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Continental-scale links between the mantle and groundwater systems of the western United States: Evidence from travertine springs and regional He isotope data

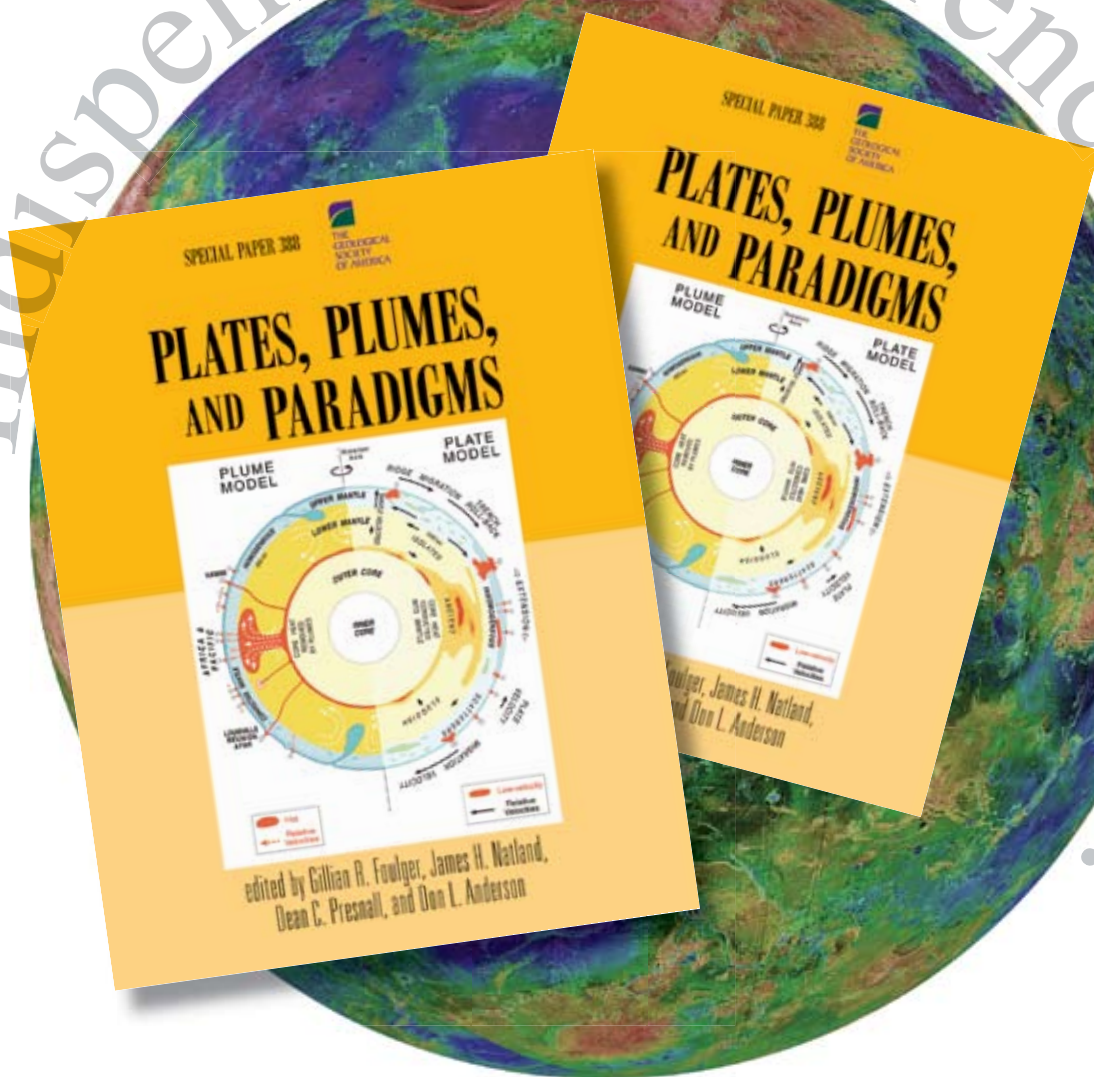
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Cover: Active travertine spring mound issuing on the Tierra Amarilla anticline, near San Ysidro, New Mexico. Photo by Dennis Newell. See "Continental-scale links between the mantle and groundwater systems of the western United States: Evidence from travertine springs and regional He isotope data," by D.L. Newell et al., p. 4–10.



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Continental-scale links between the mantle and groundwater systems of the western United States: Evidence from travertine springs and regional He isotope data

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ABSTRACT

To understand regional mantle degassing, we compiled new and existing helium isotope data measured in hot springs, gas fields, and travertine-depositing cool springs and compared these geochemical data with mantle velocity structure determined from tomographic studies. These data suggest heterogeneous mantle degassing, with regions of highest $^3\text{He}/^4\text{He}$ in groundwaters (hence, highest mantle helium contribution) corresponding to regions of lowest mantle velocity, a reflection of tectonically active and partially molten mantle. New He isotope and water chemistry data from travertine-depositing cool springs of the western United States show marked variability consistent with mixing between surface water recharge and inputs from deep crustal and mantle sources. The deeply sourced end-member fluids of these mixing trends have high $^3\text{He}/^4\text{He}$, high dissolved CO_2 , and high salinity compared to shallow recharge waters, and commonly have elevated trace element concentrations. Consequently, these fluids cause degradation of water quality in western U.S. aquifers. Our conclusions highlight a connection between neotectonics (e.g., mantle degassing) and water quality in the western United States.

INTRODUCTION

Distributed deformation associated with the western North American plate margin extends >1000 km inboard from the San Andreas fault zone to the Rocky Mountain and western Great Plains regions. This region forms an orogenic plateau with high average heat flow and is characterized by relatively low upper mantle P-wave velocities with marked heterogeneity (Godey et al., 2003; Humphreys et al., 2003). Progressive geochemical depletion of the upper mantle during generation of basaltic

melt likely occurred in several episodes since the Proterozoic (Karlstrom et al., 2005). The mantle was hydrated by flat-slab subduction during the Laramide orogeny (Humphreys et al., 2003) and now is partially molten, leading to small-scale convective exchange between an upwelling asthenosphere (Gao et al., 2004) and compositionally variable lithosphere (Dueker et al., 2001; Karlstrom et al., 2005). The mantle underlying western North America is marked by one of the largest known shear wave velocity contrasts on Earth (van der Lee and Nolet, 1997). At the continental scale, this transition reflects the heterogeneous thinning and warming of North America's lithospheric keel as the plate moved southwest in absolute plate motion in the Cenozoic into a wide zone of warm asthenosphere (CD-ROM Working Group, 2002).

We hypothesize that CO_2 -rich mineral springs and related travertine deposits in the western United States are a manifestation of this mantle tectonism, and hence the geochemistry of spring waters and gases can be used in conjunction with geophysical data sets to understand mantle heterogeneity and the processes of lithosphere-asthenosphere interaction. We report new water and gas chemistry with associated carbon and helium isotope data in the context of a synthesis of the existing noble gas isotope chemistry database for western North America. Our literature synthesis (Table DR1¹) builds on previous work in the area, with the regional helium isotope data presented in the context of a tomographic image of today's mantle. We also show that travertine-depositing cool springs contain mantle-derived volatiles in a variety of locations and tectonic settings throughout the western United States, such that many aquifer systems are influenced by mixing of deeply sourced and circulated waters.

HE ISOTOPES—BACKGROUND

The isotope geochemistry of noble gases is a sensitive tracer of mantle-derived volatiles even with a large input of volatiles derived from Earth's crust. This is because the mantle has retained a significant fraction of the terrestrial inventory of the primordial isotope ^3He acquired during Earth formation (Clarke et al., 1969), and it is still leaking to Earth's surface. In contrast, the crust has been extensively reworked over geological time and has retained very little ^3He : its helium inventory is dominated by radiogenic ^4He produced from the decay of U- and Th-series nuclides. Consequently, helium presently emanating from regions of mantle melting, such as mid-oceanic ridges or helium trapped in glass and phenocrysts in mid-oceanic-ridge basalts (MORB), is characterized by a relatively high $^3\text{He}/^4\text{He}$ ratio (R) of 8 ± 1 times that of air (R_A), which has a $^3\text{He}/^4\text{He}$ ratio of 1.4×10^{-6} (Graham, 2002). Indeed, values as high as $37 \times R_A$ have been observed in some ocean island basalts (Hilton et al., 1999) and are thought to be related to deep plumes tapping less degassed mantle reservoirs. When mantle-derived fluids are injected into the crust, mantle helium becomes progressively diluted by crustal helium characterized by low $^3\text{He}/^4\text{He}$ ratios of $\sim 0.02 R_A$. Therefore, any value higher than 0.1

¹GSA Data Repository Item 2005199, a description of sampling and analytical methods and geochemical data tables DR1–DR3, is available online at www.geosociety.org/pubs/ft2005.htm or on request from Documents Secretary, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, or editing@geosociety.org.

R_A , which lies above the range typical of various crustal lithologies, is considered to have a significant mantle He component (Ballentine et al., 2002). Conversely, areas like the Canadian Shield that have a thick, cool lithosphere and are tectonically quiescent have $^3\text{He}/^4\text{He}$ ratios $\sim 0.02 R_A$, implying that groundwater and gas reservoirs have been insulated for long periods from mantle volatile additions.

Across western North America, mantle-derived helium and elevated CO_2 levels have long been identified in fluids and gases at major volcanic centers, faults, and hydrothermal systems associated with mantle partial melting and high heat flow (Ballentine et al., 2002; Craig et al., 1978; Hilton et al., 2002; Kennedy et al., 1987, 2002; Welhan et al., 1988, and references therein). Helium-3 flux has also been used to understand magmatism in extensional tectonic settings (e.g., Oxburgh and O'Nions, 1987; Torgersen, 1993). Natural gas fields have been the focus of noble gas research and clearly show the presence of mantle-derived volatiles (Ballentine et al., 2000, 2001; Caffee et al., 1999; Hiyagon and Kennedy, 1992; Jenden et al., 1988; Kennedy et al., 2002; Poreda et al., 1986; Torgersen and Kennedy, 1999). Mantle-derived helium has been identified in the San Andreas and Walker Lane fault zones of California and Nevada (Kennedy et al., 1997; Kulongoski et al., 2005; Sorey et al., 1993; Welhan et al., 1988), suggesting that faults can serve as conduits for mantle volatiles without active magmatism.

UNDERSTANDING THE FLUX OF MANTLE VOLATILES THROUGH THE CRUST

Interpretation of the variation in helium isotopic ratios measured in groundwaters and gases is complicated by the factors that can affect the ratio during volatile movement from the mantle through the crust. Assuming the MORB value for the mantle end-member under the western United States (e.g., Ballentine et al., 2005), the factors that can lower the isotopic value below $8 R_A$ include alpha recoil addition of ^4He from uranium-series radioactive decay during movement through the crust, dilution by stored crustal helium ($0.02 R_A$), and addition from old magmatic systems that have been diluted by the same processes (Ballentine and Burnard, 2002; Torgersen, 1993). Thus, one must understand not only the initial mantle helium isotope input but the residence time, fluid flow rate, and mixing history through the crust, as well as the distribution and age of magmatic intrusions and variation in U and Th in the crust (Kennedy et al., 1997; Torgersen, 1993; Torgersen et al., 1995).

Helium does not move alone from the mantle, but travels with CO_2 and other components. Helium is a trace gas in spring gases, whereas CO_2 can comprise over 99% of the gas phase in some springs. Quantifying the CO_2 flux from the mantle is not simple, due to mixing of CO_2 from other sources such as metamorphic decarbonation of carbonate bedrock, CO_2 gas reservoirs, organi-

cally derived CO_2 , and atmospheric CO_2 (Polyak et al., 2000; Sano and Marty, 1995; Sherwood Lollar et al., 1997).

MORB has a narrow range of $\text{CO}_2/^3\text{He}$ ratios ($2\text{--}7 \times 10^9$), whereas crustal fluids are characterized by higher $\text{CO}_2/^3\text{He}$ ratios ($10^{11}\text{--}10^{13}$) (O'Nions and Oxburgh, 1988; Sherwood Lollar et al., 1997). The combination of $\delta^{13}\text{C}$ measurements and the $\text{CO}_2/^3\text{He}$ ratio has been used successfully to resolve the relative contribution of mantle CO_2 to fluids and gases (e.g., Sano and Marty, 1995).

TRAVERTINE SPRINGS OF THE WESTERN UNITED STATES

Travertine deposition is driven by the degassing of CO_2 -charged groundwater as it emerges at springs. Although it is commonly suggested in the literature that CO_2 is derived from meteoric or near-surface biological sources (e.g., Szabo, 1990), the models of Liu et al. (2003), Siegel et al. (2004) and Crossey et al. (2006) suggest that travertine-depositing springs often contain deep geological or endogenic sources of CO_2 .

Worldwide, there is recognition that travertine deposits are associated with faulting and extensional settings (Hancock et al., 1999). In the western United States, active travertine-depositing hot and cool springs (Fig. 1) are associated with basement-penetrating normal faults and lavas associated with extensional tectonics. The association of travertine deposits with hot springs and lavas suggests a link to high crustal heat flow. However, cool travertine springs are

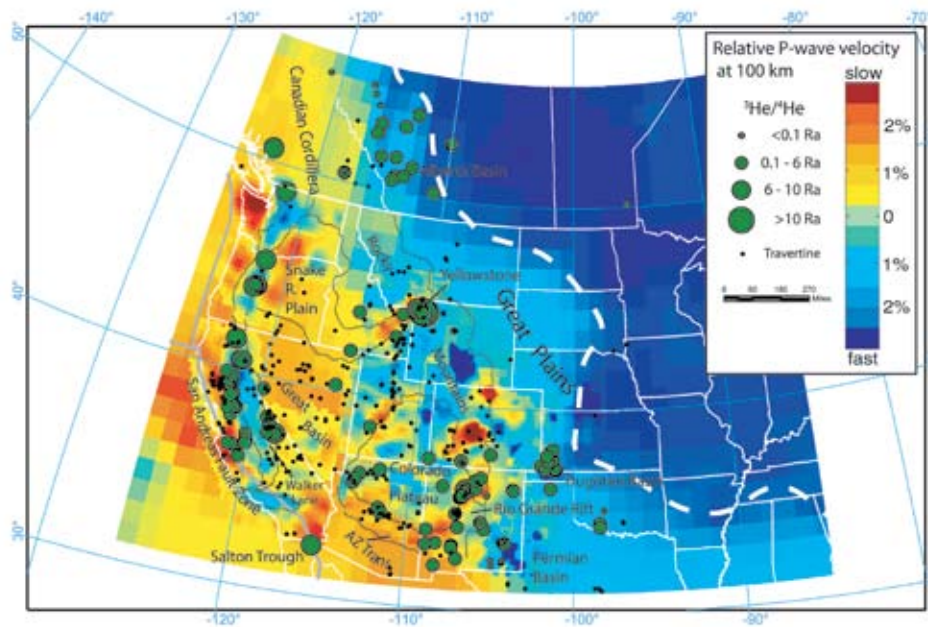


Figure 1. $^3\text{He}/^4\text{He}$ values (R/R_A notation) for hot springs, cool mineral springs, gas fields, and groundwater for the western United States and Canada. Helium isotopic values are overlain on P-wave velocity mantle tomography at 100 km depth (modified from: Humphreys et al., 2003). Blue: interpreted as high velocity, old, and cold lithosphere at 100 km depths. Yellow to red: lower velocity and warmer lithosphere and/or asthenosphere at 100 km depths, interpreted to be locally partially molten (Humphreys and Dueker, 1994). Tectonic provinces outlined in black (e.g., Rio Grande rift); white dashed line depicts our interpretation of the eastward transition from the tectonically active western U.S. mantle to the tectonically quiescent mantle. Dots show locations of western U.S. travertine deposits (Buchanan and Swain, 1998; Feth and Barnes, 1979; Heitmuller and Reece, 2003; Johnson and McCormick, 2005; Love and Chafetz, 1988).

also found in these settings, and they have similar water chemistries to hot springs. Hot springs have been sampled extensively for He isotopes as part of geothermal exploration in the western United States, especially in the Great Basin (e.g., Kennedy et al., 1996). Our work focuses on characterizing cool springs and expanding the geochemical database on travertine-depositing systems of the southwestern United States, and it highlights a direct link between neotectonics and gas and water chemistry in western U.S. aquifers.

