

May

May 11–14, **Yellowstone National Park and Montana State University Symposium,** Bozeman, Montana. Information: Carolyn Manley, Mountain Research Center, P.O. Box 173490, Montana State University, Bozeman, MT 59717-3490, (406) 994-5178, fax 406-994-5122, info@peak.mrc.montana.edu.

September

September 5–7, **American Quaternary Association (AMQUA) 15th Biennial Meeting,** Puerto Vallarta, Mexico. Information: Socorro Lozano Garcia, Instituto de Geología, Universidad Nacional Autónoma de México, Ciudad Universitaria, Apartado Postal 70-296, 04510, México D.F., Mexico, fax 52-5-550-6644.

October

October 7–9, **Risk Analysis 98,** First International Conference on Computer Simulation in Risk Analysis and Hazard Mitigation, Valencia, Spain. Information: Paula Doughty-Young, Risk Analysis 98 Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK, phone 44-1703-293-223, fax 44-1703-292-853, paula@wessex.ac.uk, http://www.wessex.ac.uk.

October 19–21, **8th International Williston Basin Symposium,** Regina, Saskatchewan, Canada. Information: Doug Paterson, Saskatchewan Geological Society, P.O. Box 234, Regina, Saskatchewan S4P 2Z6, Canada, (306) 787-2625, fax 306-787-4608, dpaterson@gov.sk.ca, http://www.gov.sk.ca/ener-mine/about/semnew.htm.

Send notices of meetings of general interest, in format above, to Editor, *GSA Today,* P.O. Box 9140, Boulder, CO 80301, e-mail: editing@geosociety.org.

GSA ANNUAL MEETINGS

1997

Salt Lake City meeting registers 5625 attendees!!

See photos and story in January GSA *Today* or visit the GSA home page for details.

1998

TORONTO 1998 Annual Meeting

October 26–29
Metro Toronto Convention Centre
Sheraton Centre Toronto Hotel
www.geosociety.org/meetings/98

General Chairs: ***Jeffrey J. Fawcett,*** *University of Toronto,*
Peter von Bitter, *Royal Ontario Museum*

Technical Program Chairs:

Denis M. Shaw, *Dept. of Geology, McMaster University, Hamilton, Ontario L8S 4M1, Canada, shawden@mcmail.cis.mcmaster.ca*

Andrew Miall, *Dept. of Geology, University of Toronto, 22 Russell St., Toronto, Ontario M5S 3B1, Canada, miall@quartz.geology.utoronto.ca*

Symposia and theme proposals due to GSA: ***January 2, 1998***
Send proposals and correspondence to GSA. Proposal form and guidelines available from:

1. GSA Web site — http://www.geosociety.org
2. November *GSA Today* (guidelines)
3. GSA Meetings Department, (303) 447-2020, x113, or fax 303-447-0648

Call for Field Trip Proposals

Field Trip Chairs:

Pierre Robin, *Dept. of Geology, University of Toronto, Erindale Campus, Mississauga, Ontario L5L 1C6, Canada, (905) 828-5419, probin@erin.utoronto.ca*

Henry Halls, *Dept. of Geology, University of Toronto, Erindale Campus, Mississauga, Ontario L5L 1C6, Canada, (905) 828-5363, hhalls@erin.utoronto.ca*

Or call Edna Collis at GSA, (303) 447-2020, x134
See November *GSA Today* for a preliminary list of trips.

All proposals are due January 15, 1998.

TORONTO MINI-CALENDAR—1998

January 2—Theme and Symposia Proposals Due to Technical Program Chair
April 1—Call for Papers Published and Distributed
May 1—Electronic Abstract Submittal Form Available on GSA Web Site
June 1—Registration and Lodging Information printed in June *GSA Today*
July 13—Abstracts Deadline
September 13—Preregistration and Housing Deadline

New GSA Members

The following 934 Members were elected by Council action during the period from March through October 1997.

Mark B. Abbott
Sigal Abramovich
Rolf V. Ackermann
Tolu M. Adedeji
Minolu Aizawa
Hisham A. Al-Siyabi
Edward F. Albin
Nicholas E. Allmendinger
Subramanya Ananthnarayan
Louise Ander
Lesleigh Anderson
Robert J. Andress
William M. Andrews, Jr.
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George P. Aponte Clark
T. Bruce Appelgate, Jr.
Hans C. Areback
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MaryAnn R. Arias
Mary E. Armstrong
Phillip A. Armstrong
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Nina L. Baghai
Russ A. Baker
René W. Barendregt
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Jorge R. Barragan
Keith M. Barron
Michelle L. Bart
Charles John Barthel, Jr.
Georgio Basilici
Kari N. Bassett
Vanessa C. Bateman
Stephen W. Bates
Thomas M. Bawden
Frederick C. Beall
Lynne M. Beatty
Patricia A. Beddows
Ken J. Bell
Ellin Beltz
Tara L. Benda
Peter A. Bennett
Kimberly M. Berends
Jill Berenson
Sandra Bezenek
Frank D. Bilotti
Michael P. Bishop
Heather M. Bittner
Bruce A. Blake
Jonathan I. Bloch
Jonathan G. Blount
Lisa M. Boettcher
Marie-Pierre Bolle
Claudia I. Borchert
Mitchell S. Bornyasz
Rita M. Bouchard
Judith Ann Boughner
Steve D. Bowman
Karin H. Brack
Angela K. Braden
Sean T. Brennan
William D. Briggs
Jason P. Briner
Brendan M. Brodie
Charles E. Brown
David O. Brown
Gordon E. Brown, Jr.
Daniel Brownstein
Nick Brozovic
Karl F. Brunner
Christy J. Brush
Chris C. Bryarly
Norman S. Buchanan
Jonathan M. Bull
Melody B. Burkins
Michael F. Burns
James H. Burton
Brian D. Campbell
Kevin G. Cannariato
Lucia Capra
John G. Cargill IV
Donna D. Carlson
Jeffrey W. Carnahan
Alejandro Carrillo
Leslie S. Carver
John S. Cesarek
Sandra L. Chandler
Richard L. Chaney
Ho-Wan Chang
Dominique H. G. Chardon
Paul D. Chasco
Laural L. Cherednik
Gabrielle C. Chianese
Yong S. Chol
William P. Clement
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Hermione A. P. Cockburn
Monika Cogoini
Denis Cohen
Camilla J. Colebatch
W. Marc Connolly
Janet K. Cook
Christopher D. Cooper
Robert A. Corbin
Thomas J. Corcoran
Maree L. Corkeron
Paul K. Coski
Robert M. Cox
Sandra A. Crabtree
Peter A. Craig
Benjamin S. Cramer
Norman B. Cranford
Timothy J. Cronan
Karen N. Csonka
Jennifer A. Curtis
Brian P. Cyr
Patricia L. Daniel
Joy D. Dass
James T. Davenport
Monica D. Davis
Christopher D. Dawkins
Katja Deckart
Kathleen A. DeGraaff
Louis Detofsky
Steve C. Devine
Nancy T. Dewitt
Raffaele Di Cuia
Derek W. Dice
Frank E. Dickerson
B. Christopher Dimeo
Luis Vicente Dimieri
Ru Ding
Stewart A. Dixon
Ravin Donald
Lisa C. Donohoe
Bruce C. Dougan
Frank L. Dougher
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Steven E. Druiett
John H. Dudley
Michael D. Duffy
Jason K. Dunning
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Barry W. Eakins
Jaelyn J. Eberle
Mark A. Ehrlich
Shawn T. Eisner
Nasser El-Deiraki
Jennifer A. Elder
Norlene R. Emerson
Javier Escartin
Alan J. Eschenbacher
Madge Evans
Olivier L. Fabbri
Karen L. Farleigh
Harold R. Fitch
Tanja M. Fitzgerald
Robert M. Flatland
Godlove T. Fonjweng
Mark A. Fonstad
Amy L. Fortin
David A. Fowle
Kari A. Fox
Terry W. Fox
Andrea K. Freeman
Stratton French
Henry C. Fricke
S. Julio Friedmann
Anke M. Friedrich
Donald A. Friend
Thomas Fritzsche
David Froehlich
Joseph Galewsky
Joseph W. Galluzzi
Pilar E. Garcia
Valerie C. Garcia
R. Christopher Gardner
Carmala N. Garzione
Marten Geertsema
Michael A. Geffert
Deboarah L. Gellar
David L. Genger
Martha L. Gerdes
David S. Gerwe
Jim J. Gharib
Brandy D. Gibson
Eulalia Gili
Alexsander Glisic
Robert H. Godwin, Jr.
Kathryn M. Goessel
Robert A. Goff
Udaya K. Gollapudi
Arturo Gomez-Tuena
Susan T. Goodfellow
Kevin L. Gooding
Matthew R. Goolsby
Thomas J. Gorgas
Spela Gorican
Jeffrey S. Grandy
Cinda M. Graubard
Shannon L. Greenan
Christopher A. Greenhoot
Matthias Grobe
Kristelle R. Groves
Yingjie Guo
Ismael Gutierrez-Moreno
Sang-Hwan Gwak
Sanjeev Gypta
Susan H. Hadden
Eckart Hakansson
Galen P. Halverson
Caitlin E. Hamer
Scott A. Hamilton
Kazuchika Hamuro
Bradley J. Harris
John H. Harris
John P. Harris
Margaret J. Harris
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Stephen T. Hasiotis
Robert W. Hastings
David P. Hawkins
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Tiffani L. Heil
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Nora Berggren Herrera
Angela M. Hessler
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M. Jean Hetherington
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Michelle A. Hill
Melanie J. Hinzpeter
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Brian R. Hitchens
Laura R. Hite
Anita M. Ho
Charles M. Hodges
Joost Hoek
Phillip J. Hogan
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Michelle M. Howell
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Sik Huh
Richard C. Hulbert, Jr.
Michael L. Hulver
Mads Huuse
Kristin T. Huysken
Fenton M. Isenor
Zeshan Ismat
Noel W. Jackson
Donald M. Jacobs
Glenn S. Jaecks
John M. Jaeger
Keith H. James
Gary E. Jaroslow
John J. Jelke
Michael D. Jensen
Guohai Jin
Lance W. Johnson
William C. Johnson
Wendell L. Jolley
David A. Jones
Gwyneth Jones
Terry A. Jones
Mette S. Jordan
Peter J. J. Kamp
Paul A. Kapp
Adityamoy Kar
Wendy L. Karna
Michael C. Kasenow
Bodo Katz
Yaron Katzir
Lev S. Kaufman
Michelle L. Kearney
Katherine A. Kelley
Scott Kelley
Louise H. Kellogg
Scott J. Kendzierski
Muhammad A. Khan
Mark A. Kiessling
Irene P. Kijak
Randy L. Kilian-Smith
Won-Sa Kim
Eileen Kincaid
Ruth A. Kirkby
Margaret H. Kloska
James C. Knight
Richard H. Knight
Paul O. Knorr
Karen Knuuti
Barry P. Kohn
Edward J. Kohut
David A. Korejwo
Eduardo A. M. Koutsoukos
Robert N. Kowalkowski
Sharon L. Kozak
Andrew L. Kozlowski
Michael A. Krol
Eric L. Kruger, Jr.
Stephen F. Kulinski
Alan G. Kunze
Peter C. LaFemina
Susan M. Landon
Stephen R. Lane
Jennifer C. Latimer
Natalie E. Latysh
Michael T. Leach
Dal-Heui Lee
Hee-Kwon Lee
Hyomin Lee
Michael T. Lee
Leonardo Legarreta
Adam C. LeGrande
Marna K. Lehnert
Robert S. Leighty
Amanda J. LeNay
Robert J. Leventry
David W. Leverington
Shoshana Z. Levin
Gaylia H. Levkoff
Michael E. Lewis
Roger Lewis
David J. Ley
Sonjia M. Leyva
Bo Li
Olav B. Lian
Joseph Licciardi
Bruce S. Lieberman
Adam F. Light
Bin Lin
Heather A. Lin
WenLong Liu
Darren R. Locke
Mark A. Loewen
William S. Logan
Kimberly A. Lohuis
Caroline M. Loop
Monica G. Lopez de Luchi
Darline Lott
K. Matthew Louth
Cole K. Lovett
Crystal G. Lovett
Fabio Lozano
Laura C. Lozano-Velazquez
Guoping Lu
George M. Lukert
Jose L. Macias
Erika L. Madaski
Eric J. Magnusson
Markus Maier
Jody V. Maliga
Simon Manoyan
Tara P. Marden
Lucia Marinangeli
James R. Marlatt
Allen W. Marquette
Michael J. Marsh
James D. Marshall
Aaron J. Martin
Daniel R. Martinioni
Jeffrey M. Marts
Erik P. Mason
Jason A. Mastrine
David L. Matchen
Scot A. Mathis
Mark E. Mathison
Crystal A. Mattox
Joseph A. Maule
Mike B. Maxwell
Rachael A. Mays
Maxine E. McBrinn
Lon A. McCarley
Theodore C. McCarthy III
Patricia E. McCartin
Wendy G. McClellan
Jeremy A. McCreary
Eileen M. McGowan
Michael F. McHugh
John P. McKiness
Marjorie Jackson McKinney
Travis L. McLing
James L. McMindes
Carl A. Medoza
Andrew L. Mehlhop
Erwin A. Melis
Ted S. Melis
Marc D. Melker
Sarah C. Meyer
Melvin C. Milaor
Monica P. Miley
Ann Marie Miller
Jennifer Diane Miller
Kevin B. Miller
Mary K. Millus
Raymond J. Minarovic, Jr.
Karen J. R. Mitchell
Martin L. Mitchell
Aleksandra Moch
Charles E. Montgomery
Melanie Moreno
Deborah J. Morrow
Lisa S. Morrow
Melissa J. Morse
Allan E. Morton
Roger L. Moses
Angela M. Moss
Claire E. Muirhead
Kevin R. Mulligan
Stephen C. Myers
Joe M. Namlick
Charles E. Narwold
Mohammed O. Nassief
Cheryl A. Naus
Jay R. Neuhaus
Nathan A. Niemi
Josef Nievoll
Melissa M. Nihsen
Francis Nimmo
Lee C. Nordt
Jon S. Novick
Trish A. Nuskievicz
Michael P. O'Connell
Diane D. O'Connor
Catherine H. O'Dell
Michael L. O'Neal
Susan D. Oakley
Emily M. Oatney
Karen R. Olson
Peter A. Omenda
Holly A. Orndorff
Robert E. Page
James L. Palandri
Scott W. Parks
Fatima Patel
Andrew P. Patrick
Karen F. Patterson
Robert T. Pavlowsky
Samuel T. Peavy
James M. Peck
Mike Peffer
Sharon D. Perez-Suarez
Dominic A. Perruccio
Carl Petersen
Candace A. Peterson
Kristine M. Peterson
Mark A. Petrie
Michael S. Petronis
Stephen D. Pierson
Jeffrey T. Pietras
Michelle A. Pike
Timothy J. Piwowar, Jr.
Michael P. Poland
Victor J. Polyak
John J. Ponczynski
David E. Pratt
Nicole E. Preuss
Alan P. Price
Jeffrey S. Price
Linda F. Prosperie
Giacomo Prosser
Michael H. Pulver
Warren C. Purdy
Jodi L. Purser
Andrew I. Quarles van Ufford
Luis Quintana
C. P. Rajendran
Frank C. Ramos
Penelope K. Ramos
Andrew S. Reeve
Eduard G. Reinhardt
Jon C. Reiten
James Repka
Thomas H. Reppe

