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Terrestrial Evidence for Two Greenhouse Events in the Latest Cretaceous



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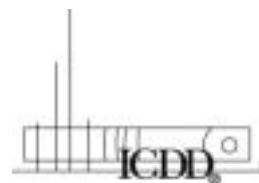
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Cover: Numerous paleosols mark Upper Cretaceous alluvial deposits of the Aguja and overlying Javalina formations near Dawson Creek in Big Bend National Park, Texas. Isotopic analyses of the paleosols have been used to calculate fluctuating temperature and carbon dioxide content of the atmosphere. See "Terrestrial evidence for two greenhouse events in the latest Cretaceous," by Nordt et al., p. 4–9.



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Terrestrial Evidence for Two Greenhouse Events in the Latest Cretaceous

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ABSTRACT

We present a terrestrial record of stable carbon and oxygen isotopes from paleosol carbonate for climate interpretations between ca. 71.0 and 63.6 Ma. Isotopic ratios point to covarying and elevated atmospheric CO₂ pressures and temperatures between ca. 70.0 and 69.0 Ma and ca. 65.5 and 65.0 Ma. These two greenhouse episodes were characterized by atmospheric CO₂ levels between 1000 and 1400 ppm *V* (*V* = volume) and by mean annual temperatures in west Texas between 21 and 23 °C (~35°N paleo-latitude). Atmospheric CO₂ and temperature relations indicate that a doubling of *p*CO₂ was accompanied by an ~0.6 °C increase in temperature. A temperature gradient of ~0.4 °C per degree of latitude is proposed for North America across the Cretaceous-Tertiary boundary when comparing temperature proxies from west Texas with paleobotanical work in North Dakota. Our data demonstrate strong coupling between terrestrial climates and ocean temperatures that were possibly forced by Deccan trap volcanic degassing, leading to dramatic global climate changes.

INTRODUCTION

Characterizing Late Cretaceous (Maastrichtian) and early Tertiary (Danian) climates across the time of the Cretaceous-Tertiary (K-T) boundary (65.0 Ma) can be important for assessing mechanisms governing greenhouse climates, for providing better empirical data for general circulation models, and for detecting potential marine-terrestrial environmental coupling.

An abundant record suggests increased ocean temperatures between ca. 69.5 and 68.5 Ma and between ca. 65.5 and 65.0 Ma based on stable oxygen (O) isotopes of foraminifera (Li and Keller, 1998a, 1998b; Barrera and Savin, 1999;

Keller, 2001; Olsson et al., 2001; Wilf et al., 2003). Terrestrial records during this time are less abundant, but recent evidence from Cojan et al. (2000) and Nordt et al. (2002) strongly indicate that stable carbon (C) and O isotopes from upper Cretaceous paleosol carbonates track shifts in the marine foraminifera isotopic record. They, along with the paleobotanical work of Wilf et al. (2003), provide compelling evidence for both elevated atmospheric CO₂ levels and temperatures between ca. 65.5 and 65.0 Ma coinciding with a well-documented warm ocean excursion, possibly forced by Deccan trap volcanism (see also Keller, 2001; Olsson et al., 2001). In contrast, no marine-terrestrial correlations have been assessed for the warm ocean excursion near 69 Ma, and doing so would further improve our understanding of marine-terrestrial linking and greenhouse events. It is also unclear whether continental ice sheets persisted during the Late Cretaceous because of conflicting ocean temperature estimates (Miller et al., 1999; Stoll and Schrag, 2000; Huber et al., 2002; Miller et al., 2003) and the inability of general circulation models to simulate empirically derived climate data (Upchurch et al., 1999).

To enhance our understanding of climate conditions near and across the K-T boundary, this study constructs atmospheric CO₂ and temperature curves between ca. 71.0 and 63.6 Ma from stable C and O isotopic compositions in paleosol carbonate. These results facilitate a better understanding of potential coupling between atmospheric *p*CO₂ and temperatures and between terrestrial and marine environments during this important time period.

SETTING

The study area is located adjacent to Dawson Creek within the Tornillo

Basin of Big Bend National Park, Texas (29.30°N, 103.52°W). From base to top, the study interval includes the Aguja, Javelina, and Black Peaks Formations, previously documented as a relatively conformable succession of Upper Cretaceous to lowermost Tertiary overbank-dominated alluvial deposits and associated paleosols (Lehman, 1985, 1990, 1991) (Fig. 1). The paleosols commonly contain carbonate nodules and exhibit well-structured surface horizons (A horizons) and subsoils that are weakly developed (Bw horizons), carbonate enriched (Bk horizons), slickensided (Bss horizons), or clay enriched (Bt horizons) (Fig. 1).

METHODS

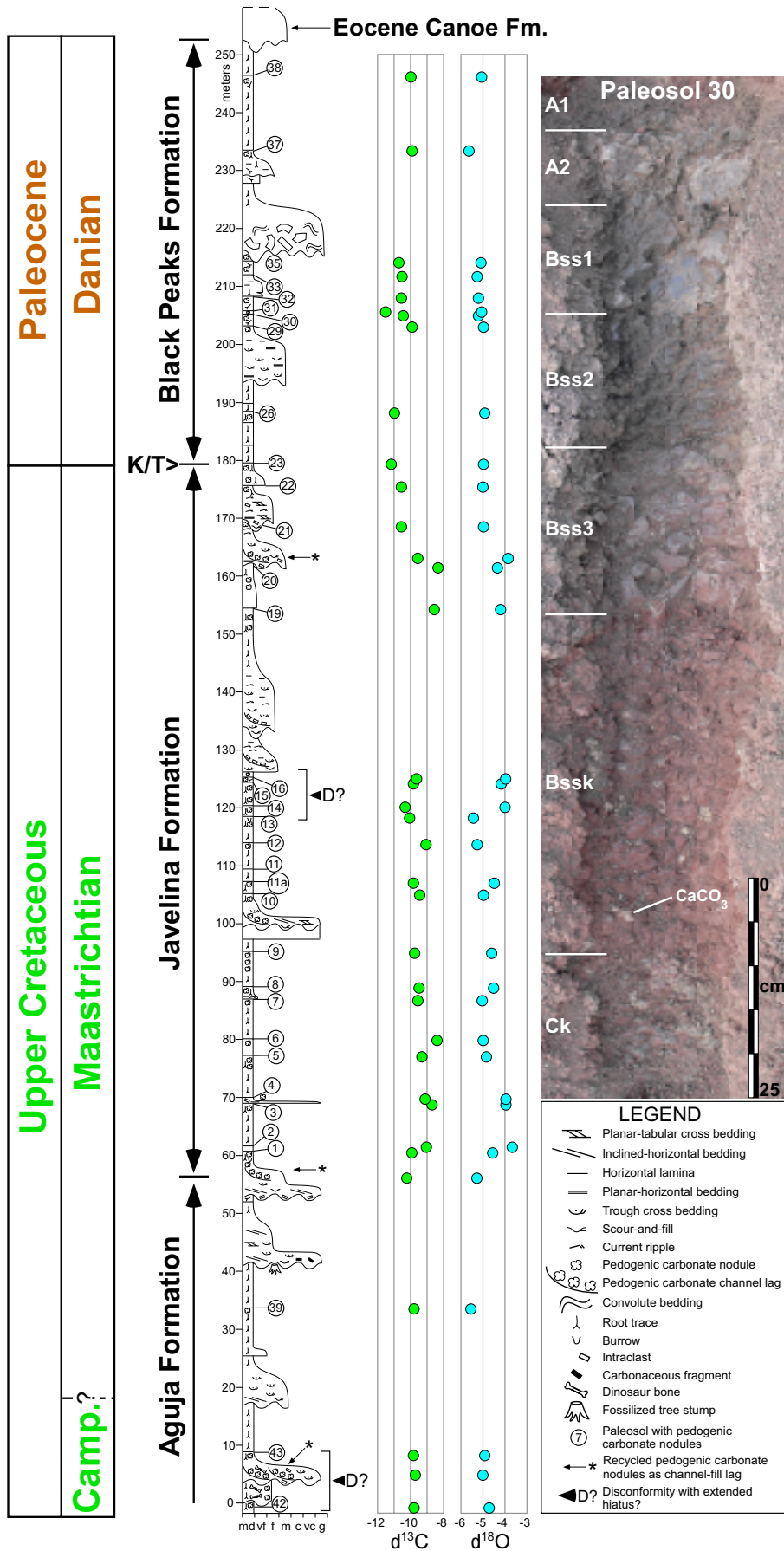
Initial Age Estimates

To bracket the stratigraphic section, we assigned the base an age of 71.0 Ma (Campanian-Maastrichtian boundary) as supported by a putative latest Campanian to earliest Maastrichtian age (Lehman, 1985). The K-T boundary was placed ~70 m below the section top, coincident with a weak iridium anomaly 5 m above the highest dinosaur remains and 26 m below Tertiary fauna (Lehman, 1990). Although the study interval experienced magnetic overprinting, Lehman (1990) concludes that the section top, within the Black Peaks Formation, coincides with polarity Chron C28R. If correct, then the section top is no younger than 63.6 Ma.

We calculated provisional paleosol ages first by assuming that virtually all of the bracketed geologic time (ca. 71.0 to 63.6 Ma) is accounted for by pedogenesis rather than by deposition and then by apportioning time among the paleosols based on soil maturity (see Retallack, 2001). The proportion of time estimated to account for each paleosol was plotted along a graphical linear scale as a cumulative succession within the age range of the study interval. A provisional age for each paleosol could then be assigned by comparing the midpoint location of its duration to the study interval age range (gray line on Fig. 2).

Sampling and Laboratory

Pedogenic carbonate nodules were collected in triplicate from Bk horizons below a depth of 50 cm in each of 33



carbonate-bearing paleosols, with three additional triplicate pedogenic carbonate nodules collected from recycled channel-fill lag. The carbonate nodules were typically round to subround, 0.5–3.0 cm in diameter (Fig. 1), and composed of distinctive micrite (fine-grained) and sparry (coarse-grained) phases. We collected micritic calcite for ¹³C and ¹⁸O analysis under the assumption that it is a conservative tracer of climatic conditions during the time of paleosol formation (Driese and Mora, 1993). The triplicate isotopic values were averaged for each paleosol to assess internal variability versus long-term trends.

Approximately 5 mg of calcite was collected from each nodule using a 2.4 mm diameter drill bit. A 300 µg aliquot of this sample was digested in anhydrous phosphoric acid at 90 °C in a Micromass Multiprep Autosampler and the resulting CO₂ analyzed for ¹³C and ¹⁸O content on a VG PRISM II gas-source mass spectrometer. The laboratory standard error was <0.01‰ for both carbon and oxygen, with results reported relative to the Peedee belemnite (PDB) standard.

Atmospheric pCO₂ Estimates

For estimates of atmospheric CO₂ concentrations, we used the paleosol carbonate barometer, which permits calculation of the contributions of atmospheric CO₂ to the total soil CO₂ pool during soil formation (Cerling, 1999):

$$C_a = S_z \left[\frac{\delta^{13}C_s - 1.0044\delta^{13}C_r - 4.4}{\delta^{13}C_s - \delta^{13}C_a} \right]$$

where C_a is atmospheric CO₂ concentration (ppm V), S_z is soil respired CO₂ concentration (ppm V), and ¹³C_s, ¹³C_r, and ¹³C_a are isotopic compositions of soil CO₂, soil-respired CO₂, and atmospheric CO₂, respectively. Assuming that

Figure 1. Stratigraphic correlation chart of the study area compiled from Lehman (1985, 1990, 1991), Gradstein et al. (1994), and Berggren et al. (1995); measured stratigraphic column with designations for the sampled paleosols; and photograph of paleosol 30 illustrating horizon designations and one of the sampled pedogenic carbonate nodules. Stable carbon (¹³C) and oxygen (¹⁸O) isotopes from paleosol carbonate are plotted to show field distributions.

the soil-atmosphere-ocean isotopic system is in equilibrium, elevated atmospheric CO₂ concentrations are isotopically recorded in the soil CO₂ pool and, ultimately, pedogenic carbonate.

After constructing a five-point running average of the ¹³C of planktic foraminifera from Deep Sea Drilling Project (DSDP) core 525A from the South Atlantic (Li and Keller, 1998a, 1998b) and DSDP 577 from the North Pacific (Shackleton and Bleil, 1985), and assuming a ‰ isotopic equilibrium fractionation between ocean and atmospheric CO₂ (Lynch-Stieglitz et al., 1995), we estimated the ¹³C of atmospheric CO₂ (¹³C_a) for the model equation. Given low levels of paleosol organic carbon in the study area, we estimated the ¹³C of respired soil CO₂ (¹³C_r) by an empirical equation relating the ¹³C of atmospheric CO₂ to paleosol organic carbon ($\delta^{13}C_{atm} = (\delta^{13}C_{organic} + 18.67)/1.10$) (Arens et al., 2000). This equation yields results in agreement with measured isotopic organic carbon values across the K-T boundary in other localities (Grocke, 1998; Arens and Jahren, 2000), with measured isotopic fractionation between modern atmospheric CO₂ and plants during photosynthesis (Buchmann et al., 1998), and with an average isotopic value of ‰ measured from three charcoal samples collected from the Aguja Formation in the study area. Temperatures determined from paleosol stable O isotopes were used to calculate the temperature-dependent carbonate equilibria fractionation (Romanek et al., 1992) in order to estimate paleosol ¹³CO₂ (¹³C_c) from measured isotopic values of paleosol carbonate. Based on sedimentological interpretations at paleo-latitude of ‰, Robinson-Roberts and Kirschbaum (1995) suggest the presence of a subtropical climate during paleosol pedogenesis. Consequently, we used a range of 5000 to 7000 ppm V for soil CO₂ concentration (S_z) (see also Brook et al., 1983; Ekart et al., 1999). Isotopically, it is assumed that the primary photosynthetic pathway across the K-T boundary was from C₃ plants (Grocke, 1998).

Temperature Estimates

Temperatures were calculated by simultaneous solution of two equations that relate the stable O isotopic composition of meteoric waters to ambient temperatures. These equations describe (1) the fractionation of oxygen isotopes from water into calcite during pedogenesis (Friedman and O'Neil, 1977), and (2) the correlation between oxygen isotopes of meteoric water and mean annual air temperature (Fricke and O'Neil, 1999). The resulting equation (3) uniquely describes mean annual air temperatures from measured oxygen isotopic compositions of pedogenic calcite:

$$\delta^{18}O_{calcite}(SMOW) - \delta^{18}O_{water}(SMOW) = 2.78 (10^6 T^{-2}) - 2.89 \quad (1)$$

$$\delta^{18}O_{water}(SMOW) = 0.498 (T-273) - 13.20 \quad (2)$$

$$-0.498 T^3 + (\delta^{18}O_{calcite}(SMOW) + 152.04) T^2 - 2.78 \cdot 10^6 = 0 \quad (3)$$

where *T* is temperature in kelvin.

There is an inverse relationship between the ¹⁸O of meteoric water and latitude and between latitude and temperature (*r*² = 0.60 for mean annual temperatures) in continental North America today (Fricke and O'Neil, 1999). In addition, White

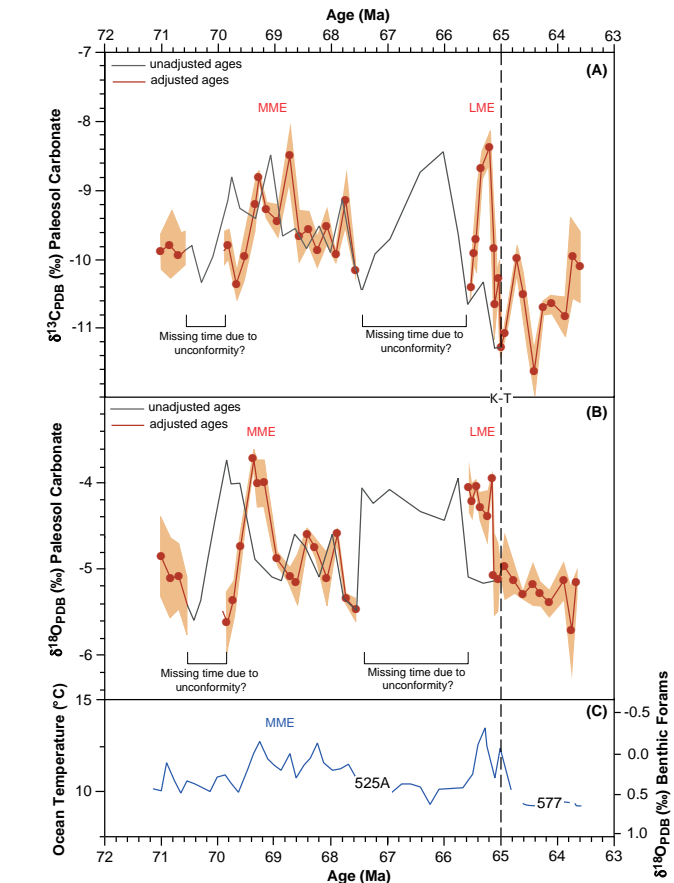


Figure 2. Stable carbon (A) and oxygen (B) isotope values measured from paleosol carbonate in the study area. Gray curves are the chronologically unadjusted isotopic data estimated by the techniques presented in “Methods” section. Brown curves are chronologically adjusted chemostratigraphically to fit the marine record and used for ¹³C values in the paleobarometer equation and for ¹⁸O values in the temperature equations. The one standard deviation window (shaded brown) is created from triplicate isotopic values from each paleosol. C: Stable O isotope curves from DSDP 525A from the South Atlantic (Li and Keller, 1998a, 1998b) and DSDP 577 from the North Pacific (Shackleton and Bleil, 1985). See Barrera and Savin (1999) for similar isotopic curves globally.

et al. (2001) show that during the middle Cretaceous, stable O isotope ratios of rainfall, as estimated from sphaerosiderite in wetland paleosols, systematically decreased with increasing latitude along the Western Interior Seaway. We proceed under the assumption that these modern and middle Cretaceous trends hold for the latest Cretaceous in our study interval. However, effects of latitude, coastal setting, rainfall amount, and altitude can shift oxygen isotopic values out of equilibrium with meteoric water (Rozanski et al., 1993). Latitudinal effects are prominent between 20°N and 20°S latitude, where the source area for most global water vapor originates and does not vary isotopically. The west Texas study area, however, is outside of this latitudinal range. The coastal effect can enrich the heavier ¹⁸O isotope in meteoric water of coastal settings, but during the K-T transition, the west Texas study area was typically at least 150 km away (Lillegraven and

Ostresh, 1990; Lehman, 1991; Davidoff and Yancey, 1993; Moran-Zenteno, 1994). The effect of precipitation amount is typical of monsoonal climates where rainwater becomes enriched in the heavier ^{18}O oxygen isotope from rain out of the lighter ^{18}O oxygen isotope, a situation not present in the study area during the K-T transition (Wolfe and Upchurch, 1987). There is no reason to believe that orographic or altitude effects were important (Lehman, 1991). Thus, the ^{18}O of pedogenic carbonate should be a reasonable proxy for air temperature based on global relationships between the ^{18}O of meteoric water and temperature.

Potential evaporative enrichment during pedogenesis and isotopic exchange with fluids after burial adds further uncertainty to temperature interpretations derived from oxygen isotopes in pedogenic carbonate (Cerling, 1984). Despite these potential problems, we use stable O isotopes and the Fricke and O'Neil (1999) relation for modern climates to estimate temperatures from west Texas paleosols based on the following observations: (1) shallow burial depth (<2 km) minimizes temperature effects on isotopic redistributions; (2) pedogenic depth functions of mobile constituents indicate minimal diagenetic alteration after burial; and (3) depth to carbonate (>50–150 cm) and deeply leached soil profiles strongly suggest the climate was humid subtropical, eliminating potential evaporative enrichment effects typical of arid climates (Cerling, 1984; Cerling and Quade, 1993).

TERRESTRIAL-MARINE CORRELATIONS

Stable C and O isotopes reveal covarying trends in the west Texas paleosol carbonate record (Fig. 2). Plotting of the chronologically unadjusted paleosol isotopic data (gray curves, Figs. 2A and 2B) against the marine ^{18}O record of benthic foraminifera (blue curve, Fig. 2C) illustrates a close, yet imperfect, correlation. The two major paleosol isotopic peaks precede those observed in the marine record by ~0.8–1.0 m.y. The imprecise correlation between the alluvial and marine record may reflect the presence of two significant unconformities within the Dawson Creek succession. The two isotopic peaks occur

above alluvial intervals characterized by the most mature and well-drained paleosols, an observation that is typically attributed to periods of lowered base level and associated channel incisement and prolonged interfluvial weathering (e.g., Wright and Marriott, 1993; Retallack, 1998). We propose that these two zones of mature paleosols record unconformities such that the isotopic record is incomplete and can be reasonably shifted to younger ages to more precisely match the marine record. This shift is reflected in the chemostratigraphically adjusted isotopic curves (brown line, Figs. 2A and 2B).

The adjusted curves from west Texas place the two isotopic peaks in the Maastrichtian between ca. 70.0 and 69.0 Ma and ca. 65.5 and 65.0 Ma. Because covarying and elevated paleosol O and C isotopic proportions indicate relatively higher atmospheric CO_2 concentrations and terrestrial temperatures (see Methods), we conclude that these time intervals and associated warm ocean waters indicate the presence of two global greenhouse climates in the Maastrichtian. Carbon and oxygen isotopic values in the paleosols each decline appreciably immediately before and through the K-T boundary into the Danian, indicating a return to somewhat lower atmospheric CO_2 concentrations and a cooling trend.

The marine record ca. 70–69 Ma is characterized by an abrupt reorganization of oceanic circulation and the first wave of Late Cretaceous extinctions, called the Mid-Maastrichtian Event (Frank and Arthur, 1999; Keller, 2001; Bralower et al., 2002). Based on chemostratigraphic correlation, the early greenhouse episode in the paleosol record from west Texas is also associated with the Mid-Maastrichtian Event (MME). The second greenhouse interval detected in the paleosol record, which we designate the Late Maastrichtian Event (LME), is chemostratigraphically correlated to warm ocean waters and the initiation of the most severe wave of end-Cretaceous mass extinctions before the K-T boundary (Li and Keller, 1998a, 1998b; Keller, 2001; Adatte et al., 2002).

TERRESTRIAL-CLIMATE CORRELATIONS

Conversion of the paleosol isotopic

data into atmospheric CO_2 concentrations and terrestrial temperatures reveals further information about climate across the K-T boundary (Fig. 3). Atmospheric $p\text{CO}_2$ during the MME was between ~1000 and 1200 ppmV, with mean annual temperatures peaking near 22°C. This also coincides with an increase in ocean temperature of ~3°C. Although this climate event appears to have emerged relatively rapidly, both the marine and associated terrestrial records indicate that the greenhouse condition subsided into background levels during a protracted transition. Following the MME, between ca. 68.5 and 67.5 Ma, atmospheric CO_2 levels ranged from ~400 to 600 ppmV and estimated temperatures from ~17.5 and 19°C, before dropping further just prior to the unconformity at 67.5 Ma. Based on estimates from other localities, atmospheric CO_2 levels ranged from ~500 to 800 ppmV during the west Texas unconformity interval between ca. 67.5 and 65.5 Ma.

Figure 3 suggests that the greenhouse condition during the LME started at about the same rate-increase of atmospheric CO_2 and temperature as the MME, but dissipated more abruptly than the MME. The LME is characterized by calculated atmospheric CO_2 levels of ~1400 ppmV and temperatures of between 21 and 22°C (Fig. 3). Elevated CO_2 levels from other studies corroborate this greenhouse interval, as do a temperature increase by ~5°C in North Dakota (Fig. 3) and a temperature increase by ~3.5°C in ocean water (Fig. 2). Immediately before the K-T boundary, CO_2 concentrations dropped dramatically to below modern levels, whereas temperatures declined by ~4–5°C. The $p\text{CO}_2$ spike at the K-T boundary from Beerling et al. (2002) was estimated based on the effects of a bolide impact instantaneously transferring large quantities of carbon from the lithosphere into the atmosphere. In the Danian, near 64.6 Ma, a final $p\text{CO}_2$ peak of approximately 800 ppmV occurred in the west Texas study area, although temperatures remained relatively steady. Atmospheric CO_2 estimates from other areas confirm decreasing levels in the Danian, as do temperature data from North Dakota. When comparing the temperature proxy from North Dakota and west Texas, there is a temperature

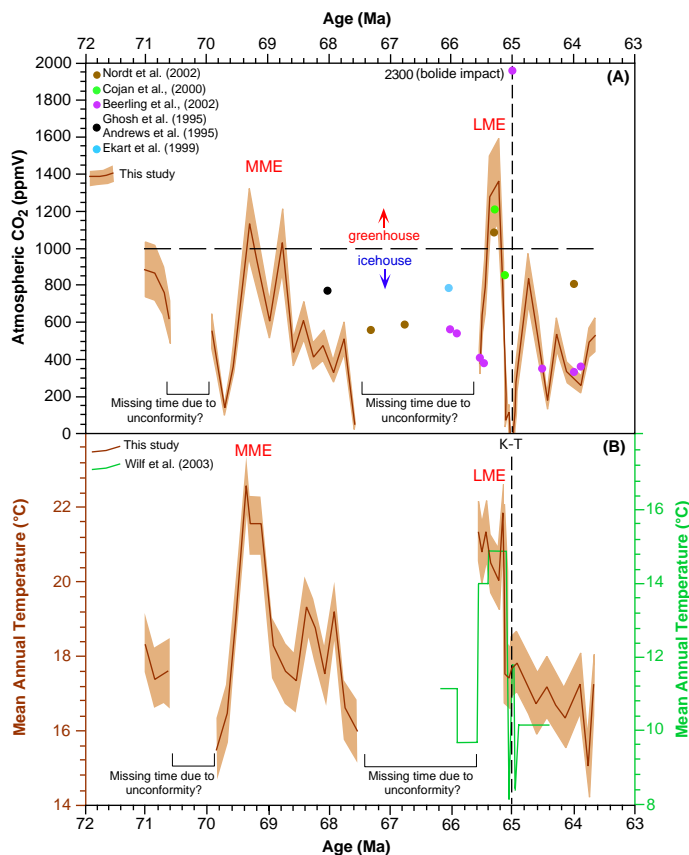


Figure 3. Calculated atmospheric CO₂ concentration and mean annual temperature curves in the study area. **A:** Data for pCO₂ from the west Texas study area shown with a range (shaded area) generated by varying S(z) from 5000 to 7000 ppmV typical of warm, low latitude settings (see Brook et al., 1983; Ekart et al., 1999). For India (Ghosh et al., 1995; Andrews et al., 1995) paleosol carbonate calculations are based on S(z) of 6000 ppmV for a latitude of 25–30°N. For paleosol carbonate data from France (Cojan et al., 2000) and Utah (Ekart et al., 1999), S(z) of 5000 ppmV was used for a latitude of 40–45°N. Paleosol carbonate data from Canada (Nordt et al., 2002) were calculated with an S(z) of 4000 ppmV for a latitude of 50°N. Atmospheric CO₂ estimates from Beerling et al. (2002) are from modeling of a stomatal index of land plant leaves. **B:** Temperature curve from the west Texas study area shown with a one-standard deviation window based on triplicate ¹⁸O values from paleosol carbonate. The temperature curve from Wilf et al. (2003) is from paleobotanical evidence in North Dakota (49°N).

gradient of ~0.4 °C per degree of latitude, which is approximately one-third less than the modern temperature gradient for North America.