RESULTS

New $^3\text{He}/^4\text{He}$ data from springs in the Arizona Transition zone, the Colorado Plateau, and the Rio Grande rift have R_A values that range from 0.08 to 1.16 R_A (Table 1). These data are merged with published values from hot springs, cool springs, geothermal wells, and gas field wells of western North America (Table DR1; see footnote 1) and are overlain on an image of the mantle velocity field at 100 km depth (Fig. 1) (Humphreys et al., 2003). Our new data are important in reinforcing the regional extent of mantle degassing and in reemphasizing that mantle helium is present in a wide variety of both thermal and nonthermal springs.

Water-free gases measured in spring waters range up to 99% by volume CO_2 and average 45%. In contrast, typical shallow groundwaters containing dissolved gases from a meteoric or soil-gas origin have <1% by volume CO_2 . A plot of nitrogen, argon, and helium shows our data in terms of potential gas source based on tectonic setting (Giggenbach, 1992). These data show a trend in source ranging from air-saturated groundwater to an end member composition dominated by crustal or mantle-derived volatiles (Fig. 2; Table DR2 [see footnote 1]). The $\text{CO}_2/{}^3\text{He}$ ratios for these springs range from 2.02×10^9 to 5.1×10^{12} (Table 1; Table DR1 [see footnote 1]), falling within both the mantle and crustal ranges. Their $\delta^{13}\text{C}_{\text{CO}_2}$ values range from -12.7 to -1.0‰ Pee Dee belemnite (Table 1), spanning the range between marine carbonates ($0 \pm 2\%$) and the mantle ($-6 \pm 3\%$) (Hoefs, 1987; Sano and Marty, 1995; Trull et al., 1993), with the more negative values indicating some influence by organic carbon sources (-20 to -30‰). While these analyses cannot quantitatively determine the source of the CO_2 present, they support the hypothesis that some of the CO_2 is mantle-derived.

Water analyses from these springs indicate that they are generally <30 °C, range in pH between 6 and 7, have alkalinities between 300 and 3000 mg/l, and have total dissolved solids up to 23,000 ppm. Chemistry for selected springs found in the Rio Grande rift is provided in Table DR3 (these springs are representative for travertine-springs of the southwestern United States). Major ion chemistry shows trends between Ca-Mg- HCO_3 and Na-Cl- SO_4 type waters (Fig. 3) that range from dilute to saline. Springs have arsenic contents ranging from <5 ppb to >5000 ppb. Similar mixing trends are present in the Grand Canyon and lead to the inference that there are different endogenic water end members that mix with the more dilute waters from surface recharge to explain the observed wide range of water compositions (Crossey et al., 2006).

CORRELATION OF HELIUM ISOTOPIC VARIATIONS WITH TECTONIC PROVINCE

Although the distribution of $^3\text{He}/^4\text{He}$ data is highly variable among tectonic provinces, in general the highest mantle

helium contributions correlate to the youngest and most active tectonic regions and the domains of lowest mantle velocity (Fig. 1). Exceptions to this exist because of mixing that can affect helium isotopic value during movement through the crust. In Yellowstone National Park, $^3\text{He}/^4\text{He}$ ratios as high as 16 R_A are observed (Craig et al., 1978; Kennedy et al., 1987); these values suggest that Yellowstone represents a high- ^3He plume end member such as is found in Hawaii and Iceland (see review by Graham, 2002). All other localities in the western United States show $^3\text{He}/^4\text{He}$ values $\leq 8 R_A$. Therefore, we assume that helium in the western United States is a mixture between a mantle end member with a

TABLE 1. NEW $^3\text{He}/^4\text{He}$ AND $\delta^{13}\text{C}_{\text{CO}_2}$ VALUES FOR SPRINGS AND GROUNDWATER OF SOUTHWEST U.S.

Location	Rc/Ra*	1 σ	X [†]	CO ₂ / ³ He (×10 ⁹)	δ ¹³ C _{CO₂} (‰ PDB)
New Mexico					
Montezuma Hot Spring (BM 290 1957) [§]	0.083	0.007	1818.91	nr	nr
Upper Owl Spring [§]	0.384	0.031	37.34	nr	nr
Manby Hot Spr Pool—near bathhouse [§]	0.316	0.015	1332.05	nr	nr
Manby Hot Spr Pool—S of bathhouse [§]	0.301	0.011	799.87	nr	nr
Ponce de Leon Hot Spr—hottest in concrete [§]	0.199	0.008	1956.96	nr	nr
No Name Spring—S of John Dunn Bridge [§]	0.09	0.006	7139.41	nr	nr
Tierra Amarilla Anticline—Grassy Spring	0.198	0.004	1330.24	42	-4.6
La Madera Spring	0.33	0.005	148.24	456	-2.2
Salt Spr—Jemez Pueblo	0.114	0.002	641.04	133	nr
Salado Arroyo Spring	0.606	0.024	11.37	5100	-1.0
Lucero Uplift unnamed mineral spring [§]	0.47	0.03	2666.02	nr	nr
Truth or Consequences Artesian Well [§]	0.37	0.02	724.30	nr	nr
Geronimo Hot Spring—Truth or Consequences [§]	0.41	0.02	372.35	nr	nr
Radium Spring—Resort bath house [§]	0.35	0.02	540.23	nr	nr
Roy Smith Well—Radium Spring Area [§]	0.292	0.012	2299.29	nr	nr
Well #10 Burgette Greenhouse Lightning Dock [§]	0.679	0.044	736.77	nr	nr
Well #1 Burgette Greenhouse Lightning Dock [§]	0.724	0.052	531.47	nr	nr
Well #4 Doc Cambell's Gila Hot Springs [§]	0.112	0.007	399.29	nr	nr
Lightfeather Hot Spring [§]	0.107	0.009	705.99	nr	nr
Turkey Creek Hot Spr—Upper Spring [§]	0.159	0.014	69.22	nr	nr
Bubbles Spring Lower Frisco Area [§]	0.425	0.022	97.79	nr	nr
Lower Frisco Hot Spring [§]	0.35	0.021	42.95	nr	nr
Upper Frisco Hot Spring [§]	0.363	0.038	6.75	nr	nr
Sedillo Spring Socorro [§]	0.4	0.023	0.36	nr	nr
Colorado					
Pagosa Hot Spring travertine summit [§]	0.093	0.006	7139.12	nr	nr
Pagosa Hot Spring—S of main terrace [§]	0.113	0.01	1421.58	nr	nr
Arizona (Verde Valley)					
Fossil Creek, upper orifice	0.31	0.005	1805.57	2.02	-11.7
Fossil Creek, downstream	0.975	0.052	3.32	nr	-12.7
Montezuma Well	1.162	0.02	21.07	500	-7.6

Note: nr—not reported; Spr—Spring.

*Rc/Ra—Air corrected R/Ra; Ra = $^3\text{He}/^4\text{He}$ in air (1.4 E-6).

†X = $(^3\text{He}/^4\text{He})_{\text{measured}} / (^3\text{He}/^4\text{He})_{\text{air}} \times [\beta\text{Ne}/\beta\text{He}]$; β—Bunsen coefficients, assuming a groundwater recharge temperature of 15 °C (Weiss, 1970).

§Unpublished data provided by M. Kennedy and M. van Soest.

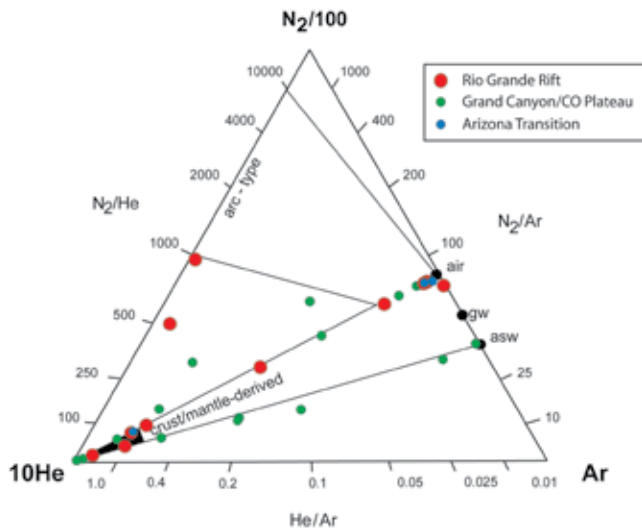


Figure 2. He-Ar-N₂ plot (after Giggenbach, 1992) for travertine-spring gases from the Rio Grande rift, Arizona Transition zone, and the Grand Canyon (Crossey et al., 2006). He values are multiplied by 10 and N₂ is divided by 100 to allow for better viewing of the data, whereas the true gas ratios are preserved on the axes. Fields for crustal and/or mantle-derived gases, air, and air-saturated groundwater (asw) are from Giggenbach (1992).

MORB-like helium isotopic composition and the crustal, radiogenic helium (0.02 R_A) reservoir (Table 2).

Table 2 summarizes R_A variations in key areas of western North America, calculated in terms of percent of mantle contribution. In active tectonic areas such as the Salton Trough, San Andreas fault, Walker Lane, Cascadia, and the Canadian Cordillera, maximum R_A values are consistently high and imply at least 50% mantle contribution to the helium inventory. Lower values reported in these regions are generally interpreted to be diluted by the crustal He reservoir. Most areas of the east of Walker Lane have much lower R_A values, implying up to 14% mantle-derived helium (notable exception: the Valles Caldera). Somewhat enigmatic are areas of tectonically quiescent sedimentary basins flanking the Cordillera (Alberta basin, Kansas-Hugoton basin, and Bravo Dome) that have elevated R_A values perhaps indicative of long-term storage of mantle-derived helium.

In order to test for a direct relationship between helium isotopic composition and underlying mantle velocity, we plotted all regional helium isotopic values reported herein versus the relative P-wave mantle velocity (Fig. 4). The velocity structure used is a compilation of P-wave tomographic studies and a shear-wave velocity model for the western United States at 100 km (Dueker et al., 2001; Humphreys et al., 2003). The highest R_A values show a good correlation with mantle velocity (r² = 0.83). The correlation omits points from Cascadia, where the velocity model reflects subduction of the oceanic slab, not the state of the North American lithosphere. Points with lower R_A in each velocity domain (resolved to 0.25%) are also not included in the correlation because these data can be explained by admixture of mantle and crustal He.

MOVEMENT OF MANTLE-VOLATILES THROUGH MAGMATISM AND ACTIVE FAULTING

There is evidence that mantle volatiles can be precursors to more obvious tectonic or magmatic activity. For example,

TABLE 2. SUMMARY OF HELIUM ISOTOPIC RATIOS AND PERCENT MANTLE CONTRIBUTION FOR KEY TECTONIC PROVINCES OF WESTERN NORTH AMERICA

Tectonic region	R _A range	Mantle contribution	References
Cascade volcanoes	2.2–8.1	28–100%	Craig et al., 1978; Evans et al., 2004; Welhan et al., 1988
Canadian Cordillera	0.06–6.5	0.5–80%	Clark and Phillips, 2000; Hiyagon and Kennedy, 1992
San Andreas fault zone	0.1–4.0	1–50%	Jenden et al., 1988; Kennedy et al., 1997; Kulongoski et al., 2005; Poreda et al., 1986; Torgersen and Kennedy, 1999
Salton Trough	6.3	75%	Welhan et al., 1988
Walker Lane	0.4–7.0	5–88%	Hilton, 1996; Sorey et al., 1993; Welhan et al., 1988
Great Basin	0.14–0.25	1–3%	Welhan et al., 1988
Colorado Plateau/Rocky Mountains	0.07–0.80	0.5–10%	Caffee et al., 1999; Crossey et al., 2006
Arizona Transition Zone	0.1–1.2	1–14%	Kennedy and van Soest (unpub.); this study
Valles Caldera	0.8–6.0	10–75%	Goff and Janik, 2002
Rio Grande rift	0.09–0.65	1–7%	Kennedy and van Soest (unpub.); this study
Bravo Dome gas (NE New Mexico)	0.3–4.3	3–53%	Ballentine et al., 2005; Caffee et al., 1999
Great Plains gas fields	0.06–0.69	0.5–8%	Ballentine et al., 2000, 2001; Ballentine and Sherwood Lollar, 2002; Hiyagon and Kennedy, 1992

cold springs at Three Sisters, Oregon, show anomalously high CO₂ and R_A values (Evans et al., 2004), and forest kills at Mammoth Mountain were correlated with increased CO₂ emissions linked to changes in magmatic activity (Evans et al., 2002; Farrar et al., 1995). Several lines of evidence can also be used to infer that volatiles are conveyed from the middle crust to the surface via seismogenic processes: the association of travertine and travertine-depositing springs with basement-penetrating faults suggests that the faults serve as fluid conduits and that spikes in mantle helium exist in active springs along fault zones (e.g., San Andreas, Walker Lane); monitoring at tectonically active areas shows that the movement of CO₂ and mantle helium correlate with seismicity. Helium isotopes showed a rapid response to earthquake swarms at Mammoth Mountain; increases in mantle contribution correlate to magmatically driven seismic swarms (e.g., Sorey et al., 1993). Also, Kulongoski et al. (2005) concluded that mantle helium found in groundwaters of the Morongo Basin east of the San Andreas fault moved via deeply penetrating faults. They cite no evidence for active magmatism in the area and speculate that episodic seismicity and associated hydrofracturing drive volatile transfer from the mantle to the crust.

LINKING MANTLE HELIUM TO TECTONICS

It is generally agreed that helium flux from the mantle is most pronounced during partial melting (Ballentine and Burnard, 2002) and that movement through the crust is aided by fracturing (e.g., Torgersen and O'Donnell, 1991), which is supported by the existence of mantle helium up to MORB values at volcanic centers and the association of mantle helium with travertine springs and faults (e.g., Kulongoski et al., 2005). However, the presence of mantle helium in the Great Plains and Alberta Basin (Fig. 1), areas without recent

tectonism and with mantle seismic velocities that preclude significant partial melt in the mantle (Humphreys and Dueker, 1994), is enigmatic. This observation has led to the interpretation that mantle volatiles trapped in some gas reservoirs are millions of years old (e.g., Ballentine et al., 2001). Ballentine et al. (2001) argue that mantle helium and CO₂ present in parts of the Permian Basin were stored for ~300 m.y. and were derived from magma degassing associated with foreland extensional basins related to the Marathon thrust belt. However, the elevated R_A values in other basins of the Great Plains do not correlate to nearby areas of magmatism nor to present-day partially molten mantle. Hiyagon and Kennedy (1992) suggest that fluids enriched in mantle volatiles entered these basins due to Laramide-to-recent compressional tectonics, a hypothesis supported by paleomagnetic studies (Enkin et al., 2000). Another explanation for the presence of mantle helium is that hydration above the Farallon slab during the Laramide orogeny may have introduced mantle volatiles that were stored in the lithosphere (Humphreys et al., 2003).

Abrupt (km- to 10-km-scale) mantle velocity transitions between velocity domains have been imaged by recent detailed tomographic studies (Dueker et al., 2001; Gao et al., 2004). The extent to which these transitions represent old compositional provinces, such as across paleosuture zones (Dueker et al., 2001; Karlstrom et al., 2005) versus active small scale asthenospheric convection (e.g., Gao et al., 2004), remains a first-order problem in understanding the western U.S. mantle and lithosphere-asthenosphere interactions. Perhaps the velocity transition beneath the western Great Plains (Fig. 1, light blues to greens, marked by white dashed line) is linked to the presence of mantle volatiles in basins, reflecting convective heat loss as the mantle starts to heat but before it melts. Mantle-derived helium may be a harbinger of mantle tectonism, hinting at slow eastward warming and subsequent dismemberment of the old, cold keel of the North American plate.