New Members
continued on p. 35

New Members
continued from p. 34

Darin M. Reuter
Amy L. Rhodes
Robert M. Riberdy
Tracy A. Rice
David R. Richards
Toby A. Rickabaugh
Richard D. Ricketts
Eric M. Riggs
David A. Rightmer
Robena D. Robinett
James P. Robinson
Richard S. Robinson
Kristen A. Rocha
Javier Rodriguez
Jonathan Paul Rogers
Denise M. Romano
Julia A. Rosdeutscher
Robert M. Roseen
Gregory T. Roselle
C. Elizabeth Ross
Thomas P. Ross
Roland M. Rueber
Jaime Rueda-Gaxiola
Garry L. Running IV
Kelly A. Rust
Regina M. Ryan
Isabelle Sacramentogrilo
Hee Sagong
Craig E. Saunders
David L. Sawicki
Robert M. Schapiro
Allison B. Schill
Sarah A. Schlichtholz
Karen R. Schmitt
Michael J. Schnieders
Lindsay Schoenbohm
William W. Schroeder
Andi Schuerzinger
Peter A. Schultz
Phil R. Schweitzer
Nina Serman
H. James Sewell
Bruce A. Shabino
Stacy H. Shafer
Dean E. Shanklin
Rajesh Sharma
Tracy S. Shirley
ShayMaria M. Silvestri
Christopher J. Simpson
Suvinay K. Sinha
Darren B. Sjogren
Steven J. Skotnicki
Michael Slattery
Andris J. Slesers
James F. Slezak
Stephen E. Smail
Kevin J. Smart
Jennifer L. Smith
Joshua B. Smith
Marian M. Smith
Michael Smoliar
Dustin G. Smyth
Darin C. Snyder
Jeffrey A. Snyder
Nikolas K. Sokol
Luigi A. Solari
Chad C. Soliz
Alejandro E. Soto
Beth A. Spear
Jeff L. Spencer
Blanka Sperner
Roger K. Spivey
Brad A. Sporleder
Lisa E. Spracklin
Alan Spraggins
Jill O. Stachura
Andrew G. Stack
C. Russell Stafford
Kenneth R. Stalder
Josette Stanley
Don W. Steeples
Theodore R. Steinke
Allan Stephens
Robert S. Sternberg
Emily M. Stewart
Uwe Strecker
Christian A. Strobl
John O. Strong
Laura Ann Stuart Leslie
Maureen A. Stuart
Diana J. Sturm
M. Pete Suess
Toshihiko Sugai
Michael A. Summerfield
Gloria J. Summers
William D. Surratt
Roger Swart
David W. Sweeten
Neil J. Tabor
Paul J. Tackley
Samuel J. Talbert
Peter W. G. Tanner

New Members
continued on p. 36

New GSA Fellows

The following 100 Members were advanced to Fellowship in October 1997.

Vincent P. Amy
L. Clark Arnold, Jr.
Rosemary A. Askin
William I. Ausich
Atilla Aydin
Loren E. Babcock
Abhijit Basu
Robert L. Bauer
Kevin T. Biddle
Robert F. Biek
James D. Carl
Philip J. Carpenter
Rufus D. Catchings
Odin D. Christensen
K. W. Ciriacks
John D. Cooper
Christopher D. Condit
Francesco V. Corona
Michael Levi Cummings
Declan G. De Paor
Helen L. Delano
Donald J. DePaolo
Albert B. Dickas
Patricia Wood Dickerson
Roy K. Dokka
John D. Dolan
Mark S. Drummond
Hugo T. Dummett
Christopher J. Eastoe
David H. Elliot
Eric A. Erslev
James E. Evans
Sandra C. Feldman
Michael Fellows
Jonathan H. Fink
Tim P. Flood
Kenneth A. Foland
John W. Geissman
Mark S. Ghiorso
Arthur G. Goldstein
Andrew M. Gombos, Jr.
Vivien M. Gornitz
Jeffrey K. Greenberg
Peter L. Guth
Claudia J. Hackbarth
Robert B. Halley
Vicki L. Hansen
Vicki M. Harder
Richard N. Hey
Murray W. Hitzman
John D. Humphrey
Gerald H. Johnson
Samuel Y. Johnson
Lee R. Kump
C. Michael Lesher
Peter Henry Lufholm
R. Heather MacDonald
Jerome F. Machamer
Richard A. Marston
Gregory E. McKelvey
Lawrence D. Meinert
Calvin F. Miller
Molly Fritz Miller
Howard D. Mooers
Charles O. Morgan
Donald C. Noble
James F. Olmstead
Naomi Oreskes
Tom Parsons
Terry L. Pavlis
Simon M. Peacock
Noel Potter, Jr.
Benjamin N. Powell
Donald R. Prothero
James M. Robertson
Stefan Schmid
Paul G. Schmidt
Jill S. Schneiderman
Richard L. Sedlock
Paul Segall
Steven B. Shirey
Richard H. Sillitoe
Carol Simpson
Virginia B. Sisson
John F. Slack
Judith Terry Smith
Parke D. Snavely III
Arthur E. Soregaroli
Richard G. Stanley
Robert J. Stern
Harold H. Stowell
Neil C. Sturchio
Christian P. Teyssier
William F. Thomann
Othmar T. Tobisch
Susan H. Treagus
Raphael Unrug
Peter N. Webb
David V. Wiltschko
Roy Woodall ■

New GSA Student Associates

The following 224 Student Associates became affiliated with the Society during the period from March to October 1997.

Kalsoum A. Abbasi
Lisa M. Adamo
Julie A. Adgurson
Khashayar Ahvari
Lesa A. Bagby
Erinn M. Banks
Matthew A. Barner
Daniel J. Beaudoin
Thomas P. Becker
Jacob S. Benner
Valerie A. Bennett
Amy E. Benoit
Richard H. Benson
Brent A. Berge
Eric M. Blackburn
Matthew T. Bleakley
Mark T. Bolivar
Mary L. Borzi
Alexander S. Bradley
Michelle H. Brewer
Joel A. Brieske
Julie Brown
Adam K. Bucki
Nathan E. Burnside
Malia B. Burrows
Luis F. Camacho
Sarah J. Cardamon
Sarah K. Carmichael
Tina L. Carrick
Ping Y. Chang
Denise S. Chidester
Kaneen E. Christensen
Ryan D. Christensen
Cynthia A. Colbert
Christopher R. P. Collet
Robert J. Conner
James E. Conolly
Tim D. Cope
David A. Cornell
Andrew J. Crittenden
Peter B. Davis
P. Allison Dean
James F. DeAngelo
Aisha H. Dennis
Nathalie N. Derrick
Laura A. Dietz
Mimi N. Divjak
Lisa J. Duke
Michelle J. Dwyer
Rana Farshoukh
Kristin L. Ferri
Timothy J. Fives
Ricardo S. Flores
Bryan J. Flynn
Jennifer E. Folta
Nancy K. Forsberg
Philip E. Foster
Ranae L. Friend
Phyllis E. Gaskin
Matt I. Gavette
Gregory Giuliani
Jeffrey K. Goodman
Zakhia X. Grant
Michael D. Gravely
Jessica K. Graybill
Matthew A. Gregory
Eric S. Gustafson
Markus G. Hagedorn
Christopher S. Hauptfleisch
Amanda M. Heasley
Kirk A. Heim
Jennifer L. Hensinger
Stephen M. Hensler
Scott W. Herman
Rebecca J. Heumann
Erin K. Hiatt
Susan M. Hinesley
Miriam E. Hornstein
Brian G. Hough
Craig M. Hovey
Andrea H. M. Hulshof
Grey P. Ingram
Matt C. Jacobs
Ryan T. Jakubowski
Shannon R. Jock
Adam N. Johnson
Christopher L. Johnson
Steven C. Johnson
Sarah E. Johnston
Sean E. Keneally
Melody J. Kent
Amanda E. Kilgore
Maria A. Koons
Sarah E. Kopczynski
Anthony G. Koval
Lena Krutikov
Tara L. Kuhn
Michelle M. Lake
Robert W. Lambert
Joanna R. Latham
Sebastien Lavoie
Melanie A. Leach
Brian G. Lebreck
Carrie E. Lee
Lai Man Lee
John V. Leone
Alanna P. Lester
Gordon Levin
John S. Linker
Peter Lissitschenko
Vanesa D. Litvak
Daniel M. Litzenberg
Andrew M. Lorrey
Sara E. A. Lyle
Elizabeth A. Madsen
Eric S. Magdar
Elizabeth A. Magno
Frank J. Marascia
Robert J. Mark
Lisa D. McAuliffe
Joseph C. McCarthy
Luke J. McCartney
Louise P. McGarry
John A. Miatech
Koreen M. Mielke
Tanya C. Mieras
Michael J. Miller
Zachary J. Miller
Dorene L. Montler
David T. Moore
Adam P. Morse
Jason R. Mulkey
Angela P. Murillo
Robert M. Myers
Angelyn Nebeker
Joy D. O'Donnell
Jeffrey J. Olejnik
Jennifer R. Olejnik
Elisabeth V. Osborn
Niki L. Pace
Judith M. Paiva
Daniel A. Parsons
John P. Pasmore
Benjamin H. Passey
Yvonne E. Paul
Adam E. Pearsall
Jeffrey C. Perkins
J. Vincent Perryman
Noah E. Petro
Christine M. Philips
David S. Pinkus
Christa J. Placzek
Chris Pollatos
Martina G. Prinzhorn
Richard M. Quesada
Terrie L. Ragins
Jose Norberto Ranalli
Melvin E. Rauch, Jr.
Harold A. Ray
Mark A. Record
Nancy R. Reese
Donald E. Rehmer
Geoffrey Reichold
Jeff P. Reinprecht
Monica K. Relle
Stephanie A. Reynolds
Anabella A. Rivara
Amelia C. Robinson
James D. Robinson
Nickolas R. Rogers
Shannon R. Rose
Demetra O. Salisbury
Nicholas J. Salkowski
Brenda K. Saville
Maria Scalzitti
Justine L. Schneider
Gunther J. Schnorr
Matthew O. Schrenk
Kathy L. Schwager
Philip G. Scoggins
Dave R. Scott-Queckett
Nicole M. Seibert
Michell R. Sequera
Danielle K. Sheheen
Maria S. Skidmore
Heather Laurina Smith
Shane V. Smith
Rachel C. Stansbery
Kiera Strohm-Herman
Toni M. Sullivan
Anne E. Swasey
Seth D. Tanner
Randal B. Thomas
Anne C. Tillery
Anne R. Tocker
Mark S. Trevor
Charles B. Trout
Matthew J. Tucker
Tiffany Tye
Erik A. Vander Horst
Mark D. Vanderbilt
Jodi M. VanderVelden
Elisheva C. Verdi
Joseph B. Vilcheck
Deborah J. Waiting
Kristoffer T. Walker
Nathaniel S. Wanner
Mary-Morning F. Washburn
Amy L. Weislogel
Heather L. Welhouse
Beth A. Wenell
Carrie Anne White
Lee A. White
Philipp Wilflingseder
Judy L. Wilkinson
Howard O. Wilson
Rick L. Wilson
Jennifer R. Wingate
Heidi A. Woelfel
Rebecca L. Yates
Mary Lynn Yurko
Kurt K. Zeiler
Darla K. Zelenitsky
Vladimir B. Zivkovic ■

GSA SECTION MEETINGS—1998

NORTHEASTERN SECTION, March 19–21, Holiday Inn by the Bay, Portland, Maine. Information: Stephen G. Pollock, Dept. of Geosciences, University of Southern Maine, Gorham, ME 04038, (207) 780-5350, fax 207-780-5167, pollock@usm.maine.edu. *Preregistration deadline: February 13, 1998.*

NORTH-CENTRAL SECTION, March 19–20, Ohio State University, Columbus, Ohio. Information: William I. Ausich, Geological Sciences, Ohio State University, 275 Mendenhall, 125 S. Oval Mall, Columbus, OH 43210, (614) 292-0069, fax 614-292-7688, ausich.1@osu.edu. *Preregistration Deadline: February 13, 1998.*

SOUTH-CENTRAL SECTION, March 23–24, OU Continuing Education Center, Norman, Oklahoma. Information: M. Charles Gilbert, School of Geology and Geophysics, University of Oklahoma, 100 E. Boyd St., Suite 810, Norman, OK 73019-0628, (405) 325-4424, fax 405-325-3140, mcgilbert@ou.edu. *Preregistration Deadline: February 6, 1998.*

SOUTHEASTERN SECTION, March 30–31, Embassy Suites, Charleston, West Virginia. Information: Larry D. Woodfork, West Virginia Geological and Economic Survey, P.O. Box 879, Morgantown, WV 26507-0879, (304) 594-2331, fax 304-594-2575, woodfork@geosrv.wvnet.edu. *Preregistration Deadline: February 27, 1998.*

CORDILLERAN SECTION, April 7–9, California State University, Long Beach, California. Submit abstracts to: James C. Sample, Dept. of Geological Sciences, California State University, Long Beach, CA 90840, (562) 985-4589, csample@csulb.edu. *Abstracts Deadline: December 12, 1997.*

ROCKY MOUNTAIN SECTION, May 25–26, Northern Arizona University, Flagstaff, Arizona. Submit abstracts to: Wendell Duffield, U.S. Geological Survey, 2255 Gemini Road, Flagstaff, AZ 86001, (520) 556-7205, wduffield@iflag2.wr.usgs.gov. *Abstracts Deadline: January 8, 1998.*

GSA Student Associate Member TRAVEL GRANTS

The GSA Foundation has awarded $4,000 grants to each of the six GSA sections. The money, when combined with equal funds from the sections, is used to assist GSA undergraduate Student Associates, as well as graduate Student Members, traveling to GSA meetings. For information and deadlines, contact your section secretary.