Some workers interpret relatively high foraminiferal ¹⁸O values and accompanying low sea level as indicative of the formation of continental ice sheets in the Late Cretaceous (Miller et al., 1999; Stoll and Schrag, 2000; Miller et al., 2003). Other marine ¹⁸O interpretations for the same time interval argue for the presence of persistent greenhouse conditions (Huber et al., 2002). Excluding the two isotopic spikes, average atmospheric CO₂ concentration estimated from the west Texas study interval is ~500 ppmV with an average temperature of ~18 °C. Global circulation models predict that extensive continental ice sheets should begin to form below atmospheric CO₂ levels of 1000 ppmV when mean global

temperatures fall below 20 °C (Oglesby and Saltman, 1990; DeConto and Pollard, 2003). Thus, our data cannot exclude the possibility of the presence of ice sheets during the K-T transition based on these climatic parameters.

Our data for the entire study interval reveal a relatively weak ($r^2 = 0.30$), but positive correlation between atmospheric CO₂ concentration and temperature, in which a doubling of CO₂ is accompanied by an ~0.6 °C increase in temperature. This is considerably less than the 2–4 °C temperature increase forecasted for a doubling of atmospheric CO₂ concentration in the next century (Adem and Garduno, 1998; Tett et al., 1999).

Ocean warming just prior to the K-T boundary has been noted to coincide with Deccan trap volcanism in India (Li and Keller, 1998a, 1998b; Barrera and Savin, 1999; Keller, 2001; Olsson et al., 2001; Wilf et al., 2003). Recent dating constrains two-thirds of Deccan trap flood basalt deposition to between 65.4 and 65.2 Ma (Hofmann et al., 2000), making it a strong candidate for CO₂ release causing the LME. Deccan trap volcanism began shortly after 69.0 Ma and lasted until 64.0 Ma (Hofmann et al., 2000), an interval that also brackets the MME and the atmospheric pCO₂ spike near 64.6 Ma.

CONCLUSIONS

Results from this investigation demonstrate that stable C and O isotopes from paleosol carbonate correlate well with the marine isotopic record and, when taken together, point to two intense greenhouse events in the Maastrichtian. These conclusions suggest that dramatic climate fluctuations were ongoing for several million years before the end-Cretaceous mass extinction. Further, they provide empirical evidence for atmospheric warming associated with elevated atmospheric CO₂ levels.

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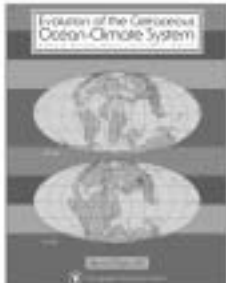
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UPCOMING DEADLINES

Committee Service

Nominations Due February 1, 2004

Candidates are needed for service on the following GSA committees: Arthur L. Day Medal Award; Education; Geology and Public Policy; Honorary Fellows; Joint Technical Program; Membership; Minorities and Women in the Geosciences; Nominations; Penrose Conferences and Field Forums; Penrose Medal Award; Publications; Research Grants; *Treatise on Invertebrate Paleontology* Advisory Committee; and Young Scientist Award. Candidates are also needed for a GSA representative to the North American Commission on Stratigraphic Nomenclature (NACSN). Service begins July 2004 for all positions except NACSN, which begins November 1, 2004, and Joint Technical Program Committee, which begins January 1, 2005.

For complete information on committee service, current vacancies, and required qualifications, see the October 2003 issue of *GSA Today*. Nomination form and instructions are available at www.geosociety.org/aboutus/commtees/.

Officers and Councilors

Nominations Due February 1, 2004

The GSA Committee on Nominations requests nominations for officers (vice president and treasurer) and councilors to serve on the GSA Council beginning in 2005. Each nomination should be accompanied by basic data and a description of the qualifications of the individual for the position recommended.

Send materials for committee, officer, and councilor nominations to Ruth Harrison, GSA, P.O. Box 9140, Boulder, CO 80301-9140, (303) 357-1000, ext. 0, 1-800-472-1988, ext. 0, rharrison@geosociety.org.

Medals and Awards

Nominations Due February 1, 2004

Nominations of candidates are requested for the following medals and awards: Penrose Medal, Day Medal, Honorary Fellows, Young Scientist Award (Donath Medal), GSA Public Service Award, and Distinguished Service Award. For details on the awards and nomination procedures, see the October 2003 issue of *GSA Today*, go to www.geosociety.org, or call (303) 357-1028. Materials and supporting information for any of the nominations may be sent to Grants, Awards, and Medals, GSA, P.O. Box 9140, Boulder, CO 80301-9140.

Student Research Grants

Applications Must be Postmarked by February 1, 2004

For information on 2004 Research Grant Program for Students, see the October 2003 issue of *GSA Today*, visit www.geosociety.org, or call (303) 357-1028. Application forms are available online or from Grants, Awards, and Medals, GSA, P.O. Box 9140, Boulder, CO 80301, awards@geosociety.org.

GSA Fellows

Nominations Due January 15, 2004

The Committee on Membership requests nominations of members to be elevated to GSA Fellow status. Any GSA Fellow may nominate a member for this honor. Two other supporting signatures are needed, along with a letter stating the member's qualifications, to be evaluated on the basis of eight established criteria. For more information, a list of the criteria, and a nomination form, please see www.geosociety.org/members/fellow.htm or contact Nancy Williams, (303) 357-1017, nwilliams@geosociety.org.

2004 Doris M. Curtis Memorial Fund for Women in Science Award

(Sponsored by Subaru of America, Inc.)

Nominations Due February 1, 2004

This award is given to a woman or group of women who have impacted the field of the geosciences in a major way based on their Ph.D. research. For nomination, eligibility, and award details, see the October 2003 issue of *GSA Today*, visit www.geosociety.org, or call (303) 357-1028. Send nominations and supporting material to Grants, Awards, and Medals, GSA, P.O. Box 9140, Boulder, CO 80301-9140.

John C. Frye Environmental Geology Award

Nominations Due March 31, 2004

In cooperation with the Association of American State Geologists, GSA makes an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys. For details, see the October 2003 issue of *GSA Today*, visit www.geosociety.org, or call (303) 357-1028. Nominations must be sent to Program Officer, Grants, Awards, and Medals, GSA, P.O. Box 9140, Boulder, CO 80301-9140.

Congressional Science Fellowship

Applications Due January 23, 2004

For application information for the 2004–2005 GSA–U.S. Geological Survey Congressional Science Fellowship, visit www.geosociety.org/science/csf/, or contact Ginger Williams, GSA Headquarters, (303) 357-1040, gwilliams@geosociety.org.

National Awards

Nominations Due April 30, 2004

Candidate nominations are needed for the following national awards: William T. Pecora Award, National Medal of Science, Vannevar Bush Award, and Alan T. Waterman Award. For details, see the October 2003 issue of *GSA Today*. Nominations should be sent to Grants, Awards, and Medals, GSA, P.O. Box 9140, Boulder, CO 80301-9140.

Call for Proposals for Keynote Symposia and Topical Sessions

GEOSCIENCE in a Changing World

2004 GSA Annual Meeting
Denver, Colorado
November 7–10, 2004

Come back to Denver for the 2004 GSA meeting! The Rocky Mountains and High Plains preserve an outstanding record of geological processes from Precambrian through Quaternary times, from mantle dynamics to surficial processes, with everything in between. With its energy resources and water issues, Denver is a particularly appropriate place for a meeting focusing on our changing world. How will our science change in response to changing global conditions and societal needs? To what extent do we need to expand our focus to include other disciplines, other agencies, and new technologies? You can play a role in answering these and many other questions by proposing a topical session or Pardee symposium for the 2004 Denver meeting! The GSA Annual Meeting is what YOU make it.

Proposal deadline: January 15, 2004
Submit proposals at
www.geosociety.org/meetings/2004.

Have you ever been frustrated to find that none of the topical sessions at a GSA meeting represent your own current area of research and excitement? If so, there is an easy answer: propose

a session yourself! The topical sessions and Pardee symposia at GSA meetings are planned entirely by your friends and colleagues. If these sessions do not adequately reflect your own interests, your voice is needed. Please plan to participate in the design of the meeting by submitting a session proposal. The reward is great: you play a direct role in attracting key people to the meeting and in formulating part of the program that will be of direct benefit to you. Yours might even be the session that has everyone talking in the corridors and the bars, or even on the evening news! You may also be well on your way to producing the next GSA Special Paper.

Program Opportunities

We welcome proposals for Pardee Keynote Symposia and topical sessions. Submit proposals electronically on or before **January 15, 2004**, via the link at www.geosociety.org/meetings/2004.

The annual meeting program structure offers opportunities for effective and dynamic program building, allowing a mixture of invited and volunteered papers and different session formats. Joint Technical Program Committee (JTPC)

representatives from GSA Divisions play a large role in decisions. Please read the various program options and guidelines at www.geosociety.org carefully before submitting a proposal of one of two types:

Pardee Keynote Symposia, made possible by a grant from the Joseph T. Pardee Memorial Fund, are *special events* of broad interest to the geoscience community. Topics appropriate for these symposia are those that are on the leading edge in a scientific discipline or area of public policy; address broad, fundamental problems; are interdisciplinary; or focus on global problems. The primary criterion for selection is excellence, and selection is on a competitive basis. All speakers will be invited; each convener is provided with a budget of \$2,000. We strive for a good mix of Pardee Keynote Symposia of interest to GSA and Associated Society members.

Topical sessions promote the exchange of timely or state-of-the-art information with respect to a focused topic and allow scheduling of interdisciplinary talks that bear on a specific topic. Organizers (advocates) may invite specific papers to ensure a successful and excellent session and are encouraged to solicit volunteered contributions. A maximum of four invited speakers may be allowed. An advocate may request more invitations if he or she can justify the larger number. However, sessions **must** include volunteered abstracts, which are solicited in *GSA Today* for all approved topical sessions. Advocates may request special formats. All requests are reviewed by the JTPC. All topical sessions must receive a minimum of 12 abstracts to be part of the technical program. Advocates are encouraged to submit their proposals as poster sessions to accommodate the growing technical program.

Oral and Poster General Sessions

Consisting entirely of volunteered papers, these sessions are an important

Technical Program Chair

Jane Selverstone

(505) 277-6528 • selver@unm.edu

Denver 2004 Dates and Deadlines

Jan. 15 Proposals due by midnight, MST. Electronic submission required.

April 1 Electronic abstract form posted at www.geosociety.org.

April 1st announcement in April *GSA Today*.

June 2nd announcement in June *GSA Today*.

July 13 Abstracts due by midnight, MST.

Aug. 2 Technical program schedule finalized.

Accepted abstracts with links to speakers and titles will be posted at www.geosociety.org after **Sept. 1**.

Propose a Session: Who Knows Where It Could Lead?

When you organize a session, you can help ensure that your area of expertise gets exposure through meeting attendees and the widely cited *Abstracts with Programs* volume. GSA's marketing and communications staff sends out press releases on sessions the media may be interested in, and GSA's publications staff is always looking for that next best-selling Special Paper.

Propose a session. Then watch your efforts come to fruition as abstracts are submitted and your initiative becomes part of science history.

component of the GSA Annual Meeting. The number of abstracts received determines the number of general sessions in each discipline. The goal of the Technical Program Chair and the JTPC representatives is to provide presenters the best possible opportunity for communicating new scientific information rather than to dictate what can or will be presented. To allow for well-attended, dynamic sessions, an effort will be made in scheduling to avoid overlap of poster and oral sessions in the same discipline.

Hot Topics

The focus of these popular lunchtime forums, held Sunday through Wednesday, is on discussion—with plenty of audience participation. Depending on the subject, a debate format is recommended, and panels are discouraged. Each session must have a moderator. Titles should be catchy and provocative. If you are interested in organizing a session, contact Nancy Carlson, ncarlson@geosociety.org.

Make Yours the Session Everyone Talks About

Topical session organizers have the ability to ensure a successful, excellent program through topical sessions, with their combination of invited speakers and volunteered papers, and through Pardee Keynote Symposia, which expand the opportunity for high-profile sessions on important developments that have an impact on our science.

We look forward to working with you to make the GSA Annual Meeting dynamic and stimulating for all GSA and Associated Society members and appealing to a wide audience. If you have any questions or concerns regarding the program, please call or e-mail.

K-16 Education Workshops Call for Proposals GSA Annual Meeting—Denver 2004

GSA invites K-12 teachers, teacher trainers, pre-service educators, and post-secondary educators to submit proposals for K-16 education workshops at the 2004 GSA Annual Meeting in Denver. For more information and a proposal packet, contact Christine McLelland, (303) 357-1082, educator@geosociety.org.

Proposals must be postmarked by January 15, 2004.

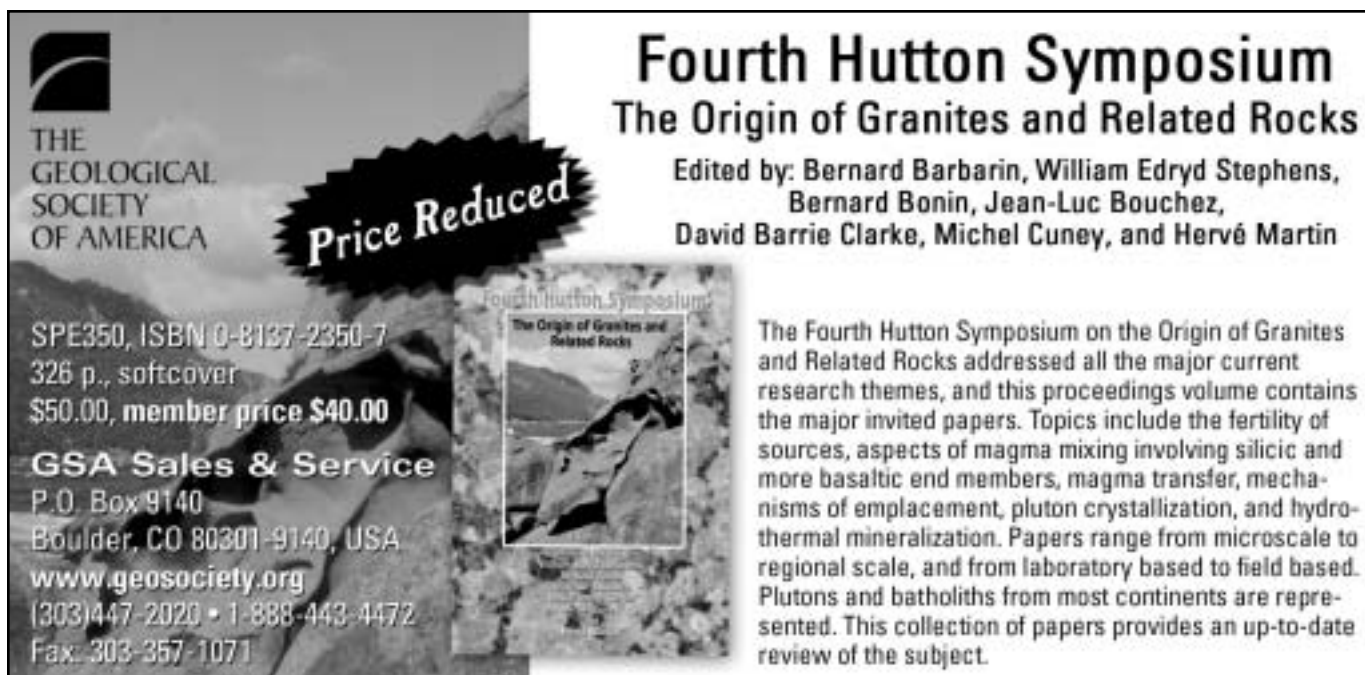
Desperately Seeking Short Courses

GSA is soliciting short course proposals for the 2004 GSA Annual Meeting in Denver that include a half-day or one-day field trip.

The GSA Committee on Professional Development invites those interested in proposing a short course to contact GSA headquarters for proposal guidelines. We are particularly interested in receiving course proposals that include a local field trip for the 2004 Denver Annual Meeting or the 2005 Salt Lake City Annual Meeting.

Proposals must be received by January 1, 2004. Selection of courses for 2004 will be made by March 1, 2004. For those planning ahead, we will also consider courses for 2005 at that time.

For proposal guidelines or information, contact Edna Collis, Program Officer, GSA Headquarters, 1-800-472-1988, ext. 1034, ecollis@geosociety.org.



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Fourth Hutton Symposium

The Origin of Granites and Related Rocks

Edited by: Bernard Barbarin, William Edryd Stephens, Bernard Bonin, Jean-Luc Bouchez, David Barrie Clarke, Michel Cuney, and Hervé Martin

The Fourth Hutton Symposium on the Origin of Granites and Related Rocks addressed all the major current research themes, and this proceedings volume contains the major invited papers. Topics include the fertility of sources, aspects of magma mixing involving silicic and more basaltic end members, magma transfer, mechanisms of emplacement, pluton crystallization, and hydrothermal mineralization. Papers range from microscale to regional scale, and from laboratory based to field based. Plutons and batholiths from most continents are represented. This collection of papers provides an up-to-date review of the subject.

JOINT MEETING

**38th Annual Meeting of the South-Central
Section, GSA, and the Annual Spring Meeting
of the Texas Section, AEG**

College Station, Texas

March 15–16, 2004

www.geosociety.org/sectdiv/southc/04scmtg.htm

HEADQUARTERS, TRAVEL, AND ACCOMMODATIONS

Hotel reservation deadline: February 15, 2004

Register online at www.geosociety.org.

Headquarters

Texas A&M University, the meeting host, is a land-grant, sea-grant and space-grant institution located in College Station, Texas. It is the state's first public institution of higher education, opened October 4, 1876, as the Agricultural and Mechanical College of Texas. In 1963, the name was changed to Texas A&M University to more accurately reflect its expanding role. The initials A&M are a link to the university's past; they no longer represent any specific words. Today, the university's enrollment includes approximately 44,000 students studying for degrees in 10 academic colleges.

College Station is located in the Brazos River valley near the K-T boundary and along the climatic boundary between the positive and negative moisture zones of the United States. To the east, precipitation exceeds potential evaporation and to the west potential evapotranspiration exceeds precipitation. College Station is situated on the Eocene Yegua formation in the upper Gulf coastal plain. The major lignite deposits of the coastal plain are associated with these and related fluvial-deltaic flood plains. Preliminary plans for field trip destinations include a Gulf Coast lignite mine, power plant, and aluminum smelter and brick-manufacturing plant; the George Bush Presidential Library; and stratigraphy of the K-T boundary zone in the Gulf Coast.

Travel

The meeting will be held in the Rudder Tower on the campus of Texas A&M. The university is centrally located, approximately equidistant from Houston, Dallas, San Antonio, and Austin. Travel to College Station is via American Airlines (Eagle) through Dallas or Continental Airlines through Houston (Bush). Driving time from Houston (91 mi.) or Austin (98 mi.) is approximately 1.5 hours and from Dallas (170 mi.) it is about 3 hours. A free shuttle bus service will be provided to transport participants from area hotels to the Rudder Tower, thereby avoiding on-campus parking problems and costs.

Accommodations

A block of rooms has been reserved at a selection of local hotels for meeting attendees; room options range from about \$64 to \$100 per room per night plus taxes. Meeting attendees are responsible for making their own housing arrangements. Hotel reservation deadline is February 15, 2004. Hotel information and reservation contact numbers are given in the table below:

1. **Best Western Inn at Cherry Hill**, 901 University Drive, (979) 260-9150; from \$69/night
2. **Hampton Inn**, 320 Texas Ave. S., (979) 846-0184: from \$64/night
3. **Holiday Inn Express**, 1203 University Drive, (979) 846-8700: from \$69/night.
4. **Quality Suites Hotel** (March 14 & 15 ONLY), 1010 University Drive, (979) 695-9500; from \$76/night
5. **TownePlace Suites by Marriott**, 1300 University Drive, (979) 260-8500; from \$89/night

Room block code is "Geological Meeting."

All hotels listed above provide free shuttle service to Easterwood Airport and a complimentary continental breakfast.

For more information on registration, lodging, and schedules, please visit the meeting Web site at: www.geosociety.org/sectdiv/southc/04scmtg.htm. Information can also be found at <http://geoweb.tamu.edu/GSAAEGmtg>.

REGISTRATION

Preregistration deadline: February 9, 2004

Cancellation deadline: February 16, 2004

Register online at www.geosociety.org.

Preregistration Fees

	FULL MEETING	ONE DAY
Professional Member	\$75	\$40
Professional Nonmember	\$80	\$45
Student Member	\$30	\$30
Student Nonmember	\$35	\$35
K–12 Professional	\$25	\$25
Guest or Spouse	\$15	N/A

ABSTRACTS

Abstract deadline: December 16, 2003

Papers are invited for symposia, theme sessions, and general sessions, in both oral and poster formats. Abstracts not included in symposia will be scheduled for theme or general sessions, as appropriate. All abstracts must be submitted online at www.geosociety.org. An abstract submission fee of \$10 will be charged. Only one volunteered paper may be presented by an individual; however, a person may be a co-author on other papers. Also, those invited for symposia may present other papers.

SYMPOSIA AND THEME SESSIONS

The proposed symposia and theme sessions follow. Additional symposia and theme session topics may still be accommodated. For more information, or to propose another symposium or theme session, contact the meeting chair: Chris Mathewson (979) 845-2488, mathewson@geo.tamu.edu. For more details, consult the meeting Web site, www.geosociety.org/sectdiv/southc/04scmtg.htm.

Symposia

1. **Licensure of Geologists.** W. Kevin Coleman, wkc@swbglobal.net. A session designed to present the history and development of the licensure process, justification for licensure, the ASBOG National Geologist Examination and the general rules and expectations of licensed geologists.
2. **Gulf Coast Growth Faults—New Discoveries.** Christopher J. Beal, bealc@campstanley.net. This symposium will address the basic theory of growth fault development, investigation technology and remedial techniques for the evaluation of Gulf Coast growth faulting.

Theme Sessions

1. **Geoscience in Human and Ecosystem Health.** Jennifer T. McGuire, mcguire@geo.tamu.edu. This session will address the interdisciplinary aspects of human and ecosystem health and encourages authors from related fields to submit abstracts and to participate.
2. **Global Change during the Carboniferous-Permian.** Tom Yancey and Anne Raymond, yancey@geo.tamu.edu. Understanding global change during the Carboniferous-Permian time frame may provide insight to global changes during later periods.
3. **Near-Surface Geological Hazards.** Douglas Sassen, dsassen@geo.tamu.edu. This session is designed to bring together researchers and practitioners to discuss recent advances and case histories of near-surface processes that represent a hazard to the built environment.
4. **Advances in Petroleum Geosciences.** Steve Dorobek, dorobek@geo.tamu.edu. The organizer encourages papers related to new discoveries and advances in our understanding of the petroleum geosciences, including stratigraphy, hydrocarbon geochemistry and geophysics.
5. **Tertiary Climate Change.** Ethan Grossman, grossman@geo.tamu.edu. A parallel session to the Carboniferous-Permian global change session, this session will review and discuss the recent advances in our knowledge of Tertiary climate change.
6. **Undergraduate Research Poster Session.** *Sponsored by the Council on Undergraduate Research, Geosciences Division.* Jeff Connelly, jbcconnelly@ualr.edu. This session is designed to allow undergraduate students to present research results. A student must be listed as the lead author and be the major presenter of the poster.

WORKSHOPS

Workshops will be held before and after the meeting on March 14 or 17. For additional information, please check the meeting Web site, www.geosociety.org/sectdiv/southc/

04scmtg.htm, or contact the workshop conveners.

1. **Ground Penetrating RADAR—New Techniques and Applications.** March 14, 1–5 p.m. Carl Pierce, cpierce@geo.tamu.edu. Cost: \$10.
2. **Immersive Visualization—New Tool in Geoscience Interpretation.** March 15. Luc Ikelle, ikelle@geo.tamu.edu. Cost: \$10.

FIELD TRIPS

Both premeeting and postmeeting field trips are planned. Registration for some trips is limited. For more information, please visit the meeting Web site, www.geosociety.org/sectdiv/southc/04scmtg.htm.

Premeeting

1. **Paleogene of the Texas Gulf Coast.** March 14, 7 a.m.–5 p.m. Tom Yancey, yancey@geo.tamu.edu. Cost: \$35.

Postmeeting

2. **Lignite, Aluminum, and Bricks—Gulf Coast Mineral Resources.** March 17, 7 a.m.–5 p.m. Chris Mathewson, mathewson@geo.tamu.edu. Cost: \$35.

STUDENT ACTIVITIES

Roy J. Shlemon Mentor Program in Applied Geology. *Sponsored by GSA Foundation.* This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues including professional opportunities and challenges that await students after graduation. Plan to attend both **free luncheons** to hear different presenters each day. Students will receive complimentary lunch tickets in their registration packet to attend both Shlemon Programs. Shlemon luncheons will be held on Monday, March 15, and Tuesday, March 16 from 11:30 a.m.–1 p.m. Space is limited, so first come, first served. For more information, contact Karlon Blythe, kblythe@geosociety.org.

Travel Grants

Travel grants are available from the South-Central Section, the GSA Foundation, and the Texas Section of AEG. Grants are available for GSA Student Associates or AEG Student Members who are presenting oral or poster papers. Students must be currently enrolled as GSA or AEG members to be eligible. Please visit the South-Central link on the GSA Web site (www.geosociety.org) for instructions on applying for the South-Central GSA grants, or contact Elizabeth Y. Anthony (eanthony@geo.utep.edu) for information.

EXHIBITS

Exhibit space will be available in an exhibit hall together with the poster sessions and all meeting coffee breaks. Exhibits will open at 8 a.m. on Monday, March 15, for morning coffee and close at 5 p.m. On Tuesday, March 16, the exhibit hall will open at 8 a.m. for morning coffee and close at 3:30 p.m. after afternoon coffee. For more information on exhibit space, please contact Chris Mathewson, (979) 845-2488, mathewson@geo.tamu.edu.

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registered meeting participants and their guests will be held at the Rudder Tower on the Texas A&M University campus on Sunday, March 14, from 5 to 8 p.m.

Joint Meeting Banquet. A meeting banquet will be held in conjunction with the meeting Monday, March 15, from 6 to 9 p.m. This will be a ticketed event. All registered meeting participants and their guests are invited to attend. Look for more details coming in the future.

Informal Lunch Meetings. Informal luncheons for special groups can be scheduled. Contact Chris Mathewson at mathewson@geo.tamu.edu or (979) 845-2488 to make arrangements.

BUSINESS MEETINGS

South-Central Section Management Board Meeting. Monday, March 15 at 4 p.m. in the Rudder Tower.

South-Central Section GSA and Texas Section AEG Business Meetings will be held in conjunction with the Monday evening banquet.

MORE INFORMATION

For more information, please contact the meeting chair, Chris Mathewson, (979) 845-2488, mathewson@geo.tamu.edu. Additional meeting information is also available at www.geosociety.org/sectdiv/southc/04scmtg.htm. GSA is committed to making all events at the 2004 meeting accessible to all people interested in attending. You can indicate special requirements (wheelchair accessibility, dietary concerns, etc.) on the registration forms.

JOINT MEETING

39th Annual Meeting of the Northeastern Section, GSA, and 53rd Annual Meeting of the Southeastern Section, GSA
Tysons Corner, Virginia

March 25–27, 2004

www.geosociety.org/sectdiv/northe/04nesemtg.htm

The hosts for the 2004 meeting of the Geological Society of America Northeastern and Southeastern Sections are the American Geological Institute, Frederick Community College, George Mason University, George Washington University, Nomad Geosciences, the U.S. Geological Survey, and the University of Maryland.