LINKS BETWEEN MANTLE DEGASSING AND WATER QUALITY

During the ascent of fluids carrying mantle-derived volatiles, rock-fluid interaction occurs, as does mixing between

shallow groundwater, basement fluids, and sedimentary basin brines. Evidence for mixing along flow-paths exists in the geochemical data from travertine-depositing springs in the Rio Grande rift and Colorado Plateau. Data show mixing of saline and dilute end members that potentially relates to local tectonic province (Fig. 2). In the Grand Canyon, radiogenic ⁸⁷Sr/⁸⁶Sr ratios derived from Precambrian basement show simi-

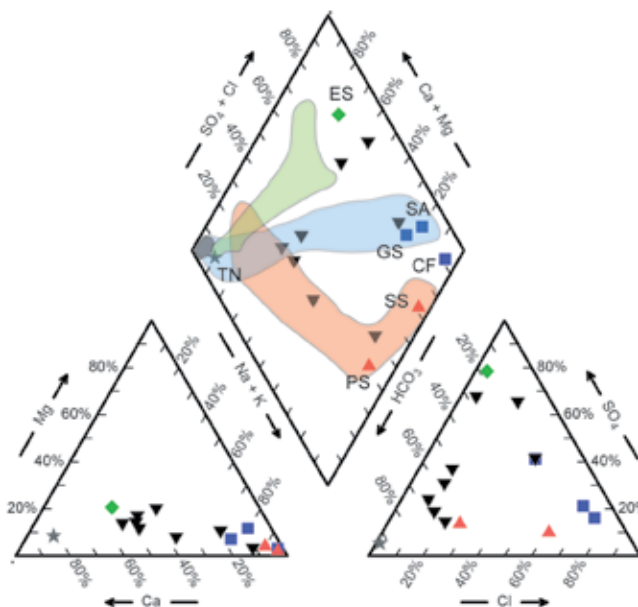


Figure 3. Piper diagram displaying the normalized concentrations in milliequivalents per liter of major cations and anions, which are projected graphically into the quadrilateral (after Piper, 1944). Observed mixing trends from tectonic subprovinces from the Grand Canyon are shown as shaded fields (from Crossey et al., 2006); representative end members from the Rio Grande rift (labels refer to data in Table DR3 [see text footnote 1]) are shown as points. Also included are average water chemistries from hydrologic zones in the Albuquerque basin (black triangles) (from Plummer et al., 2004). Recharge waters (gray + star) appear to be mixing with end members (sulfate—green + diamond; chloride—blue + square; mixed chloride-bicarbonate—red + triangle); groundwaters in the Albuquerque basin fall within these trends.

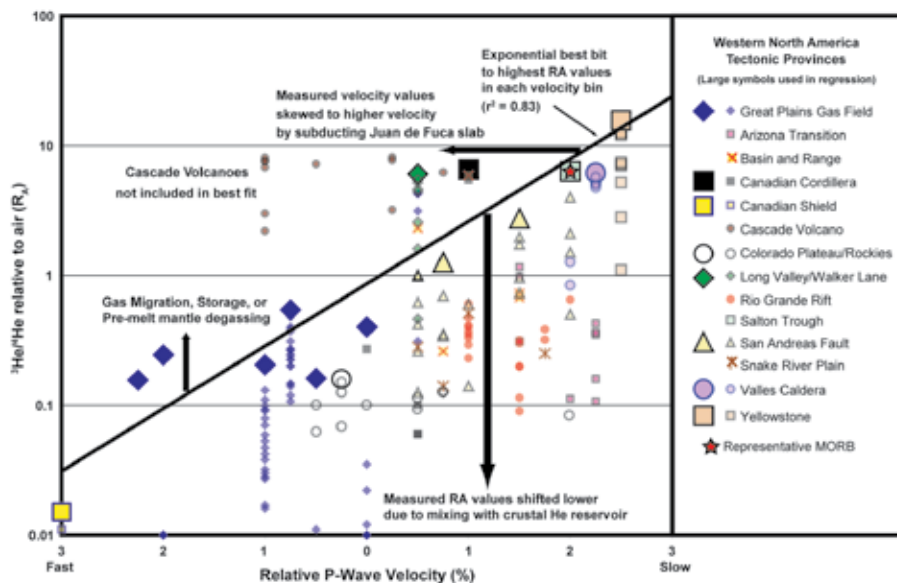


Figure 4. Correlation between relative P-wave mantle velocity at 100 km (Fig. 1) and ³He/⁴He ratios (R_A) for the different tectonic provinces of western North America. Note log scale for R_A values. An exponential fit (r² = 0.83) was applied using the maximum reported R_A for each mantle velocity domain (resolved to 0.25%). Cascadia is not included in the correlation; see discussion in text. R_A values that plot below the trend line are interpreted to represent the dilution of mantle derived fluids carrying ³He by the crustal He reservoir. Points lying above the trend line have higher R_A values than would be predicted based on seismic velocity. Reasons may include migration of gases from regions overlying seismically slower mantle, long-term storage of gases, or perhaps degassing of mantle prior to formation of partial melt.

lar mixing trends between deep and shallow waters (Crossey et al., 2006). Thus, these springs are the surface expression of groundwaters altered by complicated mixing pathways as well as the introduction of mantle-derived fluids, and we argue that these processes are occurring within groundwaters throughout the western United States.

Our data show that CO₂-charged groundwaters carrying mantle volatiles are saline, of poor quality, and are elevated in trace metals, such as arsenic (Tables DR2 and DR3 [see footnote 1]). Arsenic contents were found to exceed the U.S. drinking water standard of 10 ppb in some springs (EPA, 2004). These results are similar to travertine-spring data reported from the Grand Canyon, where springs are often saline and have arsenic and uranium contents of several parts per million (Crossey et al., 2006; Monroe et al., 2005). Rio Grande surface water quality degrades from north to south, as traced by increasing salinity, a trend often attributed to effects of agriculture and evapotranspiration. But based on water chemistry and conservative tracers, it has been suggested that the upwelling of deep sedimentary basin brines at the terminus of Rio Grande rift basins is degrading downstream water quality (Phillips et al., 2003). However, our findings show that the mixing of basin brines alone cannot explain the spring geochemistry. Groundwater in the Albuquerque basin varies widely in composition and quality (Plummer et al., 2004), and travertine-depositing springs along the Rio Grande rift encompass the distribution of these water types (Fig. 3), although the travertine springs have much higher total dissolved solids. Rio Grande rift springs also have similar water chemistry to endogenic end members identified in the Grand Canyon (Fig. 3) (Crossey et al., 2006). Endogenic water volumes are small, but their impact on water quality appears to be significant and potentially quantifiable utilizing a suite of geochemical tracers such as trace metals, chloride, and sulfate. The variability observed between endogenic fluid end members and apparent correlation with tectonic province (e.g., sulfate versus chloride rich end members; Fig. 3) is compelling, leading us to hypothesize a mantle source for some of these con-

stituents. However, it is also equally plausible that the mixing trends seen in each tectonic province are a function of different fluid mixing pathways and rock-water interaction, which is the cornerstone of most existing interpretations (e.g., Plummer et al., 2004). Yet, most existing models fail to include deeply derived inputs, such as the CO₂ and He data presented herein, and struggle to explain observations such as highly divergent chemical characteristics within individual aquifers.

CONCLUSIONS

We emphasize three main conclusions: (1) Based on new data, we show that travertine depositing springs (in addition to the hot springs and gas fields that have been the focus of work by others) provide an important record of regional mantle degassing for the western United States. Based on the distribution of travertine and travertine-springs, the entire mantle under the western United States may be heterogeneously degassing. (2) In the context of regional degassing, we combine our new data with previous work to provide a synthesis of helium isotopic data in the western United States and use mantle tomography to provide spatial context to broad scale tectonic processes (Fig. 1). To a first order, regional low mantle velocity in the western United States agrees with the observed regional degassing, evidenced by mantle helium in springs and groundwater (Figs. 1 and 4). (3) By combining water and gas chemistry for the travertine-depositing springs, we show that mantle degassing may be associated with a diffuse degradation of water quality in western U.S. aquifers. Understanding the controls on water quality in this region will continue to be a priority because of increasing population, periodic drought, and rapidly depleting high-quality groundwater resources.

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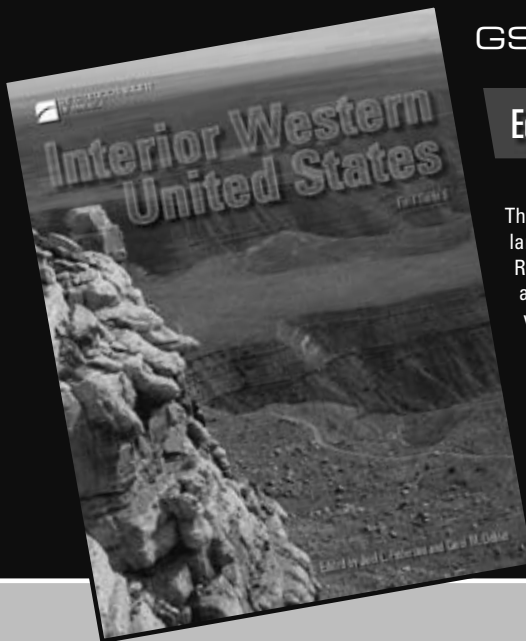
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GSA Field Guide 6

Edited by Joel L. Pederson and Carol M. Dehler

The 2005 GSA Annual Meeting in Salt Lake City provided a large and diverse terrain for field trips—from the Basin and Range to the Rocky Mountains, from the Snake River Plain, across the Colorado Plateau, to the Mojave Desert. This volume contains 22 field trip articles. All combine the latest research with useful road logs to spectacular and often classic geologic settings. The regional tour has a core of structure and stratigraphy-paleontology contributions, and is rounded off with volcanic, glacial, lacustrine, fluvial geomorphology, neotectonic, geologic hazard, and geoarchaeology articles.



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www.geosociety.org



The Pursuit of Science

*Geological Society of America
Annual Meeting & Exposition • Philadelphia, Pennsylvania
Technical Program • 22–25 October 2006*

Call for Proposals Keynote Symposia and Topical Sessions

The 2006 GSA Annual Meeting in Philadelphia, Pennsylvania, comes at a time when energy shortages and recent catastrophic earthquakes, tsunamis, and hurricanes have dramatically demonstrated the importance of earth science in everyday life. Increased recognition by society of the immediacy of earth processes adds incentive to the obligation of the earth science profession to communicate our perspective to policymakers and the general public. How can we utilize new technologies and approaches to meet the increasing demands on earth scientists? What information gaps need to be addressed to advance our understanding of earth systems? How can new advances and interdisciplinary synthesis help our understanding of complex earth systems and their interplay with society?

You can play a key role in answering these and many other questions by proposing a topical session or Pardee Symposium for the 2006 meeting. Help make this a dynamic meeting where we grow and meet the increasing demands on earth science by exchanging a wide range of ideas through topical sessions.

Proposal deadline: 10 January 2006

Submit proposals at www.geosociety.org

Have you ever been frustrated to find that none of the topical sessions at a GSA meeting represents 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 leaves 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

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 sizeable 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; selection is on a competitive basis. All speakers will be invited, and each convener is provided with a budget of US\$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 an excellent and successful session and are encour-

Building on a Foundation of Discovery

Building on a Foundation of Discovery

aged to solicit volunteered contributions. A maximum of four invited speakers may be allowed. Sessions will include a mix of invited and volunteered abstracts. All approved topical sessions will be promoted in *GSA Today*. 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. All session proposals are reviewed by the JTPC.

Oral and Poster General Sessions

Consisting entirely of volunteered papers, these sessions are an important 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 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 Sun.–Wed., 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.

Public Forum

The GSA Public Forum is an educational outreach program that extends the value of geoscience research into the GSA Annual Meeting host community. An evening presentation is promoted locally and is free to the public. Topics are of interest to the general science-reading community and are presented in nontechnical terms for the broadest level of scientific understanding. If you have an idea for a Public Forum, please contact Christa Stratton, cstratton@geosociety.org.

Make Yours the Session Everyone Talks About

Topical session organizers have the ability to ensure program excellence and success 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 2006 GSA Annual Meeting dynamic and stimulating for all GSA and Associated Society members, as well as appealing to a wide audience. If you have any questions or concerns regarding the program, please call or e-mail.

2006 LOCAL COMMITTEE CO-CHAIRS

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We welcome proposals for Pardee Keynote Symposia and topical sessions. Submit proposals electronically on or before **10 January 2006**, via the link at www.geosociety.org.

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, the widely cited *Abstracts with Programs* volume, media attention, or even a resulting GSA Special Paper. Propose a session. Then watch your efforts unfold as abstracts are submitted and your initiative becomes part of science history.

PHILADELPHIA 2006 DATES AND DEADLINES

10 Jan. 2006 • Proposals due by midnight (PST).
Electronic submission required.

April 2006 • Electronic abstract form posted at
www.geosociety.org.

• First announcement in April *GSA Today*.

June 2006 • 2nd announcement in June *GSA Today*.

12 July 2006 • Abstracts due by midnight (PST).

1 Aug. 2006 • Technical program schedule finalized.

Accepted abstracts will be posted at www.geosociety.org in mid-August, with links to speakers and titles.



NORTHEASTERN

**41st Annual Meeting
Northeastern Section, GSA
Radisson Penn Harris Hotel
and Conference Center
Camp Hill/Harrisburg, Pennsylvania**

20–22 March 2006
www.geosociety.org/sectdiv/northe/06nemtg.htm

The 2006 meeting of the GSA Northeastern Section will be joined by the Association for Women Geoscientists, the Pander Society, the Northeastern Section of the Paleontological Society, and the Eastern Section of the Society for Sedimentary Geology. Hosts are geoscientists from Dickinson College, Bloomsburg University, Franklin and Marshall College, Harrisburg Area Community College, Harrisburg Area Geological Society, Pennsylvania Geological Survey, Susquehanna University, and the U.S. Geological Survey. The meeting will be at the Radisson Penn Harris Hotel and Convention Center in Camp Hill, Pennsylvania, just across the Susquehanna River from downtown Harrisburg. We will meet in the heart of the classic Appalachian Ridge and Valley Province, in proximity to the Mesozoic basins and Piedmont in Pennsylvania.

MEETING REGISTRATION

Standard registration deadline: 13 February 2006

Cancellation deadline: 20 February 2006

GSA Headquarters will handle all registration. Please REGISTER ONLINE (www.geosociety.org/sectdiv/northe/06nemtg.htm), or you can download the paper registration form (PDF format). If you are unable to register this way, please contact GSA Sales and Service at +1-888-443-4472 or +1-303-357-1000, option 3. On-site registration will be in the Radisson Penn Harris Conference Center Lobby.

Registration Fees

	Standard		On-site	
	Full meeting	One day	Full meeting	One day
Professional Member	US\$135	US\$85	US\$165	US\$105
Professional Member (70+)	US\$65	US\$45	US\$95	US\$65
Professional Nonmember	US\$155	US\$105	US\$185	US\$135
Student Member	US\$45	US\$35	US\$65	US\$55
Student Nonmember	US\$55	US\$45	US\$75	US\$65
K–12 Professional	US\$45	US\$30	US\$55	US\$40
Guest or Spouse	US\$30	US\$15	US\$40	US\$25

On-site Registration and Standard Registration Badge Pickup Schedule

Radisson Penn Harris Conference Center Lobby

Sunday, 19 March	4–8 p.m.
Monday, 20 March	7 a.m.–5 p.m.
Tuesday, 21 March	7 a.m.–5 p.m.
Wednesday, 22 March	7–11 a.m.

Register early to qualify for lower registration fees. Costs will increase after 13 Feb. 2006. Full payment MUST accompany the registration form. Members of GSA and the GSA Associated Societies listed on the registration form (see www.geosociety.org/sectdiv/northe/06nemtg.htm) receive registration discounts. Registration is required for those attending technical sessions, field trips, short courses, and the exhibits hall. Guest registration is intended for nongeologist spouses or friends and does not include attendance at technical sessions, field trips, or short courses. Students and K–12 teachers must show a current ID at check-in to obtain special rates.

Register only one person per form and retain a copy for your records. GSA will be distributing all badges at the meeting registration desk, so badges will NOT be mailed to you prior to the meeting.

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for additions, changes, and cancellations must be made in writing to GSA Headquarters and received by 20 Feb. 2006. There will be no refunds for cancellations received after this date, and no refunds for on-site registration, the *Abstracts with Programs* book, and on-site ticket sales.

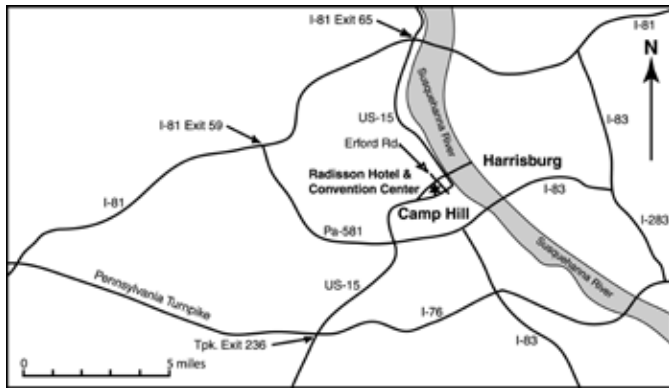
ACCOMMODATIONS

A large block of rooms at a special rate of US\$102 per night, excluding tax, has been reserved at the Radisson Penn Harris Hotel and Conference Center, 1150 Camp Hill Bypass, Camp Hill, PA 17011-3734, USA. This rate is the same for up to four persons per room. Attendees are responsible for making their own room reservations, which can be made by calling the Radisson Penn Harris Hotel at +1-717-763-7117 or +1-800-333-3333. You MUST identify yourself as attending the Northeastern GSA meeting to get the discounted room rates.