Cordilleran—Bruce Blackerby, (209) 278-2955, bruceb@zimmer.csufresno.edu; **Rocky Mountain—Kenneth Kolm,** (303) 273-3932. kkolm@mines.colorado.edu; **North-Central—Robert Diffendal, Jr.,** (402) 472-7546, rfd@unlinfo.unl.edu **Northeastern—Kenneth Weaver,** (410) 554-5532, kweaver438@aol.com; **South-Central—Rena Bonem,** (817) 755-2361, bonemr@baylor.edu; **Southeastern—Harold Stowell,** (205) 348-5098, hstowell@wgs.geo.us.edu

New Members
continued from p. 35

Christine Tappen
Paul Tapponnier
Rozemarijn F. A. Tarhule
Lucius H. Taylor
Dennis O. Terry, Jr.
E. Robert Thieler
Douglas M. Thompson
Bai Tian
Susan M. Timmons
Keith L. Tischler
Alan L. Titus
Shinji Toda
John Townend
Carolyn R. Trayler
Chin-Ho Tsai
Silvio Tschudi
Andrei Tudoran
Eva-Lena Tullborg
Allison R. Tumarkin
David Tupper
Aleta van Riper Turner
Robert J. Tuttle
Trenton N. Twedt
James A. Tyburczy
Emmanuel E. Udoh
Maria E. Uhle
Chad A. Underwood
Jon W. Van de Grift
Dixon Van Hofwegen
William P. Van Liew
Leah May B. Ver
Jan M. Vermilye
William T. Viitala
Michael J. Vollinger
Albert F. Waibel
Todd E. Wallbom
Douglas J. Walsh
Charles W. Ward
Thad A. Wasklewicz
Cheryl L. Waters
Laura E. Webb
Jennifer M. Weber
Mark Webster
Kathy C. Weinberg
Richard A. Welch
Robert E. Welsh
Micah A. Weltmer
Robert L. West
Brian D. Westhoff
Kelly D. Wheeler
Lisa L. White
Noel C. White
Robert E. Whittemore
Joanne C. Wilkin
Holly K. Williams
William J. Willis
Virginia D. Winslow
Victoria Wise
Chris Wojick
Virginia Wong
Michele M. Wood
Marcia G. Wyatt
Koshi Yamamoto
Catherine H. Yansa
Dawn A. Youngblood
Yong Jae Yu
Zhongbo Yu
Hongbin Zhan
Natalie B. Zieske
Jennifer A. Zwiebel ■

Environmental & Engineering Geoscience Contents

Volume III, Number 3, Fall 1997

Technical Notes

Book Reviews

Memorials

The Geological Society of America
BULLETIN
Volume 109, Number 12, December 1997

December *BULLETIN* and *GEOLOGY* Contents

CONTENTS

GEOLOGY
VOLUME 25
NO. 12
P. 1057–1192
DECEMBER 1997

Position Announcements *(from Employers using GSA's Employment Service at the 1997 GSA Annual Meeting)*

AMHERST COLLEGE
ENVIRONMENTAL GEOSCIENTIST

The Department of Geology at Amherst College seeks applications for a tenure-track position at the level of Assistant Professor, to begin in the fall semester of 1998. Possible fields of expertise include one or more of the following: aqueous geochemistry, biogeochemistry, glacial geomorphology, hydrogeology, paleoclimatology, paleoecology, and/or surficial geology. Teaching responsibilities will include participation in the Department's introductory courses, an intermediate level course that focuses on environmental and surficial processes, and an advanced level undergraduate course in the candidate's specialty.

Amherst College provides competitive start-up funds in support of research. In addition, if the successful candidate is a woman, she will be appointed the Clare Boothe Luce Assistant Professor of Geology.

A Ph.D. is required and post-doctoral experience is desirable. Submit a resume, three letters of recommendation, and a brief statement of your research interests to: Professor Tekla A. Harms, Department of Geology, Amherst College, Amherst MA 01002-5000 (taharms@amherst.edu). Review of applications will begin on January 1, 1998, but applications will be accepted until a pool of qualified candidates is identified. Amherst College is an equal opportunity/affirmative action employer. Women, minorities, and persons with disabilities are particularly encouraged to apply.

EXXON PRODUCTION RESEACH COMPANY (EPR)
CAREERS IN GEOSCIENCE.

Degree/Discipline Needed: Ph.D. Geology, Geophysics, Geochemistry. Desirable areas of specialization include structural geology, sequence stratigraphy/stratigraphic modeling, seismic interpretation/seismic stratigraphy, image processing/remote sensing, seismic data acquisition, organic geochemistry, geologic modeling, geostatistics, reservoir quality/diagenesis, rock mechanics, petrophysics.

MS candidates with specialization in rock mechanics, geological data analysis/mathematical geology, seismic interpretation.

MS or Ph.D. in Computer Science (artificial intelligence), Petroleum Engineering (geostatistics).

Geoscience Summer Intern, Ph.D. candidates in any geoscience-related field may apply for summer employment (3-month assignments).

Work location is in Houston, Texas. EPR is responsible for developing exploration and production technology for Exxon Corporation's global upstream activities. Additional employment information can be obtained from Judy Baker, Exxon Production Research Co., P.O. Box 2189 - Mail Stop ST-3204, Houston, TX 77252-2189. EQUAL OPPORTUNITY EMPLOYER

GEORGIA SOUTHERN UNIVERSITY
STRUCTURAL GEOLOGIST

The Department of Geology and Geography invites applications for a tenure-track position in Structural Geology. Ph.D. required by starting date of the position, August 1, 1998. Assistant Professor level with salary dependent upon qualifications. Teaching duties include teaching introductory geology (Physical and Historical) as well as advanced courses in area of specialization. The successful candidate shall be versed in both descriptive and quantitative methods. Applicants who are field oriented and have familiarity with or interest in the Appalachians and Piedmont are preferred.

Send letter of application, current curriculum vitae, unofficial transcripts of undergraduate and graduate work, evidence of teaching effectiveness, and have three current references submit letters of recommendation to: Dr. Kelly Vance, Search Chair, Search # 34919, Department of Geology and Geography, P.O. Box 8149, Georgia Southern University, Statesboro, GA 30460-8149. Application postmark deadline is January 5, 1998.

Georgia Southern University is a unit of the University System of Georgia. The names of applicants and nominees, resumes, and other general non-evaluative information are subject to public inspection under the Georgia Open Records Act. Georgia Southern is an Equal Opportunity, Affirmative Action Institution. Individuals who need reasonable accommodation(s) under the Americans with Disabilities Act in order to participate in the application process should notify the search chair.

ILLINOIS STATE UNIVERSITY
GEOHYDROLOGY/APPLIED GEOPHYSICS

The Department of Geography-Geology at Illinois State University invites applications for a tenure-track position in Geohydrology/Applied Geophysics beginning in August 1998. The position will be at the Assistant Professor level, ABD is required, Ph.D. preferred. Applicants must show promise in research, be committed to excellence in teaching at the undergraduate and graduate levels, and have good rapport with students. The successful candidate will teach an undergraduate course in Principles of Geology and graduate courses in Groundwater Modeling, Geophysics, and other related courses; supervise M.S. students in our Geohydrology graduate program; and conduct research.

For more information about Illinois State University contact our web page at: http://www.ilstu.edu. Applicants must submit a curriculum vitae; official transcripts of all college work; a statement of teaching and research interests; and the names, addresses, telephone numbers, and e-mail addresses of three references to: Dr. David Malone, Department of Geography-Geology, Illinois State University, Campus Box 4400, Normal, IL 61790-4400. Telephone: (309) 438-2692; Fax: (309) 438-5310; e-mail: dhmalon@ilstu.edu. Applications must be received by January 15, 1998. Illinois State University is an Affirmative Action, Equal Opportunity Employer Encouraging Diversity.

UNIVERSITY OF IOWA
STRUCTURAL GEOLOGIST

The Department of Geology, University of Iowa, invites applications for a tenure-track position in structural geology. Field-oriented individuals with a wide range of interests in structural geology and tectonics are especially encouraged to apply. The appointment will begin in August 1998 at the assistant professor level. We seek an outstanding researcher and teacher who will best accommodate the diverse missions of the department. Teaching responsibilities for an academic year will include a one-semester course in structural geology at the junior-senior level and two additional classes/seminars at the undergraduate or graduate level.

The successful candidate should have a Ph.D. and be active in research that will complement other research programs in the department. Women and minorities are especially encouraged to apply. Applicants should send a complete resume (including a bibliography and statement of teaching and research interests) and have at least three letters of recommendation sent to: Dr. C.T. Foster, Search Committee Chair, Department of Geology, University of Iowa, Iowa City, Iowa 52242-1379 (Phone: 319-335-1818; fax: 319-335-1821). Final evaluation of the applicants will begin on December 1, 1997 and continue until the position is filled. The University of Iowa is an affirmative action-equal opportunity employer.

VISITING POSITION IN QUATERNARY SOILS

The Department of Geology, University of Iowa, seeks a Visiting Professor who is an outstanding teacher and researcher in the area of Quaternary studies, with focus on soils and associated surficial materials. The appointment will begin in August 1998 and extend for 2 years, with the possibility of starting January 1998 for 2.5 years. Teaching responsibilities will involve at least four courses per year. These will include two upper-level undergraduate/graduate courses, Modern and Ancient Soils, and Glacial and Pleistocene Geology, and one of our general education courses (Earth History and Resources). Other courses would depend on the candidate's expertise and departmental needs, and may include a portion of Remote Sensing.

The successful candidate should have a Ph.D. and be active in research that will complement ongoing Quaternary research and surficial-process programs in the Department. Women and minorities are encouraged to apply. Applicants should send a complete resume (including a bibliography and statement of teaching and research interests) and have three letters of recommendation sent to: Dr. Richard G. Baker, Search Committee Chair, Department of Geology, University of Iowa, Iowa City, Iowa 52242-1379 (Phone: 319-335-1827; fax: 319-335-1821; e-mail drgbaker@blue.weeg.uiowa.edu. Final evaluation of the applicants will begin on 1 December 1997 and continue until the position is filled. The University of Iowa is an affirmative action-equal opportunity employer.

IOWA STATE UNIVERSITY
APPLIED GEOPHYSICIST

The Department of Geological and Atmospheric Sciences invites applications for a tenure-track position in applied geophysics at the assistant professor level beginning in mid-August 1998. Preference will be given to individuals with a strong background in the application of one or more of the following fields: seismic methods, electromagnetics, electrical methods, ground-penetrating radar, gravity, and 3-D subsurface imaging.

The successful candidate will be expected to develop a vigorous research program, supervise graduate students, attract external funding, and to participate actively in our graduate (M.S. and Ph.D.) and undergraduate teaching programs.

Applicants should send a letter of application, a statement of research and teaching interests, curriculum vitae, transcripts, and the names, addresses, e-mail addresses, and phone and fax numbers of at least three references to: Search Committee Chair, Applied Geophysics Position, Department of Geological and Atmospheric Sciences, 253 Science I, Iowa State University, Ames, IA 50011-3212. Applicants should hold a Ph.D. in geosciences at the time of appointment. To ensure consideration, applications should be received by December 1, 1997. Information about the Geological Sciences group can be found on the World Wide Web at: http://www.geology.iastate.edu.

Iowa State University is an Equal Opportunity/Affirmative Action Employer and encourages applications from women, minorities, and other protected groups.

UNIVERSITY OF KANSAS
ASSISTANT PROFESSOR, PALEONTOLOGY

The Department of Geology of The University of Kansas invites applications for a tenure-track position of Assistant Professor with a specialty in invertebrate paleontology or micropaleontology. The appointment will begin on August 18, 1998, with a later starting date possible. Primary consideration will be given to applicants whose emphasis is on specimen-based study of invertebrate fossils or microfossils. Duties include teaching at the undergraduate and graduate levels, developing and maintaining an active program of research, and working with other faculty members to develop a stronger program in sedimentary geology and paleontology.

Applicants should have the Ph.D. degree or be in the final stages of completing the degree. A letter of application, a complete résumé, graduate-school transcripts, and three letters of recommendation should be sent to Roger L. Kaesler, Search Committee Chairman, Department of Geology, The University of Kansas, 120 Lindley Hall, Lawrence, Kansas 66045-2124 (tel: 785-864-3338; fax: 785-864-5276; e-mail: kaesler@ukans.edu). Review of completed applications will begin January 10, 1998, and will continue until the position has been filled. EO/AA employer. The University is committed to increasing the ethnic and gender diversity of its faculty, and we strongly encourage women and minority candidates to apply.

LOUISIANA STATE UNIVERSITY
SEDIMENTARY GEOLOGIST

The Department of Geology and Geophysics at Louisiana State University invites applications for an anticipated tenure-track position at the assistant professor level to begin in the fall semester of 1998. The successful candidate must have a Ph.D. at the time of employment. Preference will be given to individuals with postdoctoral and/or industrial experience.

We seek an outstanding sedimentary geologist with strong interests and expertise in physical sedimentary processes and the evolution of sedimentary rocks. The ideal candidate will be field oriented with a firm grasp of fundamental and globally relevant problems in sedimentology. The applicant should also be proficient with modern techniques for characterizing and analyzing sedimentary rocks on a range of temporal and spatial scales. The successful candidate will be expected to contribute to our undergraduate and graduate teaching programs, including developing courses in such areas as sedimentation, sedimentary field and laboratory methods, basin analysis, and sedimentary petrology.