REGISTRATION

Preregistration deadline: February 16, 2004

Cancellation deadline: February 23, 2004

Register online at www.geosociety.org/sectdiv/northe/04nesemtg.htm.

GSA headquarters will handle preregistration. Please preregister online or download the PDF preregistration form at www.geosociety.org/sectdiv/northe/04nesemtg.htm. If you are unable to preregister this way, please contact GSA Member Services at 1-888-443-4472 or member@geosociety.org.

Preregistration Fees

	FULL MEETING	ONE-DAY
Professional Member	\$140	\$90
Professional Member (70 and older)	\$70	\$50
Professional Nonmember	\$160	\$110
Student Member	\$60	\$50
Student Nonmember	\$70	\$60
K–12 Professional	\$40	\$25
Guest or Spouse	\$30	\$15

Preregister to qualify for lower registration fees. Costs will increase after February 16, 2004. Full payment MUST accompany the preregistration form. Members of GSA and the associated societies listed on the preregistration form get preregistration discounts. Registration is required for those attending technical sessions, field trips, short courses, workshops, and the exhibit hall. Guest registration is intended for non-geologist spouses or friends, and does not include attendance at technical sessions. Students and K–12 teachers must send or show a current ID at check-in to obtain special rates.

Preregistration forms must be received at GSA no later than February 16, 2004. Register only one professional or student per form and retain a copy for your records. For the preregistered attendees, GSA will be distributing your badges on-site at the registration table. Your badges will NOT be mailed to

you prior to the meeting. For detailed information, visit the Web site given above.

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for additions, changes, and cancellations must be made in writing and received by February 23, 2004. There will be no refunds for cancellations received after this date, and no refunds for on-site registration, *Abstracts with Programs*, and on-site ticket sales.

On-site Registration Schedule

Hilton McLean Tysons Corner, Prefunction Area #1

Wed., March 24 4–8 p.m.

Thurs., March 25 7 a.m.–5 p.m.

Fri., March 26 7 a.m.–5 p.m.

Sat., March 27 7 a.m.–noon

Accommodations for Registrants with Special Needs

The Northeastern and Southeastern Sections of GSA are committed to making every event at the 2004 meeting accessible to all people interested in attending. If you have special requirements, please check the appropriate box on the meeting registration form. If you need more information, please contact George Stephens, geoice@gwu.edu, or Rick Diecchio, rdiecchi@gmu.edu. Requests for special accommodations should be received by February 13, 2004.

LOCATION AND DIRECTIONS

The meeting will be held at the **Hilton McLean Tysons Corner**, easily accessible by car, by shuttle service from Dulles Airport, and by taxi or shuttle service from the Washington, D.C., Metro system. The Hilton is located just west of the Capitol Beltway (I-495) at Route 123 in Tysons Corner, Virginia.

By car, take I-495 to Exit 46A (Tysons Corner/Rt. 123 South). Turn right at first light onto Tysons Boulevard. Continue on Tysons Boulevard for 1 block to light (Galleria Drive/Westpark Drive); turn right. At the next light (Jones Branch Drive), turn right. The Hilton McLean is the second building on the right.

From Dulles Airport, take the Dulles Access Road East. Exit at I-495 South (Exit 18), toward Richmond. Follow directions above. Airport shuttles are also available.

From Reagan National Airport, take George Washington Parkway North to McLean (Rt. 123, Chain Bridge Road). Take Route 123 South to Tysons Boulevard (the first right after the I-495 overpass). Follow directions above. Airport shuttles are also available. Alternately, one can take the Metro from Reagan Airport to the West Falls Church station on the Orange Line, then take the Fairfax Connector bus to the Hilton.

From Route 66, take I-495 North and follow directions above.

The closest metro station is West Falls Church on the Orange Line. The Fairfax Connector bus runs regularly from the West Falls Church station to the Hilton.

ROOM REGISTRATION

Meeting attendees will get a special room rate of \$135 single/double at the Hilton, including parking. Attendees are responsible for making their own room reservations. It is important that you identify yourself as a GSA attendee to receive

the most favorable discounted room rate. Call Hilton reservations at (703) 761-5111. Alternately, you may register online at www.mclean.hilton.com. Please use the group/convention code NSG.

The meeting organizers have attempted to keep costs for this meeting as low as possible. In doing so, we have anticipated filling our reserved room block at the Hilton as a way to minimize meeting room costs. Meeting participants can help us meet our budget by staying at the Hilton. If you stay at the Hilton, but do not reserve a room through Hilton reservations, please make this known to the conference organizers so that we may count your room toward the room quota for the meeting. Your cooperation is appreciated.

Free Room and Gift Certificate Raffles

To encourage participants to stay at the Hilton, we will hold a daily raffle. On Wednesday, Thursday, and Friday, a free night's stay at the Hilton will be raffled off, as well as two \$50 gift certificates to any shop or restaurant in the Tysons Corner Center shopping mall. Every Hilton room registered to a GSA participant on the night of each drawing will automatically be entered in the raffle. Winners of the free night's stay will have the room cost deducted from their bill for that night.

TECHNICAL SESSIONS

Papers are invited from students and professionals for presentation in oral and poster general sessions and for presentations that may fit into the symposia and theme sessions listed below. Additional general discipline sessions will be scheduled on the basis of submitted abstracts. Abstracts must be submitted online at www.geosociety.org/sectdiv/northe/04nesemtg.htm. **Abstract deadline is December 16, 2003.**

Oral Sessions

One laptop computer, one LCD computer projector, and one screen per session room will be provided for oral sessions. All speakers must bring their digital presentations as PowerPoint files on a compact disc, floppy disk, or a USB memory stick. Presentations must be turned into the AV technician by 9 p.m. the evening before the scheduled talk time. Speakers will not be allowed to use their own laptop computers for their presentations. Speakers requiring the use of a 35mm or overhead projector, or who have any special requests must contact the AV coordinator, Sean Brennan, sbrennan@usgs.gov, one month prior to the meeting to reserve a projector. As there will be only one screen per session, only one projector of any type will be allowed per presentation. Two-projector presentations will not be allowed.

Poster Sessions

Poster sessions will allow at least three hours of display time. Presenters must be present for two hours of that time. Posters must fit on a single 8' x 4' display board. Pins may be used.

Keynote Forum

Science and Public Policy, conveners: Brenda Pierce and Barbara Wainman, U.S. Geological Survey. Session will focus on how science affects public policy and how public policy influences and affects scientific endeavors in the government, the private sector, and in non-governmental organizations.

Symposia

1. **Geology and the Civil War**, Bob Whisonant, Radford University, rwhisona@radford.edu, (540) 831-5224; Drew Andrews, Kentucky Geological Survey, wandrews@kgs.mm.uky.edu, (859) 257-5500; Judy Ehlen, U.S. Army Topographic Engineering Center, jehlen@tec.army.mil, (703) 428-6887. This session will explore the connections between geology and the American Civil War. Among the topics to be examined are: mineral resources and the war, impact of terrain on strategy and tactics, geology and geomorphology of battlefields, and remote sensing/GIS analysis of battle areas.
2. **Uniting Diverse Disciplines through Ecosystem Restoration: Examples from the Eastern United States**. Bill Orem, borem@usgs.gov, (703) 648-6273, and Deb Willard, dwillard@usgs.gov, (703) 648-5320, both of the U.S. Geological Survey. This session will focus on geological, hydrological, ecological, and biological studies aimed at understanding the structure and function of ecosystems in the eastern U.S., and as the scientific foundation of restoration efforts. Examples include geologic framework, biogeochemical cycling, water quality issues, ecosystem history, hydrologic modeling in the Florida Everglades, Florida and Biscayne Bays, Chesapeake Bay, and Tampa Bay.
4. **GIS and IT Advancements in the Geosciences**. Marc Levine, mlevine@usgs.gov, (703) 648-6465, Jerry McFaul, jmcfaul@usgs.gov, (703) 648-7126, Joe East, jeast@usgs.gov, (703) 648-6450, and Chris Garrity, cgarrity@usgs.gov, (703) 648-6426, all from the U.S. Geological Survey. This session will focus on advances in geographic information systems in relation to the geosciences. Special emphasis will be placed on how advancing technology bridges the communication gap for a multi-disciplinary audience.

Theme Sessions

1. **Groundwater in Crystalline Rocks of the Eastern U.S.: How Much is There?** Bill Burton, bburton@usgs.gov, (703) 648-6904, and Earl A. Greene, eagreene@usgs.gov, (410) 238-4204, both of the U.S. Geological Survey. Rapid population growth in the eastern U.S. is causing increased groundwater withdrawals in areas underlain by igneous and metamorphic rocks, but assessing the amount of available groundwater for public use in such areas is a challenge for hydrologists and land-use managers. Papers in this session will address the topic of groundwater in fractured crystalline rocks of the Appalachian orogenic belt, with an emphasis on the control exerted by bedrock lithologies and geologic structures on groundwater yields, storage, and flow paths.
2. **New Directions in Appalachian Geomorphology**. Milan Pavich, U.S. Geological Survey, mpavich@usgs.gov, (703) 648-6963; Paul Bierman, University of Vermont, Paul.Bierman@uvm.edu, (802) 656-4411; Joanna Reuter, University of Vermont, Joanna.Reuter@uvm.edu, (802) 656-4411. Recent advances in geomorphic analysis and geochronologic methods are being applied to classic questions about the geomorphic evolution of the Appalachians. This session will highlight recent research and models that improve our understanding of the relations of landforms to climate and crustal motion in this passive margin setting.

3. **Geomorphic Process Rates on the Passive Margin.** Paul Bierman, University of Vermont, Paul.Bierman@uvm.edu, (802) 656-4411; Milan Pavich, U.S. Geological Survey, mpavich@usgs.gov, (703) 648-6963; Luke Reusser, University of Vermont, Luke.Reusser@uvm.edu, (802) 656-4411. Process geomorphology is improving dramatically through advances in various quantitative techniques. This session will focus on new methods being applied to rock weathering, erosion, and sediment transport in the Appalachians.
4. **Nature and Timing of Grenvillian Orogenesis in Eastern North America (Precambrian).** Richard Tollo, George Washington University, rtollo@gwu.edu, (202) 994-6960; Louise Corriveau, Canadian Geological Survey, lcorrive@nrcan.gc.ca, (418) 654-2672. This session will focus on the results of recent investigations aimed at elucidating the nature and timing of geologic processes responsible for development of Grenvillian crust in eastern North America. Studies involving application of multidisciplinary techniques that provide insight on the nature of crustal formation processes and the timing of orogenic and magmatic events are especially encouraged.
5. **Former Tidal Inlets and Breaches along Modern and Ancient Coasts: Formation, Evolution, and Geologic Record (ORAL AND POSTER).** Randolph McBride, George Mason University, rmcbride@gmu.edu, (703) 993-1642; Ilya Buynevich, U.S. Geological Survey, ibuynevich@usgs.gov, (508) 457-2355. This session will explore the geological signatures of former tidal inlets and breaches (e.g., ancient, relict, historical) in coastal deposits from the rock record through Holocene. Abstracts emphasizing modes of formation and/or closure, geomorphology, sedimentology, stratigraphy, and process-hindcasting are encouraged. In light of recent events, we also strongly urge abstracts about Hurricane Isabel's impact.
7. **Architecture of Triassic Basins: Influence on later Faulting and Hydrogeology.** Allen Dennis, University of South Carolina—Aiken, allend@aiken.sc.edu, (803) 777-6578; W Hames, Auburn University, hameswe@mail.auburn.edu, (334) 844-4881. This symposium is expected to be organized temporally from terminal Appalachian events and Permian gravitational collapse to extension, to Triassic faulting, basin development and magmatism, post-Jurassic deposition, and Cenozoic diagenesis, hydrogeology and tectonism.
8. **Geological Carbon Sequestration: Analogs, Opportunities, and Risks.** Julio Friedman, University of Maryland, juliof@geol.umd.edu, (301) 405-4087; Bob Burruss, U.S. Geological Survey, burruss@usgs.gov, (703) 648-6144. Geological storage of anthropogenic carbon has emerged as an important potential mitigation tool for greenhouse gas emissions. Topics include geological analogs to carbon storage sites, source and sink matching, geochemical reactions of CO₂/brine/rock systems, and monitoring through geophysical and geochemical technologies.
9. **The Role of Geology in Contaminated Mine Drainage in the Eastern United States (ORAL AND POSTER).** Sue Tewalt, stewalt@usgs.gov, (703) 648-6437, and Nora Foley, nfoley@usgs.gov, (703) 648-6179, both of the U.S. Geological Survey. Areas of extensive mining of high-sulfur coal deposits (e.g., Appalachian) and abandoned iron-sulfide metal mine dumps (e.g., northeast states) generate mine drainage that poses a significant health threat to fish, wildlife, and ultimately to human health. Researchers will present recent advances on natural occurrences, anthropogenic patterns, near-surface processes and mechanisms of release and transport of acid and metals that can have significant effects on human health, impact ecosystems, and require strategies for remediation.
10. **Salvage Geology.** Cyril Galvin, Coastal Engineer, galvincoastal@juno.com, (703) 569-9187; James C. Dawson, SUNY—Plattsburgh, james.dawson@plattsburgh.edu, (518) 564-4035. Manmade and natural changes from roadcuts, quarries, stream erosion, and landslides provide a geologic resource that must be expected in general, but is unanticipated in particular. Salvage geology recognizes this resource, which may be made opportunistically, or in some cases, permanently, available.
11. **Geomorphology of Stream Restoration and Natural Stream Design.** Steve Kite, West Virginia University, jkite@wvu.edu, (304) 293-5603; Will Harman, Buck Engineering, wharman@buckengineering.com, (919) 459-9003; Peggy A. Johnson, Penn State University, paj6@psu.edu, (814) 865-1330. Basic principles of hydraulic geometry, sediment transport, and stream ecology only recently have been integrated into engineering applications. The field of "natural stream design" has emerged, with many advocates and critics. Papers will encompass prospects for long-term stability, recent innovations, the research potential provided by large channel morphology data sets, and insights into when to intercede and when not to meddle with "nature."
12. **Understanding the Spatial Variations in Tectonite Fabrics in Metamorphic Rocks—Grenville Tectonics.** Gary S. Solar, SUNY College at Buffalo, SOLARGS@BuffaloState.edu, (716) 878-4900; David Valentino, SUNY, Oswego, dvalenti@oswego.edu, (315) 312-2798. Recent research into the nature and orientation of tectonite fabrics in Grenville rocks has produced a large database of the tectonometamorphic record of Grenvillian orogenesis. Speakers will address L v. S fabric formation processes operating during the NeoProterozoic as recorded by the development of L v. S tectonite fabric variations, and the major and minor structural zones that they define in Grenville terrains. In this session, we will continue to make connections between structural zones both within and between these terranes.
13. **Dinosaurs of Eastern North America.** Rob Weems, U.S. Geological Survey, rweems@usgs.gov, (703) 648-6930; David Weishampel, Johns Hopkins University, dweisha1@jhmi.jhmi.edu, (410) 955-7145. This session will report on recent advances in knowledge concerning the dinosaurs of eastern North America and their environment. Talks may deal with eastern American dinosaur anatomy, behavior, taxonomy, diversity, distribution, or ecology.
14. **Process in Appalachian Basin Research: Implications for Energy and Mineral Resources.** Chris Swezey,

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cswezey@usgs.gov, (703) 648-6444, Liz Rowan, erowan@usgs.gov, (703) 648-6745, and John Slack, jslack@usgs.gov, (703) 648-6337, all of the U.S. Geological Survey. An update on Appalachian Basin research including regional studies of tectonic and stratigraphic framework, burial/uplift, diagenetic, and fluid flow history. Application of these studies to energy (gas, oil, and coal) and mineral resources is emphasized.

15. **Coalbed Gas Resources and Future Potential of Eastern North American Basins.**

Peter Warwick, pwarwick@usgs.gov, (703) 648-6449, and Robert Milici, rmilici@usgs.gov, (703) 648-6541, both of the U.S. Geological Survey. This session will provide an update of the recent work to characterize the coalbed gas resource potential of eastern North American coal basins. Topics will include geology of coalbed gas reservoirs, resource evaluation, exploration, production, and CO₂ sequestration potential.

17. **Recent Developments in Industrial Minerals**

Research: Issues and Processes. Nora Foley, U.S. Geological Survey, nfoley@usgs.gov, (703) 648-6179. The session will highlight scientific research activities that enhance our understanding of: (1) geologic processes and characteristics (distribution, deposit geology, geochemistry, quality) of industrial minerals occurring in the Eastern United States; (2) environmental consequences of extracting industrial minerals; (3) the geosocietal factors of industrial minerals development and reclamation.

18. **Geologic Hazard Issues in the Eastern United States.**

Paula Gori, pgori@usgs.gov, (703) 648-6707, and Dawn Lavoie, dlavoie@usgs.gov, (703) 648-6511, both of the U.S. Geological Survey. Geologic hazards of landslides, earthquakes and coastal erosion are growing concerns in the eastern United States. The session will focus on new research and applications of research that should lessen the impacts of these hazards.

19. **Geoscience Education: Undergraduate (ORAL AND POSTER).** *Cosponsored by NAGT—Eastern Section, NAGT—Southeastern Section, and the GSA Southeast Section Education Committee.*

P. Sethi, Radford University, psethi@radford.edu, (540) 831-5619; D. Haywick, University of Southern Alabama, dhaywick@jaguar1.usouthal.edu, (251) 460-6381; R. Gottfried, Frederick Community College, rgottfried@frederick.edu, (301) 846-2581. Papers and posters regarding new or recent trends in geoscience education (pedagogy, research, use of technology, new curricula initiatives, assessment, etc.) are encouraged. Contributions relating to other aspects of undergraduate geoscience education, other types of collaborative efforts, and new trends in teacher education and certification are encouraged.

20. **Geoscience Education: K–12 (ORAL AND POSTER).**

Cosponsored by NAGT—Eastern Section, NAGT—Southeastern Section, and the GSA Southeast Section Education Committee. M. Passow, STANYS, mjpasow@earth2class.org, (201) 871-0846; N. Huebner, Fernbank Science Center, huebner@fc.dekalb.k12.ga.us, (404) 929-6312; C. Bean, Fernbank Science Center, beanc@fc.dekalb.k12.ga.us, (404) 929-6312. Papers and posters regarding new or recent trends in geoscience education in K–12

(pedagogy, research, use of technology, new curricula initiatives, and assessment) are encouraged. Contributions relating to other aspects of K–12 geoscience education, other types of collaborative efforts, and new trends in teacher education and certification are encouraged.

22. **The Value of Geologic Maps for Land and Water Resource Management—Examples from National Cooperative Geologic Mapping Program (FEDMAP, STATEMAP, and EDMAP).**

Scott Southworth, ssouthwo@usgs.gov, (703) 648-6385, and Randall Orndorff, rorndorf@usgs.gov, (703) 648-4316, both of the U.S. Geological Survey. This session will focus on the value of geologic maps produced under the NCGMP—Fedmap, Statemap, and Edmap.

23. **Assessing Natural Climate Variability Through Time.**

Stacey Verardo, George Mason University, sverardo@usgs.gov, (703) 648-6505. This session will present evidence of Earth's changing climate and its associated impacts on biogenic and abiogenic systems.

24. **Undergraduate Research Poster Session.** *Sponsored by the Council of Undergraduate Research.*

Brannon Andersen, Furman University, brannon.andersen@furman.edu, (864) 294-3366. 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 posters, and presentation.

25. **Peri-Gondwanan Terranes of the Appalachians.**

Jim Hibbard, North Carolina State University, jim_hibbard@ncsu.edu, (919) 515-7242; Sandra Barr, Acadia University, sandra.barr@acadiau.ca, (902) 585-1340; J. Wright Horton, U.S. Geological Survey, whorton@usgs.gov, (703) 648-6933; Cees van Staal, Geological Survey of Canada, cvanstaa@NRCan.gc.ca, (613) 995-4333. The eastern flank of the Appalachian orogen is composed of a variety of Neoproterozoic–early Paleozoic, accreted crustal blocks of peri-Gondwanan origin; we seek to compare these terranes by addressing questions related to their geological character, timing and nature of accretion, source craton, and timing of separation from the source craton.

26. **The Paleontology of Marginal Marine Environments.**

Cosponsored by the NE Section for SEPM (Society of Sedimentary Geology) and the Northeast Paleontological Society. Neil Tibert, Mary Washington College, ntibert@mwc.edu, (540) 654-1423; H. Allen Curran, Smith College, acurran@smith.edu, (413) 585-2489. Environments at the land-sea transition include coastal lakes, fresh and saltwater marshes, estuaries, lagoons, and shallow marine (siliciclastic shorelines) and tropical carbonate producing restricted lagoons. Within these subenvironments are a spectrum of organisms that have capitalized on the abundance of nutrients in coastal waters by developing strategies to cope with daily and season variability. All paleontological groups will be represented including trace fossils, plants, protists, invertebrates, and vertebrates from deposits of all ages (Precambrian–Recent).

27. **Process-based Modeling of Coastal Responses**

with Emphasis on Coastal Storms. Michael Fenster, Randolph-Macon College, mfenster@rmc.edu, (804)

752.3745; Maria Honeycutt, PBS&J, MHoneycutt@pbsj.com, (301) 210-6800. This session examines the coast as a process-response system, with an emphasis on the links between coastal storms and geologic/geomorphologic changes. While topics dealing with spatial variability in coastal response and post-storm recovery are encouraged, also welcomed are papers concerning volumetric change, shoreline change, overwash, new (as opposed to paleo-) inlet formation, and the impacts of antecedent topography/bathymetry or geology.

28. **Techniques and Applications to Sea Floor Mapping.** William Schwab, bschwab@usgs.gov, (508) 457-2211, and Page Valentine, pvalentine@usgs.gov, (508) 457-2239, both of the U.S. Geological Survey. Recent advances in technology applicable to geologic mapping of the sea floor are revealing new insights and processes that formed and modify the deep sea, continental margins, and coastal areas, provide critical information required to manage coastal and marine resources, and are leading further exploration and discovery. Abstracts are solicited related to new technological developments in sea floor mapping and application of this technology to marine and coastal science.
29. **Hydrogeologic Investigations in Carbonate Rock Aquifer/Landscape Systems.** Chris Groves, Western Kentucky University, chris.groves@wku.edu, (270) 745-5974; Art Palmer, State University College, palmeran@oneonta.edu, (607) 436-3064. This symposium solicits papers on the development and use of field, laboratory, and analytical methods in the study of carbonate aquifers and landscapes including, but not limited to, cave exploration and survey, dye tracing, geochemical and water quality studies, and geophysical methods. Papers describing these methodologies, as well as case studies, are welcome.
30. **Energy Mix for the Future.** Bob Milici, U.S. Geological Survey, rmilici@usgs.gov, (703) 648-6541; Scott Tinker, Texas Bureau of Economic Geology, scott.tinker@beg.utexas.edu, (512) 471-0209. This session will consider the nation's potential demand for energy during the next several decades and role of fossil fuels, nuclear energy, and renewable energy resources in meeting those demands. Where are the remaining energy resources that are readily available to us at a reasonable price, and what do we have to do to get them?
31. **From the Mountains to the Sea: Fluvial Processes in the Eastern United States.** Brannon Andersen, Furman University, brannon.andersen@furman.edu, (864) 294-3366; Gregory Hancock, College of William and Mary, gshanc@wm.edu, (757) 221-2446; Kirsten Menking, Vassar College, kimenking@vassar.edu, (845) 437-5545. Oral session focusing on the hydrology, geomorphology, sediment transport and biogeochemistry of river systems, including estuaries, in the eastern United States.

General Sessions

In addition to the symposia and theme sessions, general sessions for both oral and poster presentations will be organized to accommodate other volunteered papers.

FIELD TRIPS

Both premeeting and postmeeting field trips are listed below. Unless otherwise stated, all trips will depart from and return to the Hilton. For more information, please contact Field Trip Coordinator Scott Southworth, ssouthwo@usgs.gov, or the field trip leader listed below.

Premeeting

1. **Geologic Evolution of Northern Virginia.** *Cosponsored by NAGT and recommended for earth science teachers.* Sat., March 20, 8 a.m.–6 p.m. Rick Diecchio, George Mason University, (703) 993-1208, rdiecchi@gmu.edu, and Richard Gottfried, Frederick Community College. Cost: \$30 (\$10 for earth science teachers and NAGT members). Includes guidebook, transportation, and lunch. Trip departs from and returns to Leesylvania State Park, Va. Min.: 10; max.: 30.
2. **Mesoproterozoic Geology of the Blue Ridge Province in North-Central Virginia: Petrologic and Structural Systematics of Grenvillian Orogenesis and Paleozoic Tectonic Processes.** 1:30 p.m., Mon., March 22, to 6 p.m., Wed., March 24. Richard Tollo, George Washington University, (202) 994-6960, rtollo@gwu.edu; Chuck Bailey, College of William and Mary; and John Aleinikoff, U.S. Geological Survey. Cost: \$175. Includes: guidebook, transportation, lodging, lunches, dinners, and daily snacks. Moderate hiking; bring sturdy footwear, day pack, and extra clothes. Min.: 12; max.: 30.
3. **The Paleozoic Record of Changes in Global Climate and Sea Level: Central Appalachian Basin.** 8 a.m., Mon., March 22, to 6 p.m., Wed., March 24. Blaine Cecil, U.S. Geological Survey, (703) 648-6415, bcecil@usgs.gov; Mitch Blake and Nick Fedorko, West Virginia Geological and Economic Survey; David Brezinski, Maryland Geological Survey; Vic Skema, Pennsylvania Geological Survey; and Frank Dulong and Rob Stamm, U.S. Geological Survey. Cost: \$220, includes guidebook, transportation, and one nights lodging. Trip begins in Morgantown, W.Va., and ends at Tysons Corner, Va. Min.: 8; max.: 16.
4. **Terrain and Military Geology of the Battle of Gettysburg, July 1–3, 1863.** Wed., March 24, 7 a.m.–6 p.m., Jon Inners, Pennsylvania Geological Survey, (717) 702-2034, jinners@state.pa.us; Roger Cuffey, Pennsylvania State University; Lewis Butts; Helen Delano; Gary Fleeger; Richard Keen; John Neubaum; and Robert Smith III, Pennsylvania Geological Survey; and Victor Neubaum, Wellsville, Penn. Cost: \$25, includes guidebook and transportation. (An optional but additional \$10 charge for MRE lunch will be assessed at the time of the trip). Min.: 15; max.: 30.

Postmeeting

5. **Middle Eocene Igneous Rocks in the Valley and Ridge of Virginia and West Virginia.** 1 p.m., Sat., March 27, to 6 p.m., Sun., March 28. Lee Avary, West Virginia Geological and Economic Survey, (304) 594-2331, avary@geosrv.wvnet.edu; Gerry Wilkes, Virginia Division of Mineral Resources; Jon Tso, Radford University; Ron McDowell and Dave Matchen, West Virginia Geological and Economic Survey. Cost: \$100, includes guidebook,

transportation, lunch on Sunday and refreshments. Lodging in Monterey, Va., to be arranged by participant. Weather dependent; sturdy shoes and cold weather clothes recommended. Min.: 20; max.: 30.