Conference organizers have attempted to keep costs as low as possible. In doing so, we have anticipated filling our reserved room block at the Radisson Penn Harris Hotel as a way of minimizing meeting room costs. Please help us meet our budget, and make your own stay less hectic, by staying at the Radisson Hotel. If you stay at the Radisson Hotel, but do not reserve a room through the Radisson reservation phone numbers above, please make this known to Noel Potter so that we may count your room toward the room quota.

Accommodations for Registrants with Special Needs

GSA is committed to ensuring full participation for conference attendees with disabilities at all events. Every attempt is made for full compliance with the Americans with Disabilities Act. If you have special requirements, please check the appropriate box on the meeting registration form. For more information, please contact Noel Potter (pottern@dickinson.edu) or the Radisson Penn Harris Hotel. A limited number of especially accessible hotel rooms are available and can be reserved when making your reservation, but this is best done early. Requests for special accommodations should be received by 13 Feb. 2006.



DIRECTIONS

The Radisson Penn Harris Hotel and Convention Center is located at 1150 Camp Hill Bypass in Camp Hill, just across the Susquehanna River from downtown Harrisburg via the Harvey Taylor Bridge: exit at Erford Road and turn south to the hotel. From the Pennsylvania Turnpike, use Exit 236 and follow US-15 north to the hotel; from the south on I-81, use Exit 59 to PA-581, and then exit north to Camp Hill via US-15 to the hotel; from the northeast on I-81, use Exit 65 south (Enola), and follow US-15 through four lights (~4 miles), turn right at the fifth light (Walnut Street), and go straight through two more lights to the hotel, which will be on the right.

Harrisburg is served by long-distance bus lines (Trailways and Greyhound) and Amtrak rail. Harrisburg International Airport is 10 miles (16 km) south of Harrisburg, and rental cars and taxis are available there. The Radisson provides complimentary van service to and from Harrisburg International Airport and the Harrisburg Amtrak station.

ABSTRACTS

Abstract submission deadline: 13 December 2005

Abstracts can be submitted for theme and general discipline sessions in both oral and poster format. Volunteered papers are considered for any general discipline or theme session as listed on the GSA abstracts form. An individual may be presenter for only one volunteered paper (except for symposia and invited papers for theme sessions) but may be co-author on any number of abstracts. Those invited for symposia may present an additional paper. If you have questions regarding your abstract, please contact Nancy Carlson, ncarlson@geosociety.org. Papers based on undergraduate research will be identified as such in the program, and both oral and poster papers by undergraduates will be merged with other papers on related topics.

ORAL SESSIONS

Except in special sessions, speakers will have 15 minutes for presentation and 5 minutes for discussion. One laptop computer using Windows XP (no Macs available) and PowerPoint 2003, one LCD projector, and one screen will be provided for all oral sessions. Speakers may not use their own laptop computers for presentations. If a Mac was used to produce the presentation, the speaker should run it on one of the ready-room laptops to see if it works properly. Slide projectors, overhead projectors, and multiple screens will not be available. If you have any special requests you MUST con-

tact the AV coordinator, Duane Braun, dbraun@bloomu.edu, by 20 Feb. 2006. PowerPoint presentations may be e-mailed in before or during the meeting or brought on CD or USB memory stick to the AV technician in the speaker ready room, Radisson Penn Harris Convention Center, Keystone Room A. Detailed instructions on how to load a presentation will be e-mailed to presenters with abstract acceptance notices.

POSTER SESSIONS

Poster sessions allow at least three hours of display time. Presenters must be present for two hours of that time. All posters must fit on a single 8' x 4' display board. Electrical and network connections will not be available. Display boards will accommodate either Velcro or push pins.

TECHNICAL PROGRAM SCHEDULE

Symposium

1. **Pander Society Symposium: Conodonts in Sequence Stratigraphy, Evolution, Deposition, and Correlation.** D. Jeffrey Over, State University of New York at Geneseo, over@geneseo.edu, +1-585-245-5291.

Theme Sessions

1. **Advances in Mineralogy: From Field Association to Phase Equilibria.** David Bailey, Hamilton College, dbailey@hamilton.edu, +1-315-859-4142; Marian Lupulescu, New York State Museum, mlupules@mail.nysed.gov, +1-518-474-1432.
2. **Coastal Change: Natural and Anthropogenic Process-Response Systems.** Sponsored by *Eastern Section, Society for Sedimentary Geology (SEPM)*. Allen Gontz, University of Massachusetts–Amherst, allen.gontz@umb.edu, +1-781-812-1684; Dan Belknap, University of Maine–Orono, belknap@maine.edu, +1-207-581-2159.
3. **Meltwater Discharge Events from Proglacial and Subglacial Environments: Landforms, Deposits, and Processes.** Andrew Kozłowski, Susquehanna University, kozłowski@susqu.edu, +1-570-372-4215.
4. **History of Geology: Evolution of Thought Regarding the Appalachians.** Sarah E. Newcomb, senewcomb@earthlink.net, +1-301-622-0177; William R. Brice, University of Pittsburgh at Johnstown, wbrice@pitt.edu, +1-814-269-2942.
5. **Forensic Geology: Practical Geologic Experiences that Helped CSIs.** Susan D. Halsey, Admiral Coastal Consulting, drdunenj@aol.com, +1-609-731-6380.
6. **Paleosol Environments from Across the Landscape.** Sponsored by *Eastern Section, Society for Sedimentary Geology (SEPM)*. Jennifer Elick, Susquehanna University, elick@susqu.edu, +1-570-372-4214; Todd D. Grote, Shippensburg University, tdgrot@ship.edu, +1-717-477-1509.
7. **From Pleistocene to Present: Landscape Dynamics of the Susquehanna River Basin and Chesapeake Bay.** Chris Williams, Franklin and Marshall College, chris.williams@fandm.edu, +1-717-291-3814.
8. **Seismology of the Northeastern United States and Eastern Canada.** John E. Ebel, Weston Observatory, Boston College, ebel@bc.edu, +1-617-552-3399; Frank A. Revetta, State University of New York at Potsdam, revettfa@potdams.edu, +1-315-267-2289.

Northeastern

9. **Bringing Geoscience to the Community.** Laura Guertin, Pennsylvania State University–Delaware County, uxg3@psu.edu, +1-610-892-1427.
10. **New Developments in the Late Quaternary History and Climate of the Northeastern United States and Eastern Canada.** Robert Dineen, Pennsylvania Department of Transportation, eskers@aol.com, +1-610-286-2888.
11. **Time Slices Across the Appalachians: Tectonic and Depositional Settings of Cambro-Ordovician Rocks in the Appalachian Orogen.** Craig Dietsch, University of Cincinnati, craig.dietsch@uc.edu, +1-513-556-2547.
12. **Time Slices Across the Appalachians: Tectonic Settings of Silurian-Devonian Igneous Rocks in the Appalachian Orogen.** Sandra Barr, Acadia University, sandra.barr@acadiau.ca, +1-902-585-1340; Cees van Staal, Geological Survey of Canada, Ottawa, cvanstaa@nrcan.gc.ca; David Gibson, University of Maine–Farmington, dgibson@maine.edu, +1-207-778-7402; John Hogan, University of Missouri–Rolla, jhogan@umr.edu, +1-573-341-6935; David West, Jr., Middlebury College, dwest@middlebury.edu, +1-802-443-3476.
13. **Time Slices Across the Appalachians: Role of the Rheic Ocean in the Development of the Appalachian Orogen.** Damian Nance, Ohio University, nance@ohio.edu, +1-740-593-1107; Duncan Keppie, Universidad Nacional Autónoma de México, duncan@servidor.unam.mx, +1-525-622-4288.
14. **Time Slices Across the Appalachians: Tectonic and Depositional Settings of Alleghanian-Aged Rocks.** Rodger Faill, Pennsylvania Geological Survey, rfaill@state.pa.us, +1-717-702-2041.
15. **Rates and Processes of Appalachian Erosion.** Milan Pavich, U.S. Geological Survey, mpavich@usgs.gov, +1-703-648-6963.
16. **Applied Hydrogeology and Environmental Geology for the 21st Century.** Martin Helmke, West Chester University, mhelmke@wcupa.edu, +1-610-436-2727.
17. **Successes in K–16 Geoscience Education (POSTERS ONLY).** Jeb Baxter, Harrisburg Area Community College, jebaxter@hacc.edu, +1-717-780-2395; Ron Dowey, Harrisburg Area Community College, radowey@hacc.edu, +1-717-780-2393.
18. **Oil and Gas in the Appalachian Basin.** Sponsored by *Eastern Section, Society for Sedimentary Geology (SEPM)*. Langhorn “Taury” Smith, New York State Museum, lsmith@mail.nysed.gov, +1-518-474-2469; Rich Nyahay, New York State Museum, ryahay@mail.nysed.gov, +1-518-486-2161; John Harper, Pennsylvania Geological Survey, jharper@state.pa.us, +1-412-442-4230.
19. **Metamorphic Rocks and Shear Zones: Stitching Together Appalachian Terranes.** Gary Solar, Buffalo State University, solars@bscmail.buffalostate.edu, +1-716-878-4900; David Valentino, State University of New York at Oswego, dvalenti@oswego.edu, +1-315-312-2798.
20. **Issues with Acid Mine Drainage in the Appalachians.** Ryan Mathur, Juniata College, mathur@juniata.edu, +1-814-641-3725; Duff Gold, Pennsylvania State University, gold@ems.psu.edu, +1-814-865-7261.
21. **Falling Ground: Landslides, Sinkholes, and Other Collapse Processes.** Robert Fakundiny, New York State Geologic Survey, rfakundi@mail.nysed.gov, +1-518-486-2002.
22. **Contaminants in Groundwater and Surface Water of the Northeast: From Arsenic to Xylene.** Steve Peters, Lehigh University, scp2@lehigh.edu, +1-610-758-3957.
23. **Current Applications of Geochemistry to Marine Paleoecology.** Sponsored by *Northeastern Section, Paleontological Society*. Lisa Amati, State University of New York at Potsdam, amatili@potsdam.edu, +1-315-267-3482.
24. **Current Research on the Allegheny Plateau.** Rachel O’Brien, Allegheny College, robrien@allegheny.edu, +1-814-332-2875; Eric Straffin, Edinboro University of Pennsylvania, estraffin@edinboro.edu, +1-814-732-1574.

SHORT COURSES AND WORKSHOPS

Attendance is limited at the short courses and workshops listed below, so please register early to assure a space. For more information, contact the short course leader or short course coordinator, Noel Potter, pottern@dickinson.edu.

1. **Measurement of Indoor Radon.** Sat.–Sun., 18–19 Mar., 9 a.m.–5 p.m., Radisson Penn Harris Convention Center. Douglas Mose, George Mason University, dje42@aol.com, +1-703-273-2282; George Mushrush, George Mason University. Optional exam to earn a Radon Measurement Specialist Certificate: US\$150.
This course provides hands-on training to understand, anticipate, and measure geologically dependent indoor radon and waterborne radon. The course is for teachers and researchers, and an optional end-of-course exam earns a Radon Measurement Specialist Certification (National Radon Safety Board, www.nrsb.org). The certificate is required by federal and state regulatory agencies to list individuals authorized for employment as home inspectors in the real estate market. Min.: 5; max.: 25. Prerequisite: general knowledge of soil and hydrology. Fee: US\$350, includes course manual and lunches.
2. **Making Digital Movies for Earth Science Classes.** Sat., 18 Mar., 9 a.m.–noon, Radisson Penn Harris Convention Center. Jennifer Elick, Susquehanna University, elick@susqu.edu, +1-570-372-4214.
Have you ever wanted to use video from geologic field trips to illustrate important concepts, principles, or to highlight interesting features for your earth science classes? This short course will help you organize and edit new and old video into geoeducational movies using Macintosh computers. You will learn how to add text, voice-over, and sound, capture underwater video, add video microscopy, and provide useful illustrations that help explain geologic features in your video. Bring a video camera if you own one. Min.: 10; max.: 20. Cost: US\$12.
3. **Academic Careers and Academic Job Searches in the Geosciences: A Workshop for Graduate Students and Post-Docs.** Sat., 18 Mar., 1–5 p.m., Radisson Penn Harris Convention Center. R. Heather Macdonald, College of William and Mary, rhmacd@wm.edu, +1-757-221-2443;

Barbara J. Tewksbury, Hamilton College, btewksbu@hamilton.edu, +1-315-659-4713.

This workshop is designed for graduate students and post-doctoral fellows interested in academic careers. We will discuss characteristics of academic careers in different types of institutions, the academic job search process (including applications, interviews, and teaching statements), and strategies for preparing for the next career stage. This workshop is part of the professional development program, On the Cutting Edge: <http://serc.carleton.edu/NAGTWorkshops/>, which is sponsored by the National Association of Geoscience Teachers. Min.: 15. Cost: US\$15.

4. **Effective and Innovative Course Design in the Geosciences.** Sun., 19 Mar., 9 a.m.–4 p.m., Radisson Penn Harris Convention Center. Barbara J. Tewksbury, Hamilton College, btewksbu@hamilton.edu, +1-315-659-4713; R. Heather Macdonald, College of William and Mary, rhmacd@wm.edu, +1-757-221-2443.

This one-day workshop will focus on a goals-based approach to course design. The workshop will guide participants through the goal-setting phase with an emphasis on goals that promote higher order thinking skills on the part of students. The workshop will also help participants begin the process of choosing content, selecting teaching strategies, and designing student activities, assignments, and assessments to insure that students meet those goals. This workshop is part of the professional development program, On the Cutting Edge: <http://serc.carleton.edu/NAGTWorkshops/>, which is sponsored by the National Association of Geoscience Teachers. Min.: 15. Cost: US\$30. Lunch on your own.

OTHER SHORT COURSES/WORKSHOPS

Fundamentals of Geology and Applied Geology Seminar. Sponsored by *Pennsylvania Council of Professional Geologists (PCPG)*. Sat.–Sun., 18–19 Mar., Radisson Penn Harris Convention Center.

In this two-day course, a panel of experts selected by PCPG will provide a focused review of the subjects most strongly emphasized on the Pennsylvania Professional Geologist Licensing Examination and those most applicable in practice of the science. This course is independent of the GSA Northeastern Section short courses listed above, but is offered concurrently. Registration and logistics are being handled by PCPG. See course details at www.pcpge.org.

K–12 TEACHERS PROGRAM

In addition to the special K–12 teachers field trip to a quarry (trip 5: “From Rocks to Roads”), the following workshops will be offered on Sat., 18 Mar. (two in the morning and two in the afternoon), on the Harrisburg Area Community College (HACC) campus and at Penn Center, about a mile away from HACC. Location details will be sent to registrants. The K–12 teachers program is supported in part by a grant from the HACC Foundation. The cost for two workshops (one morning, one afternoon) is US\$20. Lunch will be on your own at locations suggested by workshop instructors.

Note: K–12 teachers are *urged* to submit papers and participate in **Theme Session 17:** Successes in K–16 Geoscience Education (POSTERS ONLY).

5. **Caught in the Web of GeoSpatial Technology.** Sat., 18 Mar., 9–11 a.m. Jeb Baxter, jebaxter@hacc.edu, +1-717-780-2395; Nicole Ernst, nlernst@hacc.edu, +1-717-780-2395. Penn Center. Min.: 5; max.: 18.

Teachers will be introduced to basic geospatial technology concepts, learn where to find Web-based geospatial resources, and use the existing Web-based global information system.

6. **Geologic Map Activities on the Web.** Sat., 18 Mar., 9–11 a.m., Jeb Baxter, jebaxter@hacc.edu, +1-717-780-2395; Ron Dowey, radowey@hacc.edu, +1-717-780-2393. Harrisburg Area Community College. Min.: 10; max.: 20.

Teachers will be shown Web-sourced geologic maps and be taught how to interpret and use these resources in their classrooms.

7. **Introduction to ArcGIS.** Sat., 18 Mar., 1–3 p.m. Jeb Baxter, jebaxter@hacc.edu, +1-717-780-2395; Nicole Ernst, nlernst@hacc.edu, +1-717-780-2395. Penn Center. Min.: 5; max.: 18.