Interested persons should send a copy of their vita, a summary of research and teaching interests, and the names, addresses, and phone numbers of three references to: Chair, Faculty Search Committee, Department of Geology and Geophysics, Louisiana State University, Baton Rouge, LA 70803. The search will be continued until a suitable candidate is found.

Louisiana State University is an equal opportunity/affirmative action employer.

MOUNT HOLYOKE COLLEGE
STRUCTURAL GEOLOGY/PLANETARY GEOLOGY/GEOPHYSICS

The Department of Geography & Geology at Mount Holyoke College invites applications for an anticipated full-time, tenure-track position at the Assistant Professor level, contingent upon final approval, beginning September 1998. The successful candidate must have a Ph.D. in structural geology, planetary science, geophysics, or a related field and will be expected to teach structural geology, introduc-

tory geology, and other courses related to his or her area of expertise. The ideal person will also be able and willing to teach introductory and/or advanced courses in either the Physics Department or Astronomy Department.

To apply, send curriculum vitae, a one-page statement of immediate teaching and research goals, and names of three references to: Steven R. Dunn, Department of Geography & Geology, Mount Holyoke College, South Hadley, MA 01075.

Applications will be reviewed as they are received, but must be received by January 1, 1998. Mount Holyoke is committed to fostering cultural diversity and multicultural awareness in its faculty, staff, and students and is an Affirmative Action/Equal Opportunity employer. Women and minorities are especially encouraged to apply.

UNIVERSITY OF NORTHERN COLORADO
STRATIGRAPHY AND HISTORICAL GEOLOGY

The Department of Earth Sciences (http://met.unco.edu) invites applications for a tenure-track position in Geology at the assistant professor level starting August 19, 1998. We seek an individual with a Ph.D. in geology with primary expertise in stratigraphy and historical geology. Additional expertise in paleontology, groundwater, environmental geology or geophysics is desired.

Responsibilities include teaching, scholarship and service in support of the Department's undergraduate programs in geology, environmental earth sciences, secondary earth science teaching and general earth sciences, and Master's program in earth sciences. Teaching will include introductory geology, historical geology, and stratigraphy and paleontology. Additional subjects could include regional geology, field methods, groundwater geology, introductory geophysics or other courses in the individual's area of expertise.

To apply, submit a letter of application, vita, official graduate transcripts, and three letters of reference to: Dr. William D. Nesse, Department of Earth Sciences, University of Northern Colorado, Greeley, Colorado, 80639; phone: (970) 351-2830; e-mail: wdnesse@bentley.unco.edu. Review of applications begins December 1, 1997 and continues until a candidate is found. Position contingent on funding. UNC is an AAEO employer.

OHIO UNIVERSITY
APPLIED SUBSURFACE GEOLOGIST

The Department of Geological Sciences at Ohio University invites applications for a tenure-track appointment in applied subsurface geology that, pending administrative approval, is anticipated to begin September 1998. We are seeking an individual who is committed to research and the development of courses in subsurface geology to expand and complement our existing programs in groundwater hydrology, environmental geology and geophysics, and to expand our petroleum-related expertise which currently includes seismology, sequence stratigraphy, basin tectonics and basin analysis. Additional interests in engineering geology or coal geology would be advantageous, as would some applied experience in industry or government. The successful applicant will possess a Ph.D. in geological sciences and must show demonstrated potential for teaching and research in subsurface geology commensurate with the rank of assistant professor.

For further information visit the university web site at http://www.ohiou.edu.

Applicants should send a vita, a description of research interests, and the names and addresses of three referees to: Dr. R. Damian Nance, Chair, Department of Geological Sciences, 316 Clippinger Laboratories, Athens, Ohio 45701-2979. Applications should be received before February 1, 1998, but will be considered until the position is filled. Ohio University is an affirmative action/equal opportunity employer. Women and minorities are especially encouraged to apply.

OLD DOMINION UNIVERSITY
HYDROGEOLOGY, REMOTE SENSING, AND ENVIRONMENTAL GEOCHEMISTRY

Old Dominion University Geological Sciences Program seeks individuals to fill three tenure track positions, one each in hydrogeology, remote sensing, and environmental geochemistry. Successful candidates will join highly collaborative efforts in environmental sciences and/or marine sciences, and be able to collaborate with existing research efforts conducted by faculty in geological sciences, oceanography, biology, chemistry, geography, engineering, and scientists at nearby NASA Langley Research Center and the Virginia Institute of Marine Sciences. Applicants should have a Ph.D. degree, including a strong academic background in geology.

Applicants should submit a curriculum vitae, description of research and teaching activities, and the names and addresses (including E-mail) of three references to: Ms. Phyllis Brown, Recruitment Administrator, Office of the Dean, College of Sciences, Old Dominion University, Norfolk, VA 23529-0163. e-mail: pfb100u@eagle.cc.odu.edu. For full consideration, applications should be received by January 1, 1998. Review of applications will begin immediately and it is anticipated that appointments will begin on August 1, 1998. Old Dominion University is an Affirmative Action/Equal Opportunity Employer and requires compliance with the Immigration Reform and Control Act of 1986. We encourage applications from women and minorities.

PORTLAND STATE UNIVERSITY
BIOGEOCHEMISTRY

The Geology Department of Portland State University seeks to fill a tenure-track Assistant Professor in the area of Biogeochemistry to begin Fall, 1998. The successful candidate is expected to teach undergraduate and graduate courses and conduct a vigorous research program, including supervision of master's students in Geology and master's and Ph.D. students in our interdisciplinary Environmental Sciences and Resources Program. Primary interest is in low-temperature microbial-geochemical processes in geological systems. Candidates should also be interested in applying their knowledge and skills to the general education of all undergraduate students.

The Ph.D. is required by the date of hire. A detailed resume including two letters of professional references and a statement of research and teaching interests must be received by February 15, 1998. Address the Biogeochemistry Search Committee, Geology Department, Portland State University, Portland, Oregon 97207-0751. Fax 503-725-3025. E-mail michael@ch1.ch.pdx.edu. The Geology Department home page is http://www.geol.pdx.edu. Portland State University is an equal opportunity/affirmative action employer and the Geology Department is committed to diversifying its faculty.

QUEENS COLLEGE (CUNY)
AQUEOUS GEOCHEMISTRY

As part of its reconfiguration as a School of Earth and Environmental Sciences, the Department of Geology at Queens College (CUNY) invites applications for a tenure-track faculty position in aqueous geochemistry to begin in the 1998 fall semester. A Ph.D. is required and candidates should have experience in field-based research.

Duties will include teaching undergraduate through doctoral courses in geochemistry and introductory environmental geology; establishing an active field-based research program; supervising student research; interacting with our physical hydrologist; and helping to develop curricula for the new School, including programs focused on Earth Science Education.

The appointment will be at either the assistant professor ($29,931–$52,213) or associate professor ($39,003–$62,394) level, depending on qualifications.

Letters of application, a curriculum vitae, transcripts of all degrees, and three letters of reference should be sent by January 31 to Dr. Allan Ludman, Chairman, Department of Geology, Queens College, Flushing, NY 11367. Address questions to Dr. Ludman at: 718-997-3300 or e-mail allan_ludman@qc.edu. For additional information about the department and college, see our Web Site: http://www.qc.edu/Geology.

SAN FRANCISCO STATE UNIVERSITY
NEOTECTONICS/STRUCTURAL GEOLOGY

The Department of Geosciences invites applications for a tenure-track faculty position at the assistant professor level in Neotectonics/Structural Geology, beginning in August 1998. The position requires a Ph.D. in geology. Some background in teaching is necessary, and experience in industry or government agency from areas of engineering geology such as trench analysis, fault interpretation and environmental geophysics is required. The successful candidate will have prime responsibility for teaching undergraduate and graduate courses in structural geology, neotectonics and plate tectonics, and will share responsibility for courses in engineering geology, geophysics and field methods, as well as non-majors classes at the introductory level. We seek someone to work with local environmental firms and agencies and to assist in expanding our new graduate program in Applied Geosciences.

To apply, send curriculum vitae including a statement of teaching and research interests, and names and addresses of three references to: John Monteverdi, Department of Geosciences, San Francisco State University. 1600 Holloway Avenue, San Francisco, CA 94132. Applications must be postmarked by January 15, 1998. For more information, contact the Dept. of Geosciences web site at http://tornado.sfsu.edu/geosciences/geosciences.html. San Francisco State University is an Equal Opportunity/Affirmative Action employer.

TRW/SAIC
CHEMIST/GEOCHEMIST

TRW (including subcontractors, e.g. Science Applications International Corp.), Management and Operating Contractor, U. S. Department of Energy Yucca Mountain Project, Las Vegas, Nevada

Position Description: Perform geochemical modeling of the degradation of high level nuclear waste forms and other materials in a waste package emplaced in an underground repository, and of the interaction of the degradation products with the material surrounding the waste package, to evaluate the possibilities of accumulating significant concentrations of these degradation products in locations external to the waste package.

Selection Criteria/Required Skills: Demonstrated capability in modeling of chemical processes; ability to research and evaluate reaction parameters available in the literature and/or to identify and obtain results of ongoing research; ability to formulate modeling problems for solution by recognized computer codes; ability to communicate with team members and with consultants and reviewers from other organizations. The individual should have good skills in the following subjects: chemical thermodynamics, physical chemistry, inorganic chemistry, mineralogy.

Required Education: Ph.D. in chemistry or geochemistry. Required Experience: 10 years post-Bachelor's degree or 5 years post-Ph.D.

Please address correspondence to: Dr. Paul L. Cloke, TRW/SAIC, 1180 Town Center Drive, Las Vegas, NV 89134, (702) 295-4867, fax 702-295-4438, e-mail: Paul_Cloke@notes.ymp.gov.

UNOCAL & SPIRIT ENERGY 76
GEOLOGIST POSITIONS

The following positions are with Unocal's Exploration and Production Technology group, and require an M.S. (Ph.D. preferred).

(1) Basin Modeling, 2-D and 3-D: Requires a background in commercial 2-D modeling programs, including expertise with fluid flow and thermal maturation predictive abilities.

(2) Structural Geology: Requires an in-depth knowledge of structural styles and rock behavior during deformation. Prefer experience in seismic interpretation, fault analysis, balanced cross-section techniques, qualitative structural modeling, salt tectonics and/or extensional basin/thrust belt structural styles.

(3) Sequence Stratigraphy: Requires expertise in clastic sedimentology and sequence stratigraphy. Must be able to analyze stratigraphic architecture within a comprehensive petroleum system.

(4) Petroleum Geochemistry: Requires expertise in interpreting molecular and isotropic geochemical data within a petroleum system. A strong background in geology is preferred.

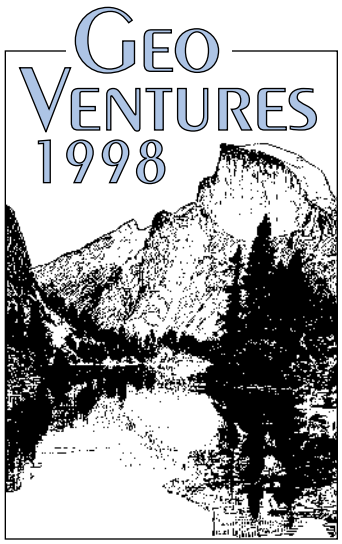
The following position is with Spirit Energy 76, and requires an M.S.: Sequence Stratigraphy. Utilize regional sequence stratigraphy expertise to generate prospects and address reservoir issues in the Upper Tertiary of the Gulf of Mexico shelf region.

Qualified applicants should send a cover letter referencing the listed opening and a resume to Unocal, Attn: Human Resources Department SLC, P.O. Box 4551, Houston, TX 77210-4551. No telephone calls please. Equal Opportunity Employers.

UNIVERSITY OF WISCONSIN—OSHKOSH
(2 POSITIONS)
HYDROGEOLOGY AND MINERALOGY/PETROLOGY

The Geology Department invites applications for two tenure-track, assistant professor positions starting Sept. 1, 1998. Ph.D. required. 1) Hydrogeologist to teach undergraduate courses in physical hydrogeology, chemical hydrology, environmental geology, and perhaps geochemistry or geophysics. 2) Field-oriented geologist to teach undergraduate courses in mineralogy and petrology every year and possibly geochemistry, economic geology, or physical geology in alternate years. Candidates should be committed to undergraduate education and to developing a research program that includes undergraduates. By Jan. 1, 1998, please submit a letter of application, which includes a concise statement of your teaching and research interests and experience, a resume, and transcripts; also have 3 current letters of reference sent directly to the department. Send to: Dr. Norris Jones, Chair, Geology Department, University of Wisconsin Oshkosh, Oshkosh, Wis. 54901.

The Geology Department is a University of Wisconsin System Center of Excellence with 8 full-time faculty and about 55 undergraduate majors. The faculty have a strong commitment to undergraduate instruction, which is supported by excellent facilities and equipment. Additional information about the department and its programs can be found at http://www.uwosh.edu/departments/geology. AA/EOE.



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We encourage you to make your decision as soon as possible. There is great interest in these trips.

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Single or Shared Accommodation: Some trip fees are based on double occupancy. However, if you wish single accommodations, a limited number of rooms are available at extra cost on a first-come, first-served basis. In the case of double occupancies, we will do our best to help find a suitable roommate, but if none is found, the single rate will apply. Please read the lodging information for each trip.

Age Requirement: Participants must be at least 21 years old.

Health Recommendations and Special Needs: You must be in good physical and mental health. Any physical condition requiring special attention, diet, or treatment must be reported *in writing* when the reservation is made. We will do our best to accommodate special needs, including dietary requirements and physical disabilities. Please feel free to discuss your situation with us; however, we reserve the right to decline any person as a member of a trip. We also reserve the right to require a person to withdraw from the trip at any time when such action is determined to be in the best interests of the health, safety, and general welfare of the group.

Air Travel: We urge you to make air travel arrangement via agent Rodney Saunders of Cain Travel. Rodney's direct telephone number is (303) 938-2741, rodneys@cain-travel.com. We have discussed the trips in detail with Rodney and he is ready to help you find the least expensive routing to your destination. Please call Rodney for a no-obligation price quote at the above number or at Cain Travel's toll free number 1-800-346-4747, or (303) 443-2246. The fax number is (303) 447-0145.