6. **Recognition of Taconian, Acadian, and Alleghanian Domains and Faulting in the Piedmont West of Washington, D.C., Using $^{40}\text{Ar}/^{39}\text{Ar}$ Dating.** Sun., March 28, 8 a.m.–5 p.m. Michael Kunk, U.S. Geological Survey, (303) 236-4850, mkunk@usgs.gov; Robert Wintsch, Indiana University; Scott Southworth, U.S. Geological Survey. Cost: \$55, includes guidebook, transportation, lunch, and snack. Min.: 10; max.: 36.
7. **Terraces of the Potomac River at Great Falls.** *Cosponsored by NAGT and recommended for earth science teachers.* Sat., March 27, 1 p.m.–5 p.m. E-an Zen, University of Maryland, (703) 648-6166, ezen@erols.com; Paul Bierman, University of Vermont; Milan Pavich, U.S. Geological Survey; Luke Reusser, University of Vermont. This trip will provide background for the Beryllium-10 trip on Sunday. Participants are encouraged to take both trips if possible. Cost: \$5. Meet at Great Falls Park, Va.
8. **Beryllium-10 and the Incision History of a Passive Margin River, the Potomac near Great Falls.** Sun., March 28, 8 a.m.–5 p.m. Paul Bierman, University of Vermont, (802) 656-4411, paul.bierman@uvm.edu; Milan Pavich, U.S. Geological Survey; E-an Zen, University of Maryland; Luke Reusser, University of Vermont. The Terraces of the Potomac trip on Saturday will show the geomorphic observations and interpretations that are background for this trip. Participants are encouraged to take both trips. Cost: \$60, includes guidebook, transportation, lunch, and snack. Min.: 18; max.: 27.
9. **The Goochland/Chopawamsic Terrane Boundary in the Central Virginia Piedmont.** 1 p.m., Sat., March 27, to 5 p.m., Mon., March 29. David Spears, Virginia Division of Mineral Resources, (434) 951-6361, david.spears@dmme.virginia.gov; Brent Owens and Chuck Bailey, College of William and Mary. Cost: \$230, includes guidebook, transportation, lodging, lunches and snacks. Min.: 16; max.: 24.
10. **Effective Use of Terrain: The Battle of Fredericksburg, Virginia, December 1862.** Sun., March 28, 8 a.m.–6 p.m. Judy Ehlen, Topographic Engineering Center, (703) 428-6887, jehlen@tec.army.mil. Cost: \$38. Includes guidebook, transportation, and lunch. Min.: 6; max.: 12.
11. **Geology and Paleontology of the Chesapeake Bay, Maryland.** *Cosponsored by NAGT.* Sunday portion of trip is recommended for earth science teachers. Sat., March 27, noon–6 p.m. and Sun., March 28, 8 a.m.–3 p.m. Lauck Ward, Virginia Museum of Natural History, (276) 666-8628, lward@vmnh.net. Cost: \$175. Includes guidebook, transportation, lodging, lunch, dinner, and snack. Min.: 20; max.: 30. For Sunday only, \$25 (\$5 for earth science teachers and NAGT members) includes guidebook, transportation and lunch. Min.: 20; max.: 30.

SHORT COURSES AND WORKSHOPS

Unless otherwise noted, courses and workshops are limited to 24 people. Please register even if the course is free; this will ensure you a space. For more information, contact the leader of the course or workshop, or contact Short Course and Workshop Coordinator Linda Gundersen lgundersen@usgs.gov.

Short Courses

1. **Stability of Rock Slopes.** Wed., March 24, 8 a.m.–5 p.m., Hilton Hotel. Chester (Skip) Watts, Radford University, cwatts@radford.edu. Fee: \$130 includes course materials, CD, and refreshments.
2. **Medical Geology.** Wed., March 24, 8:30 a.m.–5 p.m., Hilton Hotel. Joseph Bunnell, jbunnell@usgs.gov and Geoff Plumlee, U.S. Geological Survey. Fee: \$100 includes course materials and coffee.
3. **Using Electrical Imaging to Monitor and Understand the Environment.** Wed., March 24, 9 a.m.–4 p.m., Hilton Hotel. Lee Slater, Rutgers University, lslater@andromeda.rutgers.edu. Fee: \$75. Includes course materials and coffee.
4. **Interpretation of Seismograms of Local and Distant Earthquakes.** *Cosponsored by NAGT and recommended for earth science teachers.* Sat., March 27, 1–3 p.m., Hilton Hotel. Frank Revetta, SUNY Potsdam, revetta@potsdam.edu. Fee: \$5 includes course materials. Participants must register.

Workshops

1. **Communicating with Congress: A Capitol Hill Primer.** *Sponsored by American Geological Institute.* Wed., March 24, 9 a.m.–noon, Capitol Hill, meeting place to be determined. David Applegate, American Geological Institute, applegate@agiweb.org; Peter Folger, American Geophysical Union. Fee: Free, includes continental breakfast and workshop materials. Registrants will need to provide own transportation or take public transportation such as Metro to Capitol Hill. Attendance limited to 40, you must register to attend. (Optional visits with members of Congress can also be scheduled in afternoon.)
2. **Girl Scout Badge Training.** *Cosponsored by SE-GSA Education Committee; NAGT—Eastern Section, NAGT—Southeastern Section.* Wed., March 24, 1:30–4:30 p.m., Hilton Hotel. Terry Everett, Weinman Mineral Museum, terrye@weinmanmuseum.org; Pamela Gore, Georgia Perimeter College. Fee: \$25 includes course materials.
3. **AGI Workshop: Introduction to the Middle and High School Earth Science Curricula—EarthCom and CUES (Constructing Understandings of Earth Systems).** *Sponsored by AGI and cosponsored by NAGT—Eastern Section, NAGT—Southeastern Section, and the GSA Education Committee; recommended for earth science teachers.* Sat., March 27, 9 a.m.–4 p.m., Hilton Hotel. Roderic Brame, AGI, rib@agiweb.org. Fee: \$10 includes curricula manual, materials, and coffee.
4. **NSF Workshop: Educational Funding Opportunities through NSF.** *Sponsored by NSF.* Sat., March 27, 1–3 p.m., Hilton Hotel. Jeff Ryan, Program Director, NSF/EHR-DUE, jryan@nsf.gov. Fee: Free, includes materials and coffee. Attendance limited to 40.
5. **Exceptional Space Science Materials: A Multi-Sensory Approach for Grades 4–8.** *Sponsored by the NASA Office of Space Science and cosponsored by NAGT.* Recommended for earth science teachers. Sat., March 27, 1 p.m.–5 p.m. Cassandra Runyon, College of Charleston, South Carolina, RunyonC@cofc.edu. Fee: \$10 includes course materials and coffee.

EXHIBITS

Exhibit space will be available in an exhibit hall adjacent to the main registration area. Exhibits will be open 6–8 p.m., Wed., March 24; 9 a.m.–5 p.m., Thurs. and Fri. March 25–26; and 9 a.m.–noon, Sat., March 27. For more information on exhibit rates and space reservations, please contact Exhibit Coordinator Giuseppina Kysar, gkysar@gmu.edu, (703) 993-1045.

SPECIAL EVENTS AND GUEST ACTIVITIES

Opening Reception. Wed., March 24, 6–9 p.m., Hilton. As always, we will open the exhibits and get things started at a Wednesday evening reception and cash bar. Come and visit with friends and colleagues. Registration desk will be open until 8 p.m..

Tour of U.S. Geological Survey National Center. Thurs., March 25, 1–5 p.m., cost: \$10, min.: 20; max.: 25.

Back-to-School Night. Thurs., March 25, 6–9 p.m., Hilton. You are used to this at the national meeting, now join us for an East Coast alumni night. Colleges and universities are encouraged to bring a banner and gather your brood together over a beer or other refreshments from the cash bar. The U.S. Geological Survey will also have a gathering place. Please contact Rick Diecchio, rdiecchi@gmu.edu, by March 1 to reserve a spot for your school on the ballroom floor.

Tour of Smithsonian Museum of Natural History. Fri., March 26, 1–5 p.m. Cost: \$15; min.: 20; max.: 25.

Conference Banquet. Fri., March 26, 7:30 p.m., Hilton. \$60/person, alcoholic drinks not included. Vegetarian option is available.

Dinner Cruise on the Potomac. Sat., March 27, 5:30–11 p.m., leaves from Hilton. Enjoy a relaxing dinner cruise aboard the SS *Dandy* on the Potomac. This is the best way to view Washington, D.C., from the river. Bus will leave the Hilton at 5:30 p.m. \$110/person, alcoholic drinks not included. Min.: 25; max.: 30.

Washington, D.C., Museums and Federal Government Offices. Most of what D.C. has to offer is available and accessible by metro. Please see anyone at the registration desk for more information during the meeting.

Shopping Malls. Tysons Corner Center and Tysons Galleria shopping malls are adjacent to the Hilton and are easily accessible by the hotel shuttle service.

NORTHEAST AND SOUTHEAST SECTION SCHEDULED EVENTS

GSA Southeastern Section Management Board Meeting. Wed., March 24, 4–6 p.m.

GSA Northeastern Section Management Board meeting. Wed., March 24, 4–6 p.m.

Association of Women Geoscientists Breakfast. Thurs., March 25, 6:30–8:30 a.m., \$20.

Northeastern and Southeastern Section of the Paleontological Society Luncheon. Thurs., March 25, noon–1:30 p.m., \$30.

SEPM Northeast and Southeast Section Business Meeting and Reception. Thurs., March 25, 5–7 p.m.

Map Blast VI. Thurs., March 25, 6–9 p.m. Informal session for display and discussion of newly published, unpublished, or in-progress geologic maps of any sort. Poster session room.

NAGT Social. Thurs., March 25, 6–9 p.m.

GSA Campus Representative Breakfast. Fri., March 26, 6:45 a.m.

NAGT Southeast Section Business Meeting. Fri., March 26, noon–1:30 p.m.

Other meetings and functions can be scheduled and will be announced at the meeting.

SPONSORSHIP

The Local Program Committee is actively seeking sponsorship for this conference from industry and government agencies. If you are interested in sponsoring an event or coffee breaks, or in donating to the general sponsorship of the conference, please contact one of the meeting Co-Chairs, George Stephens, geoice@gwu.edu, and Rick Diecchio, rdiecchi@gmu.edu.

SUPPORT FOR STUDENTS

Travel grants are available from the Northeastern and Southeastern Sections and the GSA Foundation. Grants are available to both graduate and undergraduate students who are presenting oral or poster papers. Students must be currently enrolled as GSA members to be eligible.

Student members of the Northeastern Section should contact Stephen Pollack, Secretary-Treasurer, GSA Northeastern Section, Pollack@usm.maine.edu. Deadline for receiving Northeastern Section travel grant applications is 23 January 2004. The application form for Southeastern Section student travel grants can be found at <http://core.ecu.edu/geology/neal/segss/travel.html>.

Student members of the Southeastern Section may contact Secretary-Treasurer, GSA Southeastern Section, Donald Neal, neald@mail.ecu.edu, with specific questions. Deadline for receiving Southeastern Section travel grant applications is 28 February 2004.

We are seeking students to assist at the meeting. Student assistants will have their registration fees reimbursed. For more information, please contact Paul Tomascak, tomascak@geol.umd.edu.

ROY J. SHLEMON MENTOR PROGRAM IN APPLIED GEOSCIENCE

Sponsored by GSA Foundation. Thurs., March 25, and Fri., March 26, 11:30 a.m.–1 p.m. Karlon Blythe, kblythe@geosociety.org. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues including professional opportunities and challenges that await students after graduation. Plan to attend both free luncheons to hear different presenters each day. Students will receive FREE LUNCH tickets to attend both Shlemon Programs in their registration packets. However, space is limited. First come, first served.

DETAILED INFORMATION

For further information, please contact the Meeting Co-Chairs, George Stephens, geoice@gwu.edu, and Rick Diecchio, rdiecchi@gmu.edu. Additional meeting information is also available at www.geosociety.org/sectdiv/northe/04nesemtg.htm.

NORTH-CENTRAL SECTION, GSA

38th Annual Meeting
St. Louis, Missouri

April 1–2, 2004

[www.geosociety.org/sectdiv/northc/
04ncmtg.htm](http://www.geosociety.org/sectdiv/northc/04ncmtg.htm)

The 38th Annual Meeting of the North-Central Section of the Geological Society of America will be hosted by the Department of Earth and Atmospheric Sciences of Saint Louis University. The meeting will be held at the Millennium Hotel St. Louis, located across from the famous Gateway Arch and Busch Stadium and only minutes from the Laclede's Landing entertainment district near the Mississippi River.

ABSTRACTS

Abstract deadline: January 6, 2004

Papers are invited for theme and general discipline sessions in both oral and poster format. Volunteered papers will be considered for any general discipline session as listed on the GSA abstract form. Authors interested in volunteering papers for symposia should contact the appropriate symposium conveners before submitting abstracts. For further information, please contact the Technical Program Chair, Tim Kusky, kusky@eas.slu.edu. Abstracts of papers must be submitted using the electronic submissions form at www.geosociety.org/sectdiv/northc/04ncmtg.htm. If you have questions regarding abstract submission, please contact Nancy Carlson, ncarlson@geosociety.org.

REGISTRATION

Preregistration deadline: February 23, 2004

Cancellation deadline: March 1, 2004

GSA Headquarters will handle preregistration. Please register online at www.geosociety.org. If you are unable to preregister this way, contact GSA Member Services, 1-888-443-4472. On-site registration will be possible at the Millennium Hotel St. Louis. Field trip participants are strongly encouraged to preregister for the meeting. On-site registration for a field trip is possible if space is still available.

Registration Fees

	PREREGISTRATION	ON-SITE REGISTRATION
Professional Member	\$125	\$145
Professional Nonmember	\$165	\$185
Student Member/Associate	\$40	\$50
Student Nonmember	\$50	\$60
K–12 Professional	\$30	\$30
Guest or Spouse	\$20	\$30

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for additions, changes, and cancellations must be made in writing and received by March 1, 2004. There will be no refunds for on-site registration, *Abstracts with Programs*, or ticket sales. Refunds will be mailed from GSA only after the meeting.

ACCOMMODATIONS

A block of rooms has been reserved at the Millennium Hotel St. Louis (200 South 4th Street, St. Louis, MO 63102; (314) 241-9500; www.millenniumhotels.com), which will be the site for all meeting sessions and activities. It is strongly recommended that participants take advantage of the convenience of staying at the Millennium Hotel. The group rate extended to GSA is \$99 for a single room and \$109 for a double/triple/quad. Prices do not include state and city taxes amounting to 14.9% total. These discounted rates will be extended to on-site registrants if rooms are still available.

TECHNICAL PROGRAM

Tim Kusky, Technical Program Chair, Saint Louis University, kusky@eas.slu.edu.

Symposia

- Urban Geology.** Joachim Dorsch, Saint Louis University, dorsch@eas.slu.edu; Mimi Garstang, Missouri Department of Natural Resources, nrgarsm@mail.dnr.state.mo.us.
- Carbonate-Hosted Ore Mineralization and Genesis.** Kevin L. Shelton, University of Missouri—Columbia, SheltonKL@missouri.edu; Jay M. Gregg, University of Missouri—Rolla, greggjay@umr.edu.
- New Madrid Zone: Seismicity, Tectonics, Paleoseismology and Tectonic Geomorphology.** John Holbrook, Southeast Missouri State University, jholbrook@semovm.semo.edu; Margaret Guccione, University of Arkansas-Fayetteville, guccione@comp.uark.edu; Buddy Schweig, U.S. Geological Survey, schweig@usgs.gov.
- Remote Sensing and GIS Applications to Geology.** Gary Higgs, Saint Louis University, higgsgb@slu.edu; Sharon Hawk, National Imagery and Mapping Agency, hawks@nima.mil.

Theme Sessions

- Recent Developments in Understanding Carbonate Geology of the Midcontinent.** *Sponsored by the Great Lakes Section of the Society for Sedimentary Geology (SEPM).* Gene Rankey, University of Miami, grankey@rsmas.miami.edu; Zak Lasemi, Illinois State Geological Survey, lasemi@isgs.uiuc.edu.
- Hydrogeologic Modeling and Heterogeneity—Addressing the Complexities of the Sediment Record.** Don Keefer, Illinois State Geological Survey, keefer@isgs.uiuc.edu.
- Extending Geoscience Education, K–16 and Beyond.** *Sponsored by the Central Section of the National Association of Geoscience Teachers.* Russanne Low,

University of Minnesota, rlow@cce.umn.edu; Kerry L. Keen, University of Wisconsin—River Falls, kerry.l.keen@uwrf.edu.

4. **New Understandings of the Geology and Hydrology of Buried Valleys.** Skip Nelson, Illinois State University—Normal, rsnelso@ilstu.edu; Tim Larson, Illinois State Geological Survey, tlarson@isgs.uiuc.edu.
5. **Recent Research in Economic Geology: From Missouri to the World.** Richard D. Hagni, University of Missouri—Rolla, rhagni@umr.edu; Cheryl M. Seeger, Missouri Department of Natural Resources, nrseegc@mail.dnr.state.mo.us.
6. **Undergraduate Research in the Geosciences (Poster Session).** *Sponsored by the Council on Undergraduate Research.* Robert Shuster, University of Nebraska—Omaha, rshuster@mail.unomaha.edu; Dave Matty, Central Michigan University, david.j.matty@cmich.edu.
7. **Quaternary Mapping Applied to Hydrogeologic or Environmental Issues.** Edward Smith, Illinois State Geological Survey, esmith@isgs.uiuc.edu; David Grimley, Illinois State Geological Survey, grimley@isgs.uiuc.edu.
8. **Fossil Reef Systems.** *Sponsored by the Paleontology Society North-Central Section.* Ann Budd, University of Iowa, ann-budd@uiowa.edu; Christopher Crow, Indiana University—Purdue University Fort Wayne, crowc@ipfw.edu.

GENERAL DISCIPLINE SESSIONS

General discipline sessions for both oral and poster sessions will be organized to accommodate volunteered papers. The General Discipline Sessions are in addition to Symposia (invited papers and selected volunteered papers) and Theme Sessions (volunteered papers).

FIELD TRIPS

One premeeting and six postmeeting field trips are scheduled. Because of the tremendous benefits gained by participating in field trips, we have tried to make these trips affordable for undergraduate and graduate students. We encourage faculty to bring their students to the meeting and field trips. Field trip costs include transportation, guide book (will include all field trips), one lunch, park entrance fees, and lodging (double occupancy), unless indicated otherwise. Minimum number of participants is required for each trip, therefore we strongly encourage preregistration. More detailed information regarding the field trips and logistics can be found at www.geosociety.org/sectdiv/northc/04ncmtg.htm, or www.eas.slu.edu/ncgsa/index.html. Questions can be sent to Field Trip Coordinator, David Kirschner, Saint Louis University, dkirschn@eas.slu.edu.

1. **Urban Expansion Hazards.** Wed., March 31. Bill Dule and Peter Price, Missouri Department of Natural Resources, nrduleb@mail.dnr.state.mo.us. Cost: \$50. Students: \$35.
2. **Architecture and Heterogeneity of Middle Mississippian Grainstones, Eastern Missouri.** Sat., April 3. Gene Rankey, University of Miami, grankey@rsmas.miami.edu. Cost: \$50. Students: \$35.
3. **Late Upper Cambrian Syndepositional Tectonics, St. Francois Mountains, Missouri.** Sat., April 3. Cheryl

Seeger, Missouri Department of Natural Resources, nrseegc@mail.dnr.state.mo.us. Cost: \$50. Students: \$35.

4. **A Trip Back in Time in the St. Francois Mountains (primarily for students and K–12 teachers).** Saturday, April 3. Jay Gregg, University of Missouri—Rolla, greggjay@umr.edu; John Hogan, University of Missouri—Rolla, jhogan@umr.edu. Cost: \$50. Students: \$35.
5. **Event Stratigraphy and Mineral Resources of Silurian Rocks in West-Central Illinois and Northeast Missouri.** Sat. and Sun., April 3–4 (one night in Pierre Marquette State Park lodge). Don Mikulic, Illinois State Geological Survey, mikulic@isgs.uiuc.edu; Joanne Kluessendorf, University of Wisconsin—Fox Valley, jkluesse@uwc.edu; Rodney Norby, Illinois State Geological Survey, norby@isgs.uiuc.edu. Cost: \$150. Students: \$120.
6. **Neotectonics of the New Madrid Seismic Zone.** Fri. evening to Sun., April 2–4 (two nights). John Holbrook, Southeast Missouri State University, jholbrook@semovm.semo.edu; Peggy Guccione, University of Arkansas—Fayetteville, guccione@comp.uark.edu; David Hoffman, Missouri Department of Natural Resources, nrhoffd@mail.dnr.state.mo.us. Cost: \$180. Students: \$150.
7. **Overview of Geology and Karst Development Along the I-44 Corridor Between St. Louis and St. James, Missouri.** Sat., April 3. Jim Vandike, Missouri Department of Natural Resources, nrvandj@mail.dnr.state.mo.us; Bill Duley, Missouri Department of Natural Resources, nrduleb@mail.dnr.state.mo.us. Cost: \$50. Students: \$35.

WORKSHOPS

1. **Roy J. Shlemon Mentor Program in Applied Geoscience.** *Sponsored by the GSA Foundation.* Thurs., April 1, 11:30 a.m.–1 p.m., or Fri., April 2, 11:30 a.m.–1 p.m. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real-life issues such as the professional opportunities and challenges that await students after graduation. Students will receive a FREE LUNCH ticket to attend the Shlemon Program in their registration packet; however, space is limited! Interested students should contact Karlon Blythe, kblythe@geosociety.org, to guarantee their participation in the workshop.
2. **Woolly Mammoth Comes Alive for K–12 Educators.** Sat., April 3 (Principia College, Elsah, Illinois). A workshop for K–12 teachers to support teaching about Ice Age mammals will be held on the Principia College campus where a woolly mammoth is being excavated. Leaders: Janis Treworgy, Principia College, jdt@prin.edu; William Slattery, Wright State University, William.Slattery@wright.edu. Contact Janis Treworgy directly to register.

POSTER SESSIONS

Poster should be designed to mount on a 4' × 8' landscape-format panel. The panel will have felt-covered cardboard. Materials can be mounted with Velcro, tacks, or pins.

EQUIPMENT FOR ORAL PRESENTATIONS

Rooms for oral presentations will have only one projection screen. Windows-compatible PowerPoint presentations will

be the standard format. Speakers are requested to provide Windows-compatible CDs with their presentations saved as a show. The computer will also have a floppy disc drive in case presenters are unable to provide a CD. One 35mm slide projector and one overhead projector will also be available if needed. Speakers should bring their own carousel if they will be using the slide projector. CDs or slide carousels, clearly labeled with the speaker's name, session number, and speaker number, must be brought to the session room 20 minutes prior to the session. Hooking up of personal laptops for presentations cannot be accommodated.

SPECIAL EVENTS

Ice Breaker Party. Wed., March 31, 6–9 p.m. Meeting registration required to attend.

North-Central Section Annual Business Meeting. Wed., March 31, 6:30–7:30 p.m.

North-Central Section Management Board Meeting and Breakfast. Thurs., April 1, 7–8:30 a.m. Invitation Only.

Association of Women Geoscientists (AWG) Central Section Business Meeting. Thurs., April 1, 7–8 a.m.

North-Central Section GSA Campus Representatives and Department Chairs Meeting. Fri., April 2, 7–7:30 a.m.

Central Section National Association of Geoscience Teachers (NAGT) Business Meeting and Luncheon. Fri., April 2, 11:30 a.m.–1 p.m. Cost: \$27/professional, \$19/student.

Paleontology Society (PS) North-Central Section and Society for Sedimentary Geology (SEPM) Great Lakes Section Business Meeting and Luncheon. Fri., April 2, 11:30 a.m.–1 p.m. Cost: \$27/professional, \$19/student.

GUEST ACTIVITIES

Group guest activities will be offered for some St. Louis attractions including the (1) Missouri Botanical Garden, (2) St. Louis Art Museum, (3) History Museum, and (4) St. Louis Science Center, which includes an Omnimax theater. Prices, schedules, and more information for these guest tours will be posted on the North-Central Section meeting Web site (www.geosociety.org/sectdiv/northc/04ncmtg.htm, or www.eas.slu.edu/ncgsa/index.html).

STUDENT TRAVEL SUPPORT

Application deadline: February 2, 2004

The North-Central Section of GSA, in cooperation with the GSA Foundation, will provide grants for travel assistance of up to \$200 (exclusive of field trip fees) to student members and associates of GSA. Assistance will be offered on a first-come, first-served basis with priority given to students presenting papers (oral presentation or poster). Send applications to Joachim Dorsch, General Meeting Chair, Saint Louis University, dorsch@eas.slu.edu. Application forms and mailing address are available at <http://csd.unl.edu/ncgsa/current-forms/student-forms.htm>.

STUDENT AWARDS

The North-Central Section of GSA and the Great Lakes Section of SEPM will present cash awards for best and honorable-mention student papers (both oral and poster). To be eligible, students must be lead authors and presenters and should indicate their status on the submission form.

EXHIBITS

Exhibits will be located in the Millennium Hotel St. Louis. For information on exhibit rates and space reservations, contact Exhibits Coordinator David Kirschner, Saint Louis University, dkirschn@eas.slu.edu.

ACCESSIBILITY

GSA is committed to ensuring full participation for conference attendees with disabilities at all events at the 2004 meeting. Every attempt is made for full compliance with the Americans with Disabilities Act. You can indicate special requirements on your registration form and should inform General Meeting Chair Joachim Dorsch, dorsch@eas.slu.edu, at least one month prior to the meeting. If you require an accessible room, please inform the hotel of your needs when making your room reservation.

SPONSORSHIP

The organizing committee is actively seeking sponsorship for this conference from government and corporate agencies. Sponsors will be recognized during the meeting and acknowledged in the printed program and on the meeting Web sites. Those interested in sponsoring an event, audiovisual equipment, coffee breaks, or making a donation to the general fund of the conference should please contact General Meeting Chair Joachim Dorsch, dorsch@eas.slu.edu.

POLICY ON CAMERAS, SOUND EQUIPMENT, AND SMOKING

North-Central Section GSA regulations prohibit the use of cameras or sound equipment at technical sessions. A no-smoking policy applies to all North-Central Section GSA annual meeting events and will be followed in technical sessions, workshops, and social events.

DETAILED INFORMATION

For further information and details, please visit the meeting Web sites at www.geosociety.org/sectdiv/northc/04ncmtg.htm, or www.eas.slu.edu/ncgsa/index.html. You may also contact General Meeting Chair Joachim Dorsch at the Department of Earth and Atmospheric Sciences, Saint Louis University, 329 Macelwane Hall, 3507 Laclede Ave., St. Louis, MO 63103, (314) 977-3124, fax 314-977-3119, dorsch@eas.slu.edu.

Students: Mark your Calendars!

Shlemon Mentor Programs for 2004

Students: If you have career-related questions, plan to attend a Shlemon Mentor Program at a 2004 GSA Section Meeting to chat one-on-one with practicing geoscientists. These volunteers will answer your questions and share insights about how to get a job after graduation. When programs are scheduled for multiple days, each day's program will offer a different set of mentors. These programs are made possible by the Roy J. Shlemon Fund, administered by the GSA Foundation.

FREE LUNCHESES will be served (to students only) at the following Shlemon Mentor Programs at the spring GSA Section Meetings. Stop by the GSA registration desk to get the location of the luncheon.