This workshop will introduce teachers to basic global information system (GIS) principles and acquaint them with ArcGIS and ArcExplorer software packages.

8. **Web-Based Laboratory Exercises.** Sat., 18 Mar., 1–3 p.m., Jeb Baxter, jebaxter@hacc.edu, +1-717-780-2395; Ron Dowey, radowey@hacc.edu, +1-717-780-2393. Harrisburg Area Community College. Min.: 10; max.: 20.

Teachers will be introduced to various Web-based laboratory exercises such as Virtual Earthquake and virtual field trips.

FIELD TRIPS

All field trips will depart from and return to the front of the Radisson Penn Harris Convention Center. Field trip coordinators are Andy DeWet, andy.dewet@fandm.edu, and Zeshan Ismat, zeshan.ismat@fandm.edu, of Franklin and Marshall College, but for detailed information, please contact individual field trip leaders. Fees include transportation, guidebook, and, for all-day field trips, lunch.

1. **Cambrian Microbial Reefs, LWB Quarry, York County, Pennsylvania.** Sponsored by *Eastern Section, Society for Sedimentary Geology (SEPM)*. Sun., 19 Mar., 12:30–5 p.m. Carol de Wet, Franklin and Marshall College, cdewet@fandm.edu, +1-717-291-4388.

Much of the central Appalachian region’s Cambro-Ordovician carbonate section is dolomitized or structurally deformed, but in York County, Pennsylvania, an exceptionally well-preserved microbial reef complex retains its original calcite mineralogy, revealing bedded microbial strata, stromatolites, and fibrous submarine cements filling a network of primary depositional cavities. Numerous features indicative of deposition on an active subtidal shelf margin will be shown (slump structures, truncation features, intraclast and breccia beds), and new mechanisms will be proposed to help interpret the formation and infill of the meter-scale cavities. Limit: 20. Cost: US\$20 for professionals; US\$15 for students.

Northeastern

- Pleistocene to Present Landscape and Stream Evolution in Lancaster County, Pennsylvania, and Implications for Restoring Streams.** Sun., 19 Mar., 8:30 a.m.–5 p.m. Dorothy Merritts; Bob Walter; Chris Williams; Andy de Wet, Franklin and Marshall College, andy.dewet@fandm.edu, +1-717-291-3815.

We will explore the difference in magnitude between pre- and post-settlement landscape-forming processes and examine how they relate to stream evolution, modern sediment sources, and the long-term success of stream restoration efforts in Lancaster County. Limit: 40. Cost: US\$50 for professionals; US\$40 for students.
- Nappe Mechanics and Changing Tectonic Patterns in Lancaster County, Pennsylvania.** Sun., 19 Mar., 8:30 a.m.–5 p.m. Don Wise, University of Massachusetts at Amherst, dwise@geo.umass.edu, +1-423-253-5342; G. Robert Ganis, Consulting Geologist.

This field trip will examine the tectonic style, transport, and development of Taconic nappe structures from central Lancaster County northwestward into Dauphin County. Excellent exposures in three quarries (Prospect, Rheems, and Steelton) will be visited as well as several classic localities, including Chickies Rock. Limit: 80. Cost: US\$50 for professionals; US\$40 for students.
- Karst Subsidence Problems along Bushkill Creek, Northampton County, Pennsylvania.** Sun., 19 Mar., 8:30 a.m.–5 p.m. Bill Kochanov, Pennsylvania Geological Survey, wkochanov@state.pa.us, +1-717-702-2033.

This field trip will examine the karst geology of the area around the Bushkill and Schoeneck Creeks and discuss the incredible series of events starting in fall 2000 that resulted in the failure of two bridges as well as damage to the Bushkill and Schoeneck creeks and the local community of Brookwood; a classic case history. There will also be a stop in Hershey to examine an excellent exposure of Ordovician-aged carbonates and to visit Chocolate World. Limit: 40. Cost: US\$50 for professionals; US\$40 for students.
- From Rocks to Roads: The Geology of a Mineral Aggregates Quarry, Rohrer's Quarry, Lancaster County, Pennsylvania (for K–12 Teachers).** Sponsored by *Rohrer's Quarry Inc.* Sun., 19 Mar., 11:30 a.m.–4:30 p.m. Ron Dowey, Harrisburg Area Community College, radowey@hacc.edu, +1-717-780-2393.

Teachers will travel to a limestone quarry, see its operation, learn about the many products of quarries, and learn the geologic processes that occurred to form the rocks as they are found today. We suggest that you bring a camera along on this trip; there will be plenty to photograph and take back to your students. Limit: 60. Cost: US\$30, including lunch.
- A Sampling of Conodont-Bearing Strata in the Central Appalachians.** Sponsored by *Pander Society.* Sun., 19 Mar., 8 a.m.–5 p.m. John Repetski, U.S. Geological Survey, jrepetski@usgs.gov, +1-703-648-5486.

This trip will visit stops in the folded Appalachians, about a two-hour drive west of Harrisburg, in the following intervals: (A) upper Lower to Upper Ordovician, (B) Upper Silurian and Lower Devonian, and (C) upper

Mississippian, with an opportunity to examine a broad variety of Laurentian carbonate lithofacies and collect conodont samples from these strata. Limit: 20. Cost: US\$50 for professionals; US\$40 for students.

- Acid Drainage Problems at Skytop, Pennsylvania.** Sun., 19 Mar., 8:30 a.m.–5 p.m. Duff Gold, Pennsylvania State University; Ryan Mathur, mathur@juniata.edu; Larry Mutti, Juniata College, Pennsylvania; Arnold Doden, GMRE, Inc., State College, Pennsylvania, +1-814-641-3725.

On this trip, we will visit outcrops containing epigenetic and syngenetic pyrite (along with other sulfide minerals) in Paleozoic rocks between Lewistown and State College. The leaders will discuss how mineralization may have occurred and the current problems of and possible resolutions for these acid-generating rocks. Limit: 40. Cost: US\$50 for professionals; US\$40 for students.

SPECIAL EVENTS

Northeastern Section GSA, Management Board Meeting. Sun., 19 Mar., 4–6 p.m.

Opening Reception. Sun., 19 Mar., 6–8:30 p.m., Radisson Penn Harris Conference Center Ballroom South. The opening reception and nearby open exhibits will help start off the meeting. Snacks and cash bar; a ticket for your first beverage comes with registration. Come visit with friends and colleagues. The registration desk will be open until 8 p.m.

Paleontological Society Luncheon and Business Meeting. Mon., 20 Mar., noon–1:30 p.m. Cost: US\$14.

Plenary Session: Special Hot Topic Lecture—Mars Exploration Rovers: Latest Geology, Geochemistry, and Mineralogy Results. Mon., 20 Mar., 4–5 p.m., Ballroom North. Jim Bell of Cornell University will bring us the latest results from the NASA Mars Exploration Rover (*Spirit* and *Opportunity*) mission.

Society for Sedimentary Geology (SEPM) Northeast Section Business Meeting. Mon., 20 Mar., 5–6:30 p.m. Free.

GSA Northeastern Section Map Blast VIII. Mon., 20 Mar., 7–9:30 p.m. Informal session for display of newly published, unpublished, or in-progress geologic maps of any sort. All attendees are welcome to bring, post, and discuss ancient, recent, or planned mapping efforts. Radisson Hotel Ballroom South; cash bar.

Association of Women Geoscientists Career Development Workshop Breakfast. Tues., 21 Mar., 6:30–8 a.m. Cost: US\$18 for professionals; US\$9 for students.

Conference Banquet. Tues., 21 Mar., 7–9 p.m., Radisson Hotel Ballroom North. All attendees invited! The meal will be a buffet; a cash bar will be open 6–7 p.m. in the ballroom foyer. Cost: US\$30.



THE GEOLOGICAL SOCIETY
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ACTIVITIES FOR STUDENTS

Roy J. Shlemon Mentor Program in Applied Geoscience. Sponsored by *GSA Foundation*. Mon.–Tues., 20–21 Mar., 11:30 a.m.–1 p.m.; Veranda Room, Radisson Penn Harris Hotel and Convention Center. Karlon Blythe, kblythe@geosociety.org. This is a chance for students to discuss career opportunities and challenges with professional geoscientists from multiple disciplines. Plan to attend both free luncheons to hear different presenters each day. Students will receive FREE LUNCH tickets in their registration packet to attend both Shlemon Programs. However, space is limited: first come, first served. For further information, contact kblythe@geosociety.org.

John Mann Mentors in Applied Hydrogeology Program. Sponsored by *GSA Foundation*. Mon., 20 Mar., 5–6:30 p.m. Veranda Room, Radisson Penn Harris Hotel and Convention Center. Karlon Blythe, kblythe@geosociety.org. This early evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with interest in applied hydrogeology or hydrology as a career to interact and network with practicing hydrogeologic professionals. This program is a focused, small-scale event that features a free pizza dinner for participants. Students will receive a ticket to attend the Mann Program event in their registration packets, but space is limited: first come, first served. For further information, contact kblythe@geosociety.org.

STUDENT TRAVEL GRANTS

Application deadline: 1 March 2006

Travel grants are available from GSA's Northeastern Section in cooperation with the GSA Foundation. Grants are available to undergraduate and graduate students who are GSA Members, currently enrolled in Northeastern Section schools, and are presenting oral or poster papers at this meeting. Applications are available online at www.geosociety.org

or through Stephen Pollock, secretary-treasurer of GSA's Northeastern Section, pollock@usm.maine.edu.

GUEST ACTIVITIES

Click on "Area Information" on the Radisson Penn Harris Web site, www.radisson.com/camphillpa, to view a wide variety of Web links to area attractions, including Harrisburg, Hershey, Lancaster County, and Gettysburg.

EXHIBITS

Reservation and payment deadline: 20 February 2006

Exhibits will be located in the Radisson Penn Harris Hotel and Conference Center Ballroom South. This space is centrally located with considerable exposure to meeting crowds. Exhibit rates are US\$100 for nonprofit organizations and US\$200 for others. Booth space will include an 8' × 10' space with draped framing, one table, one chair, and a header sign. Electricity is US\$60 extra for the meeting. To reserve booth space and to make other arrangements, contact the exhibits coordinators: Michelle Curry, meshale13@netzero.net, or Anne Lutz, anlutz@state.pa.us.

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 meeting Web sites. Those interested in sponsoring an event, AV equipment, coffee breaks, or making a donation to the general fund of the conference should contact Bob Ganis, treasurer, bobganis@aol.com.

CONTACT INFORMATION


More information can be found at the Dickinson College Department of Geology's meeting Web site, www.dickinson.edu/public/geodept/departments/geol/negsa2006.htm, or by contacting the general meeting chair, Noel Potter, pottner@dickinson.edu.


Abstracts submission through
13 Dec. 2005
Standard registration through
19 Feb. 2006

**BACKBONE
OF THE AMERICAS**
PATAGONIA TO ALASKA
3–7 April 2006 • Mendoza, Argentina

Backbone of the Americas—Patagonia to Alaska is a GSA specialty meeting co-convened with the Asociación Geológica Argentina. The principal themes are ridge collision, shallow subduction, and plateau uplift along the Americas. Field trips are planned to Patagonia, the Chilean flat-slab, or Central Andean Puna plateau before and after the meeting. Suzanne Kay and Victor Ramos are meeting co-chairs.

Co-convened by:


Asociación Geológica
Argentina


THE
GEOLOGICAL
SOCIETY
OF AMERICA

See www.geosociety.org/meetings/06boa/ to submit abstracts, register, and to sign up for e-news.



SOUTHEASTERN

55th Annual Meeting
Southeastern Section, GSA
Knoxville, Tennessee

23–24 March 2006

www.geosociety.org/section/southe/06semtg.htm

LOCATION

Knoxville is situated in the Appalachian Valley and Ridge of east Tennessee, in a region that has been the cradle of geoscience research for over a century. Several fundamental concepts have resulted from local and regional research, but the southern Appalachians remains an area where fundamental contributions continue to be made. Knoxville is no more than an hour from sites of classic stratigraphic-sedimentologic, paleontologic, petrologic, and structural contributions. The region is one of the world's former major zinc producers and is an area of active oil and gas exploration. There is a large geoscience community in the Knoxville–Oak Ridge area, with geoscientists employed by the University of Tennessee, Tennessee Division of Geology, Oak Ridge National Laboratory, Tennessee Department of Transportation, Tennessee Valley Authority (TVA), Tennessee Board of Regents community colleges, numerous environmental engineering companies, and small independent oil and gas producers.

The Knoxville metro area has a population of ~500,000, and the Department of Energy facilities in Oak Ridge, the TVA, and the university are the largest employers. A short driving distance from Knoxville are the Great Smoky Mountains National Park, Big South Fork National Recreation Area, the Cherokee National Forest, the Joyce Kilmer–Slickrock Wilderness Area, numerous state parks, and TVA reservoirs.

Weather in Knoxville in late March could be spring-like, or it could be more like late winter. We have already put in a request for good weather for all of the field trips so that everything goes well for the meeting.

CALL FOR PAPERS

Abstract Deadline: 5 January 2006

Papers are invited from students and professionals for oral and poster presentations in general discipline sessions, theme sessions, and symposia. Abstracts must be submitted online at the GSA Web site, www.geosociety.org. An abstract submission fee of US\$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. Individuals invited to participate in symposia may present an additional volunteered paper.

REGISTRATION

Standard registration deadline: 20 February 2006

Cancellation deadline: 27 February 2006

Register online at the GSA Web site, www.geosociety.org. On-site registration will be available at the Marriott Hotel during the meeting.

Registration Fees

	Standard	On-site	One day
Professional Member	US\$170	US\$180	US\$90
Professional Nonmember	US\$185	US\$200	US\$100
Professional Member (70+)	US\$75	US\$85	US\$50
Student Member	US\$60	US\$75	US\$35
Student Nonmember	US\$75	US\$85	US\$45
K–12 Professional	US\$35	US\$40	US\$20
Guest	US\$35	US\$40	US\$20
Field Trip/Workshop Only	US\$90	US\$100	N/A

CANCELLATIONS, CHANGES, AND REFUNDS

All requests for additions, changes, and cancellations must be received at GSA Headquarters by 27 February 2006. No refunds will be made on cancellation notices received after this date. Refunds will be mailed from GSA after the meeting. Refunds for fees paid by credit card will be credited to the card identified on the registration form. No refunds will be available for on-site registration and ticket sales.

ACCOMMODATIONS

Hotel registration deadline: 28 February 2006

A block of rooms has been reserved at the Marriott Hotel at US\$99 per night for 1–4 occupants. For reservations, please call the Marriott reservation line at +1-800-836-8031 and request a reservation under SEGSA 2006. The Marriott Hotel is located at 500 Hill Avenue SE, Knoxville, TN 37915. It is 20 minutes from McGhee-Tyson Airport, 45 minutes from Great Smoky Mountains National Park, and a short walk to the University of Tennessee, the Women's Basketball Hall of Fame, and the Tennessee River riverfront walk. The Marriott has high-speed Internet capabilities, an on-site fitness center, an outdoor swimming pool, and two restaurants. Additional restaurants are located a short walk from the hotel.

TRANSPORTATION

Knoxville is located at the intersection of Interstates 75 and 40 in eastern Tennessee and has air transport through the McGhee-Tyson Airport. McGhee-Tyson receives more than 75 incoming flights a day and is served by Delta, American Eagle, United, Northwest Airlines, Continental, US Airways, and Independence Air. Car rental is available through Alamo, Avis, Budget, Enterprise, Hertz, National, and Thrifty. Taxi service is also available.

TECHNICAL PROGRAM

Oral Sessions: Oral presentations will be given in the convention headquarters Marriott Hotel. Conveners of all oral sessions are requested to keep their sessions on schedule. Each speaker will be allowed 20 minutes, which includes ~15 min for presentation and 5 min for questions.

Computer projectors will be provided for oral presentations. Personal laptops cannot be used for presentations. Authors should bring PowerPoint presentations on a CD-ROM or memory stick to the Speaker Ready Room at least 12 hours before their presentation. Zip drives *will not* be available.

Poster Sessions: Poster presenters have one 4-ft by 7-ft-5-inch horizontal ("landscape" view) display. Posters will be scheduled for half-day sessions. The use of tables is not encouraged, but can be arranged upon advance request at author cost. Electrical hookups will not be available; all computer equipment must be battery powered.