Cancellation Processing Fee: Deposits and payments are refundable, less processing fee, up to the cut-off date. Termination by an individual during a trip in progress for any reason whatsoever will not result in a refund, and no refund will be made for unused parts of the trip.

Full Itineraries: Detailed itineraries for each GeoVenture and helpful travel information are available from GSA. Please feel free to contact Edna Collis, GSA Meetings Department, at 1-800-472-1988, ext. 134 or (303) 447-2020, fax 303-447-0648, ecollis@geosociety.org.

1998 GeoVentures Fee Schedule

	Grand Canyon	Durango	Tetons
Dates	April 10–18	June 27–July 2	July 18–23
No. of Days	9	6	6
Member Fee	$1745	$660	$675
Nonmember Fee	$1845	$710	$725
Deposit	$200	$100	$100
Balance Due	January 2	April 30	May 29
100% Deposit refund date (less processing fee)	January 2 ($50)	April 30 ($20)	May 29 ($20)

Register Today!

Send a deposit to hold your reservation; please pay by check or credit card. You will receive further information and a confirmation of your registration within one week after your reservation is received.

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GT982—Grand Canyon	$200	____	$_____
GH981—Durango	$100	____	$_____
GH982—Tetons	$100	____	$_____
		TOTAL DEPOSIT	$_____

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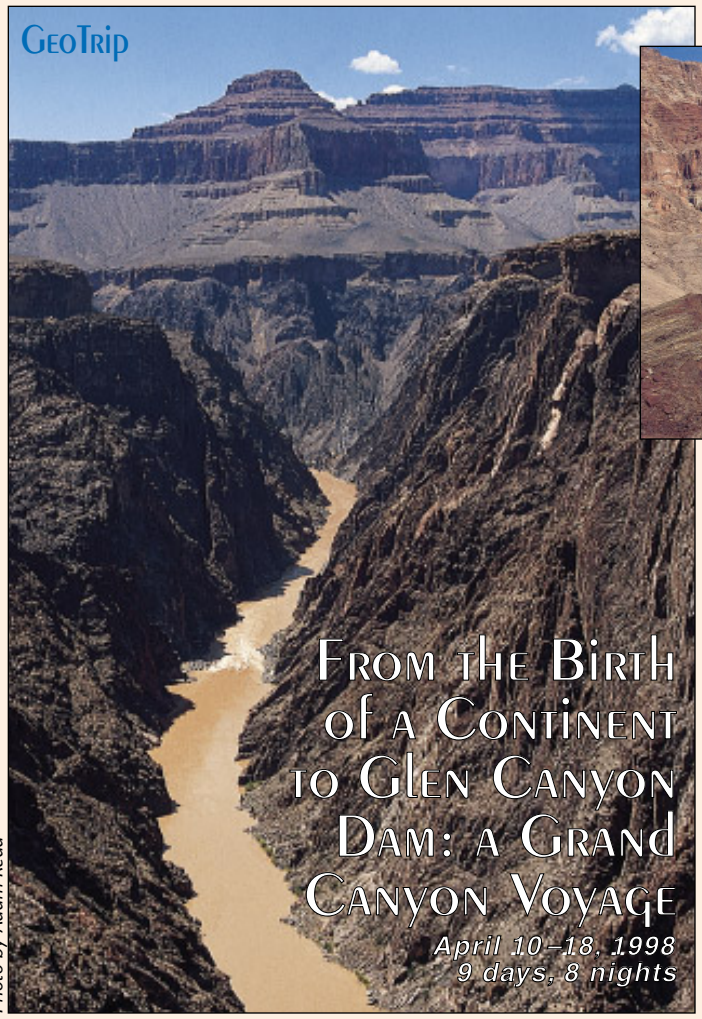
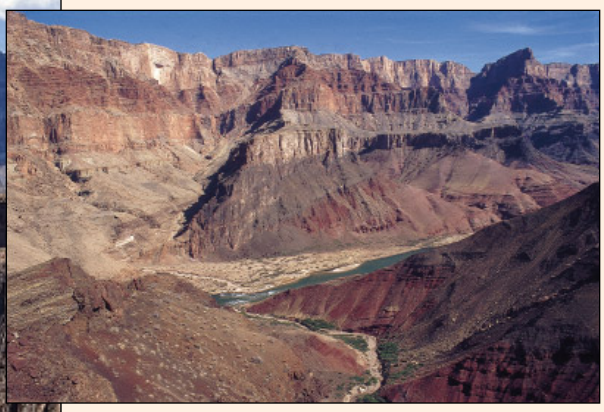


Photo by Adam Read



Scientific Leaders

Brad Ilg, Cerro Alto Geological Consultants, Inc., Glorieta, New Mexico
Jeff Bennett, Northern Arizona University, Flagstaff
Mike Timmons, University of New Mexico, Albuquerque
Joel Pederson, University of New Mexico, Albuquerque

This fantastic trip will float the Colorado River in the Grand Canyon with several Grand Canyon geologists. Brad Ilg, the lead instructor for the trip, has been guiding exciting geology river trips in the Grand Canyon since 1990 for various universities and museums. His work on the Precambrian rocks of the Upper and Middle Granite Gorges is included in the new *Geologic Map of the Eastern Grand Canyon*. Brad will show the group seldom-visited side canyons in the Granite Gorges, locations that yield insights to the island-arc origins of the highly deformed Precambrian rocks. The group will discuss the models for continental growth through island arc accretion and examine features that record island arc assembly to the proto–North American continent. Mike Timmons, a Grand Canyon Supergroup specialist and professional Grand Canyon river guide, will lead the group to the old "horse thief trail" in Chuar Valley, to explore the Precambrian rift-related Chuar sedimentary rocks, visit 800-million-year-old stromatolites, and see the incredibly organic-rich Precambrian Chuaria Formation. Jeff Bennett, a Grand Canyon beach and aquatic systems specialist and professional Grand Canyon river guide, will lead discussions on the results of the experimental flood of 1996 and discuss sediment mass balance and river systems dynamics in the postdam environment. The strong monsoon season of 1997 has had a dramatic effect on the sediment load in the river channel, and the group will see, first hand, the effects of another artificial flood scheduled for release in late 1997. Joel Pederson, a geomorphologist and sedimentologist working in the western end Grand Wash Trough, will review the evidence for the timing of the cutting of the canyon. He will also review the various models for the evolution of the Grand Canyon, from stream capture via headward erosion to Major John Wesley Powell's models of "superposition" and "antecedence."

This is an exceptional opportunity for the physically fit person to visit the world's premier natural laboratory. April is a beautiful time of year to visit the Grand Canyon. There are few other trips on the river at that time, and the weather is usually perfect for hiking. Participants will see locations in the canyon that are rarely visited by standard commercial trips. We will run some of the world's best white water and visit such magical locations as Elves Chasm and Deer Creek Falls, in the context of learning about the cutting edge of Grand Canyon geologic theory.

Lodging, Meals, and Transportation

Arizona River Runners and the science leaders will provide all meals, field instruction, professional river guides, river-related equipment (including camping gear), and transportation from Las Vegas, Nevada, to Lee's Ferry, Arizona, on April 11 and from Pearce Ferry, Arizona, to Las Vegas, Nevada, on April 18.

Elite Travel is familiar with the trip itinerary and can handle all reservations in and out of Las Vegas; they can also arrange hotel and airfare discounts. Call Jill or Dora with Elite Travel at 1-800-441-5880.

Physical Requirements

This trip includes several moderately difficult, always optional, hikes that are usually less than two miles round trip from the boats. Although at a reasonable pace with many points to rest and to explore the geology, these hikes should be undertaken only by persons in good health who are physically active. Verification of health coverage will be required. No rafting experience is necessary.

Fee and Payment

GSA Member: $1745 *Nonmember: $1845*
Based on 25 people. The trip may be more if there are fewer registrants. A $200 deposit, due with your reservation, is refundable through January 2, 1998, less $50 processing fee. Total balance due: January 2, 1998. Minimum age: 21.

Included: All meals beginning with lunch on April 11 and ending with breakfast on April 18. Transportation by bus from Las Vegas, Nevada, to Lee's Ferry, where you will meet the science leaders and crew, and bus transportation from Pearce Ferry, Arizona, back to Las Vegas, Nevada. All river equipment including tents, sleeping bags, sleeping pads, geological reading materials, and river guidebook.

Not included: Airfare to and from Las Vegas.

More GeoVentures *on p. 44*

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additional lines	$1.35	$2.35
Code number: $2.75 extra		

Agencies and organizations may submit purchase order or payment with copy. Individuals must send prepayment with copy. To estimate cost, count 54 characters per line, including all punctuation and blank spaces. Actual cost may differ if you use capitals, centered copy, or special characters.

To answer coded ads, use this address: Code # ----, GSA Advertising Dept., P.O. Box 9140, Boulder, CO 80301-9140. All coded mail will be forwarded within 24 hours of arrival at GSA Today office.

Positions Open

FACULTY POSITION
ENVIRONMENTAL STABLE ISOTOPE GEOCHEMISTRY
Geological Sciences / Ohio State University

The Department of Geological Sciences invites applications for one tenure-track position at the assistant professor level, or higher, to begin as early as September 1998. A Ph.D. in geological sciences or related field is required. Candidates should have a strong record of funded research, refereed publications, a commitment to teaching, and collaboration with colleagues in other areas of specialization. The successful candidate will be expected to develop an independent research program in paleoclimatic reconstruction, work closely with the Ohio State ice-core paleoclimate research program (including the elemental and isotopic composition of trapped gases in ice cores or atmospheric isotope geochemistry), and participate broadly with Department research programs. Teaching will involve courses at introductory and advanced levels.

The Department of Geological Sciences has 24 full-time faculty and approximately 70 graduate students. The Department is well equipped with laboratory and computing equipment and is occupying newly renovated laboratory, classroom, and office space. The successful candidate will be expected to maintain strong research ties with the Byrd Polar Research Center and with faculty in Geological Sciences and other departments and disciplines, e.g., Department of Chemistry and Atmospheric Sciences. Also,the successful candidate will be expected to generally participate in the Ohio State University Environmental Sciences initiative.

To apply, send a curriculum vitae, statements of research and teaching interests, and names of three referees to Search Committee Chair, Department of Geological Sciences, 155 South Oval Mall, Columbus, OH 43210. The search committee will begin reviewing applications January 1, 1998, and continue until a suitable candidate is hired. The Ohio State University is an Equal Opportunity, Affirmative Action Employer. Women and Minorities, Vietnam-era veterans, disabled veterans and individuals with disabilities are encouraged to apply.

TENURE-TRACK FACULTY POSITION IN
HYDROGEOLOGICAL SCIENCES
DEPARTMENT OF GEOSCIENCES
THE PENNSYLVANIA STATE UNIVERSITY

The Department of Geosciences at Penn State seeks an individual in the field of hydrogeology, for a tenure-track faculty position to be filled at any level. Rank, salary, and tenure-status will be commensurate with prior experience and qualifications.

We seek an outstanding scientist and educator in any area of hydrogeology which emphasizes subsurface fluid flow. Examples of interest include, but are not restricted to, contaminant transport, basinal fluid flow, multi-phase flow, fluid-flow/tectonics interactions, unsaturated zone flow, and hydraulic properties and their scaling relationships.We are particularly interested in individuals whose research couples observation with theory, and whose research is of both an applied and fundamental nature.

The successful candidate will join a large, dynamic and well-equipped department dedicated to innovative teaching and research, which seeks a national and international leadership role in Hydrosciences. Opportunities exist for campus-wide collaborative research and teaching in the Hydrosciences. Appointments as an affiliate of the Earth System Science Center and the Center for Environmental Chemistry and Geochemistry are possible.

Applicants should demonstrate a history of, or potential for, funded research and high-quality teaching. A Ph.D. is required at the time of appointment. Applications should include a complete resume, examples of published work, a statement outlining teaching and research interests and the names and addresses of at least four (4) individuals who could provide references. Send application materials to: Head, Department of Geosciences, The Pennsylvania State University, 503 Deike Bldg., University Park, PA 16802.

The search process begins immediately and will continue until suitable candidates are identified.

An Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

CHAIR, GEOSCIENCES
UNIVERSITY OF NEBRASKA—LINCOLN

The Department of Geosciences, University of Nebraska—Lincoln, invites applications and nominations for the position of department chair. The successful candidate will be responsible for promoting the growth and stature of the department, budgetary and personnel matters, developing teaching schedules, and alumni development. The chair must also guide the instructional and outreach activities of the department, and provide appropriate service to the University. The successful candidate should be a senior geoscientist with a record of internationally recognized, externally funded research. Evidence of effective leadership in academic administration or in funding agencies will be a positive factor. Candidates should have a research specialty that bridges departmental strengths in hydrogeology, meteorology and climatology, micropaleontology, Quaternary geology and geomorphology, remote sensing and GIS, sedimentology, and vertebrate paleontology.

Screening of applications will begin on December 15, 1997, and continue until the position is filled. Potential candidates should send a letter of interest, curriculum vitae, and the names of 5 references. Send nominations and applications to: Dr. Richard M. Kettler, Department Chair Search, College of Arts and Sciences, 1223 Oldfather Hall, University of Nebraska—Lincoln, Lincoln, NE 68588-0312. Phone: (402) 472- 2663; fax: 402-472-4917; e-mail: rkettler@unlinfo.unl.edu.

The University of Nebraska—Lincoln is committed to a pluralistic campus community through Affirmative Action and Equal Opportunity and is responsive to the needs of dual career couples. We assure reasonable accommodation under the Americans with Disabilities Act; contact Richard Kettler for assistance.

ASSISTANT PROFESSOR POSITION IN
GEOMORPHOLOGY

The Department of Geology and the Center for Environmental Sciences & Education at Northern Arizona University solicit applications for a tenure-track, Assistant Professor position in geomorphology, to begin in August 1998. The position is a joint appointment between two academic units in the College of Arts & Sciences.

Applicants must have a Ph.D. in Geological Sciences. The successful candidate will be a process-oriented and quantitative geomorphologist with research experience in neotectonics, geochronology, climatology, and ecosystem-level processes. Because NAU is committed to serving the rural, Hispanic, and Native American populations of the Colorado Plateau and Southwest, experience with diverse cultures is desirable.