South-Central Section Meeting

Mon. and Tues., March 15–16
11:30 a.m.–1 p.m.
College Station, Texas

Northeastern–Southeastern Sections Joint Meeting

Thurs. and Fri., March 25–26
11:30 a.m.–1 p.m.
Tyson's Corner, Virginia

North-Central Section Meeting

Mon. and Tues., April 1–2
11:30 a.m.–1 p.m.
St. Louis, Missouri

Cordilleran–Rocky Mountain Sections Joint Meeting

Mon. and Tues., May 3–4
11:30 a.m.–1 p.m.
Boise, Idaho

Students will receive a **FREE LUNCH** ticket along with their registration badge to attend each Shlemon Program. However, space is limited. First come, first served.

Call for Geological Papers: 2004 GSA Section Meetings

South-Central Section

March 15–16, 2004

Texas A&M University, College Station, Texas

Abstract deadline: December 16, 2003

Information: Christopher Mathewson, Texas A&M University, Department of Geology & Geophysics, 3115 TAMU, College Station, TX 77843-3115, (979) 845-2488, mathewson@geo.tamu.edu

Northeastern–Southeastern Sections Joint Meeting

March 25–27, 2004

Hilton McLean Tyson's Corner, Washington, D.C.

Abstract deadline: December 16, 2003

Information: George Stephens, George Washington University, Department of Earth & Environmental Sciences, 2029 G St., NW, Washington, D.C. 20052-0001, (202) 994-6189, geoice@gwu.edu; Rick Diecchio, George Mason University, Department of Environmental Science & Policy, MS 572, 4400 University Dr., Fairfax, VA 22030-4444, (703) 993-1208, rdiecchi@gmu.edu

North-Central Section

April 1–2, 2004

Millennium Hotel, St. Louis, Missouri

Abstract deadline: January 6, 2004

Information: Joachim O. Dorsch, Saint Louis University, Department of Earth & Atmospheric Science, 3507 Laclede Ave., St. Louis, MO 63103-2010, (314) 977-3124, dorsch@eas.slu.edu

Rocky Mountain–Cordilleran Sections Joint Meeting

May 3–5, 2004

Boise Centre on the Grove, Boise, Idaho

Abstract deadline: January 27, 2004

Information: C.J. Northrup, Boise State University, Department of Geosciences, 1910 University Dr., Boise, ID 83725, (208) 426-1009, cjnorth@boisestate.edu

www.geosociety.org/sectdiv/sections.htm

Networking—Learn How at a Shlemon Program

Karlon Blythe, Program Officer

The 2003 season of Roy J. Shlemon Mentor Programs in Applied Geoscience has been exceptionally successful and has set record numbers in participation by both students and mentors. The programs are designed to extend the mentoring reach of individual professionals from applied geology to undergraduates and graduate students attending GSA Section Meetings. Over free lunches, mentors and students discuss professional opportunities and challenges that await students after graduation. The program boasts success in promoting the hire of at least half a dozen students this year. These students made their connections for part-time or full-time positions while attending a Shlemon Mentor Program in Applied Geoscience, presented by GSA and supported by the GSA Foundation.

This past spring, all six sections participated in the Shlemon Programs, and program funds provided box lunches free to 301 students and 53 mentors. The ratio of mentors to students was an admirable one to five. The mentors represented a broad range of experience and expertise from private and public businesses, state surveys, and government agencies.

If you are interested in participating as a mentor at a GSA 2004 Section Meeting, please contact Karlon Blythe, kblythe@geosociety.org.

The Roy J. Shlemon Mentor Program in Applied Geoscience gratefully acknowledges the following mentors for their individual gifts of time and for sharing their expertise with GSA's student members.

David W. Abbott

Todd Engineers
Emeryville, California

John W. Attig

Wisconsin Geological Survey
Madison, Wisconsin

Katharine Lee Avary

West Virginia Geological Survey
Morgantown, West Virginia

Sharon Barnes

City of Kansas City
Kansas City, Missouri

Dan A. Billman

Billman Geologic Consultants, Inc.
Mars, Pennsylvania

Thomas Bissig

Mineral Deposit Research Unit
Vancouver, British Columbia

Jeffrey W. Brame

Brame GeoScience
Durango, Colorado

Cliff Caudle

ATC Associates
Memphis, Tennessee

Chris Cornelius

Evergreen Resources, Inc.
Denver, Colorado

David Dockery

Mississippi Office of Geology
Jackson, Mississippi

Dave Drake

U.S. Environmental Protection Agency
Kansas City, Kansas

Susan Eaton

Prendegast Petroleum Ltd.
Calgary, Alberta

Tom G. Farr

Jet Propulsion Lab
Pasadena, California

Tom Fouch

President, GSA Foundation
U.S. Geological Survey, Retired
Boulder, Colorado

Kate Freeman

EnSafe, Inc.
Memphis, Tennessee

Walter Gage

Souder, Miller & Associates
Farmington, New Mexico

Brett Gilley

Simon Fraser University
Burnaby, British Columbia

Andrew S. Gosnell

U.S. Army Corps of Engineers
Kansas City, Missouri

Richard E. Gray

GAI Consultants
Monroeville, Pennsylvania

Brian V. Hall

International Croesus Ventures Corp.
Bowen Island, British Columbia

Andrew B. Heckert

New Mexico Museum of Natural History
Albuquerque, New Mexico

Chris Henry

Nevada Bureau of Mines & Geology
Reno, Nevada

G. Warfield "Skip" Hobbs

Ammonite Resources Company
New Canaan, Connecticut

Mark Hudson

U.S. Geological Survey
Denver, Colorado

Steven J. Jirousek

U.S. Army Corps of Engineers
Kansas City, Missouri

William Jones

SRS
Aiken, South Carolina

Brian D. Keith

Indiana Geological Survey
Bloomington, Indiana

Tom Kuper

Kuper Consulting LLC
Tualatin, Oregon

Dorian Kuper

Kuper Consulting LLC
Tualatin, Oregon

Todd LaMaskin

URS Corporation
Richmond, Virginia

Mark R. List

Regional Water Quality Control Board
Sacramento, California

David Lumsden

University of Memphis
Memphis, Tennessee

Charles Lumsden

Federal Express
Memphis, Tennessee

Tom Martel

Corridor Resource Inc.
Halifax, Nova Scotia

Richard L. Moberly

URS Corporation
Overland Park, Kansas

Jim Morrison

Tennessee Dept. of Environment &
Conservation Division
Memphis, Tennessee

Anne Muecke

Griffiths Muecke Associates
Halifax, Nova Scotia

David C. Noe

Colorado Geological Survey
Denver, Colorado

Randal Rogers

Shaw E & I, Inc.
Knoxville, Tennessee

Robert M. Rohlfs

Leggette, Brashears & Graham, Inc.
North Kansas City, Missouri

Malcolm Schaeffer

Framatome ANP
Charlotte, North Carolina

Harry Siebert

Consultant
Dolores, Colorado

Janet L. Slate

U.S. Geological Survey
Denver, Colorado

Evan Spann

Buchart-Horn, Inc.
Memphis, Tennessee

Robert J. Sterrett

Engineering Mgt. Support, Inc.
Arvada, Colorado

David Stous

Burns & McDonnell Engineering
Company
Kansas City, Missouri

John F. Szturo

HNTB Corporation
Kansas City, Missouri

Steve Thibodeaux

Fruitland Coal Team
Burlington Resources
Durango, Colorado

Grant D. Wach

Dalhousie University
Halifax, Nova Scotia

Kemble White

SWCA Environmental Consultants
Austin, Texas

Kristin White

Horizon Environmental Services, Inc.
Austin, Texas

Donald H. Wilkison

U.S. Geological Survey
Lee's Summit, Missouri

Charles D. Winker

Shell International EP
Houston, Texas

COAL DIVISION OFFERS MEDLIN AWARD

GSA's Coal Geology Division announces the availability of the Antoinette Lierman Medlin Scholarship in Coal Geology for the 2004–2005 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 2004–2005 scholarship award. In addition, the recipient of the scholarship may be provided with a stipend to present results of the research at the 2005 GSA Annual Meeting. For the academic year 2004–2005, the Coal Geology Division is also offering a field study award of approximately \$1,500. The recipient of this award will also be eligible to receive travel funds to present results of the study at the 2005 GSA Annual Meeting.

A panel of coal geoscientists will evaluate proposals for the scholarship and the field study award. 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 cover 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 should be no more than five double-spaced pages in length, including references); and (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: Romeo Flores, U.S. Geological Survey, Box 25046, MS 939, Denver Federal Center, Denver, CO 80225, USA; fax 303-236-0459, rflores@dncrds0.cr.usgs.gov.

The proposal and letter of recommendation must arrive no later than February 15, 2004. Applicants will be notified of the Scholarship Committee's decision by April 1, 2004.

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

The GSA Foundation manages the Antoinette Lierman Medlin Scholarship fund.

COMMENTARY

Research and Education in Taiwan

Anne E. Egger, *Math/Science Department, San Juan College, 4601 College Blvd., Farmington, New Mexico 87402, eggera@sanjuancollege.edu*

I found my seat in the DC-10, grateful to have collected enough air miles in the past year to qualify for the “Economy Plus” section and five more inches of legroom. The passenger in the seat next to me pulled out a few familiar items: a schedule, a stack of papers to grade. I turned to him and said, “Are you on your way to the Penrose Conference, by any chance?”

He confirmed my suspicions. We introduced ourselves, and, not recognizing my name, he said, “You must be from the tectonics end of things.”

“Well, sort of,” I replied. “I’m actually attending this meeting as an educator.”

He looked surprised, so I elaborated. “I teach geology at a community college in New Mexico. I’m a structural geologist, too, but the interdisciplinary nature of this topic could provide some great educational opportunities.”

“Oh,” he said. “Wow. Good luck.”

We chatted occasionally over the next 13 hours or so until the plane touched down in Taipei, Taiwan. Then he took a cab and I took a bus to the hotel.

My attendance at the “Tectonics, Climate, and Landscape Evolution” Penrose Conference in Taiwan in January 2003 was something of an experiment. Penrose Conferences, as most GSA members are aware, are typically subject-specific work sessions for researchers who share interests or, in this case, approach similar problems from a wide range of backgrounds. To explore the relationships between tectonics, climate, and landscape evolution, the conveners had accepted applications from meteorologists, geophysicists, structural geologists, geomorphologists, experi-

mental sedimentologists, and GIS experts from all over the world. The topic immediately caught my eye—few things appeal to me more as a teacher than the chance to connect several concepts together into an interdisciplinary exploration. Many scientists and educators have made these broad connections before: plate tectonics built the Cascades, for example, which create a long rain-shadow in eastern Oregon, where a daunting desert landscape looks more like Nevada than the Oregon coast. The chance to explore these interactions in more detail with experts was compelling.

Having made a choice to teach at a community college rather than to pursue a research career, I had little to contribute to the conference. Community college instructors generally teach 15 credit hours per semester (four to five classes), leaving little time for research and often making it difficult to stay current within their discipline. There is no chance to teach higher level classes, as the students who would potentially take those courses have transferred to four-year colleges by that time. I thought I might be able to experience the excitement of

Their response overwhelmed me—they asked if I would like to attend the conference to do just that.

the conference vicariously, though, and contacted the conveners to see if they had plans for creating any educational materials as a result of the conference. Their response overwhelmed me—they asked if I would like to attend the conference to do just that.

I leapt at the chance. We agreed on the details of what I would do there and arranged funding that would enable my travel.

Unsure what to expect, I anticipated one main outcome: I would collect a pile of material about tectonics, climate, and landscape evolution to be repack-

aged for a non-specialist audience. At the end of ten days in Taiwan, it was clear that I had underestimated the possibilities. There was no shortage of content, and my notebook quickly filled with detailed notes, names and URLs, and thoughts for educational materials. But two unanticipated results also surfaced: a highly enlightening and ongoing discussion about how we do science, and the collection of a whole host of good ideas and problems concerning earth science education.

The interdisciplinary nature of the content of the meeting created an ideal atmosphere for the discussion of education, in no small part because of the logistics involved in bringing meteorologists, structural geologists, and geomorphologists together into the same room—there was a lot of educating to do. Our field trip through the central mountains of Taiwan to look at the change in metamorphic grade and fabric across the crest, for example, included an impromptu (and oft-repeated) lecture by Ron Smith on the foehn (say “fern”) cloud spilling over the divide. Presentations were geared toward the non-specialist, and presenters took time to explain what they may have considered basic concepts before delving into the details of their work. No one was embarrassed to ask, “What is *e*?” or “What does *that* mean?” Throughout the conference, language was very important—words used in one sense in one discipline had to be clarified for people in other disciplines who used them differently. This confusion reflects a common situation in the classroom, when students misunderstand the word “theory” or “error,” for example, leading them to draw inaccurate conclusions about the general acceptance of plate tectonic theory.

The conference also offered an amazing amount of insight into how scientists educate themselves and how they pursue education in the classrooms where they teach. Most university science faculty are chagrined when their students do not recognize that science is not a collection of facts and figures, but an ongoing series of ques-

tions. These same faculty may be uncomfortable sharing their own experiences in the classroom—that they spent a year building an experimental apparatus that didn't work, or that the results of their research were completely unanticipated and caused a shift in focus. But this is how we do science. We do field work, we experiment, we model, we collect samples, we start out asking one question and find out it's not the right one. This is a fundamental aspect of science that we often forget when we are standing in front of an introductory geology class. But the process of science is just as important as the explanations that come out of the process.

People told me about great things they had done in their classrooms and problems they were having in their departments. Many schools are shifting from "geology" departments to "earth science" or "earth system science" departments, often forcing faculty to teach more interdisciplinary courses. Several people told me about the innovative, problem-based classes they had designed to fulfill this need.

Possibly the most frequently cited problem was gender. Out of 100+ participants in the Taiwan conference, there were eight women, half of whom were graduate students. This ratio accurately reflects the faculty gender ratios in many earth science departments, but graduate student ratios have been close to 50:50 for more than a decade. What is happening? This article is not the place to explore this question, but concerns were raised that it may relate to the method of education or the perception of life as a tenure-track research faculty member.

Amidst the wide range of conversations about these topics, I began to realize just how unlikely and unusual my presence in Taiwan was. There are few resources available for community college faculty to pursue or stay involved in research, and few reasons to do so. Unlike at four-year institutions, there is no tenure carrot at the end of the research stick. It is a challenge to find time to write grant proposals, much less to actually perform the research, when teaching four classes per semester without teaching assistants or graduate students. Travel grants and discounted meeting registration generally are usu-

ally available only to K–12 educators. These factors leave many college science faculty whose focus is on teaching out of the research loop and hard-pressed to stay current.

Yet most scientists agree that integrating ongoing research into teaching is a critical component of science education at all levels, especially the college level. And 44% of all undergraduates in the U.S. are enrolled at community colleges. Did you get that? Nearly half of all of the students pursuing undergraduate degrees in the U.S. are doing so at community colleges. Full-time tuition at community colleges averages \$1,300 per year, and is by far the most affordable higher education available. And yet this year, as state budgets fell short and federal funds diminished, many community colleges were the first to feel the heat.

GSA is expertly prepared to provide a forum for the presentation of research through its annual and sectional meetings and publications. It facilitates student research through its student grants and promotes ongoing research through Penrose Conferences and field trips. Recently, the Education & Outreach Department of GSA has begun to collect and publish educational materials for K–12 educators on its Web site. But I must ask: How many GSA members are K–12 educators? The materials available on the Web site represent a tremendous amount of work and dedication, but so far, little has been done to reach out to college-level educators, who are the majority of GSA members.

Granted, a lot of opportunities for professional contributions in geoscience education exist. There are geoscience education technical sessions at GSA meetings. The National Association for Geoscience Teachers (NAGT) publishes the *Journal of Geoscience Education*, where many faculty find an outlet for peer-reviewed papers about teaching methods, classroom success stories, and innovative ideas. NAGT also offers field camp scholarships to a small number of qualified undergraduate students. The Digital Library for Earth Science Education (DLESE) has done a fantastic job of reviewing and compiling appropriate websites for classroom use. The Geoscience Education program within the National Science Foundation funds the best proposals that integrate geosci-

ence research and education.

But something is missing. Where GSA could truly take a leading role is in the granting of funds to college-level educators, at both four- and two-year institutions, to pursue and promote professional development and short-term educational goals. Ideally, GSA would develop a program similar to the existing student research grants but intended instead for college faculty to develop curricular materials, attend research meetings (at which they are NOT presenting research) to stay current, and pursue educational research within their geoscience classrooms. None of these goals requires huge sums of money, so the size of the student research grants (averaging \$1,800) would be appropriate. Money doesn't fall out of the sky, of course, especially when teachers are the ones asking for it, but donations could be sought in a format similar to the GSA Foundation. Additionally, GSA could provide space on its Web page for the archiving of educational materials generated through these small grants. This may expand to include appropriate materials presented at technical sessions, reviewed through an existing process like that used by DLESE.

Attending the Penrose Conference was an incredibly valuable experience for me both as a geologist and as an educator—an experience that I believe should be available to more college faculty who are primarily teachers. I would argue that my presence was equally important for the other participants who shared their content, insights, and concerns with me. Everyone present was concerned about education, whether it was their own or their colleagues', their students' or policy makers'. We are obliged to stay current not only to be competitive in our research, but in order to convey the excitement of research to our students. I hope my experimental trip to Taiwan will not stand alone, and similar ventures will become not only common, but an essential element of geoscience education and outreach.

An upcoming GSA Special Paper will collect the work of the presenters and attendees of "Tectonics, Climate, and Landscape Evolution," a Penrose Conference held in Taiwan in January 2003.



And Now for a Bit of Good News...from Washington?

Robert L. Fuchs, Honorary Trustee

Enough of deficits, stealth tax increases, and political back biting. In mid-September Congress finally got down to work and did something positive for America's charitable organizations by passing the CARE Act (Senate bill S. 476) and the Charitable Giving Act (House bill H.R. 7) by resounding majorities. Even the White House got into the "act" by stating that H.R. 7 "will strengthen America's charities and expand the important work of faith-based and grass roots groups." The legislation will now go to conference committee to merge the two bills, already quite similar, into a final product for President Bush to sign.

Just what is the CARE Act, as this law will probably be called? There are three main provisions that will enhance the giving ability of U.S. taxpayers. First (and probably the most wide-ranging attribute), millions of people who now take the standard deduction will also be able to deduct a portion of their charitable gifts when calculating their income taxes. This will apply to donation amounts up to \$500 when contributions exceed \$500 on joint returns. That is, the second \$500 of donations will be deductible. A taxpayer with \$1,000 of contributions could take a \$500 deduction; with \$1,200 of contributions, the deductible amount would still be \$500.

Second, taxpayers age 70½ and older will be able to make tax-free donations from their IRAs. Anyone who is in the mandatory distribution years—older than 70½—knows how irritating these distributions can be, since they are taxed at regular income rates. The CARE Act will allow IRA owners to give funds from their accounts (or an entire IRA for that matter) directly to charities at full value (i.e., no taxes withheld along the way).

Third, there is a basket of additional specialized provisions that loosen charitable giving rules for small businesses and Subchapter S corporations. Included in the basket is language

allowing direct, non-taxable charitable distributions by individuals older than 59½ to split-interest entities (i.e., charitable remainder trusts, charitable gift annuities, and pooled income funds). These are key elements of any planned giving program, including that of the GSA Foundation. John Mann's notable generosity to the Foundation includes a charitable remainder trust. Split-interest refers to the dual beneficiaries of these entities, generally the donor and/or spouse's income interest and the charity's remainder interest.

As with any piece of legislation in joint conference committee, the final outcome may contain a few surprises. But congressional support has been strong, and the indications are that the President will sign the CARE Act into law. In addition to all the recent tax law changes, the CARE Act presents a further reason for some estate plan fine-tuning with the assistance of your professional advisor.

Bob Fuchs is a former President of the GSA Foundation, and Honorary Trustee now living in Fort Myers, Florida, where he assists several charities in their planned giving programs.

Deadline for Tax Credit in 2003

In order to receive a tax credit in 2003, your contribution to the GSA Foundation must be postmarked no later than December 31, 2003.

You may send your contribution directly to the Foundation office, 3300 Penrose Place, Boulder, Colorado 80301, call the Foundation office directly at 303-357-1054, or donate directly online at www.geosociety.org/gsaf. You may also e-mail the Foundation at gsaf@geosociety.org for a confirmation of your total giving for the year.

Your support of the GSA Foundation and GSA programs is appreciated.

Donate Online

It's easy! It's quick! It's secure!
Go to www.geosociety.org
Click on "Donate Online" and follow the user-friendly instructions today!



GSA FOUNDATION

3300 Penrose Place, P.O. Box 9140
Boulder, CO 80301-9140 ■ (303) 357-1054
drussell@geosociety.org

Enclosed is my contribution in the amount of \$_____.

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Field Forum Report



Steve Israel (University of British Columbia) shakes off sea spray after landing on a tightly folded marble outcrop that forms part of a mid-crustal fold-thrust belt exposed in Caswell Sound. Photo by K. Klepeis.

Structural Controls on Magma Transport and Vertical Coupling in the Continental Lithosphere

Fiordland, New Zealand, April 26–May 6, 2003

Leaders: Keith Klepeis, University of Vermont; Geoffrey Clarke, University of Sydney; Tracy Rushmer, University of Vermont; and Andrew Tulloch, Institute of Geological and Nuclear Sciences.

This Field Forum was held in Fiordland National Park on the South Island of New Zealand. The Fiordland setting allowed us to examine processes that affect crustal evolution at unusually deep levels of an ancient arc (25–50 km paleodepth). Our goal was to use these exposures to test our understanding of arc structure and magma generation and migration through the lower crust. The trip began with a two-day workshop where participants from seven countries met to discuss relevant work. Fields of expertise included igneous, metamorphic, and experimental petrology; geochemistry; structural geology; geodynamics; and volcanology. Workshop discussions were mixed with helicopter trips to nearby exposures. Following the workshop, we accessed shoreline exposures from aboard the *Milford Wanderer* for five days. The following topics focused our discussions.

Melt segregation and transfer mechanisms in the lower crust

The Fiordland exposures provided evidence that diking and melt-enhanced fracturing aided melt transfer through the lower crust. Structural elements in ductile shear zones also were discussed as pathways for melt transport. Geoff Clarke, Nathan Daczko, Peter Robinson, and Harold Stowell led

discussions on the effects of fluid and melt migration, including crustal dehydration. Tracy Rushmer and Alberto Patino-Douce emphasized the role of mineral reactions in controlling melt volumes and segregation mechanisms. Simon Harley led discussions on how hot fluids may affect zircon chemistry and can influence interpretations of crystallization and metamorphic ages.

Variations in magma composition

Andy Tulloch presented evidence for two distinctive margin-parallel plutonic suites. Diorite and tonalite-granodiorite plutons displaying high Sr/Y ratios developed inboard of slightly older gabbro-diorite-granite plutons with lower Sr/Y ratios. Similar paired suites occur in other arcs and a HiSY (high Sr/Y), LoSY (low Sr/Y) terminology was introduced in preference to terms such as adakite, TTG (tonalite-trondhjemite-granodiorite). Ian Turnbull and Andrew Allibone pointed out that the lower crust is very heterogeneous compositionally (“... a mixed bag containing a multitude of sins!”), and Robert Wiebe showed how the magmas interacted. Weecha Crawford and Julie Vry emphasized the effects of compositional variability on the mineral reactions controlling melt production. Jon Davidson and Michael Dungan explored what volcanoes tell us about magma generation and degree of mixing in the deep crust. We concluded that Fiordland may be an example where crust-mantle mixing occurred beneath a deep mafic intrusion and the rapid ascent of hybrid magmas inhibited shallow crustal contamination.

Variations in structural style with crustal depth

Bob Miller, Jinny Sisson, and Cees van Staal led discussions on arc structure. Keith Klepeis showed that steep shear zones in the lower crust cut vertically upward to merge with a mid-crustal fold-thrust belt. Arthur Goldstein, Jim Dunlap, Brad Hacker, and

Jeff Lee discussed how displacements were relayed vertically through the arc. Discussions on distinguishing extensional and contractional structures, led by George Gibson, and the Cenozoic reactivation of Cretaceous structures, led by Rupert Sutherland, also were important to the interpretations. The Fiordland setting is stimulating new ideas about magma genesis and how deep-level processes relate to those in the shallow crust. The Field Forum confirmed the value of combining diverse fields of expertise to study crustal evolution. Discussions will continue at the American Geophysical Union December meeting in special session V09 (“Birth, growth and death of magmatic arcs: Comparisons among arcs in different settings”) cosponsored by Volcanology, Petrology and Geochemistry and Tectonophysics.

Participants

Andrew Allibone
Art Goldstein
Peter Robinson
Peter Blattner
Bradley Hacker
Tracy Rushmer
Geoffrey Clarke
Jacqui Halpin
Jinny Sisson
Bill Crawford
Simon Harley
Harold Stowell
Weecha Crawford
Steven Israel
Rupert Sutherland
Nathan Daczko
Keith Klepeis
Andrew Tulloch

Jon Davidson
Jeffrey Lee
Ian Turnbull
Michael Dungan
Stephen Marcotte
Cees van Staal
Jim Dunlap
Robert Miller
Julie Vry
Joel Fitzherbert
Gabriela Mora-Klepeis
Robert Wiebe
Scott Giorgis
Alberto Patino-Douce
Tina White
George Gibson
Robert Price
Carlos Zuluaga
Horst Zwingmann

Acknowledgments

We thank the GSA for sponsoring the Field Forum. Edna Collis and Gabriela Mora-Klepeis provided valuable assistance. Grants from the GSA Pretorius Fund and the National Science Foundation helped students attend the meeting. The Institute of Geological and Nuclear Sciences (New Zealand) provided logistical support. We thank the Department of Land Conservation, Te Anau, for permission to visit park localities.



Milford Wanderer edges close to an outcrop along the shores of Caswell Sound, Fiordland National Park. Photo by A. Tulloch.



PENROSE CONFERENCE SCHEDULED

Mass Redistribution in Continental Magmatic- Hydrothermal Systems

September 6–11, 2004

Yellowstone National Park and Butte
(Fairmont Hot Springs), Montana

Conveners:

John H. Dilles, *Department of Geosciences, Wilkinson Hall 104, Oregon State University, Corvallis, Oregon 97331-5506, USA, (541) 737-1245, fax: 541-737-1200, dillesj@science.oregonstate.edu*

Greg B. Arehart, *Department of Geological Sciences, University of Nevada, Reno, Nevada 89557-0138, USA, (775) 784-6470, arehart@unr.edu*

Peter I. Nabelek, *Department of Geological Sciences, University of Missouri, Columbia, Missouri 65211, USA, (573) 884-6463, fax 573-882-5458, nabelekp@missouri.edu*

Todd C. Feeley, *Department of Earth Sciences, 4 Hitching Post Road, Montana State University, Bozeman, Montana 59717-0348, USA, (406) 994-6917, fax 406-994-6923, tfeeley@montana.edu*

Description and Objectives

This conference will provide a forum for discussion of how large-scale, magmatically driven hydrothermal systems operate in the continental crust and how they produce enormous geochemical redistribution of elements that sometimes result in economic mineral deposits. After magma transport, hot aqueous fluids ranging from nearly pure water to complex gas mixtures and brines produce the largest mass transfer within the crust. The conveners invite participants whose research spans diverse fields including igneous processes, geophysics, contact metamorphism, fluid flow, water-rock reactions, isotopic and chemical tracers, and mineral deposits. We will examine what we know about these mass transfer processes,

what we wish to know in the future, and how we should set about obtaining and analyzing the requisite new data.