Technical Sessions: Symposia, theme sessions, and field trips scheduled as of 28 September are listed herein. Additional events may be accommodated. If you wish to propose an additional session, please contact technical and field trip program co-chairs Robert D. Hatcher, Jr., bobmap@utk.edu, Linda C. Kah, lckah@utk.edu, or Theodore C. Labotka, tlabotka@utk.edu. Updated session listings will be posted on the GSA Web site, www.geosociety.org.

SYMPOSIA

1. **New Geochronologic and Isotopic Approaches to Constraining Appalachian Tectonics.** Sponsored by *GSA Structural Geology Division*. Bob Tracy, Virginia Tech, rtracy@vt.edu; Calvin Miller, Vanderbilt University, calvin.miller@vanderbilt.edu; Brent Miller, Texas A&M University, bvmiller@geo.tamu.edu.
The development of focused geochronologic techniques, particularly in situ isotopic and non-isotopic methods and of new methodologies and approaches using isotopic tracers, has created new opportunities for constraining ages of deformational and thermal events and the origins of enigmatic terranes. This symposium will examine application of these methods to Appalachian tectonic problems.
2. **Frontiers of Appalachian Tectonics.** Sponsored by *GSA Structural Geology and Tectonics Division*. Robert D. Hatcher, Jr., University of Tennessee at Knoxville, bobmap@utk.edu; William A. Thomas, University of Kentucky, geowat@uky.edu.
This symposium is intended to present state-of-the-art concepts related to both Appalachian foreland fold-thrust belt development and that of the more internal parts of the mountain chain. Several contrasting ideas have evolved recently about the timing of assembly of different components of the orogen. We hope to have all points of view represented to encourage discussion.
3. **Grenville Terranes of the Appalachians and Their Boundaries.** Sponsored by *GSA Structural Geology Division*. Mervin J. Bartholomew, University of Memphis, jbrthlm1@memphis.edu; Carl E. Merschat, North Carolina Geological Survey, carl.merschat@ncmail.net.
The theme of this symposium is to define and characterize dismembered terranes and their boundaries in the Grenville orogen, which are now found in the Appalachian orogen.
4. **Impacts in the Field.** Cosponsored by *Planetary Geoscience Institute; GSA Planetary Geoscience Division*.

Keith A. Milam, University of Tennessee at Knoxville, kmilam@utk.edu.

This symposium will focus on field investigations of impact craters in the south and elsewhere. Presentations that include discoveries, observations, sample analyses, and field techniques of terrestrial (and even nonterrestrial) impact craters are welcome.

5. **Paleontological Perspectives: A Symposium in Honor of Frank K. McKinney.** Sponsored by *Paleontological Society*. Steven J. Hageman, Appalachian State University, hagemansj@appstate.edu.

This symposium will consist of talks that deal with observations of modern living organisms and ecology that are applied to Paleozoic taxa-faunas (and vice versa). Traditionally, most invertebrate paleontologists who work on Paleozoic faunas are trained in geology programs where their introduction to Phanerozoic diversity is from a paleozoological perspective. When these workers are eventually exposed to living organisms in modern faunas (marine laboratories or on research cruises), they bring a perspective of morphology and ecology that is not necessarily shared by neobiologists observing paleontological data. The epiphany of bringing modern insights to Paleozoic organisms (and vice versa) by classically trained paleontologists has led to great advances in our understanding of changing ecosystems through the Phanerozoic.

6. **Symposium in Honor of Donald C. Haney.** John D. Kiefer, Kentucky Geological Survey, kiefer@uky.edu; James C. Cobb, Kentucky Geological Survey, cobb@uky.edu.

This symposium will highlight two of the favorite endeavors of Don Haney: the role of geology in public policy and the National Cooperative Geologic Mapping Program.

7. **Magmatism in the Eastern U.S. and Beyond: A Symposium in Honor of Paul C. Ragland.** James S. Beard, Virginia Natural History Museum, jbeard@vmnh.net; Harry Y. McSween, University of Tennessee-Knoxville, mcsween@utk.edu.

This symposium is intended to honor the memory and career of Paul C. Ragland, whose research spanned the range of mafic and granitic rocks, petrology, and geochemistry. Papers will be welcome on any related topic suitable to honor Paul's work and life.

THEME SESSIONS

Oral Sessions

1. **Burial, Uplift, and Thermal History of the Appalachian Basin.** Sponsored by *GSA Structural Geology and Tectonics Division*. Christopher S. Swezey, U.S. Geological Survey, cswezey@usgs.gov; Elizabeth L. Rowan, U.S. Geological Survey, erowan@usgs.gov.
The goal of this session is to bring together research focused on the burial, uplift, and thermal history of the Appalachian basin. Tools used to determine these histories include fluid inclusions, apatite, and zircon fission tracks, and indicators of thermal maturity (e.g., vitrinite reflectance and CAD), as well as regional structure and

Southeastern

stratigraphy. This fundamental knowledge of basin history provides a framework within which to study relations between tectonic activity, diagenesis, fluid flow, and hydrocarbon and mineral occurrences.

2. **Recent Advances in Western Blue Ridge Geology.**

Sponsored by *GSA Structural and Tectonics Geology Division*. C. Scott Southworth, U.S. Geological Survey, ssouthwo@usgs.gov.

This session will highlight new research on the stratigraphy, structure, metamorphism, paleontology, geochronology, and surficial processes of the western Blue Ridge province of Georgia, Tennessee, North Carolina, and Virginia.

3. **The Brevard Fault Zone: Physical Characteristics and New Perspectives.**

Sponsored by *GSA Structural and Tectonics Geology Division*. Randy Kath, University of West Georgia, rkath@westga.edu; John Costello, Georgia Department of Natural Resources, john_costello@dnr.state.ga.us.

Goals of this session are to define various characteristics within the Brevard fault zone from Alabama to North Carolina to better comprehend internal lithostratigraphy, structure, and the role of this conspicuous element in southern Appalachian orogen tectonic evolution. Topics including lithologic and mineralogic assemblages, metamorphic and macro- to micro-scale structural characteristics, topographic-physiographic characteristics, and hydrogeologic and mineral-resource potential are welcome. Additionally, data from three new metro Atlanta-area tunnels (Nancy Creek—strike-parallel to the Brevard; Chattahoochee—nearly strike-perpendicular to the north; and Atlanta West Combined Sewer Overflow—nearly strike-perpendicular to the south) will be presented.

4. **Metamorphic Framework of the Southern**

Appalachians Theodore C. Labotka, University of Tennessee at Knoxville, tlabotka@utk.edu.

The emerging picture of metamorphism in the southern Appalachians is one of superposed events formed in high- to medium-pressure environments. Evidence for the metamorphic history is gathered from elemental and isotopic compositions of porphyroblasts and inclusions in porphyroblasts. The various data are to be assembled into a coherent framework of the metamorphic development of the Appalachians.

5. **Geology of the Cambro-Ordovician Section of the Southern Appalachian Basin.**

Gary G. Bible, Miller Petroleum, tamia@nxs.net; Jeff Bailey, Tengasco Inc., jbailey@tengasco.com.

The purpose of the session will be to discuss the structure, stratigraphy, reservoir characteristics, source rocks, and facies distribution of the Cambro-Ordovician carbonate section in the southern Appalachian basin. Presentations are sought that cover either the present development of oil and gas fields or exploration trends within the Cambro-Ordovician section.

6. **Origin, Evolution, and Resource Utilization of Planets and Planetesimals.**

Cosponsored by *Planetary Geoscience Institute; GSA Planetary Geoscience Division*. James Day, University of Tennessee at Knoxville, [\[utk.edu\]\(mailto:ehill10@utk.edu\); Eddy Hill, University of Tennessee at Knoxville, \[ehill10@utk.edu\]\(mailto:ehill10@utk.edu\); Yang Liu, University of Tennessee at Knoxville, \[yangl@utk.edu\]\(mailto:yangl@utk.edu\).](mailto:jday13@</p></div><div data-bbox=)

This session aims to tie together disparate aspects of planetary science. Presentations on petrography, geochemistry, remote sensing, and in situ resource utilization of planetary materials are welcome.

7. **New Views on Old Rocks: Insights on Biospheric Evolution from the Precambrian Sedimentary Record.**

Cosponsored by *GSA Sedimentary Geology Division; Eastern Section, Society for Sedimentary Geology (SEPM)*. Linda C. Kah, University of Tennessee at Knoxville, lckah@utk.edu; Chris Fedo, University of Tennessee at Knoxville, cfedo@utk.edu.

This session will focus on both existing and emerging data sets that integrate sedimentologic and stratigraphic analysis with biological, geochemical, and chronological information to explore the evolution of the Precambrian biosphere. We welcome submissions of both local and global geographic focus.

8. **Carbonates Then and Now: How Much Has Changed? A Session in Honor of Kenneth R. Walker.**

Cosponsored by *GSA Sedimentary Geology Division; Eastern Section, Society for Sedimentary Geology (SEPM)*. Bosiljka Glumac, Smith College, bglumac@email.smith.edu; Stan Dunagan, University of Tennessee at Martin, sdunagan@utm.edu.

This session will explore various approaches and techniques used in studies of carbonate sediment and rocks over the years. Modern investigations will be placed in their historical context to highlight recent advancements in carbonate sedimentology, stratigraphy, and diagenesis.

9. **Developing Approaches to Terrestrial**

Paleoclimatology. Sponsored by *GSA Sedimentary Geology Division*. Claudia I. Mora, University of Tennessee at Knoxville, cmora@ut.edu.

This session will consider the development and application of terrestrial climate proxies, including isotopic, sedimentologic, and tree-ring studies. We are particularly interested in presentations that consider the complex climate issues of the southeastern region, but encourage all related submissions.

10. **Karst Feature Distribution in the Southeastern Region.**

Yongli Gao, East Tennessee State University, gaoy@mail.etsu.edu.

Many active karst areas are located in the southeastern United States. This session focuses on understanding controls of karst feature distribution, groundwater flow in carbonate aquifers, and karst hazard assessment.

11. **Surficial Geology and Geomorphology in the Appalachians: Progress and Applications.**

Hugh Mills, Tennessee Tech University, hmills@tntech.edu; Mike Clark, University of Tennessee at Knoxville, clarkgmorph@utk.edu.

This theme session seeks to highlight recent developments in surficial geology and geomorphology in the Appalachian region, in particular applications of these fields to practical problems, including landslide hazards,

river management, road construction, geoarchaeology, and ecology.

12. **Landslides and Rock Falls—Investigation, Analysis, and Remedial Action.** Harry Moore, Tennessee Department of Transportation, harry.moore@state.tn.us; Vanessa Bateman, Tennessee Department of Transportation, vanessa.bateman@state.tn.us.

Presentations on landslides and rock fall events and their effects on highways and other man-made structures as well as the natural landscape are welcome. In addition, presentations on remedial projects that involve landslide and rock-fall events are encouraged. Unusual occurrences, innovative treatments, and inventory and rating methods of landslides and rock falls are also welcome.

13. **Coastal Management and Environmental Lessons from Recent Southeastern U.S. Hurricanes.** David M. Bush, University of West Georgia, dbush@westga.edu; Robert S. Young, Western Carolina University, ryoung@wcu.edu.

Recent (2003–2005) hurricanes affecting the southeastern Atlantic and Gulf of Mexico coasts include Isabel, Charley, Frances, Ivan, Dennis, Katrina, and Rita. Each hurricane affords the opportunity to better prepare for the next one. This session will address hurricane physical interaction with the coastal zone, property damage mitigation, improved public awareness, and better management of coastal resources. Discussions of any physical, social, and engineering aspect of hurricane-coastal interactions are welcome.

14. **Geology and Groundwater Resources in Carbonate and Crystalline Rocks of the Eastern U.S.: Methods, Geologic Controls, and Exploration Approaches.** Lester Williams, U.S. Geological Survey, lesterw@usgs.gov; Tom Crawford, University of West Georgia, tcrawfor@westga.edu.

Specialized methods and knowledge of geologic controls are needed for assessing the availability, quantity, and quality of groundwater in carbonate and crystalline rock aquifer systems. This session seeks presentations that highlight methods and/or exploration approaches used to study groundwater in complex aquifer systems, as well as studies highlighting geologically significant features that influence groundwater recharge, flow paths, and contamination.

15. **Groundwater Contamination: Transport, Fate and Remediation.** Sponsored by *GSA Hydrogeology Division*. Ed Perfect, University of Tennessee at Knoxville, eperfect@utk.edu; Larry McKay, University of Tennessee at Knoxville, lmckay@utk.edu.

This session will cover the behavior of inorganic, organic, and microbial contaminants in a variety of geologic settings, including coastal sand aquifers, fractured rocks, karst, saprolite, and soils. Both fully and partially saturated conditions will be considered. Papers can be based on the results of laboratory experimentation, field observations, model simulations, or experience at contaminated sites. We are particularly interested in studies that combine approaches from a variety of disciplines to

deal with contaminant problems over a range of spatial and temporal scales.

16. **Applications and Innovations in Near-Surface Geophysics.** Sponsored by *GSA Geophysics Division*. Gregory S. Baker, University of Tennessee at Knoxville, gbaker@tennessee.edu; Edward W. Woolery, University of Kentucky, woolery@uky.edu.

The objective of this session is to bring together researchers who (1) are developing new techniques and new technology in near-surface geophysics, or (2) have applied examples of state-of-the-art technology used for constraining geologic, hydrologic, archaeologic, or other problems in the southeastern United States. Presentations may include innovations (in such areas as instrument development, survey design, data analysis, imaging, etc.) with or without associated case studies or specific near-surface geophysics case studies.

17. **Paleontology, Paleoecology, and Paleoenvironments of the Gray Fossil Site, Gray, Tennessee.** Sponsored by *Paleontological Society*. Steve Wallace, East Tennessee State University, wallaces@mail.etsu.edu; Blaine Schubert, East Tennessee State University, schubert@mail.etsu.edu.

The Gray Fossil Site was discovered in May 2000, during road construction in Washington County near Gray, Tennessee. The deposit provides a rare opportunity to study the Miocene paleoecology of southern Appalachia. This session will focus on emerging paleontological and paleoecological data from this extraordinary fossil site.

18. **Hands-on Ichnology and the Union Chapel Track Site.** Cosponsored by *Paleontological Society*; *Eastern Section*, *Society for Sedimentary Geology (SEPM)*. Andrew K. Rindsberg, Geological Survey of Alabama, arindsberg@gsa.state.al.us.

The Carboniferous ichnology of the Union Chapel track site (Steven C. Minkin Paleozoic Footprint Site, Alabama) will be showcased, and talks on any aspect of ichnology are welcome. Attendees are invited to bring a specimen or image for general discussion.

19. **Bringing Research into the Undergraduate Classroom.** Sponsored by *National Association of Geoscience Teachers, Southeast Section*. Ben Tanner, Western Carolina University, btanner@utk.edu.

This session will focus on ways to integrate research experiences into the undergraduate classroom and to determine the value of research derived from undergraduate classes.

20. **Current Status of K–12 Science Standards and Earth Science Education in the Southeast.** Cosponsored by *National Association of Geoscience Teachers, Southeast Section*; *GSA Southeastern Section Education Committee*. Michael A. Gibson, University of Tennessee at Martin, mgibson@utm.edu; Doug Haywick, University of Southern Alabama, dhaywick@jaguar1.usouthal.edu.

Science standards for K–12 education in the southeast have undergone revision in response to test scores, national initiatives, and education reform movements over the past 20 years. What is the current status of earth science education in the southeast and what are the implications for higher education programs? State science

Southeastern

coordinators from the southeast will be invited to report on the status of standards-based science education in their states, areas still in need of attention, and expected trends in earth science education.

21. **Hydrology and Water Quality Issues in the Southeast.** Sponsored by *Southeastern Water Research Institute; GSA Hydrogeology Division*. Randy Gentry, University of Tennessee, rgentry@utk.edu; Larry McKay, University of Tennessee, lmckay@utk.edu.

This session invites papers dealing with a range of water supply, water quality, and aquatic habitat issues facing the rapidly growing populations of the southeastern United States. These include Total Maximum Daily Loads, wellhead protection, storm water discharges, water supply, water disputes, stream ecology and restoration, microbial contamination, etc. Papers can address these problems from a variety of perspectives and disciplines, including geology, engineering, microbiology, ecology, economics, and social policy.

25. **Technological Advances in the Collection and Communication of Geologic Information.** Douglas C. Curl, Kentucky Geological Survey, +1-895-257-5500; Matthew M. Crawford, Kentucky Geological Survey, +1-859-257-5500, mcrawford@kgs.mm.uky.edu.