Primary teaching responsibilities will be courses in geomorphology and climatology. Additionally, the successful applicant will teach introductory core courses in Geology and Environmental Sciences on a rotating basis, and will devlop undergraduate and graduate courses in his/her specialty. He/she will be expected to seek external funding and establish an active research program in geomorphology centered around the Colorado Plateau and the desert Southwest.

Applicants for this position should send a letter outlining teaching and research interests, curriculum vitae and names, addresses (including e-mail), and telephone numbers of five references. Send to Chair, Screening Committee, Department of Geology, Box 4099, Northern Arizona University, Flagstaff, Arizona 86011. The search will remain open until the position is filled; however, the screening committee will begin reviewing applications on December 1, 1997. Visit our web site at http://www.nau.edu. The Northern Arizona University community is composed of faculty, staff, and students from a wide range of cultural backgrounds. Applicants should have the experience and commitment necessary to work with such a diverse population.

CALIFORNIA, BERKELEY 94720-4740. University of California, Berkeley, tenure-track Assistant Professor position, starting 1 July 1998, for a Physical Geographer/ Earth Scientist with primary research in geomorphology and environmental change. A commitment to a high rate of scholarly productivity and excellence in classroom and field methods teaching is expected. Applicant must have Ph.D. or completed dissertation. Submit letter of application, vitae, and complete list of publications, and the names of three references and addresses, by January 12, 1998. Apply: Richard Walker, Chair, Department of Geography.

The University of California is an Equal Opportunity, Affirmative Action Employer.

CALIFORNIA STATE UNIVERSITY, SACRAMENTO

The Geology Department at California State University, Sacramento seeks to fill one tenure-track position in Engineering Geology and/or Surficial Processes at the assistant professor level. Closing date for applications is February 1, 1998, or until position is filled.

Submit resume, letter of application, and three letters of reference to: Dr. Brian Hausback, Geology Department, California State University, Sacramento, 6000 J Street, Sacramento, CA 95819-6043.

Further details can be found at: <http://www./csus/edu/nsm/index.html>

CALIFORNIA INSTITUTE OF TECHNOLOGY
POSTDOCTORAL SCHOLAR IN GEOLOGY

We are seeking a well-qualified individual for a postdoctoral position in geology at Caltech. Expertise of the successful applicant may be in any area of current geological research encompassed by our faculty. These areas include plate tectonics, continental tectonics, earthquake geology, paleomagnetism, magnetostratigraphy, petrology, mineralogy, volcanology, and quaternary geology. The duration of the appointment will be for 2 years, contingent upon good progress in the first year. The annual stipend will be $30,000 or higher in the first year, depending on qualificaitons. Scholars may participate in Caltech's benefit package. Completion of the Ph.D. is required. Caltech is an affirmative action/equal opportunity employer.Women, minorities, veterans, and disabled persons are encouraged to apply. Postdoctoral scholars are eligible to participate in Caltech health plans.

Applications may be acquired through our website, www.gps.caltech.edu. Further information may be obtained by contacting Marcia Hudson, GPS Division Office, 170-25, Caltech, Pasadena, CA 91125 (tel.: (626) 395-6111; e-mail: marcia@gps.caltech.edu)

ENVIRONMENTAL GEOCHEMIST
SIMON FRASER UNIVERSITY

The Earth Sciences Program is seeking to fill a tenure-track position at the Assistant Professor level in the area of geochemistry. The ideal candidate will be capable of teaching some combination of low-temperature, environmental, and isotope geography at the graduate and undergraduate levels, and will have an established record of research in geochemistry related to field studies. The successful candidate must have a commitment to both undergraduate and graduate education as well as to developing a funded research program. An interest in field research, as well as laboratory studies, is a necessity. For detailed information about this position refer to the Program's home page: http://www.sfu.ca/earth-sciences.

A Ph.D. is required at the time of appointment and the successful candidate will be eligible, prefereble, for professional registration in BC (APEGBC). The appointment will commence in September 1998. In accordance with Canadian Immigration requirements this advertisement is directed to Canadian citizens and Permanent Residents. Simon Fraser University is committed to the principle of equity in employment and offers equal employment opportunities to qualified applicants. This position is subject to

budgetary approval. Applicants should send a curriculum vitae, a letter describing current and near-term research interests and copies of appropriate reprints; an e-mail address, a fax number and names of at least three referees by January 31, 1998 to: Dr. Michael C. Roberts, Director, Earth Sciences Program, Simon Fraser University, Burnaby, BC, Canada, V5A 1S6. Phone (604) 291-4657; Fax (604) 291-4198; mroberts@sfu.ca.

SEDIMENTARY GEOLOGY AT DUKE UNIVERSITY

The Division of Earth & Ocean Sciences (EOS) of the Nicholas School of the Environment at Duke University invites applications for an anticipated tenure-track position in the general area of sedimentary geology to be filled at the assistant professor level. The starting date will be open, but we hope to fill the position by fall 1998.

EOS at Duke includes 14 full-time faculty, 3 faculty with secondary appointments from other units, and 3 research scientists. Research and educational programs of EOS cover a broad spectrum of subdisciplines in geology, marine geology, hydrology, and oceanography. Supporting facilities at Duke include a wide range of computer hardware and software, analytical equipment, laboratories,and research vessels. We look forward to receiving applications from qualified applicants who will enhance the existing strengths of EOS and NSOE in these areas. Please see our web site at http://www.geo.duke.edu for addtional information.

The successful candidate will hold a Ph.D. degree and will be expected to develop a vigorous research program in his or her specialty as well as being committed to both undergraduate and graduate teaching, including B.S., M.S., and Ph.D. level geology degree candidates. The position is broadly defined in terms of specialty and could include outstanding individuals with innovative approaches to stratigraphy, sedimentation, sedimentary petrography, basin analysis, etc. We especially encourage applications from candidates who use the sedimentary record in investigations of global change and tectonics.

Send vitae and names of 3 references to: Chair of the Search Committee, Division of Earth & Ocean Sciences, Box 90230, Duke University, Durham, NC 27708-0230. All applications received by March 1, 1998 will be guaranteed consideration. Duke University is an Equal Opportunity/ Affirmative Action Employer.

TENURE-TRACK FACULTY POSITION
SOUTHWEST TEXAS STATE UNIVERSITY

The Department of Physics at Southwest Texas State University (SWT) invites application for a tenure-track, assistant professor of geology position to begin September 1, 1998. Geology faculty is housed administratively within the Department of Physics and offer a minor in geology. The successful applicant must have a Ph.D. in geology with a strong commitment to excellence in teaching and scholarship. The courses that must be taught are Physical and Historical Geology, Mineralogy, Hydrogeology, Sedimentation and Stratigraphy, Applied Geology, and a Field Course in Geology. Send curriculum vitae with publications list, a list of three references with addresses and telephone numbers, and a brief statement of research interest and teaching philosophy to Dr. James R. Crawford, Department of Physics, Southwest Texas State University, San Marcos, TX 78666-4616. Completed applications will be reviewed starting January 15, 1998. SWT has an enrollment of over 20,000 and is located on the edge of the Hill Country in central Texas between Austin and San Antonio. Southwest Texas State University is an Affirmative Action/Equal Employment Opportunity employer and encourages applications from qualified minority and women applicants.

ENVIRONMENTAL GEOSCIENCE
MIDDLEBURY COLLEGE

The Geology Department invites applications for an entry-level tenure-track appointment in environmental geoscience beginning September, 1998. Appointment will be made at the rank of assistant Professor (Ph.D.) or Instructor (ABD). Candidates should have training in environmental aspects of geology and related fields. Expertise should be in one (preferably more) of the following subfields: earth resources and economic geology, soils, sedimentary geology, low-temperature geochemistry, hydrology and environmental geology. The successful candidate will be responsible for teaching introductory-level geology courses and courses in the interdisciplinary environmental studies program. A vigorous student/faculty research program, particularly on environmental problems, is

Classifieds *continued on p. 44*

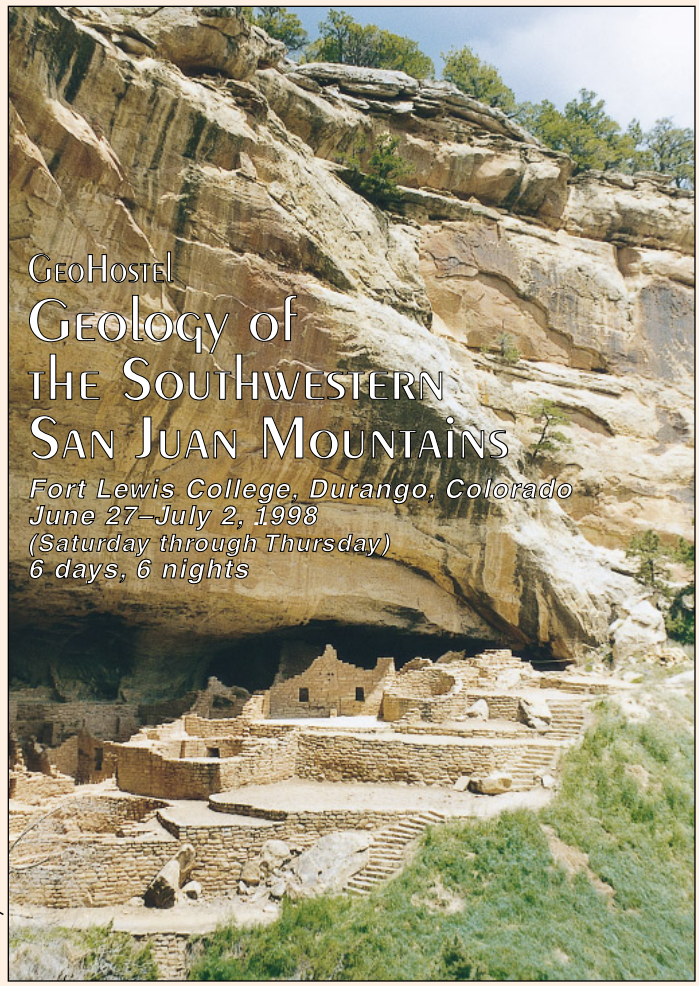
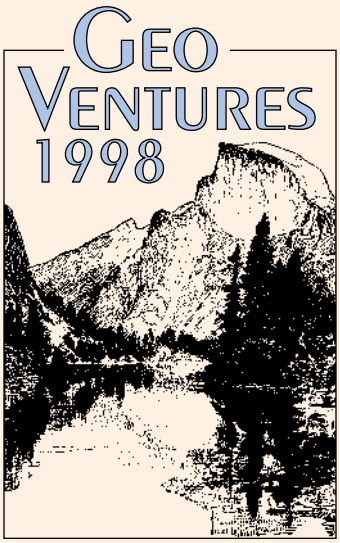


Photo by Ken Kolm.

Scientific Leaders

Gregory Holden and Kenneth Kolm,
Colorado School of Mines, Golden, Colorado

Greg Holden and Ken Kolm are experienced GeoHostel leaders and ran a Durango GeoHostel in 1992. Both are associate professors at the Colorado School of Mines and know the Durango area well. You will find them informed, informing, and enthusiastic.



Description

Durango, Colorado, was founded more than a century ago as the supply center for the mining camps of the San Juan Mountains. Located at the boundary of the Colorado Plateau and the Colorado Rockies, the town today is the recreational center for some of the most scenic, historic, and geologically diverse country in the west. The Durango townsite was the terminus to the Ice Age Animas River glacier, largest to drain the San Juan icefield. Fort Lewis College is 300 feet above the town, on the remnant of an outwash terrace. Erosion during Neogene uplift has exposed Precambrian basement rocks, a complete Paleozoic and Mesozoic sedimentary section, and Tertiary caldera-related pyroclastic rocks and associated mineralization. The area is home to the historic Durango & Silverton Narrow Gauge Railroad, Anasazi Indian ruins, ghost towns, and spectacular mountain wildflowers and scenery.

Lodging, Meals, and Ground Transportation

The group will be lodged at Fort Lewis College, West Hall. All lodging is based on single occupancy, or doubles for couples. Meals will include plentiful hors d'oeuvres at the Welcoming Reception–Orientation on Saturday evening, daily breakfasts and sack lunches, and a hearty farewell dinner on Thursday evening. Field trip transportation will be provided in air-conditioned, 15-passenger vans.

Fee and Payment

$660 for GSA Members $710 for Nonmembers
$100 deposit is due with your reservation and is refundable through April 30, less $20 processing fee.
Total balance due: April 30.

Included: Classroom programs and materials; field trip transportation; lodging for 6 nights (single-occupancy, or double for couples); breakfast and lunch daily, train ride on the Durango & Silverton Narrow Gauge Railroad, welcoming and farewell events.

Not included: Transportation to and from Durango, Colorado; transportation during hours outside field trips; and other expenses not specifically included.

CLASSIFIED ADVERTISING *continued from p. 43*

expected. Candidates should provide evidence of commitment to excellent teaching and demonstrate scholarly potential. The successful candidate will complement a 4.5-person faculty with expertise in marine geology, oceanography, geomorphology, structural geology and igneous petrology. The department runs a field-oriented program centered on the natural environment in Vermont. The department has XRD, SEM and ICAP lab facilities, a modern, well-equipped research vessel on Lake Champlain, up-to-date computer facilities including a silicon Graphic workstation, and access to a high-speed network and a GIS laboratory. A new science facility is under construction and is scheduled for completion in the fall of 1999. Send a letter of application with curriculum vitae, statement of research and teaching interests, transcripts, a sample of scholarly work, and three letters of recommendation, to Patricia L. Manley, Chair of Search Committee, Geology Department, Middlebury College, Middlebury, VT 05753 by January 30, 1998. Middlebury College is an Equal Opportunity Employer and it encourages applications from women and members of minority groups.

STRUCTURAL GEOLOGY / TECTONICS

Boise State University seeks applications for a tenure-track position at the assistant professor level beginning August, 1998. Individuals with research and teaching interests in any sub-discipline of structural geology, including rock mechanics, fabric analysis, and active tectonics, or in tectonophysics, are encouraged to apply. A Ph.D. is required at the time of appointment.