Outline of Conference

The conference will include two days of field trips and three days of oral and poster presentations and discussions. All participants are expected to contribute a poster or oral presentation. Field trips and unscheduled time will allow opportunities for informal discussion and other activities.

Participants arrive on September 6, and meet at Yellowstone National park. The following two days will be conducted at Yellowstone (Yellowstone Volcanic Observatory, YVO, geophysical and volcanic monitoring system), the site of magmatism and hydrothermal activity from ca. 3 Ma to present and including some of the largest known pyroclastic eruptions of rhyolite in the world. A full-day field trip will allow examination of features of the geothermal and magmatic systems as well as shallow crustal structure and permeability. Presentations will focus on what is known about magmas, crustal structure, and geothermal systems from geophysical imaging, structural studies, and permeability models based on active geothermal systems. Igneous petrology presentations will focus on emerging techniques and data, including experimental studies, spectroscopy and microanalysis of melt inclusions and glasses that have advanced understanding of the volatile (water, CO₂, SO₃, Cl), and major/trace element contents of magmas. The sources (mantle vs. crust) of volatiles, major, and trace elements will be assessed using isotopic tracers. We'll also discuss when and how a volatile phase physically separates from magma and its likely chemical composition, including acids, metals, sulfur, alkalis, etc.

Three days will be used to examine deeper parts (~5–10 km depth) of ancient magmatic-hydrothermal systems, including field examinations of the late Cretaceous Boulder Batholith and mineral deposits of Butte district. The enormous porphyry Cu-Mo and base metal lode deposits at Butte contain ~35 M tonnes of Cu metal. The evolution of structural style, veinlets, hydrothermal wallrock alteration, and sulfide mineralization will be examined as a function of time, temperature, and spatial position, and discussions will focus on ore fluid composition, fluid flow paths and water-rock interactions.

A session will focus on mid-crustal fluid flow and metamorphism in contact aureoles of plutons and how mass and heat are transferred in the mid-crust. The links between metamorphism and anatexis to produce hydrous granitic melts will be examined. Another session will focus on the compositions of crustal fluids as determined via fluid inclusion (including LA-ICP-MS), fluid-mineral equilibria, and isotopic tracer studies. A session will review the thermal models and permeability data used to model fluid advection and mass transfer via fluid-rock reactions in the middle and upper crust. A session will examine data from hydrothermal mineral deposits, which are sites of unusual and extreme enrichment of elements generally formed via focussed fluid flow of reactive and metal-enriched magmatic-hydrothermal fluids. Although mineral deposits are

chiefly sites of deposition of ore components and intense metasomatism, they also serve a means of quantifying the duration of hydrothermal and magmatic activity, net flux of aqueous fluids, and mass transfer. What can we learn about sources of ore components and their pathways through rocks from large mineral deposits?

Optional Field Trips

A half-day premeeting field trip to Yellowstone National Park will include a 6-mile round-trip hike to the summit of Mount Washburn to examine exposures of Eocene volcanic rocks of the Absaroka Volcanic Province and provide an overview of the Yellowstone caldera.

A one-day postmeeting field trip to the Butte district will include a half-day



Castle Geyser in the Upper Geyser Basin, a particularly good example of a "cone-type" geyser with a prominent cone of siliceous sinter enclosing the geyser vent. Photograph by S.R. Brantley on 23 May 2001.

underground tour of the Lexington tunnel with exposures of Main Stage Pb-Zn-Ag veins and mine waters led by Chris Gammons, and a half-day examination of drill core/hand samples of porphyry Cu-Mo mineralization.

Participation

The conference is limited to 65 participants. We encourage interested graduate students to apply. The registration fee, which will cover lodging, meals, field trips, local transportation, and all other conference costs except personal incidentals and optional field trips, is estimated to be about US\$1,150 (US\$500 for a limited number of students). Participants will be responsible for their own travel to and from Bozeman, Montana.

For further information, please obtain a conference outline and a tentative list of keynote/invited speakers at

<http://terra.geo.orst.edu/users/dillesj/Penrose.html>.

Application Deadline: May 1, 2004

Geoscientists interested in magmatic-hydrothermal processes and with expertise in petrology, geophysics, geochemistry, fluid transport, and mineral deposits are encouraged to apply. Potential participants should send a letter of application to Greg Arehart or Peter Nabelek (addresses above) that includes a brief statement of interests, the relevance of the applicant's recent work to the themes of the meeting, the subject of any proposed presentation (poster or verbal), and contact information (including e-mail address for the period June through September). Invitations will be e-mailed to participants early in June 2004.

Cosponsor: *Society of Economic Geologists*



View east of Butte, Montana, with Anselmo Shaft ("Main Stage" Cu lode) in foreground, Continental Pit (porphyry Cu-Mo ore) in middle distance, and the forested Continental Divide in background. Photograph by J.H. Dilles, 16 July 2003.

GeoVentures™ 2004



Photo by Ivo Lucchitta.

Want to find out about all our latest GeoVenture trips? Join our E-News GeoVentures list from our Web page, www.geosociety.org/geoVentures.



Photo by John Karachewski.

GeoTrip Rio Colorado: A Geologic Exploration of the Colorado River and Its Grand Canyon—Lee's Ferry to Diamond Creek

April 22–29, 2004 (8 days, 7 nights)

Scientific Leader: Ivo Lucchitta, U.S. Geological Survey (emeritus), Flagstaff, Arizona. Ivo has been in, through, and around the Grand Canyon since 1963, when he started his Ph.D. dissertation in the upper Lake Mead area under the tutelage of Eddie McKee. His interests include continental extension (from the perspective of Colorado Plateau–Basin and Range interface); uplift of the Colorado Plateau; history of Grand Canyon and Colorado River; and Cenozoic/Quaternary geology, geomorphology, and processes, especially as applied to southwestern drainage systems.

Description

Even though the stately succession of strata that form the imposing walls of the Grand Canyon will by no means be ignored, the geologic focus of the trip will be more on processes operating within the Canyon, its Quaternary geology and geomorphology, and the interrelation between the activities of the Colorado River and those of humans, including thorny subjects of current interest

and unexpected insights into the activities of prehistoric Puebloan farmers.

Non-geologists on the trip will be treated to many talks presented in non-technical language and designed to make them aware of the wonderful stories Earth has to tell. The purpose of the trip is to learn, travel through some of the most remarkable scenery on Earth, enjoy good companionship, and have fun.

Fees and Payment: \$2,875 for GSA members; \$2,975 for nonmember spouses; \$3,125 for nonmembers. A \$300 deposit is due with your reservation and is refundable through February 1, less a \$50 processing fee. The total balance is due February 1. Minimum: 14. We are holding 14 spaces. Any additional spaces will be based on availability. If you would like to participate in this trip, we recommend that you register today. **Included:** Guidebooks to the river; geologic guide; ground transportation from Las Vegas to and from the river; waterproof bags for clothes; life jacket; camping gear, including a two-person tent, sleeping bag and pad, and eating utensils; all river meals; and soft drinks on the river. **Not included:** Airfare to and from Las Vegas; nights and meals in Las Vegas; alcoholic beverages.

To register for this trip, please fill out and return the registration form on page 38.

GeoClass

Two Billion Years in Two Days—A Front Range Geology Primer GeoClass

June 25–28, 2004

Boulder, Colorado,

Best Western Boulder Inn

Scientific leader: Alan Lester, University of Colorado, Boulder. Lester, a recipient of multiple teaching awards at the University of Colorado, is a research associate and senior instructor in the Department of Geological Sciences. His research interests include Laramide magmatism, Front Range kimberlite emplacement, and Eocene sedimentary rocks of southwest Wyoming.

Description

Experience three days of scenic geology excursions along the eastern margin of the Front Range, south-central Rocky Mountains, Colorado. Situated at the foot of the Front Range, Boulder is a picturesque and convenient vantage point from which to launch explorations. In Boulder, home of the University of Colorado, participants,

spouses, and family will find ample opportunities for dining and shopping. Our excursions, although geological in focus, will also be wonderful opportunities for bird and wildlife watching.

The western backdrop for Boulder features the spectacular tilted (late Paleozoic) sedimentary rocks of the Flatirons and the uplifted crystalline basement along the Continental Divide. In this GeoClass, designed for those with relatively little prior background in Front Range geology, we examine the nearly two-billion-year history of Boulder's geologically fascinating "backyard." On Saturday, we'll take a short hike along the Mesa Trail in the Boulder Mountain Parks, searching for clues with which to interpret the ancient depositional environments of this layered and tilted sequence of Paleozoic and Mesozoic sedimentary rocks. The trail is gentle and takes us through pine forests with wonderful views of the Flatirons and the city below. On Sunday, we'll journey to the Indian Peaks Wilderness, near Nederland, Colorado, to view both the Precambrian basement rocks and intrusions associated with the northeast portion of the Colorado Mineral Belt. Here we will take a four-mile round-trip hike (with minimal altitude gain, but at nearly 10,000 feet above sea level) through meadows with alpine flowers, along rushing streams, and into a region of glacial lakes. We will consider the mechanisms for crust formation during the Precambrian, mountain building and magmatism during the Laramide phase of Rocky Mountain uplift, and the evidence for Late Pleistocene glaciation.

Fees and Payment: \$650 for GSA members; \$700 for spouses; \$750 for nonmembers. A \$200 deposit is due with your reservation and is refundable through May 1, less a \$20 processing fee. Total balance is due May 1. Minimum: 12; maximum: 22. **Included:** Classroom programs and materials; field trip transportation; lodging for three nights (single occupancy or doubles for couples); breakfast on Saturday, Sunday, and Monday; boxed lunch on Saturday and Sunday, welcoming and farewell events. **Not included:** Transportation to and from Boulder, Colorado, transportation during hours outside field trips, alcoholic beverages, and other expenses not specifically included.

To register for this trip, please fill out and return the registration form on page 38.

GeoTrip Iceland: A Student Only—Oriented GeoTrip

July 11–25, 2004

Scientific Leader: James Reynolds, Brevard College, Brevard, North Carolina. Jim is a magnetostratigrapher with interests in Neogene volcanism and foreland basins who has been leading international field trips since 1996.

Description

Designed for students only, this GeoTrip will visit the classic geological localities of Iceland on a low-frills budget. Participants will camp and prepare meals in a group kitchen tent. Eighty kilometers of hikes will take us through spectacular volcanic and glacial scenery.

The trip begins in Baltimore and will fly to Reykjavik to make a 12-day loop around the country, starting at Thingvellir, Gullfoss waterfall, and Geysir geothermal area, near the capital. Next, we'll head to Myvatn, in northeastern Iceland, where we will hike through Krafla caldera and investigate other volcanic areas. Then, after passing steep table mountains to get to Askja caldera, we'll swim in the acidic water of the 1912 Viti crater within the caldera. Several days will be spent in southeastern Iceland around the Vatnajökull ice sheet, visiting the valley glaciers descending from the large icecap. Hikes at Skaftafjell National Park lead to spectacular overlooks of the ice. We'll continue across southern Iceland to the Lakigigar craters from the 1783 eruptions and proceed to the hot springs at Landmannalauger where a slowly cooling obsidian flow heats the water. Upon returning to Reykjavik, we'll have a free day and night in the city with the final stop at the Blue Lagoon on our way to the airport.

Fees and Payment: \$2100 for GSA student members; \$2200 for nonmembers. \$200 deposit is due with your reservation and is refundable (less \$75) through May 1. Balance is due May 1. *Firm* minimum number of participants: 21. **Included:** Ground transportation, all meals, classroom programs and materials, guidebook, and map. **Not included:** Roundtrip airfare to Iceland from Baltimore, airfare to and from Baltimore, camping equipment (tent and sleeping bag), alcoholic beverages, and other expenses not specifically included.

To register for this trip, please contact Sandy Doss, Holbrook Educational Tours at sdoss@holbrooktravel.com, 1-888-890-0632.

GeoTrip Geological Excursion to Central and Northern Mongolia

July 24–August 11, 2004

Scientific co-leaders: Gregory S. Holden, Department of Geology and Geological Engineering, Colorado School of Mines, Golden, Colorado. Greg has 26 years of teaching experience in petrology and field geology and has led five previous GSA GeoHostels. He will provide general geological background to complement the local expertise of the Mongolian trip leaders. Greg led a student field trip to Mongolia with B. Tumenbayar and Ch. Minjin in 2001. If you would like to discuss the trip further, please contact Greg at gholden@mines.edu, (303) 273-3855. **Ch. Minjin,** Mongolian Technical University, is well published and an internationally recognized expert on the stratigraphy and paleontology of Mongolia. **B. Tumenbayar,** Mongolian Academy of Sciences and BEMM Consulting, is a mineralogist and active consulting exploration geologist. Tumenbayar's firm, BEMM Consulting,

GeoVentures™ 2004 for GSA Members and Friends

For complete details on GeoVentures or for full itineraries, contact Edna Collis, Program Officer, 1-800-472-1988, ext. 1034, fax 303-357-1072, ecollis@geosociety.org.

Participants must be 18 or older and in good health. Any physical condition requiring special attention, diet, or treatment must be reported in writing when reservations are made. We'll do our best to accommodate special needs, including dietary requirements and physical disabilities. Deposits and payments are refundable less a processing fee, up to the cutoff date. Termination by an individual during a trip in progress for any reason will not result in a refund, and no refund will be made for unused parts of trips. For details on accommodations and occupancies, see trip descriptions or contact Edna Collis.



The Govi at Mushagai. Photo by Lisa R. Lytle.

which has provided logistical support for numerous international geological field trips and for exploration efforts by international minerals companies, will be responsible for all logistical support in Mongolia. His company has an experienced staff of coordinators, cooks and drivers, many of whom speak English well. **J. Byamba**, Mongolian State University.

Description

Central Mongolia is a high, dissected plateau with numerous peaks over 3000 meters, well above timberline. Thick birch and larch forests cover the high slopes above valleys carpeted with grass and flowers of the Central Asian steppe. Big, fish-filled rivers flow north, ultimately into Siberia's famous Lake Baikal and on to the Arctic Ocean.

The steppe supports horses, camels, and yaks, herded by nomads living in gers, their traditional round tents. Wolves and snow leopards still roam the more remote areas.

This GeoTrip provides a unique opportunity to explore the geology, flora, fauna and culture of this amazing country in the company of two expert guides from the Mongolian Technical University and the Mongolian State University. The 19-day trip, including two travel days, begins in Ulaan Baator, the capital and only major city in Mongolia, then proceeds west across the north slopes of the Khangai Mountains, with opportunities to examine the often highly

deformed Paleozoic metamorphic and sedimentary basement and Mesozoic intrusive rocks that underlie the mountains. We'll visit a Cenozoic volcanic area and the famous Kuvsgul Lake, which is similar in style, size, and origin to Lake Baikal. We will visit phosphorite, placer gold, and porphyry copper deposits. On several nights, we'll camp near monasteries and will have ample occasions to meet and get to know local people. We'll have time to hike, climb peaks, and fish on an individual or group basis.

Travel will be via Russian 4-wheel-drive minivans and jeeps and, since hotels are rare, we'll camp most nights. Participants will bring their own tents and sleeping bags. Meals will be traditional Mongolian fare, cooked by an experienced, local expedition staff. This will not be an easy trip, and participants need to be ready for some rough rides and rough weather in a very remote area. For those who love geology and have always wanted to see central Asia, this will be an adventure of a lifetime, a chance to see the magnificent unfenced landscape, and an opportunity to meet the wonderful people of Mongolia.

Fees and Payment: \$2,700 for GSA members; \$2,800 for spouses; \$2,950 for nonmembers. \$200 deposit is due with your reservation and is refundable (less \$100) through May 15. Balance is due May 15. Minimum number of participants: 12; maximum: 20. *Most nights will be spent camping. Participants must supply their own mountain tent, good quality sleeping bag, and foam pad.* **Included:** Four nights in ger hotels, all meals, field trip transportation, local guides, and guidebook and program materials. **Not included:** Roundtrip airfare to Ulaan Baator from San Francisco, airfare to and from San Francisco, alcoholic beverages, and other expenses not specifically included.

To register for this trip, please fill out and return the registration form at bottom of this page.

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There are four specialist trips for K-12 teachers running next summer. These trips are to Hawaii, Iceland, South Dakota, and New Mexico. For more information, see www.geosociety.org/geoVentures.

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Mailing Address _____

City/State/Country/ZIP _____

Phone (business/home) _____

E-mail _____

Guest Name _____

GSA Member # _____

	DEPOSIT PER PERSON	NO. OF PERSONS	TOTAL PAID DEPOSIT
GRAND CANYON	\$300	_____	\$ _____
BOULDER	\$200	_____	\$ _____
MONGOLIA	\$200	_____	\$ _____
TOTAL DEPOSIT			\$ _____

VISA MasterCard American Express Discover

Credit Card # _____ Exp. Date _____

Signature _____

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2004 GSA GeoVentures, GSA Sales and Service
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ANNOUNCEMENTS

MEETINGS CALENDAR

2004

- January 5–8 Conference on Sustainable Range Management, New Orleans, Louisiana, USA. Information: The Conference Group, 1580 Fishinger Road, Columbus, OH 43221, USA, 1-800-783-6338 (USA and Canada), (614) 488-2030, fax 614-488-5747, info@confgroupinc.com, www.battelle.org/rangecon.
- January 30–31 Atlantic Geoscience Society 30th Colloquium & Annual General Meeting, Moncton, New Brunswick, Canada. Information: <http://is.dal.ca/~walla/ags/>. (*Abstract deadline: January 6, 2004.*)
- April 14–20 5th International Symposium on Eastern Mediterranean Geology, Thessaloniki, Greece. Information: <http://geonet.geo.auth.gr/5thISEMG/>.
- April 25–30 European Geosciences Union 1st General Assembly, Nice, France. Information: www.copernicus.org/egu2004. (*Abstract deadline: January 11, 2004; preregistration deadline: April 8, 2004.*)
- April 26–29 Second Hydrogen Expo, USA, and the National Hydrogen Association's 15th Annual Conference, Los Angeles, California. Information: www.hydrogenexpo.com, www.hydrogenconference.org.
- March 14–18 Alaska Miners Association 19th Biennial Conference: "Mining—The Road to Alaska's Future," Fairbanks, Alaska. Information: www.alaskaminers.org, Milton Wiltse, mfwiltse@acsalaska.net.
- May 9–12 Edmonton 2004: Canadian Institute of Mining and Metallurgy—Annual General Meeting Mining Industry Conference and Exhibition. Information: www.cim.org.
- May 24–27 Fourth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California, USA. Information: The Conference Group, 1580 Fishinger Road, Columbus, OH 43221, USA, 1-800-783-6338 (USA and Canada), (614) 488-2030, fax 614-488-5747, info@confgroupinc.com, www.battelle.org/chlorcon.
- June 7–11 Paleosols: Memory of Ancient Landscapes and Living Bodies of Present Ecosystems, Florence, Italy. Information: Organizing Committee, Institute for Soil Study and Conservation, P.za M.D'Azeglio, 30, 50121 Firenze, Italy, www.issds.it/paleo/.
- July 11–15 American Society of Mechanical Engineers' 2004 Heat Transfer and Fluids Engineering Summer Conference, Charlotte, North Carolina, USA. Information: www.asmeconferences.org/HTFED04/.

Visit www.geosociety.org/calendar/ for a complete list of upcoming geoscience meetings.

AWG Announces New Officers

The Association for Women Geologists has named the following people to its 2003–2004 Executive Committee. President—GSA Fellow **Helen Delano**, Pennsylvania Geological Survey; president elect—GSA member **Allyson Anderson**, ExxonMobil Exploration Company; past president—GSA member **Mary Gillam**, independent geologist, Durango, Colorado; secretary—GSA member **Cynthia Fisher**, West Chester University; treasurer—GSA member **Kata McCarville**, South Dakota School of Mines and Technology; editor—**Marguerite Toscano**, Smithsonian Department of Paleobiology; assistant editor—**Lorraine Manz**, North Dakota Geological Survey; GAEA advertising editor—GSA member **Jane H. Gill**, environmental geologist, North Carolina; publicist—GSA member **Pranoti M. Asher**, Georgia Southern University; and business manager—**Carol Dicks**.

Heineken Prize Call for Nominations

The Royal Netherlands Academy of Arts and Sciences will award the Dr. A.H. Heineken Prize for Environmental Sciences in 2004. The prize, consisting of an award and \$150,000, rewards outstanding scientific achievements in the field of environmental research, in particular to those who have made major contributions toward improving the relationship between man and his environment. See www.knaw.nl/heinekenprizes for information on qualifications and the nomination procedure (self nomination is not allowed), or contact Prof. Dr. Ir Wim P.M. van Swaaij, Royal Netherlands Academy of Arts and Sciences, P.O. Box 19121, 1000 GC Amsterdam, The Netherlands, heinekenprizes@bureau.knaw.nl.

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Positions Open

GEOLOGY/ENVIRONMENTAL GEOSCIENCES CONCORD COLLEGE

Applications are invited for a tenure-track position beginning fall 2004 supporting a new degree program in environmental geosciences. Ideal candidates will be broadly trained and should have interests in teaching introductory and/or advanced courses in geology, and developing one or more upper-division courses within the broad field of environmental or engineering geoscience. Specialization is open, however, candidates with primary or secondary interest in a field generally related to water resources would be beneficial to development of the program; applicants from traditional fields of geology or geoscience education that complement existing strengths in structural geology will also be considered. The successful candidate is expected to have a Ph.D. in geology by the time of appointment, a strong commitment to quality teaching at a liberal-arts institution, and an interest in developing one or more environmentally relevant geoscience courses. The college is located in a scenic rural area east of the Appalachian coalfields at the boundary between the valley and ridge and plateau provinces. Opportunities exist for supervision of undergraduate research projects that utilize the local geologic setting and/or interface with the environmental and energy resources industry. Review of applications will begin by 1/5/04 and continue until the position is filled. Submit detailed cover letter, vita, copies/photocopies of all transcripts, statement of teaching interests and philosophy, and 3 letters of reference to: Dr. J.L. Allen, Chair, Division of Natural Sciences, Campus Box 19, Concord College, Athens, WV 24712-1000. Concord College is an equal opportunity/affirmative action employer.

DIVISION OF EARTH SCIENCES NATIONAL SCIENCE FOUNDATION ARLINGTON, VIRGINIA

NSF Division of Earth Sciences (EAR) is seeking a qualified candidate for Program Officer for the EarthScope Program. The Program covers a wide range of scientific areas and the EarthScope facility includes the seismic element USArray, the geodetic element Plate Boundary Observatory (PBO), and the drilling and deep instrumentation element San Andreas Fault Observatory at Depth (SAFOD). This position involves responsibility and oversight of the facility management, construction, operation and oversight of the EarthScope science component.

Appointment to this position will be on a permanent basis with a salary range of \$81,602 to \$127,168. Applicants must have a Ph.D. or equivalent experience in the earth sciences, seismology, space-based geodesy, drilling technology, geophysics, hydrogeology, stratigraphy, geochemistry, tectonics, or related disciplinary fields, plus six or more years of successful research, research administration, and/or managerial experience beyond the Ph.D. Experience managing large facility construction and/or operations are desirable.

Announcement E20040013, with position requirements and application procedures, are located on the NSF Home Page at www.nsf.gov/jobs. Applicants may also obtain the announcements by contacting Yvonne Woodward at 703-292-4386 (Hearing impaired individuals may call TDD 703-292-8044).

NSF is an Equal Opportunity Employer.

THE OHIO STATE UNIVERSITY COLLEGE OF MATHEMATICAL AND PHYSICAL SCIENCES DEPARTMENT OF GEOLOGICAL SCIENCES SOLID EARTH SCIENCE

The Department of Geological Sciences invites applications and nominations for a tenure track/tenured position available September 2004, in solid earth science. This is broadly defined to include studies of the composition, behavior, or physical properties of solid earth materials (mantle and crust) and the processes affecting them. A Ph.D. in geological sciences is required. The Department prefers to hire at the assistant professor level but applications from exceptional individuals at all levels will be considered. Candidates should have an established record of research, refereed publications, and a commitment to quality teaching.

The successful candidate will be expected to develop an innovative, independent, funded research program. Many opportunities exist for collaboration with existing research programs and faculty in the department and university in geophysics, geochemistry, geochronology, petrology, tectonics, materials science, and other areas. Teaching will involve courses in the physical, chemical, and optical properties of earth materials and other courses in selected areas of specialty. More information about the position is available at www.geology.ohio-state.edu.

The Department of Geological Sciences has 23 full-time faculty and over 50 graduate students. This is one of three new positions open in the department this year with others in Environmental Stable Isotope Geochemistry and Earth Surface Dynamics. The Department contains state-of-the-art laboratory facilities, computing equipment, and is housed in a recently renovated building that includes ample laboratory and office space for the successful candidate.

To nominate a colleague for the position, please send a letter to the Chair of the Search Committee. To apply for the position, send a curriculum vitae, statement of research and teaching interests, and names of at least three referees to: Search Committee Chair, Professor Mike Barton, Department of Geological Sciences, The Ohio State University, 125 South Oval Mall, Columbus, OH 43210, (barton.2@osu.edu).

The search committee will begin reviewing applications January 1, 2004, and will continue until a suitable candidate is hired.

The Ohio State University is an equal opportunity / affirmative action employer. Women, minorities, veterans, and individuals with disabilities are encouraged to apply.

THE OHIO STATE UNIVERSITY COLLEGE OF MATHEMATICAL AND PHYSICAL SCIENCES DEPARTMENT OF GEOLOGICAL SCIENCES EARTH SURFACE DYNAMICS

Applications and nominations are invited for a tenure track/tenured position in the field of *Earth Surface Dynamics*, which is interpreted broadly to include neotectonics, seismotectonics, quantitative geomorphology, regional-scale surface hydrology, Quaternary chronometry, and geodynamic modeling. The Department prefers to hire at the assistant professor level but applications from exceptional individuals at all levels will be considered. This position will expand the Department's efforts to better understand the coupled surface-climate-tectonic system of the Earth. Candidates should be able to utilize data from modern observing systems such as GPS, LIDAR and INSAR, and analyze these observations using physical principles and mathematical and numerical models.

The successful candidate will be expected to demonstrate established research funding, or the promise of funding from multiple federal and state sources, a high-quality publication record, and a commitment to excellence in teaching at the undergraduate and graduate levels. Teaching consists of introductory courses in geological sciences and advanced courses in appropriate specialty areas. A Ph.D. in geology or a closely related field is required.

The Department of Geological Sciences has 23 full-time faculty, over 50 graduate students and a similar number of undergraduate majors. Excellent research facilities and ample space for new facilities are available in our recently renovated building. This is one of three new positions the Department has open this year; the other two are in *Stable Isotope Geochemistry* and *Solid Earth Science*. For more information, see the Department web site at www.geology.ohio-state.edu.

Exceptional opportunities exist for interdisciplinary collaboration with faculty and researchers in Geological Sciences, the Department of Civil & Environmental Engineering & Geodetic Science, the Byrd Polar Research Center, and especially with the recently appointed Ohio Eminent Scholar in Geodynamics. The broad spectrum of earth science research at The Ohio State University

includes geodesy, tectonics, remote sensing, geophysics, geomatics, climate and paleoclimate, glaciology and glacial geology, sedimentary geology, geochemistry/geochronology, and hydrology/hydrogeology, among others. Opportunities for collaboration on geodynamic topics also exist with federal and state agency programs, such as the OhioSeis earthquake network.