This session will focus on how geoscientists are using technology to collect, manage, and distribute geological information. Presentations on topics such as global positioning system usage in the field, Internet mapping, the geographic information system and digital mapping techniques, and geological database management are welcome.

POSTER SESSIONS

22. **Geologic Maps, Digital Geologic Maps, and Derivatives from Geologic Maps.** Sponsored by *GSA Structural Geology and Tectonics Division*. Ralph F. Crawford, The Geologic Mapping Institute, crawford@sprintmail.com; Michael W. Higgins, The Geological Mapping Institute, mhiggins@mindspring.com.

Geologic maps are the most fundamental tool of geological science. State-of-the-art geologic maps (both classical and GIS-based) are welcome.

23. **Undergraduate Research in Watershed Assessment.** Randa Harris, University of West Georgia, rharris@westga.edu; Curtis Hollenbaugh, University of West Georgia, chollaba@westga.edu; Julie Bartley, University of West Georgia, jbartley@westga.edu.

Watershed assessment is an important avenue for research in the southeast and provides many opportunities for undergraduate involvement. Frequently, such assessment is used as a training ground for undergraduate researchers and enables them to learn both field and laboratory techniques and to analyze complex interactions among water quality variables. This session will focus on both training methods and results of undergraduate research driven by watershed assessment programs.

24. **Undergraduate Research Poster Session.** Sponsored by *Council for Undergraduate Research*. Brannon Andersen, Furman University, brannon.andersen@

furman.edu; Jeff Ryan, University of South Florida, ryan@chuma.cas.usf.edu.

The Council on Undergraduate Research will sponsor a poster session highlighting research performed by undergraduates in all areas of the earth sciences. First authors must be undergraduate students, and students must be responsible for the bulk of the research, preparation of posters, and presentation of results.

FIELD TRIPS

Premeeting

1. **Geology of the Middle Proterozoic Basement and Younger Cover Rocks in the West Half of the Asheville 100K Quadrangle, North Carolina and Tennessee—An Updated Look.** (Two days) Carl Merschat, North Carolina Geological Survey, +1-828-296-4630, carl.merschat@ncmail.net; Bart Cattanach, North Carolina Geological Survey, bart.cattanach@ncmail.net; Leonard Wiener, North Carolina Geological Survey, retired, thaisw@juno.com; Mark Carter, Virginia Division of Mineral Resources, mark.carter@dmme.virginia.gov. Tues.–Wed., 21–22 Mar. Depart 8 a.m., return 2 p.m. Cost: US\$60, including transportation, lunch, snacks, and field trip guidebook. Min.: 12; max.: 30.

This field trip begins and ends in Asheville, North Carolina. Lodging must be purchased separately by each participant. A block of rooms is reserved at the Holiday Inn Biltmore–East (+1-828-298-5611; Oteen Exit 55 on I-40). Lodging is also available in other parts of Asheville. The field trip focuses on the middle Proterozoic basement map units of the Blue Ridge of western North Carolina, northwest of Asheville. It addresses their age, mappable characteristics, and relationships with the overlying Ashe-Tallulah Falls and Ocoee Supergroup sequences. Evidence for high-grade Grenville metamorphism and subsequent Paleozoic overprints will be examined, with emphasis on the Alleghanian.

2. **Geologic Excursion across Part of the Southern Appalachian Foreland Fold-Thrust Belt in Northeastern Tennessee.** (One day) Peter J. Lemiszki, Tennessee Division of Geology, +1-865-594-6200, peter.lemiszki@state.tn.us; Martin S. Kohl, Tennessee Division of Geology, martin.kohl@state.tn.us. Wed., 22 Mar., 7 a.m.–5 p.m. Cost: US\$70, including transportation, lunch and a guidebook. Min.: 8; max.: 20.

This one-day field trip will begin and end at the Marriott Hotel in Knoxville, Tennessee. The field trip will traverse the northeastern part of the Tennessee Valley and Ridge to examine results from recent STATEMAP-supported geologic quadrangle mapping. Stops will include exposures of the Copper Creek and Town Knobs thrusts, folding and fracturing in the Martinsburg Formation and Sevier Shale (Ordovician), unusual sedimentary features in the Nolichucky Shale (Cambrian), and a visit to a farm where participants can collect small quartz crystals we fondly refer to as Tennessee field diamonds. At each stop, we will discuss the local structure, stratigraphy, mineral resources, and geohazards in a regional context. The trip is a great opportunity for professional geolo-

gists, academics, and teachers looking for an overview of regional geology.

Postmeeting

3. **The Formation, Denudation, and Natural History of Mount Le Conte, Great Smoky Mountains National Park, Tennessee.** (One day) Sponsored by *National Association of Geoscience Teachers*. C. Scott Southworth, U.S. Geological Survey, +1-703-648-6385, southwo@usgs.gov; Arthur Schultz, U.S. Geological Survey, aschultz@usgs.gov. Sat., 25 Mar., 8 a.m.–5 p.m. Cost: US\$40, including bus transportation, lunch, snacks, guide, geologic map, and video. Min.: 15; max.: 27.

This trip will originate and end at the Sugarland Visitor Center, Great Smoky Mountains National Park. Check out of your hotel and depart Knoxville by 8 a.m. to get to the Visitor Center by 9 a.m. Wear sturdy footwear, warm clothes, and bring rain gear. K–14 teachers, students, professionals, and guests are invited to participate. The trip will consist of four stops around Mount Le Conte: (1) Carlos Campbell Overlook; (2) a short, steep hike to Buckeye Cove; (3) lunch at the Chimneys picnic area; and (4) a moderate 4.5-mile round-trip hike to Alum Cave. We will highlight the origin of the rocks; the timing and conditions of deformation, metamorphism, and uplift; and erosion and surficial deposits that have contributed to the geomorphology.

4. **Lessons from Limestone.** (One day) Don Byerly, University of Tennessee at Knoxville, dbyerly@utk.edu; Michael A. Gibson, University of Tennessee at Martin, mgibson@utm.edu. Sat., 25 Mar., 8 a.m.–5 p.m. Cost: US\$10 (the major costs of the trip are being funded by the Crushed Stone Producers of Tennessee–Rinker Materials, Inc., Rogers Group, Inc., and Vulcan Materials Corporation). Max.: 30.

This field trip begins and ends at the Marriott Hotel, Knoxville, Tennessee. The trip will feature limestone as an instrument for teaching National Science Education Content Standards, including chemical reactions (Standard B), biological evolution (Standard C), geochemical cycles (Standard D), and natural and human-induced hazards (Standard F). Some of the topics covered by the trip include using fossils to develop concepts of paleoecology and evolution; using limestone to reconstruct ancient geography (including plate tectonics); the importance of limestone in our society as a natural resource; hazards associated with karst (caves and sinkholes); and where, how, and why limestone forms.

5. **Diverse Mafic and Ultramafic Rock Sequences of the Central Blue Ridge, North Carolina–Georgia.** (Two days) Jeff Ryan, University of South Florida, ryan@chuma.cas.usf.edu; Steve Yurkovich, Western Carolina University, yurkovich@wcu.edu; Virginia Peterson, Grand Valley State University, petersvi@gvsu.edu. Sat.–Sun., 25–26 Mar. Departs 8 a.m. and returns 2 p.m. Sunday. Cost: US\$140, including transportation, two nights lodging (double occupancy) and continental breakfast, box lunches, and field trip guide. Max.: 20.

This field trip begins and ends at the Comfort Inn, Sylva, North Carolina. Participants are expected to arrange their own travel to and from the departure locality. The focus of the trip will be the varied mafic-ultramafic rock exposures in the south-central Blue Ridge, their likely origins, and tectonic implications. The trip will emphasize new mapping and petrologic results from the Buck Creek and Carroll Knob mafic-ultramafic complexes, and from rocks in the Webster–Addie–Balsam Gap area.

6. **Geotraverse: Geology of Northeastern Tennessee and the Grandfather Mountain Region.** (Two days)

Robert D. Hatcher, Jr., University of Tennessee at Knoxville, +1-865-974-2366, bobmap@utk.edu. Sat.–Sun., 25–26 Mar. Departs 8 a.m.; returns 5 p.m. Sunday. Cost: US\$275, includes two nights lodging, transportation, two lunches, and guidebook. Participants will be responsible for breakfasts and dinners. Min.: 10; max.: 32.

This field trip will start and end at the Marriott Hotel, Knoxville, Tennessee. The trip will consist of a traverse from the Johnson City–Elizabethton area in northeastern Tennessee, where the Shady Valley thrust sheet contains a complete section from Grenville basement through the Knox Group (Valley and Ridge or Blue Ridge), across the Mountain City window into the Stone Mountain thrust sheet and other Grenville and pre-Grenville (Mars Hill) terrane and rifted-margin igneous rocks (Bakersville complex) in western Blue Ridge thrust sheets, and across the Chattahoochee–Holland Mountain thrust sheet into eclogite bearing Ashe Formation rocks. We also will examine Grandfather Mountain Formation rocks inside the Grandfather Mountain window and the Linville Falls fault.

7. **Lower Pennsylvanian Siliciclastic Rocks of the Northern Cumberland Plateau, Including Marine Margin Sandstones Crawling with Life.** (One day) Molly Miller, Vanderbilt University, molly.miller@vanderbilt.edu; Andrew Rindsberg, Geological Survey of Alabama, arindsberg@gsa.state.al.us. Sat., 25 Mar., 8 a.m.–5 p.m. Cost: US\$60, including transportation and lunch.

This field trip will begin and end at the Marriott Hotel, Knoxville, Tennessee. Diverse trace fossils in a unique flagstone within the Fentress Formation in a small quarry near Jamestown, Tennessee, reflect deposition under marine conditions. In contrast, the overlying Rockcastle Conglomerate was deposited in braided streams. This trip affords an opportunity to observe biogenic structures in a well-exposed sedimentologic context, to discuss how and where the structures were produced and by what, to see the facies and facies relationships of the Rockcastle Conglomerate, to reconstruct the succession of depositional processes and environments, to consider tectonic-climatic scenarios reflected by the sequence, and to order rock for a lovely patio that will increase Earth awareness on your campus.

8. **The Geology and Ecology of the Late Miocene to Early Pliocene Gray Fossil Site, Northeast Tennessee.** (One day) Steven C. Wallace, +1-423-439-6085, wallaces@mail.etsu.edu; Blaine W. Schubert, +1-423-439-8419,

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schubert@mail.etsu.edu, East Tennessee State University. Sat., 25 Mar., 8 a.m.–5 p.m. Cost: US\$75, includes bus transportation, lunch, snacks, guide, and guidebook. Min.: 40; max: 50.

This one-day trip will originate and end at the Marriott Hotel in Knoxville, Tennessee. The field trip is an opportunity to examine one of the few late Miocene to early Pliocene vertebrate sites in the eastern United States. It will be in two parts, including a stop at the Gray site to see the excavations and examine the deposits, depositional setting, and geology. After lunch, the trip will proceed to East Tennessee State University to examine fossil finds and receive an overview of the fauna and the importance of the site.

WORKSHOPS

Measurement of Indoor Radon in Geologically Diverse Terranes. Sponsored by *GSA Engineering Geology Division*. Sat.–Sun., 25–26 Mar., 8 a.m.–5 p.m. Douglas Mose, George Mason University, dje42@aol.com; George Mushrush, George Mason University. Optional exam earning Radon Measurement Specialist Certificate: US\$150. This course provides hands-on training to understand, anticipate, and measure geologically dependent indoor radon and waterborne radon. The course is designed for teachers and researchers. An optional exam earns a Radon Measurement Specialist Certificate (National Radon Safety Board, info@nrsb.org) for full- or part-time employment as a home inspector in the real estate market. A general knowledge of soil and hydrology is required. Limit: 40. Fee: US\$360, includes course manual and lunches.

ACTIVITIES FOR STUDENTS

Roy J. Shlemon Mentor Program in Applied Geoscience. Sponsored by *GSA Foundation*. Thurs.–Fri., 23–24 Mar., 11:30 a.m.–1 p.m. Location information available at GSA's on-site registration desk. Karlon Blythe, kblythe@geosociety.org. This is a chance for students to discuss career opportunities and challenges with professional geoscientists from multiple disciplines. Plan to attend both free luncheons to hear different presenters each day. Students will receive FREE LUNCH tickets in their registration packet to attend both Shlemon Programs. However, space is limited: first come, first served. For further information, contact kblythe@geosociety.org.

John Mann Mentors in Applied Hydrogeology Program. Sponsored by *GSA Foundation*. Thurs., 23 Mar., 5–6:30 p.m. Location information available at GSA's on-site registration desk. Karlon Blythe, kblythe@geosociety.org. This early evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with interest in applied hydrogeology or hydrology as a career to interact and network with practicing hydrogeologic professionals. This program is a focused, small-scale event that features a free pizza dinner for participants. Students will receive a ticket to attend the Mann Program event in their registration packets, but space is limited: first come, first served. For further information, contact kblythe@geosociety.org.

MEETINGS AND SPECIAL EVENTS

Wednesday, 22 March

Southeast GSA Business Meeting. 4–6 p.m., Marriott Hotel Board Room.

Welcoming Reception. 7–9 p.m., Marriott Hotel.

Thursday, 23 March

Eastern Section, Society for Sedimentary Geology (SEPM). 5 p.m., Marriott Hotel.

Friday, 24 March

Luncheon, Southeast Section of the Paleontological Society. Noon, Marriott Hotel. Cost: US\$20.

Business Meeting, Southeast Section of the Paleontological Society. 1:30 p.m., Marriott Hotel.

EXHIBITOR INFORMATION

Exhibit space will be available in a centrally located exhibit hall. For more information on exhibit rates and space reservations, contact Edmund Perfect, eperfect@utk.edu.

SPONSORSHIP INFORMATION

Corporate and government sponsorship are welcome. Sponsors will be recognized during the meeting and with an acknowledgment in the printed program. Sponsors may designate their gift for a specific event or technical session, with recognition during that event. For more information on sponsorship, please contact Edmund Perfect, eperfect@utk.edu.

STUDENT TRAVEL GRANTS

Travel grants are available from the GSA Southeastern Section and GSA Foundation to both undergraduate and graduate students who are presenting papers and are GSA Student Members. Information and applications are available at <http://core.ecu.edu/geology/neal/segasa/travel.html> or via link on the GSA Web site, www.geosociety.org.

ACCOMMODATIONS FOR REGISTRANTS WITH SPECIAL NEEDS

GSA's Southeastern Section is committed to making every event at the 2006 meeting accessible to all people interested in attending. If you have special requirements, please contact the local committee chair, Claudia I. Mora, cmora@utk.edu.

ADDITIONAL INFORMATION

For further information, please contact the local committee chair: Claudia I. Mora, cmora@utk.edu. Additional meeting information will be available on the GSA Web site, www.geosociety.org. Visitor information for the city of Knoxville and the surrounding eastern Tennessee region can be found at www.ci.knoxville.tn.us/.



THE GEOLOGICAL SOCIETY
OF AMERICA



SOUTH-CENTRAL

**40th Annual Meeting
South-Central Section, GSA
School of Geology and Geophysics and
Oklahoma Geological Survey
University of Oklahoma, Norman, Oklahoma**

6–7 March 2006

www.geosociety.org/sectdiv/southc/06scmtg.htm

The University of Oklahoma (OU) is the largest public university in Oklahoma, enrolling over 24,000 students from more than 100 countries. The South-Central Section meeting will include two days of technical presentations (oral and poster) and student activities, plus a very active premeeting program—six field trips and five workshops (two designed especially for teachers) are planned. Three “less”-technical tours of campus geoscience collections also will be held. In addition, GSA Members and guests will want to visit the Fred Jones Museum of Art, which houses the largest collection of French Impressionist paintings ever donated to a public university. The Sam Noble Oklahoma Museum of Natural History displays the largest dinosaur skull (*Pentaceratops*) ever found and the oldest piece of art found in North America. Bizzell Library houses a world-class history of science collection. The Geologic Gallery of the School of Geology and Geophysics and the Laurence S. Youngblood Energy Library in Sarkeys Energy Center contain superb mineral and fossil displays. Finally, no visit to Norman would be complete without visiting the Barry Switzer Center, celebrating the seven-time national football champion OU Sooners. For more information on what to see and do on the OU campus, visit www.visit.ou.edu/vc_vtstart.htm.