Applicants should have the abilities and interest necessary to effectively incorporate field studies in their teaching and research. The successful candidate will also possess strong quantitative skills and will be expected to: 1) teach the undergraduate course in structural geology and additional graduate and undergraduate courses in his/her field of expertise, 2) supervise M.S. theses and undergraduate research projects, and 3) establish an active, externally funded research program.

Please submit a curriculum vitae, a list of publications, statement of research and teaching interests and objectives, and the names, phone numbers and e-mail addresses of three references to: Search Committee, Department of Geosciences, Boise State University, Boise, ID 83725. Review of applications will begin February 1, 1998. Details about our department can be found on the World Wide Web at: http://earth.idbsu.edu. BSU is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

EMPORIA STATE UNIVERSITY
EARTH-SYSTEM SCIENCE

The Earth Science department solicits applications in the field of earth-system science for an entry-level, tenure-track position to begin fall semester 1998. Teaching responsibility includes an introductory course in earth science (geology, meteorology, astronomy), undergraduate courses in physical geography, climatology and meteorology, and graduate courses in the area of expertise. Research interests should include aspects of interactions within the atmosphere, hydrosphere and lithosphere in the Earth (modern or ancient) or on other planets. Experience would be desirable for computer modeling, remote sensing, field investigations, authoring web pages, and/or distance learning.

Ph.D. required at the time of employment, August 9, 1998. Screening will begin January 15, 1998 and continue until the position is filled. Send letter of application addressing teaching goals and research interests, complete resume, transcripts, relevant supporting materials including evidence of teaching experience of potential, and three letters of reference under separate cover to J. S. Aber, Earth Science, Campus Box 4030, Emporia State University, Emporia, KS 66801-5087. Telephone (316) 341-5981; fax 316/341-5886; e-mail aberjame@esumail.

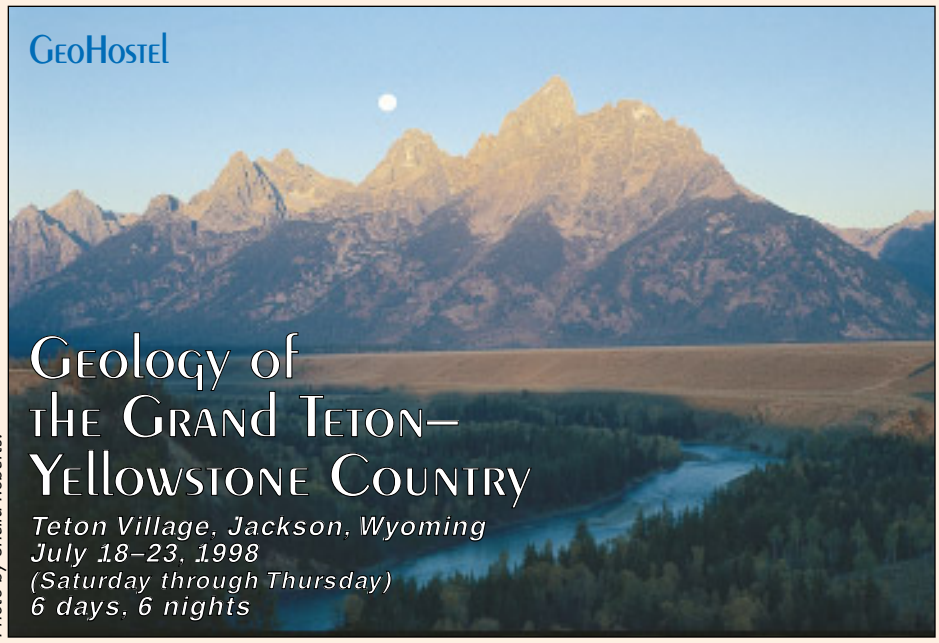


Photo by Sheila Roberts.

Scientific Leaders

Rob Thomas and Sheila Roberts,
Western Montana College–UM, Dillon, Montana

Rob Thomas is an associate professor and chair of the Department of Environmental Sciences at Western Montana College–UM, in Dillon, Montana. Rob developed an interest in the geology of the Grand Teton–Yellowstone country while working on Cambrian mass extinctions for his dissertation at the University of Washington. Since then, his research has broadened to include the study of the dynamics of carbonate platform development and destruction, the origin and timing of extensional tectonism in southwestern Montana, interdisciplinary geosciences program development, and geoscience teacher-education reform.

Sheila Roberts is an assistant professor of geology in the Department of Environmental Sciences at Western Montana College–UM, in Dillon, Montana. Having lived and worked much of her life in Montana and Wyoming, she has a deep passion for educating people about the geology of her home area. She has extensive experience with the geology of Wyoming as a result of her tenure as geoscience editor at the Wyoming Geological Survey in Laramie. Her doctoral research at the University of Calgary focused on Pleistocene paleoclimates recorded in saline lacustrine sediments of Death Valley, California.

Description

The geology of the Grand Teton–Yellowstone country is some of the most spectacular in North America. From Archean metamorphic rocks to Quaternary glacial deposits, the Grand Teton-Yellowstone region has geology that promotes dynamic discussion and debate. The GeoHostel will include trips to look at Archean through Holocene geology of the Grand Tetons, the glacial and tectonic history of Jackson Hole, the eruptive history of the Yellowstone caldera in Yellowstone National Park, mafic volcanics of the Snake River Plain country, and extensional tectonics of the "wake zone" of the Yellowstone hot spot in the Quake Lake region of southwestern Montana. The trips are both full day and half-day, and some leisure time will be available to enjoy sightseeing in Jackson and the spectacular scenery of the Grand Teton–Yellowstone country.

Lodging, Meals, and Ground Transportation

The group will be lodged at The Hostel[s] in Teton Village. All lodging is based on single occupancy, or doubles for couples. Meals will include plentiful hors d'oeuvres at the Welcoming Reception–Orientation on Saturday evening, daily breakfasts and sack lunches, and a hearty farewell dinner on Thursday evening. Field trip transportation will be provided in air-conditioned, 15-passenger vans.

Fee and Payment

$675 for GSA Members $725 for Nonmembers
$100 deposit is due with your reservation and is refundable through May 29, less $20 processing fee.
Total balance due: May 29.

Included: Classroom programs and materials; field trip transportation; lodging for 6 nights (single-occupancy, or double for couples); breakfast and lunch daily, welcoming and farewell events.

Not included: Transportation to and from Jackson, Wyoming; transportation during hours outside field trips; and other expenses not specifically included.

emporia.edu; website http://www.emporia.edu/www.earthsci/earthsci.htm. AA/EOE

THREE-YEAR FACULTY POSITION
IGNEOUS/METAMORPHIC PETROLOGY
HOBART AND WILLIAM SMITH COLLEGES
GENEVA NEW YORK

The Department of Geoscience seeks applications for a full-time, three-year position to replace a colleague on assignment with the Colleges' administration.

This is one of two solid-earth positions in a four-person department. The successful applicant will teach each year introductory geology and mineralogy and in alternate years, either structure or petrology. In addition, an upper level geoscience course which complements the other offerings in the department may be developed for the second and third years. Undergraduate research is very important in the department and this new colleague will work with us to foster it.

The Colleges' web site (www.hws.edu) and the Department's (www.hws.edu/aca/depts/geo/index.html) provide more information about the institution, the Department of Geoscience, its programs and equipment.

To apply, please send 1) a letter describing teaching and research interests, 2) have letters of reference sent by three people familiar with your teaching and research, adn 3) a current resume to: Don Woodrow, Department of Geoscience, Geneva, NY 14456. The Search Committee will begin evaluating applications on December 1 and continue until the position is filled.

MACKAY SCHOOL OF MINES
UNIVERSITY OF NEVADA, RENO

Applications are invited for graduate students to join our program in Geomechanics. One new position is anticipated for a qualified Ph.D. student starting in July 1998 in the area of planetary structural geology and numerical geomechanics. The successful applicant will possess strong academic skills, be highly motivated, and have demonstrated prior experience in research. Applicants must also have background and/or experience in planetary science; M.S. degree in planetary geology or geophysics would be an assest. Related attributes include good field and interpersonal skills along with proficiency in computer applications including unix systems.

For information contact Prof. Richard Schultz, Geomechanics-Rock Fracture Group, Department of Geological Sciences/172, Mackay School of Mines, University of Nevada, Reno, NV 89557-0138; schultz@mines.unr.edu; for information on specific program areas refer to http://unr.edu/homepage/schultz.

ASSISTANT PROFESSOR OF GEOLOGY
UNIVERSITY OF SOUTHERN INDIANA

The Department of Geosciences invites applications for a tenure-track Assistant Professor position beginning Fall Semester, 1998. We seek a broadly trained, field-oriented geologist with a preferred area of speciality in Shallow-Earth Geophysics, Geomorphology, Environmental Geochemistry, or Paleoclimatology. A person capable of offering courses in two or more of the above fields and in related fields such as Field Geology, Structural Geology, Petrology, GIS, and/or Remote Sensing is most desired. Additional responsibilities include supervision of student research and participation in University and community affairs. A Ph.D. is required, but ABD candidates will be considered. Candidates must have a primary interest in undergraduate teaching and a clear vision for a research program that involves undergraduate students.

The University of Southern Indiana is a young and vibrant institution that is the fastest-growing university in Indiana (http://www.usi.edu/). The department has about 20 undergraduate majors and is currently expanding in physical space. Program start-up funds are available. The

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University is committed to excellence in teaching, scholarship and professional activity, and service to the University and the community.

Submit a resume, a statement of teaching and research interests, and names and addresses of three referees to: Search Committee Chair, Dept. of Geosciences, University of Southern Indiana, 8600 University Blvd., Evansville, IN 47712. Review of applications will begin on January 15 and will continue until the position is filled. Minorities and women are encouraged to apply.

USI is an Affirmative Action/Equal Opportunity Employer.

STANFORD UNIVERSITY
ROCK FRACTURE PROJECT

The Rock Fracture Project has an immediate opening for a Postdoctoral Research Scientist to participate in a project characterizing the basic architecture of a reservoir analog. The candidate should have a Ph.D. in Structural Geology with a focus on brittle deformation, preferably faulting, the ability to perform detailed mapping of outcrop-scale features, recognize distribution patterns, and rationalize formation mechanisms. Additional experience in determining petrophysical properties of fault rocks, geomechanical modeling, and seismic image analyses of faults is preferred. The candidates is expected to travel and do field work in remote areas.

This one-year position may be extended for an additional year depending on funding availability. Salary ranges between US$31–35K depending primarily on experience. Applications will be reviewed starting December 15, 1997, and the search will continue until the position is filled. A vitae and other supporting material should be sent to Atilla Aydin, The Rock Fracture Project, Department of Geological and Environmental Sciences, Stanford University, Stanford, California, 94305-2115. E-mail: aydin@pangea.stanford.edu. AA/EOE.

UNIVERSITY OF ALABAMA
DEPARTMENT OF GEOLOGY

The Department of Geology at the University of Alabama invites applications for 2 tenure-track positions at the assistant professor level, beginning August 16, 1998.

Position 1: Surficial Processes. The ideal candidate for this position would be a watershed hydrologist with interests in fluvial systems/sediment transport and/or vadose zone research. The successful candidate will have a quantitative background, a strong field orientation, and a Ph.D. in geology or a related field. The candidate will be expected to establish an active, externally funded research program, attract graduate students, and be an effective classroom teacher. The UA Department of Geology trains M.S. and Ph.D. students in environmental geochemistry and hydrogeology, as well as more traditional areas of geology. Opportunities for interdisciplinary research exist with the Environmental Geology faculty (R. J. Donahoe, W. B. Lyons, and C. Zheng), and other faculty associated with the Center for Freshwater Studies.

The Department has state-of-the-art laboratories and analytical equipment housed in a central analytical facility-for wet chemical, XRF, XRD and electron microscopic techniques. In addition, facilities will be available for analysis of organic compounds by January 2000. Hydrogeologic equipment and facilities include submersible and digital variable-speed pumps, computerized data loggers and sensors, down-well water-quality analyzers and a groundwater modeling laboratory.

Applicants are requested to send a vitae, statements of research and teaching interests, copies of transcripts, and the names and addresses of three references to: Dr. W. Berry Lyons, Search Committee Chair, Department of Geology, Box 870338, The University of Alabama, Tuscaloosa, AL 35487-0338.

Position 2: Reflection Seismology. The ideal candidate for this position would be an individual whose research focuses on understanding the relationship between reflectivity and rock and fluid properties at varous scales of resolution and depth. A Ph.D. in geology, geophysics or a related field is required. and post-doctoral or industry experience in reflection seismology is preferred. Experience with stochastic methods and geophysical inverse theory is desired. The successful candidate will be expected to develop and to teach graduate courses in teh field of specialization, to attract and supervise master's and doctoral students, to obtain external funding to support his/her research efforts, to participate in interdisciplinary team research projects, and to conduct a vigorous research program in the area of reflection seismology. This position is expected to enhance existing program areas in sedimentary basin analysis, sequence and seismic stratigraphy, tectonics, and petroleum systems.

Among the equipment available is a digital, high-resolution, marine seismic-reflection system and a seismic data processing facility based on Sun, RS6000, and SGI workstations; access is available to ground-penetrating radar and to the State super-computer network.

Applicants are requested to send a vitae, statements of research and teaching interests, copies of transcripts, and the names and addresses of three references to: Dr. Ernest A. Mancini, Search Committee, Department of Geology, Box 870338, The University of Alabama, Tuscaloosa, AL 35487-0338.

The UA Department of Geology consists of 11 full-time faculty. Departmental information is available on our web site at <http://www.geo.ua.edu>. Applicants will be reviewed beginning January 16, 1998, but the search will continue until suitable candidates are identified.

The University of Alabama is an Equal-Opportunity, Affirmative-Action Employer. Applications are solicited form women and minority candidates.