To nominate a colleague, please send a message to the Search Committee Chair. To apply, please send a curriculum vitae, statement of research and teaching interests, and the names of at least three referees to: Search Committee Chair – Earth Surface Dynamics, Department of Geological Sciences, The Ohio State University, 125 S. Oval Mall, Columbus, OH 43210, (surface@geology.ohio-state.edu).

Applications will be reviewed beginning January 1, 2004, and will continue until the position is filled.

The Ohio State University is an equal opportunity / affirmative action employer. Women, minorities, veterans, and individuals with disabilities are encouraged to apply.

ASSISTANT PROFESSOR, SCHOOL OF GEOLOGY OKLAHOMA STATE UNIVERSITY

The School of Geology at Oklahoma State University seeks applications for a tenure-track faculty position in the general area of basin analysis/basin evaluation. The appointment will be as an assistant professor, effective August 1, 2004. Applicants are required to have the Ph.D. Degree at the time of appointment. The applicants must show promise of an outstanding research program and be committed to excellence in teaching.

Applicants should have demonstrated research capabilities in any discipline related to basin analysis/basin evaluation. Preference will be given to those candidates who have strong computing skills (expertise in state of the art computer applications), have previous undergraduate teaching experience, and have published refereed articles in his or her discipline. The successful candidate will be expected to develop a fundable research program that is discipline specific and/or interdisciplinary that involves coordination with other researchers within the School of Geology, other departments at Oklahoma State University, and/or other universities.

The regular teaching load at the School of Geology is two courses per semester. The successful candidate will teach at least one section of Geology for non-majors course per semester. In addition, he or she will be expected to supervise M.S. graduate students and develop courses in his or her specialty.

Candidates should submit a letter of application, including a discussion of research interests and approach to teaching, along with a curriculum vitae; academic transcripts; and the names, addresses, e-mail addresses, and phone numbers of three references to: Assistant Professor Search, School of Geology, 105 Noble Research Center, Oklahoma State University, Stillwater, Oklahoma 74078-3031. Phone: (405)-744-6358. Fax: (405) 744-7841. Screening of candidates will begin on January 26, 2004 and will continue until the position is filled.

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

GEOLOGY FACULTY, BYU—IDAHO

The Geology Department at Brigham Young University—Idaho is accepting applications for a full-time faculty to begin August 2004. A Ph.D. in a relevant field is preferred, master's degree required. Responsibilities include teaching undergraduate courses in stratigraphy, sedimentology, and introductory geology/earth science. Experience in education and a field-oriented background are helpful. Salary is dependent on experience and degree. Applications will be accepted until January 29, 2004. For more information and application details, see www.byui.edu/personnel.

Located in Rexburg, Idaho, BYU-Idaho is a baccalaureate institution centered on innovation in undergraduate teaching and learning in an atmosphere of faith. BYU-Idaho is a private university affiliated with The Church of Jesus Christ of Latter-day Saints. All faculty are required to be members in good standing of the affiliated church. EOE.

ASSOCIATE DIRECTOR FOR EARTH SYSTEMS RESEARCH BUREAU OF ECONOMIC GEOLOGY

The Bureau of Economic Geology (BEG) is part of the Jackson School of Geosciences at The University of Texas at Austin. The BEG earth systems research group consists of 20 scientists working in hydrogeology, coastal studies, near-surface and airborne geophysics, carbon sequestration, remote sensing, and geological mapping and characterization. This group is expected to grow during the Associate Director's tenure, supported by a combination of large Federal, State, and private grants in combination with the University of Texas Geology Foundation. The Associate Director will be responsible for program development, project coordination, and employee

supervision. The Associate Director will coordinate BEG research efforts with other departments and institutes across UT, including the Environmental Science Institute. Qualifications include a doctorate or equivalent with a minimum of 5 years of postgraduate experience, preferably in a field related to our core areas of earth systems research. We seek an individual with widely acknowledged contributions in earth systems research, strong skills in verbal and written communication, and a demonstrated ability to raise and administer funds from a variety of sources. For further information and online job application, please visit our Web site at <http://www.beg.utexas.edu/mainweb/employ01.htm>. This is a security-sensitive position. Conviction verification is conducted on applicants selected.

The University of Texas at Austin is an Equal Employment Opportunity/Affirmative Action Employer.

**DEPARTMENT HEAD
EASTERN MICHIGAN UNIVERSITY**

Eastern Michigan University, The Department of Geography and Geology, invites applications for the position of Department Head. The department of eighteen tenure-track faculty and ten to fifteen lecturers offers bachelor's degrees in Geography, Geology, Earth Science, and Urban & Regional Planning, and masters' degrees in Historic Preservation and GIS & Planning. EMU is a comprehensive regional institution with 24,000 students and is the largest producer of education professionals in the U. S. EMU is located five miles from Ann Arbor and 35 miles from Detroit. The EMU faculty is an AAUP collective bargaining unit.

The successful candidate will be responsible for promoting the growth and stature of the department, budgetary and personnel matters, developing faculty teaching schedules, and providing appropriate service to the university. We are looking for a person who will provide leadership and will work cooperatively with a multidisciplinary faculty and staff and a diverse student body.

Requirements: Ph.D. or equivalent terminal degree in a field represented in the department. Evidence of leadership and administrative potential including organizational, budgetary, and communication skills. Record of excellence in teaching, scholarship, and service sufficient to warrant appointment as a full professor in the department. Demonstrated commitment to excellence in undergraduate and graduate instruction and research.

The Department Head position is a 12-month administrative appointment. The anticipated date of appointment is July 1, 2004. There is an expectation of limited teaching. Applicants should submit a curriculum vita, a letter of interest, list of potential references, evidence of administrative and teaching ability, samples of scholarly work, and a statement summarizing administrative philosophy. Send applications or requests for further information to: Job Posting #APAA0407, Academic Human Resources, 202 Boone Hall, Eastern Michigan University, Ypsilanti, Michigan 48197.

The selection process will begin January 5, 2004, and continue until the position is filled. Eastern Michigan University is an EO/AA employer. Women and minority candidates are encouraged to apply. For additional information about the department and the university see our website: www.emich.edu/public/geo/welcome.html.

Women and members of minority groups are encouraged to apply. EMU is an affirmative action/equal opportunity employer committed to faculty, staff and student diversity.

**EDUCATION AND PUBLIC OUTREACH MANAGER
PHOENIX MARS MISSION
UNIVERSITY OF ARIZONA
LUNAR AND PLANETARY LABORATORY**

The University of Arizona, Lunar and Planetary Laboratory seeks a full-time Education and Public Outreach Manager for the Phoenix Mars Mission under the direction of Mr. Peter Smith. In cooperation with the Mars Exploration Program education office and with oversight by authorized NASA HQ Office of Space Science education officials, the E/PO Manager will be responsible for the planning, management, and coordination of all formal and informal education activities. For full position description and minimum qualifications, please refer to the website <http://www.hr.arizona.edu/27227xcox.htm>. To apply, please submit a cover letter, resume and the names and contact information for three references to Ms. Lynn Lane, Lunar and Planetary Laboratory, University of Arizona, P.O. Box 210092, Tucson, AZ 85721-0092. The University of Arizona is an AA/EEO/ADA employer - M/W/D/V.

**ENVIRONMENTAL INITIATIVE, DIRECTOR
LEHIGH UNIVERSITY**

Lehigh University seeks a distinguished senior faculty member to serve as Director of its Environmental Initiative (EI). The EI is a multi-disciplinary effort to bring scientists, engineers, social scientists, and humanists together to

Workshop on the Theory and Methods of Quaternary Geochronology

February 2-8, 2004

Venue: University of California, Riverside
and Mojave Desert

Organizers: Robert Finkel and Lewis Owen

Contributors: Robert Finkel, Lewis Owen, Warren Sharp, Joerg Schaefer, and Darrell Kaufman

The workshop will examine methods, applicability and recent developments in Quaternary numerical dating techniques, with emphasis on practical applications.

Topics covered include: sampling; cosmogenic radionuclides; optically stimulated luminescence; noble gases; amino-acid dating; U-series dating; lichenometry. Open to students and professional geologists, numbers limited and enrolment closes December 31. For further details contact: Robert Finkel, Lawrence Livermore National Laboratory, 7000 East Avenue, Livermore, CA 94550 (finkel1@llnl.gov) and Lewis Owen, Department of Earth Sciences, University of California, Riverside, CA 92506 (lewis.owen@ucr.edu).

focus their expertise on environmental research and education. The Director provides synergistic leadership for a multi-disciplinary group of faculty and staff across Lehigh's colleges: Arts and Sciences, Engineering and Applied Science, Business and Economics, and Education. Candidates must possess a national and/or international scholarly reputation in a field related to the environment; a commitment to excellence in graduate and undergraduate education; a successful record of external fundraising; familiarity with a university setting, preferably in an administrative capacity; and outstanding communication and leadership skills. Candidates must have the Ph.D., but the specific area is open and might include the environmental sciences, engineering, or the social sciences and humanities. The position will be a joint appointment within the Environmental Initiative and a department best suited to the successful candidate's field. Review of applications will begin January 15, 2004 and continue until the position is filled. Candidates should submit a curriculum vita, a statement of educational philosophy and multi-disciplinary research opportunities in the area of the environment, and a list of four references with complete contact information. Electronic submission is preferred: ineidire@lehigh.edu. For further information, contact: Prof. Stephen Cutcliffe, Chair, El Director Search, 31Williams Drive, Bethlehem, PA 18015, or go to: www.ei.lehigh.edu. Lehigh University is an equal opportunity/affirmative action employer and committed to recruiting and retaining women and minorities.

**ASSISTANT PROFESSOR OF GEOLOGY
THE CITY UNIVERSITY OF NEW YORK
COLLEGE OF STATEN ISLAND**

The Department of Engineering Science and Physics of the College of Staten Island, a senior college of The City University of New York, seeks candidates for an anticipated tenure-track position as assistant professor of geology, beginning September 2004. Required: Ph.D. in geology and a demonstrated commitment to research and teaching. Postdoctoral experience preferred. Responsibilities include teaching undergraduate geology courses to liberal arts students, teaching graduate courses in environmental science, performing department and college service, and engagement in an active and productive research agenda. The successful candidate will present credentials appropriate for appointment to the doctoral faculty of the CUNY Graduate School. Salary range: \$47,331-\$61,111, commensurate with qualifications. Review of applications will begin immediately and

continue until the position is filled. Send a letter of application describing teaching experience and research interests, a curriculum vitae, and the names, addresses, and telephone numbers of at least three references to Prof. A. Ohan, Chair, Geology Search Committee, Department of Engineering Science and Physics, College of Staten Island/CUNY, 2800 Victory Blvd., Staten Island, NY 10314. EEO/AA/ADA employer.

**ENVIRONMENTAL SCIENCE/GEOLOGY
UNIVERSITY OF PUGET SOUND**

FT, tenure-line Assistant Professor; begins Fall Term 2004. Teach an introductory, interdisciplinary, lab-based Environmental Science class (course currently uses Botkin and Keller) and play a key role in the Environmental Studies Program. We seek an individual with a background in coastal/shallow marine geological processes or paleolimnology/physical limnology who can establish an environmentally-based research program that involves undergraduates and has relevance to the Puget Sound/Pacific Northwest region. In addition, teach sedimentology/stratigraphy or earth history/paleontology and an upper-division geology course in area of expertise. Ph.D. (ABD considered) in related field, and commitment to undergraduate teaching and liberal arts education. A review of applications will begin on January 5, 2004. To apply, submit interest letter, curriculum vitae, teaching statement (including course descriptions), statement of research interests, and three reference letters to: Geology Search, University of Puget Sound, Campus Mail Box 1007, Tacoma, WA 98416-1007.

**EARTH MATERIALS/MINERALOGY
CENTRAL WASHINGTON UNIVERSITY**

Central Washington University's Department of Geological Sciences (<http://www.geology.cwu.edu>) invites applications for a 9-month, tenure-track appointment at the Assistant Professor level in earth materials/mineralogy to begin September, 2004. The department seeks candidates who express commitment to excellence in undergraduate education. The successful candidate is expected to teach mineralogy, introductory courses, and upper division courses in their specialty, as well as advise undergraduates. The successful candidate will be expected to develop an externally funded research program, including supervision of M.S. graduate students and undergraduate research projects. Preference will be given to those who show potential for incorporating our new geochemistry

facilities, especially the XRD laboratory, into the curriculum. A Ph.D. in Geological Sciences or a closely allied field is required at the time of employment.

The department is composed of dynamic and enthusiastic faculty who maintain active, diverse, and internationally recognized research programs in which undergraduate and M.S. graduate students participate. Central Washington University is located in Ellensburg, population 15,000, which provides one of the finest living environments in the Pacific Northwest.

To apply, mail a hard copy of letter of application, resume, statement of teaching and research interests and experience, and names of at least three references to: Search Committee Chair, Department of Geological Sciences, Central Washington University, Ellensburg, WA 98926. For additional information, see <http://www.geology.cwu.edu/memposition.html>, phone (509) 963-2801, or e-mail: memsearch@geology.cwu.edu. Screening will begin on Jan. 15, 2004 and continue until the position is filled. AA/EOE/Title IX Institution.

STRUCTURAL GEOLOGIST and WELL LOGGING PETROPHYSICIST PETROLEUM INSTITUTE, ABU DHABI

The Petroleum Geosciences Program of The Petroleum Institute, Abu Dhabi, is seeking outstanding candidates for structural geology/rock mechanics and for well logging petrophysics positions, although other specializations will be considered. An appointment is desired in August, 2004.

Applicants should possess a Ph.D. in Geology or Geophysics. Experience in the petroleum industry is desirable. Appointments probably will be at the Assistant Professor rank, although senior appointments will be considered for candidates with strong teaching and industry experience. Faculty in Petroleum Geosciences will teach undergraduate and graduate courses, develop an active research program that impacts the UAE petroleum industry, and engage in institutional service work. Opportunities exist to work with PI industry stakeholders in research.

The Petroleum Institute is a small, highly focused, new teaching and research institute that offers educational programs that will lead to B.Sc., M.Sc., and Ph.D. degrees in engineering and petroleum geosciences. Staff will have the resources to equip laboratories with up-to-date analytical equipment and computer software and hardware to support teaching and research. The Colorado School of Mines is the PI's academic advisor.

The compensation package for staff includes housing, utilities, home furnishings loan, an automobile purchase loan, health insurance, and annual leave travel.

This is an unusual opportunity for self-motivated geoscientists to help build a world-class teaching and research institution. Additional information is at www.pi.ac.ae/. Interested candidates should send a letter of application and their resume electronically to piapp@pi.ac.ae. Please submit a hardcopy application only if unable to submit electronically to Ms. Dixie Termin, Petroleum Institute, P.O. Box 2533, Abu Dhabi, United Arab Emirates.

Candidates are encouraged to submit an application as soon as possible, but no later than January 31, 2004.

GEOHAZARDS, COLLEGE OF CHARLESTON TENURE-TRACK ASSISTANT PROFESSOR,

The College of Charleston Department of Geology and Environmental Geosciences (www.cofc.edu/~geology) is accepting applications for a tenure-track Assistant Professor position in the area of Geological Hazards with an interest in undergraduate education and research. We are looking for a dynamic geologist with a commitment to undergraduate education and who will develop an active research program involving undergraduate students in support of the College's 4th Century Initiative. The successful candidate will demonstrate skills within one or more areas: Geological Hazard Assessment, Hazard Modeling, Coastal and Marine Hazards, Volcanic and Earthquake Hazards, Natural and Human Induced hazards, Forensic Geology, etc. Persons interested in developing a means of integrating active research, computer applications, and possibly geoinformatics into undergraduate introductory curriculum are strongly encouraged to apply. The successful candidate will teach a total of 18 contact hours a year, 12 of which will be introductory courses. The successful candidate may be involved in the Masters of Environmental Studies Program. A Ph.D. is required at the time of employment in August 2004. Salary is dependent upon experience. To apply, send a letter of interest, current curriculum vitae, a statement of research goals, a statement of teaching goals, and arrange for at least three letters of reference to be sent to: Robert L. Nusbaum, Chair, Geological Hazards Search Committee, Department of Geology & Environmental Geosciences, College of Charleston, 66 George Street, Charleston, SC 29424. For additional information, email nusbaumr@cofc.edu. Applications will be accepted through January 15, 2004.

ACTIVE TECTONICS—FACULTY POSITION PURDUE UNIVERSITY

The Department of Earth and Atmospheric Sciences at Purdue University seeks a broadly educated geologist/geophysicist who conducts innovative research in the analysis of earthquakes and active crustal deformation. Individuals who apply modern quantitative techniques in earthquake geology or seismology, or space geodesy (including InSAR) and combine them with physical models of active deformation and earthquake processes are particularly encouraged to apply.

The appointee is expected to develop a vigorous, externally funded research program, in phase with national initiatives such as Earthscope that interacts with and complements ongoing activities of the Geodynamics and Active Tectonics research group at Purdue (www.eas.purdue.edu/academics/research/gatgrp). We are also interested in applicants whose research links with earthquake engineering (<https://engineering.purdue.edu/CE/Groups/Structural>).

Candidates are expected to have completed a PhD by the time of appointment. This appointment will be tenure-track and at the Assistant Professor level, to begin in August 2004. The appointee is expected to teach at the undergraduate and graduate level. Screening of applications will begin on January 15, 2004, and the search will continue until the position is filled.

Please direct questions and send a completed application (resume, research and teaching statements, names and contact information for at least 3 references) to: Chair of the Active Tectonics Search Committee, Purdue University, Dept. of Earth and Atmospheric Sciences, West Lafayette, IN 47907, USA; Voice (765) 496-2915, Fax (765) 496-1210, Email ecalais@purdue.edu.

Purdue University is an Equal Opportunity/Equal Access/Affirmative Action employer and is committed to building a diverse faculty of excellence. Purdue makes special efforts to accommodate dual-career couples.

ASSISTANT PROFESSOR GEOLOGY GEORGIA COLLEGE & STATE UNIVERSITY

The Department of Biological and Environmental Sciences at Georgia College & State University seeks candidates in the area of environmental geology, sedimentology, and hydrology. A Ph.D. in geology or a related field is required for this tenure-track position. The successful candidate will support the Environmental Science major and will teach introductory courses in geology and upper level courses in sedimentology, mineralogy, hydrology, and other subjects specific to their research. Research ties with local kaolin companies are possible and will be encouraged by the department. Equipment available includes an XRD and SEM. Effective teaching, scholarship, and university and community service are required for promotion and tenure. Starting salary will be commensurate with qualifications and experience. Starting date is August 2004. Review of applications will begin January 15, 2004, and will continue until the position is filled. Submit letter of application, teaching philosophy, research statement, curriculum vitae, copies of transcripts, and the names and contact information for three references to: Dr. Robert M. Chandler, Geology Search Committee, Department of Biological and Environmental Sciences, CBX 081, Georgia College & State University, Milledgeville, GA 31061-0490. GC&SU, Georgia's Public Liberal Arts University, is an Equal Opportunity/Affirmative Action Institution.

PALEOCLIMATOLOGY UNIVERSITY OF ALABAMA

The Department of Geological Sciences invites applications for a tenure track position in Paleoclimatology beginning in August 2004. The position will be filled at the Assistant Professor level. We seek an outstanding individual who will focus on understanding paleoclimate through the investigation of rates and cycles of global change as reflected in the geological record. We expect that such an individual will employ geological, geophysical and/or geochemical tools and techniques. This position will compliment existing strengths in Geological Sciences at the University of Alabama in environmental geology, sedimentary basin analysis, and tectonic and petrologic studies. Research areas of particular interest include, but are not limited to, (1) development of novel methods for retrieval of paleoclimate information from geological archives (modern and ancient); (2) application of time-series analysis and cyclostratigraphy to reconstruct rates and patterns of climate processes, and to characterize ocean-atmosphere-biosphere-crust interactions and their link to climate. The successful applicant will be expected to establish a rigorous, externally funded research program and to teach introductory geology, and advanced undergraduate- and graduate-level courses in paleoclimatology. Applicants must hold a Ph.D. in paleoclimatology or a related field at the time of appointment. Please send curriculum vitae, statements of research and teaching interests, and contact information for 4 referees to Dr.

Carl W. Stock, Paleoclimatology Search Committee Chair, The University of Alabama, Department of Geological Sciences, Box 870338, Tuscaloosa, AL 35487-0338. The Department of Geological Sciences is housed in a modern research facility that provides laboratory space as well as state-of-the-art analytical instrumentation and computing equipment. Further information is available on our departmental website at <http://www.geo.ua.edu>. Review of applications will begin on January 7, 2004 and continue until the position is filled.

The position is contingent on budgetary approval. The University of Alabama is an Equal-Opportunity, Affirmative-Action Employer. Applications are solicited from women and minority candidates.

SEDIMENTARY GEOLOGIST UNIVERSITY OF NEW HAMPSHIRE

The Department of Earth Sciences at the University of New Hampshire invites applications for a tenure-track position in sedimentary geology at the level of assistant or associate professor, starting August 2004 or as soon as possible thereafter. The successful candidate will be expected to teach undergraduate and graduate courses in his or her specialty and develop a strong research program that involves undergraduate and graduate students. We seek candidates who are interested in applying sedimentary geology to fundamental problems in the earth sciences. The ideal candidate will complement existing departmental strengths. A strong commitment to undergraduate teaching and familiarity with field methods are essential. The Department and Graduate School offer degrees in the earth and environmental sciences from the bachelor to doctorate levels. The Department has strong ties with the Institute for the Study of Earth, Oceans, and Space and the Center for Coastal and Ocean Mapping. Further information about the department may be found at www.unh.edu/esci. Starting salary and rank will be commensurate with experience and qualifications. Candidates should have completed a Ph.D. at the time of appointment. Review of applications begins December 15, 2003. Please send complete CV, statement of research and teaching interests, and names and addresses of three references to Search Committee, Department of Earth Sciences, University of New Hampshire, 56 College Road, Durham NH 03824. UNH is committed to excellence through diversity among its faculty and strongly encourages women and minorities to apply.

TENURE TRACK FACULTY POSITION: APPLIED GEOLOGY CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA GEOLOGICAL SCIENCES DEPARTMENT

The Geological Sciences Dept. invites applications for an Assistant Professor level tenure-track appointment beginning September 2004. All applicants must have a doctorate in Geology (ABD's considered) at the time of appointment. Specialties of interest include, but are not limited to the broad areas of hydrogeology, sedimentary geology, engineering geology, computer applications, environmental geophysics and geochemistry. Applicants must have a strong commitment to a polytechnic approach of educating undergraduates for applied careers in the geosciences. Candidates must have the ability to work with a diverse student body and be able to teach a variety of lower and upper division general education and service classes as well as implement new courses in their area of expertise. Applicants who can teach such classes as Engineering Geology, Oceanography, Astronomy, Natural Disasters and / or Science Education are encouraged to apply. Candidates are expected to develop a research program involving undergraduates. Collaborative, interdisciplinary research with other faculty is encouraged. Additional responsibilities include: student advising, mentoring, university service activities. Applicants must submit a letter of interest, resume, statement of teaching and research interests, names of three current references (within the last two years), unofficial transcripts of doctoral work and a completed application form (supplied by the Department). After initial screening three written references (electronic OK) are required. A campus interview, three formal signed letters of reference and official confirmation (transcripts) of degree are required of all finalists. Initial screening: January 5, 2004, position open until filled or terminated. Mail requests and materials to: Dr. John A. Klasik, Chair, Geological Sciences Dept., Cal Poly Pomona, Pomona, Calif. 91768. Email requests to: jaklasik@csupomona.edu. EO/AA employer.

ASSISTANT PROFESSOR IN PALEONTOLOGY UNIVERSITY OF CALIFORNIA, DAVIS

The Department of Geology, University of California, Davis, invites applications for a tenure-track faculty position in paleontology, at the Assistant Professor level. We seek an outstanding vertebrate or invertebrate paleontologist asking questions of broad importance, using quantitative,



NICHOLAS SCHOOL OF THE
ENVIRONMENT AND EARTH SCIENCES
DUKE UNIVERSITY

EOS

Graduate Assistantships in Earth & Ocean Sciences

Undergraduate and graduate students interested in pursuing graduate studies leading to the M.S. or Ph.D. degree are invited to apply for admission to the graduate program in the Division of Earth and Ocean Sciences (EOS) in the Nicholas School of the Environment and Earth Sciences at Duke University.

Research and Teaching Assistantships with full tuition waiver are available and are awarded on a competitive basis. EOS faculty are an active research group of 13 geologists, geophysicists and oceanographers involved in a broad range of investigations in the general areas of Climate Change, Solid Earth Processes, and Surficial Processes. Additional interdisciplinary research opportunities are available through joint studies with other faculty in NSOEEES, Biological Anthropology and Anatomy, Biology, and Civil and Environmental Engineering. For more information, see <http://www.nicholas.duke.edu/eos/>. To request an application, please contact:

Director of Graduate Studies
Division of Earth and Ocean Sciences
Nicholas School of the Environment and
Earth Sciences
Duke University
Durham, North Carolina 27708
(919) 681-8077 Phone
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rigorous methodologies, whose interests and expertise complement those of existing faculty. Our exceptional program in geology, together with the tremendous depth and breadth of related sciences across campus (Evolution and Ecology, Environmental Science and Policy, and Population Biology, to name a few), make UCD particularly attractive for paleontological research. The successful candidate will be expected to develop an independent, productive research program, advise graduate students, and contribute to our undergraduate and graduate teaching program in paleontology. Candidates should possess the Ph.D. or equivalent degree in the geological sciences or a closely related field at the time of appointment; post-doctoral experience is desirable, but not required. For additional information about the department, see our web page <http://www.geology.ucdavis.edu>.

Applicants should send a curriculum vitae, a statement of research and teaching interests, and names, addresses, phone numbers and e-mail addresses of at least three people who can be contacted for recommendations to: Chair, Paleontology Search Committee, Department of Geology, One Shields Avenue, University of California, Davis, Davis, CA 95616, Phone: (530) 752-0350, Fax (530) 752-0951, E-mail: Paleo-Search@geology.ucdavis.edu.

The position will be effective starting July 1, 2004. To ensure full consideration, applications should be received by January 5, 2004; we will begin reviewing applications on December 1, 2003. The position will remain open until filled.

The University of California is an affirmative action/equal-opportunity employer. The University undertakes affirmative action to assure equal employment opportunity for minorities and women, for persons with disabilities, and for special disabled veterans, Vietnam era veterans, and any other veterans who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized.

SEDIMENTOLOGY/STRATIGRAPHY FACULTY POSITION UNIVERSITY OF NEVADA, LAS VEGAS

The Department of Geoscience invites applications for a full-time, 9 month, tenure-track position at the Assistant Professor level with expertise in carbonate sedimentology/stratigraphy. The successful candidate will have a field-based research approach. Preference will be given to individuals with expertise in one or more of the following areas: sequence stratigraphy, chemostratigraphy, invertebrate paleontology, petroleum geology, computer modeling, or facies analysis. The successful applicant will be expected to teach graduate courses in carbonate petrology and carbonate depositional systems, and other graduate courses in the area of specialization. In addition, he/she will be expected to teach upper level undergraduate courses in the area of the applicant's expertise, and introductory geoscience courses. Development of a rigorous, externally funded research program and supervision of graduate students at both the master's and doctoral levels is expected. Additional information may be obtained at <http://www.unlv.edu> and <http://www.geoscience.unlv.edu>.

Qualifications include a Ph.D. in an appropriate earth science discipline from an accredited college or university. Demonstrated teaching experience is desired. The appointment will begin in August, 2004. Salary is commensurate with qualifications and experience. Position is contingent upon funding.

To apply, please submit a letter indicating teaching and research interests; a detailed CV; unofficial transcripts; and the names and contact information of five references. The review of materials will begin January 15, 2004. Documentation may be mailed to: Sedimentologist Search Committee, Department of Geoscience, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Box 454010, Las Vegas, NV 89154-4010.

Specific questions may be addressed to David Kreamer at kreamer@nevada.edu or kreamer@unlv.nevada.edu. UNLV is an Affirmative Action / Equal Opportunity educator and employer committed to excellence through diversity.

GEOMORPHOLOGY OR STRUCTURAL GEOLOGY INDIANA UNIVERSITY-PURDUE UNIVERSITY FORT WAYNE

The Department of Geosciences at Indiana University-Purdue University Fort Wayne invites applications for a tenure-track position at the Assistant Professor level, beginning August, 2004. The successful candidate will teach undergraduate courses in physical geology, weather and climate, maps/GIS, geomorphology and structural geology. Candidates must develop an active research program in their field of specialty. Ph.D. required.

The Geosciences Dept. has 5 faculty, secretary and technician located in new facilities designed for geology.

Candidates must submit a C/V, interests statement, and have three letters of reference sent to Anne Argast, Chair,

Dept. of Geosciences, IPFW, Fort Wayne, IN 46805-1499. Inquiries to Argast@ipfw.edu. Applications will be reviewed starting March 1, 2004. IPFW is an AA/EAAA institution. More at www.geosci.ipfw.edu.

MARSHALL UNIVERSITY/FACULTY POSITION

The Department of Geology at Marshall University invites applications for a tenure track teaching position beginning August 17, 2004. The position will be filled at the Assistant or Associate Professor level. The successful applicant will be expected to teach upper level courses in Geomorphology, Environmental Geology, Engineering Geology, and Soils as well as service courses in General Geology, Earth Materials Lab. A Ph.D. is required and several years teaching experience is preferred. The successful applicant will be expected to integrate a strong field component into upper level courses and develop a vigorous, externally supported research program that involves undergraduates.

Candidates should submit a letter of application, curriculum vitae, undergraduate and graduate transcripts, a statement of teaching and research interests, and the names and contact information (including e-mail addresses) for three references. All application materials should be sent to Dr. Ronald Martino, Chair, Department of Geology, Marshall University, Huntington, WV 25755. Review of applications will begin on January 15 and continue until the position is filled.

Marshall University is an EO/AA employer. Women and minorities are encouraged to apply. For additional information about the Department of Geology and Marshall University, please visit the website www.marshall.edu.

GEOMORPHOLOGY/SURFICIAL PROCESSES FACULTY POSITION UNIVERSITY OF NEVADA, LAS VEGAS

The Department of Geoscience invites applications for a full-time, 9 month, tenure-track position at the Assistant Professor level with in Geomorphology/Surficial Processes. The successful applicant will have an active, field based research program that will complement existing departmental strengths and a strong commitment to teaching at both graduate and undergraduate levels. Development of a rigorous externally funded research program and supervision of graduate students at both the master's and doctoral levels is expected. Additional information may be obtained at <http://www.unlv.edu> and <http://geoscience.unlv.edu>. We seek applicants with research strengths that include: rates of geomorphic processes, low-temperature/environmental geochemistry related to surficial processes, paleolimnology; and quantitative, tectonic, fluvial, eolian, or arid lands geomorphology. Preference will be given to those who use/teach GIS.

Qualifications include a Ph.D. in an appropriate earth science discipline from an accredited college or university. Demonstrated teaching experience is desired. The appointment will begin in August, 2004. Salary is commensurate with qualifications and experience. Position is contingent upon funding.

To apply, please submit a letter indicating teaching and research interests; a detailed CV; unofficial transcripts; and the names and contact information of five references. The review of materials will begin January 15, 2004. Documentation may be mailed to: Geomorphology Search Committee, Department of Geoscience, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Box 454010, Las Vegas, NV 89154-4010.

Specific questions may be addressed to Terry Spell at tspell@ccmail.nevada.edu. UNLV is an Affirmative Action / Equal Opportunity educator and employer committed to excellence through diversity.

TENURE TRACK FACULTY POSITION SOLID EARTH GEOPHYSICIST

The Department of Geology at Miami University invites applications for a tenure-track faculty position at the Assistant Professor level, beginning August 2004. Applicants must have a Ph.D. degree at the time of appointment. The successful applicant will be expected to teach effectively at the undergraduate and graduate levels, supervise student research at the undergraduate, M.S. and Ph.D. levels, and initiate and maintain a vigorous, externally funded research program.

We are seeking an outstanding candidate who is undertaking significant field and/or laboratory based research in solid earth geophysics or geodynamics. The particular research emphasis should complement current program strengths indicated below.

The successful applicant will join an active department that consists of ten faculty members, four research/technical staff members, forty undergraduate majors and twenty four graduate students. The department maintains active research programs in geomicrobiology, geomorphology, hydrogeology, igneous petrology, isotope geochemistry, low-temperature geochemistry, mineralogy, sedimentology and stratigraphy, structural geology,

tectonics, volcanology, and Quaternary geology. Included among departmental instrumentation are: DC plasma spectrometer, multi-collector thermal ionization mass spectrometer, HPLC ion chromatograph, atomic force/scanning tunneling microscope, single-crystal and powder x-ray diffractometers, single-crystal x-ray cameras, electrophoretic mobility analyzer, and cathode luminescence. The department also owns a truck-mounted hollow-stem auger drilling rig. Please visit www.muohio.edu/geology/ for additional information.

Miami University, with 16,000 students, is located in a small-town setting within a one-hour drive of Cincinnati and Dayton. Interested candidates should submit a packet containing a letter of application, curriculum vitae, statement of teaching and research objectives and accomplishments, transcripts, and arrange three letters of reference to be sent to: Geophysicist Search Committee, Department of Geology, Miami University, 114 Shideler Hall, Oxford, OH 45056 (fax: 513-529-1542). Applications will be accepted until December 19, 2003 or until the position is filled.

We encourage applications from women, members of ethnic minority groups, and individuals with disabilities. Miami University offers equal opportunity in employment and education.

U.S. GEOLOGICAL SURVEY MENDENHALL POSTDOCTORAL RESEARCH FELLOWSHIP PROGRAM

The U.S. Geological Survey (USGS) invites applications for the Mendenhall Postdoctoral Research Fellowship Program for Fiscal Year 2005. The Mendenhall Program provides opportunities to conduct research in association with selected members of the USGS professional staff. Through this Program the USGS will acquire current expertise in science to assist in implementation of the science strategy of its programs. Fiscal Year 2005 begins in October 2004.

Opportunities for research are available in a wide range of topics. The postdoctoral fellowships are 2-year appointments. The closing date for applications is January 16, 2004. Appointments will start October 2004 or later, depending on availability of funds. A description of the program, research opportunities, and the application process are available at <http://geology.usgs.gov/postdoc>. The U.S. Geological Survey is an equal opportunity employer.

ASSISTANT RESEARCH GEOLOGIST IDAHO GEOLOGICAL SURVEY

The position at the University of Idaho requires research and public service. The research emphasis is geologic mapping of Idaho. Please see www.idahogeology.org for details about the position and the Survey. Strong preference will be given to candidates with demonstrated ability and experience in geologic mapping and related topical research in a variety of geologic settings.

Please send a letter of application, curriculum vitae, statements of research interests and philosophy of geological service to the public, and contact information for three or more referees to: Kurt Othberg, Idaho Geological Survey, University of Idaho, Moscow, ID 83844-3014; or via email to igs@uidaho.edu. The Idaho Geological Survey and the University of Idaho are equal opportunity/affirmative action employers.

TENURE TRACK FACULTY POSITION IN CHEMICAL OR PHYSICAL SURFICIAL PROCESSES BOISE STATE UNIVERSITY

The Department of Geosciences at Boise State University invites applications for a tenure-track faculty position in biogeochemistry, aqueous geochemistry, water quality or surficial processes as applied to surface and/or near-surface hydrology. Desirable areas of research focus include, but are not limited to: nutrient cycling in watersheds, water/rock interactions, fluvial or hillslope geomorphology, and sediment transport processes. We especially encourage applicants with combined strengths in field experiments, laboratory/analytical skills, and modeling. The successful applicant will develop a nationally-recognized research program supported by extramural funding and will complement our existing research and educational strengths in hydrology, hydrogeology, and surficial processes. Interest in and ability to contribute effectively to collaborative research efforts, participate in developing analytical facilities, provide research opportunities for undergraduate and graduate students, and deliver courses for undergraduate and graduate geoscience programs are essential. A PhD in a related Earth Science or Engineering discipline is required at the time of appointment.

Boise State University, with an enrollment exceeding 18,000 students, is located in a metropolitan area (population over 400,000). Boise is the state capitol and business, financial, and cultural center of Idaho. Numerous state and federal agencies are located in the city and the Geosciences Department benefits from collaborative activities with several of these agencies. The area is rec-

ognized as one of America's best places to live and has emerged as one of the nation's major growth regions in technology-related industry. The moderate climate and a wide variety of wild and scenic areas contribute to an outstanding quality of life with a wide variety of recreational opportunities. Additional information about the Department of Geosciences and the university can be found through our web site: <http://earth.boisestate.edu/>.

Boise State University is an EOE/AA institution and is strongly committed to achieving excellence through cultural diversity. The University actively encourages applications from women, persons of color, and members of other underrepresented groups. Veteran's preference may be applicable. Applicants should send a Curriculum Vita, Statement of Research and Teaching Interests, and contact information for a minimum of three referees to: Search Committee, Department of Geosciences, Boise State University, Boise, ID 83725. Review of applicants will begin on 11/17/2003, and will continue until a qualified applicant pool is established. Email correspondence (questions or submission of application materials) can be sent to jmncnamar@boisestate.edu.

TENURE-TRACK FACULTY POSITION HYDROGEOLOGY AND WATER RESOURCES UNIVERSITY OF WISCONSIN—EAU CLAIRE BEGINNING AUGUST 23, 2004

Instructional responsibilities will include water resources, physical hydrogeology, chemical hydrogeology, computer modeling in hydrogeology, and introductory geology courses as needed by the department. Applicant must also involve students in high-quality collaborative research projects. A PhD in geology or a closely related discipline is required at the time of appointment. The department has modern facilities in hydrogeology, geophysics, geochemistry, and sedimentology.

To apply, please send a letter of application, curriculum vita, copies of college transcripts, and arrange to have three letters of recommendation sent to the department. Reply to Dr. Robert Hooper, Chair, Department of Geology, University of Wisconsin-Eau Claire, Eau Claire, WI, 54702-4004. To be considered for priority screening all application materials must be received by January 15, 2004; however, screening may continue until position is filled.

For a complete position description, call 715/836-3732 or visit <http://www.uwec.edu/geology>. UW-Eau Claire is an AA/EEO employer and encourages applications from women and minorities.

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL SEDIMENTARY GEOLOGY AND EARTH SYSTEM HISTORY POSITION

The Department of Geological Sciences at the University of North Carolina at Chapel Hill invites applications for a tenure-track faculty position at the assistant professor level to begin July 1, 2004.

We seek applicants with a broad range of research interests in earth system history, including one or more of the following areas: (1) Marine geobiology, including paleoecology, paleobiogeography, and paleoceanography, with an emphasis on the relationships between geology, plate tectonics, climate, and biological evolution; (2) Quantitative studies of past climates, including abrupt climate change, utilizing marine, terrestrial, and/or ice core data; (3) Evolution of sedimentary basins, including stratigraphic, biostratigraphic, geochronologic, and paleoenvironmental investigations, and the relationship between climate and sediment supply. This position will complement existing strengths at UNC-CH in paleobiology, climate modeling, continental margin geology, and tectonics. The successful candidate will be expected to interface with existing departmental research programs and advance undergraduate and educational programs through developing cross-disciplinary ties with other units on campus.

The department houses several laboratories including a scanning electron microscope, thermal ionization mass spectrometer, and DCP, and has access to an ICP-MS and electron microprobe at Duke University. The Department of Marine Science houses a GC-C-IR mass spectrometer. UNC-CH and Duke jointly operate the R/V Cape Hatteras, a part of the UNOLS oceanographic research fleet. The university offers access to several in-house supercomputing facilities.

Applicants must hold a Ph.D. at the time of appointment. Postdoctoral and teaching experience is highly desirable. The candidate will be expected to develop a vigorous, externally funded research program, and to demonstrate excellence in both undergraduate and graduate teaching.

Applicants must submit a letter of application, names, addresses, and email and phone numbers of four references, statements of teaching and research interests, and their vitae to Prof. J. A. Rial, Chair, Search Committee for Earth System History, Department of Geological Sciences, CB# 3315, University of North Carolina,

Chapel Hill, NC 27599-3315. Review of applications will begin on December 15, 2003, and will continue until the position is filled. Informal meetings with UNC-CH faculty at GSA or AGU meetings can be arranged. More information about the department can be found at <http://www.geosci.unc.edu>. UNC-CH is an Equal Opportunity/Affirmative Action employer. Women and minorities are encouraged to apply.

**DEPARTMENT OF EARTH & OCEAN SCIENCES
UNIVERSITY OF BRITISH COLUMBIA
ASSISTANT PROFESSOR**

APPLIED SEDIMENTOLOGY AND/OR STRATIGRAPHY
The Department of Earth and Ocean Sciences at the University of British Columbia invites applications for a tenure-track faculty position in the area of sedimentology and/or stratigraphy. We seek a scientist whose research enhances and extends our existing strengths, particularly in areas that are process oriented and/or applied, including but not limited to, exploration and exploitation of fossil fuels, environmental studies and economic geology. This appointment is at the Assistant Professor level although applications from exceptionally well-qualified, more senior scientists will be considered, particularly if they address under-representation of designated equity groups such as women, visible minorities, disabled persons or aboriginal peoples. Candidates from all relevant fields of Science and Engineering are encouraged to apply. The position will be available as early as July 1, 2004. A Ph.D. is required by the commencement date. Teaching at the undergraduate and graduate levels is expected.

The University of British Columbia hires on the basis of merit and is committed to employment equity. All qualified persons are encouraged to apply; however, Canadians and Permanent Residents of Canada will be given priority. For more information about the Department and this position, visit our web site at <http://www.eos.ubc.ca>.

Applicants should send their curriculum vitae, a statement of research and teaching interests, and the names and complete contact information of three referees to Dr. Paul L. Smith, Head, Department of Earth and Ocean Sciences, the University of British Columbia, 6339 Stores Road, Vancouver, British Columbia V6T 1Z4. E-mail: psmith@eos.ubc.ca; Fax: 604-822-9014. Applications will be considered until January 9, 2004.

**HOFSTRA UNIVERSITY
ASSISTANT PROFESSOR
SEDIMENTOLOGY/FIELD GEOLOGY**

The Department of Geology, Hofstra University, invites applications for a tenure track position at the assistant professor level beginning September, 2004. We seek a candidate with a background in sedimentology and field geology who is strongly committed to excellence in undergraduate teaching and research. The successful candidate will have a nine contact hour per semester teaching load and will be expected to teach one introductory level and one advanced undergraduate course per semester. The ideal candidate will teach physical geology and should be prepared to offer advanced laboratory courses in sedimentology and field methods, as well as one additional advanced course in a topic of interest to the candidate. We are looking for a dynamic individual who combines excellence in teaching with breadth and versatility in professional productivity, and who shares our commitment to close student-faculty interaction, including a vigorous program of field trips and student involvement in faculty research and professional activities.

Hofstra University is located in suburban Long Island, New York, about 25 miles from Manhattan. The University occupies a beautiful 240 acre campus that is also a registered arboretum and enrolls over 13,000 undergraduate and graduate students. The Geology Department consists of four full time and seven adjunct faculty and offers undergraduate degrees in Geology and Environmental Resources.

Applicants should have their Ph.D. completed by September, 2004. Send a letter of introduction discussing your teaching and research interests, a curriculum vitae, and three supporting letters to: Dr. Dennis Radcliffe, Chair - Department of Geology, 114 Hofstra University, Hempstead, NY 11549-1140. We will begin reviewing applications on November 15, 2003.

Hofstra University is an equal opportunity employer and is dedicated to ethnic and cultural diversity among the faculty and student body.

Opportunities for Students

Graduate Assistantships in Tropical Paleoclimatology at the University of Nevada, Las Vegas. The Department of Geoscience at UNLV is seeking qualified Ph.D. and M.S. level students to participate in tropical paleoclimate

research. Available projects utilize U-series dating, stable isotopes, and luminescence banding of stalagmites from tropical caves in southern Central America to reconstruct late Quaternary variability in the Central American Monsoon and the El Niño/Southern Oscillation. Travel to field sites and collaborating institutions is likely. Proficiency in Spanish and caving experience are considered beneficial. Teaching and Research Assistantships for qualified students may be available as early as January 2004. Application deadlines for 2004 Spring and Fall semesters are November 15, 2003, and March 15, 2004 respectively. For further information please contact Matthew Lachniet (matthew.lachniet@ccmail.unlv.edu); (702)895-4388. For application materials contact: Graduate Coordinator, University of Nevada, Las Vegas, Dept. of Geoscience, 4505 Maryland Parkway, Las Vegas, NV 89154-4010 or see our website <http://geoscience.unlv.edu>.

Research/Teaching Assistantships. Graduate Program of Hydrologic Sciences. University of Nevada, Reno. Applications are encouraged for graduate teaching/research assistantships beginning July 1, 2004. Positions carry an annual stipend of a minimum of \$15,000 including tuition and fees. Students interested in the area of ground water, surface water and aqueous geochemistry are encouraged to apply. Additionally, numerous funded assistantships are available in contaminant transport, watershed hydrology and numerical simulation, as well as scholarships and doctoral fellowships offered through UNR and the Desert Research Institute. Completed application packages are due January 10, 2004 and should be mailed to: Graduate Program of Hydrologic Sciences, Mail Stop 175, LMR 267, Reno, NV 89557-0180. Information on assistantships and fellowships in the Hydrologic Sciences Graduate Program can be found at www.hydro.unr.edu or by calling 775-784-6250.

Ph.D. Student Assistantships. Oregon State and Portland State Universities are offering ten Ph.D. research assistantships to explore all aspects of the Earth's subsurface microbial biosphere. Tuition and stipend are provided by the NSF IGERT program and the two universities. Students will work in interdisciplinary teams of engineers, oceanographers, microbiologists, microbial ecologists, geologists, soil scientists, and chemists to solve environmental problems, to understand global chemical cycles, and to determine the impact of subsurface microorganisms on surface ecosystems. More information can be found at: <http://oregonstate.edu/dept/igert>, or Martin R. Fisk, College of Oceanic and Atmospheric Sciences, Oregon State University, mfisk@coas.oregonstate.edu. Students from all scientific backgrounds are encouraged to apply to departments represented by IGERT faculty at either institution. U.S. citizens or permanent residents can be supported by IGERT funds however students of all nations can participate in the program. Review of applications starts 1/15/04. Oregon State and Portland State Universities are committed to equality in education.

Graduate Research Assistantships in Near-Surface Geophysics. Funding is currently available for several graduate research assistants through the Environmental Geophysics Research Lab at the University at Buffalo (www.geophysics.buffalo.edu). The first project (NSF) involves archaeogeophysical investigations in southern Jordan focusing on visualization and quantitative methods for fusing GPR, electrical resistivity, and magnetic gradiometry data. The second project (EPA/Forest Service) consists of developing hydrogeophysical models of ecologically significant perched wetlands in the Central Great Basin, Nevada. The third project (DOD) includes environmental site characterization using the full suite of geophysical tools on military installations near Anchorage and Fairbanks, Alaska. The final project (NSF) involves promoting diversity in the geosciences by providing unique opportunities to underrepresented student populations through the Buffalo Geosciences Program (www.bgp.buffalo.edu). Funding is available now for students planning to begin January 2004 (preferred), but later start times are possible. Evaluation of candidates for assistantship positions will begin in November and continue until the positions are filled (<http://www.geology.buffalo.edu/graduate.html>). Contact Dr. Gregory Baker (gbaker@geology.buffalo.edu; 716.645.6800 ext 2252) for more information.

Jonathan O. Davis Scholarship. Division of Earth and Ecosystem Sciences. Desert Research Institute. The family and friends of Jonathan O. Davis, a prominent U.S. geologist and geochronologist and a DRI faculty member, have established an endowment that provides a yearly national Jonathan O. Davis Scholarship.

Jonathan was tragically killed in an automobile accident in December 1990. It is the wish of his family and friends to support graduate students working on the

Quaternary geology of the Great Basin and surrounding areas, research areas close to Jonathan's heart. The national scholarship is \$4,000.00.

Administered by the Division of Earth and Ecosystem Sciences of the Desert Research Institute, it is open to graduate students enrolled in an M.S. or Ph.D. program at any university in the United States. Quaternary geology, as used here, encompasses a wide range of topics normally considered as part of the Quaternary sciences. The research, however, must have a substantial geologic component or demonstrate a strong reliance on geological techniques and must be focused on the Great Basin and immediately adjacent areas.

Applications should include: (1) A cover letter explaining how the individual qualifies for the award. Please include your social security number and state; (2) A current résumé or vitae; (3) A two-page, single spaced description of the thesis/dissertation research, which describes research methods, use of funds, and expected results. Figures, tables, and references do not count against the 2-page limit; (4) A letter of recommendation from the thesis/dissertation supervisor, which emphasizes the student's ability and potential as a Quaternary scientist.

Applications must be post-marked by February 2, 2004. Applications should be addressed to: Executive Director, Division of Earth and Ecosystem Sciences, Desert Research Institute, 2215 Raggio Parkway, Reno, NV 89512.

If you have further questions regarding the awards or the application process, please contact Barbara Jackson at (775) 673-7454 or bj@dri.edu.

Graduate Research Fellowships in the Geological Sciences. The Department of Geological Sciences at Indiana University has openings for Fellowships in a number of disciplines which may include Clay Mineralogy, Petroleum Geology, Geophysics, Sedimentary Geology, and Paleontology beginning in the Fall Semester, 2004.

These competitive fellowships are available to both master- and doctoral-level candidates and carry a tuition waiver plus an award of \$12,000 to \$24,000 for 12 months. Information on the Department can be found at www.indiana.edu/~geosci/. Applicants should have a good background in one or more of the disciplines for which they are applying. Interested students should contact Mary Iverson, Department of Geological Sciences, Indiana University, 1001 E. 10th St., Bloomington, IN 47405, USA; phone: 800-553-2592; geograd@indiana.edu.

Graduate Assistantships in Hydrogeology Florida International University. The Earth Sciences Department at Florida International University (holding Carnegie Foundation's highest rating, "Doctoral/Research University—Extensive") has MS and Ph.D. assistantships in the areas of soil physics, hydrogeology, and chemical hydrogeology. One project involves using natural chemical tracers to evaluate sources of freshwater to Biscayne Bay and is funded through the Florida Seagrass College Program. Other areas of research include applications of lattice Boltzmann models to a myriad of problems: solute transport, ground water flow in karst, multiphase fluid flow in porous media, and fractals and percolation theory. Additional projects involve investigation of Everglades hydrogeology. Ideal candidates will possess an undergraduate degree in a natural science discipline, engineering, or mathematics, and have a grade point average of at least 3.0 on a 4-point scale. FIU requires verbal+quantitative GRE > 1000 for MS and >1120 for Ph.D. There are TOEFL requirements for non-native English speakers. Interested students should contact either Dr. René Price (305-348-3119; pricer@fiu.edu) or Dr. Mike Sukop (305-348-3117; sukopm@fiu.edu). Further information can be obtained at www.fiu.edu/~geology.

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Water-Rock-Life Labs—a comprehensive analytical contract facility providing metal analyses on a variety of environmental matrices (e.g., EPA 200.8, EPA 6020) by DRC-ICP-MS. Laser ablation ICP-MS also available. Contact Dr. Robyn Hannigan (870-972-3086; hannigan@astate.edu) or <http://www.cas.astate.edu/geochemistry> for more information.

Employment Postings

www.GeoscienceJobs.com. Worldwide Job Postings for Geoscientists & Geo-Engineers. Email: info@geosciencejobs.com.

Imaging

Southwest Satellite Imaging. Affordable custom image processing, optimized for geologic mapping and analyses. 866-230-8941, dohrenwend@rkymtnhi.com.

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GSA's GeoVentures. Contact Edna Collis, 800-472-1988, x1034, ecollis@geosociety.org; www.geosociety.org/geoventures/.

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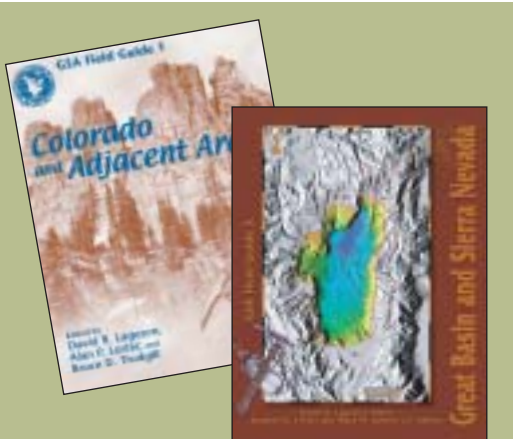
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Western Cordillera and Adjacent Areas

Edited by
Terry W. Swanson

This volume includes guides for 15 of the field trips held in conjunction with the 2003 GSA Annual Meeting in Seattle. Topics covered include Glacial Lake Missoula and the Clark Fork Ice Dam; the Sauk Sequence in western Utah; the geology of wine in Washington state; the Columbia River basalt and Yakima Fold Belt; Alpine glaciation of the North Cascades; and recent geochronological discoveries in central Washington. Quaternary geology of Seattle, engineering geology in the central Columbia Valley, and the tephrostratigraphy and paleogeography of southern Puget Sound also are covered, as are trips to the central Cascade Range and the White River.

FLD004, 284 p., ISBN 0-8137-0004-3, softcover
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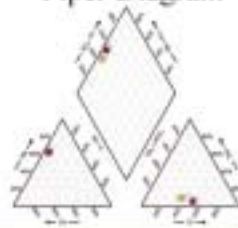
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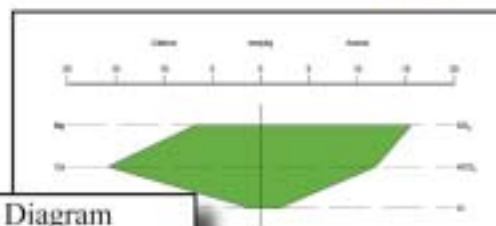
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Stiff Diagram

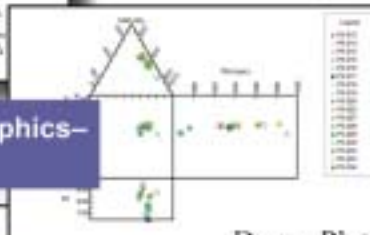


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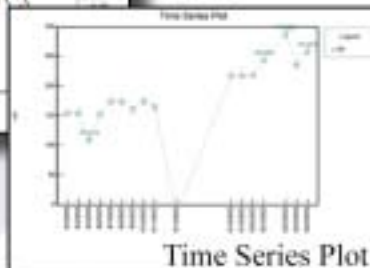
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