EARTH SCIENCE / GEOGRAPHY EDUCATION

Eastern Michigan University's Department of Geography & Geology seeks to fill a tenure-track assistant professor position in Earth Science and Geography Education. Successful applicant's primary responsibility is to teach earth science and geography education methods courses, both undergraduate and graduate. Additional responsibilities include teaching introductory earth science and geography, as well as coordinating the earth science lab program. Interaction with local and regional earth science and geography education groups expected. Position offers an opportunity to develop innovative curricula and pedagogy to serve education majors and to direct masters' theses in a department with a 90-years history. EMU is the nation's largest educator of professional K–12 teachers. A minimum of five years of K-12 Earth Science/Geography teaching experience and evidence of creative teaching are required. Preference given to those with a completed Ph.D./Ed.D. Eastern Michigan University is an EO/AA institution. Women and minorities are encouraged to apply. Send letter of application, cv and the names and addresses of three references to Prof. Michael Kasenow, Search Chair, Position F9819, 318 King Hall, Eastern Michigan University, Ypsilanti, MI 48197. Applications preferred by January 7, 1998, but accepted until position filled.

TWO FACULTY POSITIONS IN GEOSCIENCE
(TENURED OR TENURE-TRACK)
UNIVERSITY OF ILLINOIS AT URBANA–CHAMPAIGN

The Department of Geology, University of Illinois at Urbana–Champaign, invites applications for two full-time (9 month academic year) faculty appointments to begin in August, 1998.We will consider applications at all levels in the following fields: microbial geoscience, mineralogy/environmental mineralogy, sedimentary geology, environmental geochemistry.

At least one of the appointments will be at the senior level in the area of microbial geoscience, although applicants at all levels in each of the disciplines listed above are encouraged to apply. With these positions we will fill the Ralph E. Grim Professor in Geology at the rank of full professor, and also the Environmental Council Professor of Geology. Salary is negotiable.

We seek candidates with demonstrated potential for research and teaching excellence. The successful candidates will be expected to establish innovative, externally funded research programs, and will participate in teaching and student research supervision at all levels. The Department of Geology offers B.S., M.S., and Ph.D. degrees in geology, environemental geology, and geophysics (see our homepage at http://www.geology.uiuc.edu/). Opportunities exist for collaboration with Departmental staff in hydrogeology, geochemistry, structural geology, clay mineralogy, carbonate sedimentology, geophysics, and paleontology. There is also outstanding potential for collaboration with staff in Microbiology, Biochemistry, Civil Engineering, Materials Sciences, with the Illinois State Geological Survey, and with other units on campus.

To apply, please submit a curriculum vitae, a list of publications, a description of research and teaching interests, and the names of three references to Jay D. Bass, Head, Department of Geology, University of Illinois, 1301 W. Green St., Urbana, IL 61801. Please contact Prof. Bass either by e-mail (bass@hercules.geology.uiuc.edu) or by phone (217-333-1018) with any questions about these positions. In order to ensure full consideration, all application materials must be received by Jan. 15, 1998. The University of Illinois is an Equal Opportunity/Affirmative Action Employer.

PRINCETON UNIVERSITY
DEPARTMENT OF GEOSCIENCE
FACULTY POSITION

The Department is seeking applicants for a junior, tenure-track faculty appointment. The search will concentrate on the following areas, but we also encourage outstanding applicants in other areas of the earth sciences.

Surficial and Tectonic Processes — including erosion and deposition, geomorphology, structural geology, continental dynamics, interface between petrology and tectonophysics, andlinks to climate and geochemistry. Paleoclimates — including observational and modeling studies of past as well as present climate. Environmental Mineralogy and Biogeochemistry — chemical and biological processes, particularly with interests in mineralogy and/or microbiology.

Applicants may strengthen, and benefit from, three related programs at Princeton. The Program in Atmospheric and Oceanic Sciences and the NOAA Geophysical Fluid Dynamics Laboratory support numerical modeling of atmospheric and oceanic processes and of present and past climate. The Princeton Environmental Institute is involved in research at the interface of biology, engineering, chemistry, and the geosciences. The Princeton Materials Institute facilitates interdisciplinary research in Materials Sciences.

Send resume, statement of teaching and research interests, and the names, addresses, and phone numbers of at least three references to Professor George H. Philander, Chairman, Department of Geosciences, Princeton University, Princeton, NJ 08544-1003, (609) 258-4100, FAX 609-258-5275. Applications received by January 31, 1998 will receive formal consideration. Princeton University is an Affirmative Action Equal Opportunity Employer; women and members of minority groups are encouraged to apply.

KECK GEOLOGY CONSORTIUM
SUMMER UNDERGRADUATE STUDENT/FACULTY RESEARCH PROJECTS

We seek two geoscientists who can provide research expertise and mentor students in our undergraduate research groups. The first opening is on a project applying GIS to geoscience problems in Texas. The second opening is for either a process sedimentologist to work with Precambrian clastic rocks in Arizona, or for a eprson with expertise in hydrology, water chemistry, or stable isotope geochemistry to work on a watershed analysis in Massachusetts. Candidates may be employed in academia, industry, or government. Preference will be given to applicants from ethnic groups underrepresented in the sciences. A stipendof $4500 and all expenses are paid for participation in a 4- to 5-week summer project. Interested persons should contact Dr. Cathryn A. Manduca, Keck Geology Consortium Coordinator at (507) 646-4425 or e-mail: cmanduca@carleton.edu.

Services & Supplies

Advertise to over 15,000 earth scientists each month! Use this economical column to promote your products and services.

Opportunities for Students

Graduate Research opportunities in Geology, Geochemistry, Geophysics, and Space Physics at UCLA. The Department of Earth and Space Sciences at UCLA is seeking qualified graduate students to join our top-ranked research program in many related fields including volcanology, petrology and isotope geochemistry of active volcanoes around the Pacific rim; tectonics of the Himalayas, Tibetan plateau, and the North American Cordillera; the origin, explosion, and extinction of life; seismology, earth structure, earthquake dynamics, mineral physics, and mantle dynamics; adn the physics of the terrestrial and giant planets, including their climate, space environments, and interaction with the sun. Student support is available through combinations of competitive fellowships, and also graduate research and teaching assistantships. Our graduate programs offer an environment where students are encouraged to explore the frontiers of science working in close collaboration with our faculty. UCLA has outstanding facilities for research including mass spectrometers for analysis of stable and radiogenic isotopes and rare gases, and high resolution ion microprobe, electron microprobe, experimental petrology laboratories, ongoing experiments on the Galileo, Mars Polar Pathfinder, FAST and Polar spacecraft, as well as superb instrument fabrication facilities, a GPS laboratory, one of the continent's most extensive libraries, and we are a principal institution in the Southern California Earthquake Center. Information about

our programs can be obtained by writing Spring Verity, Student Affairs Officer, Department of Earth and Space Sciences, University of California, Los Angeles, CA 90095-1567, or e-mailing verity@ess.ucla.edu, or by calling toll-free (888) ESS-UCLA. (377-8252). Please note that completed applications are due January 15, 1998; applications can be submitted electronically via http://www.gdnet.ucla.edu. Also, watch our evolving departmental home page at http://www.ess.ucla.edu/.

Graduate Research Assistantships in Earth Surface Processes. Research assistantships are available at Iowa State University for motivated Ph.D. and M.S. students with interests in glaciology, geomorphology, or environmental geology. Research opportunities include field experiments on glaciers in Norway, laboratory and field studies of sediment deformation beneath glaciers and on hillslopes, and field studies of gully development in loess soils. For more information, contact Dr. Neal Iverson, Department of Geological and Atmospheric Sciences, Iowa State University, Ames, IA 50011. (515) 294-8048. E-mail: niverson@iastate.edu. Departmental web site: http://www.geology.iastate.edu.

Graduate Traineeship: 4-year traineeships available for graduate study in conjunction with interdisciplinary Research Training Group (RTG) in ecology, geology, archaeology, geography, and soils to enhance training in "Paleorecords of Global Change." Only citizens, nationals, or permanent residents of the U.S. qualify for stipends. The University of Minnesota is an equal opportunity educator and employer. Application deadline January 2, 1998. For application contact Sue Julson, RTG, University of Minnesota, Ecology, Evolution and Behavior, 100 Ecology, 1987 Upper Buford Circle, St. Paul, MN 55108. Phone (612) 624-4238; fax (612) 624-6777; e-mail: julso001@tc.umn.edu.

Graduate Research Opportunities in Active Tectonics. The Geology Dept. at Southern Illinois University at Carbondale offers funding for Masters- or Ph.D.-level research in the area of Active Tectonics. Active Tectonics involves the multidisciplinary study of the Earth's dynamic crust, particularly as it relates to human society such as through earthquake hazard. New graduate-student projects include research in the Pannonian Basin of Hungary and in the Northern Channel Islands off the coast of southern California. For more information about these projects, contact Dr. Nicholas Pinter at npinter@geo.siu.edu or at (618) 453-7375. M.S. and Ph.D. opportunities also exist at Southern Illinois University in the areas of environmental geology, hydrogeology, geophysics, coal geology, and other fields. For more information or to request application material, contact the Geology Department at (618) 453-3351 or mail requests to Geology Dept., Southern Illinois University. Carbondale, IL 62901-4324.

Graduate Studies in Geology & Geophysics, Boston College. The Department of Geology & Geophysics, Boston College, invites applications for graduate study. Students can earn the M.S. in Geology or Geophysics, or the M.S.T., Masters of Science in Teaching, in Geology. We seek applicants with undergraduate degrees in a variety of subject areas, including biology, chemistry, computer science, Earth Sciences, engineering, environmental studies, and mathematics.

Research opportunities are available in interpretive tectonics, structural geology, seismology, environmental geology & geophysics, coastal and estuarine processes, and global change geochemistry. See our web page for further specialties and details about laboratory facilities.

Boston College offers both Teaching and Research Assistantships.

For more information or an application, contact Dept. of Geology & Geophysics, Boston College, Devlin Hall, Room 213, Chestnut Hill, MA 02167-3843. Phone (617) 552-3640. Fax 617-552-2462. E-mail: John.Ebel@bc.edu. http://www.bc.edu/bc_org/avp/cas/geo/geologyhome-page.html.

Applications received by February 1, 1998 will receive fullest consideration for financial assistance.

Needed: for graduate students studying geostatistics at the Federal University of Rio Grande do Sul (UFRGS): Information regarding exhausted diamond mine data or areas without identification on which to apply geostatistics. Please contact Edison Thaddeau Pacheco, Geologist, A. Oswaldo Aranha, 99, Sala 516, 90.035-190, Porto Alegre, RS, Brasil.

Undergraduate Research Opportunities for Students of Color. The Keck Geology Consortium is seeking students from ethnic groups underrepresented in the sciences to participate in its summer research program. Sophomore studnets who have completed at least one geology course are invited to apply for five weeks of research in Texas or Massachusetts. Junior students who have declared a geology major are invited to apply for any of six projects involving four weeks of summer research followed by term or year of independent study at the student's home institution. All applicants must be U.S. citizens or permanent residents and have a faculty sponsor who agrees to supervise their work during the academic year. Students receive a stipendof $1200 and expenses. Information and application mateials are available at www.carleton.edu/curricular/GEOL/resource/keck/keck.html or from Dr. Cathryn A. Manduca, Keck Geology Consortium Coordinator at (507) 646-4425, or e-mail: cmanduca@carleton.edu. Student selection will begin Feb. 8, 1998.

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DHAHRAN, SAUDI ARABIA

DEPARTMENT OF EARTH SCIENCES

The Earth Sciences Department at King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia, seeks qualified candidates with a strong commitment to high quality teaching and research for appointment in the following positions:

1. PETROLEUM GEOLOGIST: (Full Professor or Associate Professor)

   Excellence in seismic interpretation, petrophysics, log interpretation and reservoir modeling is required. Experience in the oil industry is preferred.

2. BIO STRATIGRAPHER : (Full Professor or Associate Professor)

   Excellence in sequence stratigraphy, reservoir characterization, paleontology and core analysis is required. Experience in the oil industry is preferred.

The University offers a two-year renewable contract with a competitive salary commensurate with qualifications and experience; benefits according to the policy that include annual repatriation air tickets for up to four persons; monthly transportation allowance; two months' paid leave; educational assistance grants for school-age dependent children; gratuity; and rent-free air conditioned, furnished accommodation on campus with basic utilities.

The campus has a range of recreational and other facilities, including a medical and dental clinic. Faculty have access to an extensive Library, computing; research and teaching laboratories facilities.

Please send cover letter and resume to:

Dean of Faculty & Personnel Affairs
King Fahd University of Petroleum & Minerals
Dept. No. 9750
Dhahran 31261, Saudi Arabia

GSA ON THE WEB

Visit the GSA Web Site at **http://www.geosociety.org.**
From our home page you can link to many information resources. Here are some highlights:

The **News Notes** page appears periodically to provide information on newsworthy events and includes links to sites with more details.

On our **Membership** page you'll learn about the GSA Employment Service, find out how to become a GSA Campus Representative, or learn how to get forms to join GSA as a professional or as a student. You'll also find information here on how to nominate a GSA Member to Fellowship standing.

Try out the **Meetings** site for a first look at the 1998 Annual Meeting in Toronto, with links to key Toronto Web sites.

From the **Publications** heading, you can visit the GSA Bookstore, where you'll find prices on DNAG publications slashed by 50% (and GSA Member discount still applies). You'll find two Treatise volume revisions, a new 1998 calendar celebrating *Geology's* 25th year, an Explore Kilauea multi-media CD-ROM, a new Reviews in Engineering Geology volume, and several new Memoirs and Special Papers. There's a general page with information for contributors, details on copyright permissions, a free geologic time scale, and more. Don't forget the *GSA Data Repository*—you can download valuable supplementary materials relating to articles in *GSA Bulletin* and *Geology*. As always, you'll find abstracts of all articles in those journals posted monthly.

In the **Education** section, read about GSA's educational programs, including PEP (Partners for Education Program), and the Earth and Space Science Technological Education Project (ESSTEP). Find out about GSA's environment and public policy activities in the **Institute for Environmental Education** section, including updates on the GSA Congressional Science Fellowship program, the Roy J. Shlemon Applied Geology Mentor Program, and the new program on "Prediction in the Earth Sciences."

Under **Foundation** you will find information on the Foundation and the current annual giving campaign, a list of trustees and officers, and several ways to make a planned gift.

See the **Administration** section for information on GSA Medals and Awards, research grants, and other general information about GSA. You can also link to the pages for GSA Sections and Divisions for specific information on each of these.