The school of geology and geophysics (SGG) currently has 15 academic faculty members, 78 undergraduate students, and 75 graduate students. The vision of the SGG is to be “a preeminent center of excellence for study and research in geology and geophysics, with emphasis in applied areas such as energy. Students shall be provided with a high quality education that stresses the fundamentals of science within a creative, interdisciplinary environment, and that prepares them for success in their professional careers by instilling knowledge, skills, confidence, pride, principled leadership, and the ability to contribute to the wise stewardship of the earth and its resources.”

The Oklahoma Geological Survey (OGS) is an applied research and public-service agency authorized by the state constitution. Its charter is to investigate the land, water, mineral, and energy resources of the state and to disseminate the results of those investigations. The OGS engages in a wide variety of field investigations throughout the state either independently or with other state and federal agencies.

LOCATION AND TRAVEL INFORMATION

Norman is 20 miles south of Oklahoma City (OKC) near the boundary between the Cherokee Shelf and the Anadarko Basin. Surface strata consist of Leonardian (Lower Permian) redbeds overlain by Quaternary deposits associated with the Canadian River. Outcrops of the Garber-Wellington aquifer, a principal source of water for the OKC metro area currently being studied because of its locally high arsenic content, occur on the east side of Norman.

OU is located just south of the center of Norman and is easily accessed by Interstate 35. The meeting will be held at the Oklahoma College of Continuing Education (OCCE), south of the main campus. Registration parking will be immediately south of the OCCE Forum building and north of Timberdell Avenue. A map of the OU campus is available at www.ou.edu/visitorcenter/vc_campus_map.htm.

ACCOMMODATIONS

A block of rooms has been reserved at the Sooner Hotel and Suites, located next to the OCCE. Rooms cost about US\$55 per room (1–2 beds per room) per night at the hotel and about US\$91 per cottage (2 rooms; 1 bed per room) per night. To obtain these rates, you must phone the hotel at +1-405-329-2270 or +1-888-777-0477 and state that you are affiliated with OU/GSA. The deadline for reserving rooms is 1 February 2006.

A complete list and a map of other Norman motels can be found at www.visitnorman.com/lodging.html. All of these require driving; none are within walking distance of campus.

Accommodations for Registrants with Special Needs

GSA is committed to making all events at the South-Central 2006 meeting accessible to all people interested in attending. Special requirements (wheelchair accessibility, dietary concerns, etc.) should be indicated on the registration form.

REGISTRATION

Standard registration deadline: 31 January 2006

Cancellation deadline: 6 February 2006

Registration Fees

	Standard		On-site	
	Full meeting	One day	Full meeting	One day
Professional Member	US\$100	US\$65	US\$120	US\$75
Professional Nonmember	US\$120	US\$75	US\$140	US\$85
Student Member	US\$50	US\$35	US\$55	US\$40
Student Nonmember	US\$60	US\$45	US\$65	US\$50
K–12 Professional	US\$30	US\$30	US\$40	US\$40
Guest or Spouse	US\$25	US\$20	US\$35	US\$30

GSA Headquarters will handle meeting registration. Register online at www.geosociety.org. On-site registration will be available at Sarkeys Energy Center late afternoon and early evening on Sun., 5 Mar., and at OCCE during the meeting.

Admission to the Sam Noble Oklahoma Museum of Natural History is free to registrants with their OU/GSA name tags. The museum will conduct a limited number of small-group, behind-the-scenes tours on a first-come, first-served, sign-up basis. Registrants will also be able to tour the History of

South-Central

Science Collections at Bizzell Library on a small-group basis. Reservations for these tours can be made at the registration desk during the meeting.

CALL FOR PAPERS

Abstract deadline: 6 December 2005

Papers are invited for symposia, theme sessions, and general sessions, in oral and/or poster formats. Abstracts not included in symposia will be scheduled for appropriate theme or general sessions. All abstracts must be submitted online to www.geosociety.org. There is an abstract submission fee of US\$10.

SYMPOSIA AND THEME SESSIONS

For more information, or to propose additional symposia or theme sessions, contact Neil Suneson, nsuneson@ou.edu, +1-405-325-3031.

Symposia

1. **Sequence Stratigraphy and Paleontology of Carboniferous and Permian Strata of the Northern and Southern Mid-Continent.** Darwin Boardman, Oklahoma State University, amm0001@okstate.edu, +1-405-744-6358, fax +1-405-744-7841.

This symposium will focus on the stratigraphic, sequence stratigraphic, biostratigraphic, and paleoecologic aspects of the mid-continent and north-central Texas Carboniferous and Permian succession. Of particular interest, this session will focus on Upper Mississippian Barnett and Caney Formations, as well as sequence stratigraphy of the Cherokee, Council Grove, and Chase Groups of Oklahoma and Kansas.

2. **Geological and Environmental Issues of the Tar Creek Superfund Site, Picher Mining District, Northeastern Oklahoma.** Ken Luza, Oklahoma Geological Survey, kluza@ou.edu, +1-405-325-3031, fax +1-405-325-7069.

This half-day session will focus on the many challenges and issues that are associated with the Tar Creek Superfund Site in northeastern Oklahoma. Some of these challenges and issues include size (>41 mi²), land ownership, legal issues, elevated blood-lead levels, data availability, a large number of mine and mill-waste sites, ongoing subsidence, and oversight and accountability.

Theme Sessions

1. **Drivers of Regional Water Management: Who's Stopping to Ask Directions?** Todd Halihan, Oklahoma State University, halihan@okstate.edu, +1-405-744-6358, fax +1-405-744-7841.

Sound water management requires an integration of scientific, political, and social expertise in order to derive long-term management plans. Most water management is reactive, based on lack of supply due to drought or population increases. This theme session examines ways that are being employed to make water management follow a coherent map toward sustainable supplies on a regional scale.

2. **Geology and Public Policy.** Melanie Barnes, Texas Tech University, melanie.barnes@ttu.edu, +1-806-742-3204, fax +1-806-742-0100.

Over the last year, the Gulf of Mexico has weathered three major hurricanes (Ivan, Katrina, and Rita) that have had a direct impact on our energy infrastructure. With this theme session, we would like to initiate a dialogue about the role geologists have, can, and should play in the crafting of a sound energy policy. An integration of scientific, political, and social expertise is required in order to derive a sound long-term energy policy for our nation. Papers on all aspects of this issue are welcome. We plan to design the session to encourage interaction between the presenters and the audience.

3. **Undergraduate Research Poster Session.** Sponsored by *Council on Undergraduate Research, Geosciences Division* (www.cur.org); *GSA Education Committee* (www.geosociety.org/educate/). Wendi Williams, University of Arkansas–Little Rock, wjwilliams@ualr.edu, +1-501-569-3546.

Undergraduate students are invited to submit abstracts for a special poster session highlighting activities by undergraduate researchers. Undergraduate students involved in independent, team, or class-related research are highly encouraged to submit abstracts regarding their research projects, activities, techniques, internship experiences, and/or preliminary results for this session. The presenter and first author must be an undergraduate student, but co-authors may include faculty sponsors and/or graduate students and/or high school students.

4. **Addressing the Pseudoscience of Intelligent Design in the K–16 Classroom.** Iris Totten, Kansas State University, itotten@ksu.edu, +1-785-532-6724, fax +1-785-532-5159.

This session will focus on issues of educating the K–16 population on evolution and intelligent design (ID) in the classrooms and communities. States including Kansas and Georgia are experiencing great controversies in their schools regarding equal time for creationism and ID and evolution. In August 2005, the Kansas School Board of Education voted 6–4 to include greater criticism of evolution in its school science standards. This session is intended to engage the audience in a discussion regarding the consequence of these controversies to our K–16 science programs, to share strategies for promoting the understanding of evolution in our classrooms and communities, and to further define the role of the geosciences with respect to this controversial national issue.

5. **Igneous Petrology: What the Rocks Are Telling Us.** Charles Gilbert, School of Geology and Geophysics, University of Oklahoma, mcgilbert@ou.edu, +1-405-325-4501; David London, School of Geology and Geophysics, University of Oklahoma, dlondon@ou.edu, +1-405-325-7626, fax +1-405-325-3140.

Papers on all aspects of igneous petrology are welcome, with especial emphasis on textures, descriptions of field sites, estimating conditions of crystallization, and on any general principles used in explicating igneous processes.

WORKSHOPS AND SHORT COURSES

See www.geosociety.org/sectdiv/southc/06scmtg.htm for updates and possible sponsorships.

1. The Role of Trace Fossils in Interpreting

Depositional Sequences. Sun., 5 Mar., in Norman.

James R. Chaplin, Oklahoma Geological Survey, jchaplin@ou.edu, +1-405-325-3031, fax +1-405-325-7069.

This workshop will focus on the importance of trace fossil analyses in recognizing ichnofacies, identifying key stratal surfaces, reconstructing depositional environments, and determining and using ichnofabric indices as an aid in reservoir characterization. Hands-on trace fossil exercises will be used to demonstrate important trace fossil applications in recognizing and interpreting depositional sequences. Min.: 10; max.: 25. Cost: US\$30 (students: US\$15), includes snacks, lunch, and workshop manual.

2. Basics of the Petroleum Geology of Deepwater

Depositional Systems. Sun., 5 Mar., in Norman. Roger

M. Slatt, School of Geology and Geophysics, University of Oklahoma, rslatt@ou.edu, +1-405-325-3253, fax +1-405-325-3140.

This workshop will focus on deepwater depositional systems, including recent deepwater exploration and production history, architectural elements, and related reservoir performance. A written text will be provided for follow-on with lecture material. Min.: 5; max.: 25. Cost: US\$70, includes lunch and a copy of "Petroleum Systems of Deep-Water Settings" by P. Weimer and R.M. Slatt (2004).

3. Hands-on Geology Projects for Group Learning.

Sat. morning, 4 Mar., in Norman. Vince Cronin, Vince_Cronin@baylor.edu, assisted by Rena Bonem, Rena_Bonem@baylor.edu, Baylor University, +1-254-710-2361, fax +1-254-710-2673.

Teachers will participate in a series of short (5–10 min) projects that illustrate important geological processes, generally involving materials and devices that are readily available. The workshop will show the participants how to reproduce these projects for individual classroom use. Min.: 8; max.: 21. Cost: US\$25.

4. Earth and Space at Your Fingertips: Infusing

Technology-Rich Resources into Your Lessons. Sat. afternoon, 4 Mar., in Norman. Wendi Williams, University of Arkansas–Little Rock, wjwilliams@ualr.edu, +1-501-569-3546; Keith Harris, krharris@ualr.edu, University of Arkansas–Little Rock, +1-501-569-3546.

Participants will explore technology-rich resources aligned to meet National Science Education Standards, as well as begin mapping participants' state standards. Example resources of products included are from GSA, the National Aeronautics and Space Administration, the American Geological Institute, the Incorporated Research Institutions for Seismology (IRIS) Consortium, the Digital Library for Earth System Education (DLESE), the National Science Teachers Association, and National Science Foundation-funded resources. Earth and Mars will be emphasized. Min.: 5; max.: 21. Cost: US\$35 K–16; US\$20 pre-service.

5. **Measurement of Indoor Radon.** Sat.–Sun., 4–5 Mar., in Norman. Douglas Mose, George Mason University, dje42@aol.com, +1-703-273-2282, fax +1-703-993-1055; George Mushrush, George Mason University, gmushrus@gmu.edu. Optional exam to earn a Radon Measurement Specialist Certificate: US\$150.

This course provides hands-on training to understand, anticipate, and measure geologically dependent indoor radon and waterborne radon. The course is for teachers and researchers, and an optional end-of-course exam earns a Radon Measurement Specialist Certification (National Radon Safety Board, www.nrsb.org). The certificate is required by federal and state regulatory agencies to list individuals authorized for employment as home inspectors in the real estate market. Min.: 5; max.: 25. Prerequisite: general knowledge of soil and hydrology. Fee: US\$350, includes course manual and lunches.

FIELD TRIPS

1. Hydrogeology and Water Management of the Arbuckle-Simpson Aquifer, South-Central Oklahoma.

Sat., 4 Mar. Noel Osborn, Oklahoma Water Resources Board, niosborn@owrb.state.ok.us, +1-405-530-8800, fax +1-405-530-8900.

The Arbuckle-Simpson aquifer, which underlies more than 500 mi² in south-central Oklahoma, is the source of several springs and streams, including those in the Chickasaw National Recreation Area and Blue River, Pennington Creek, and Honey Creek. The field trip will examine the geologic histories of the Arbuckle and Hunton anticlines, and how the different structural and geologic frameworks can affect aquifer characteristics and groundwater flow. A multidisciplinary team of researchers from various agencies and universities will discuss the techniques they are employing to understand the highly fractured carbonate aquifer and associated springs and streams. Field stops will include outcrops, streams, a climatic station, an artesian well, and scenic Turner Falls. Min.: 10; max.: 40. Cost: US\$50, includes transportation, water, soft drinks, and a field guide. Lunch will be at a restaurant; participants are responsible for their own lunch expenses.

2. **Environmental Stratigraphy of Permian Garber-Wellington Red Beds: Context for Groundwater and Land-Use Issues.** Sun., 5 Mar. Stanley T. Paxton, Oklahoma State University, pstanle@okstate.edu, +1-405-744-6358, fax +1-405-744-7841.

The purpose of this trip is to demonstrate that prudent development of both groundwater and the landscape can be enhanced by a working knowledge of the origin, distribution, and burial history of Oklahoma's Permian red beds. Field trip stops will enable participants to examine lines of evidence for the proposed depositional setting of these stratigraphic units and the role that provenance and lithofacies play in the distribution of naturally occurring arsenic in the region's drinking water. Susceptibility of the landscape to erosion will also be observed and discussed. Min.: 10; max.: 22. Cost: US\$50, includes transportation, water, soft drinks, lunch, and field trip guide.

South-Central

3. **Tar Creek Superfund Site and its Many Challenges.**

Sat.–Sun., 4–5 Mar. (two-day trip). Ken Luza, Oklahoma Geological Survey, kluza@ou.edu, +1-405-325-3031, fax +1-405-325-7069.

The Tar Creek Superfund Site is located in northeastern Oklahoma near the Oklahoma-Kansas border in Ottawa County. The site consists of ~41 mi² (26,000 acres) and is part of the Tri-State Mining District (Okla., Kans., and Mo.). The Mississippian rock units, principally the Boone Formation, are the host for most of the ore deposits. Zinc and lead ores (principally sphalerite and galena) were mined in the Picher Field in northeastern Oklahoma and southeastern Kansas for more than 60 years. The Superfund site contains over 2,500 acres that are underlain by underground lead-zinc mines and 1,150 mine shafts. Significant quantities of mill-waste material were generated by milling of the lead-zinc ores. Approximately 5,000 acres in Oklahoma were overlain by mine and/or mill byproducts. On this field trip, we will visit mine and mill-waste sites, locations where ongoing ground failure is occurring, a reclamation and restoration project, sites where mine water is discharging from mine shafts and boreholes, and a mill-waste reprocessing plant. We will discuss the many challenges and issues that are associated with the Tar Creek Superfund Site. Min.: 10; max.: 22. Cost: US\$100, includes transportation, lodging (double-occupancy), soft drinks, two lunches, and a field trip guide. Participants are responsible for their own breakfast and dinner expenses.

4. **Interpreting Textures of Granitic and Gabbroic Rocks, Wichita Mountains, Oklahoma.**

Sun., 5 Mar. Charles Gilbert, School of Geology and Geophysics, University of Oklahoma, mcgilbert@ou.edu, +1-405-325-4501; David London, School of Geology and Geophysics, University of Oklahoma, dlondon@ou.edu, +1-405-325-7626, fax +1-405-325-3140.

Petrologists utilize or sometimes rely on texture to infer the conditions and history of crystallization in igneous rocks, but our knowledge of textural interpretation comes mostly from two sources: (1) what we were taught as students, and (2) intuition. A third source of understanding is available from a rather small number of important experimental studies on the crystallization of silicate melts at compositions and conditions relevant to natural igneous systems.

The purpose of this one-day trip is to view a variety of textures in granitic and gabbroic rocks exposed in the Wichita Igneous Province, southwest Oklahoma, and as individuals, to evaluate the geologic history of each texture based on (1) our existing knowledge base, and then (2) on the basis of several pertinent experimental summaries that will be distributed at the beginning of the field trip. Each participant will be encouraged to develop and present his or her own interpretation of the rock texture, which may include the history of crystallization, the structural environment or rheology of the melt, qualitative estimates of intensive (e.g., P , T , $a_{\text{H}_2\text{O}}$, a_{O_2}) and extensive variables, and so forth. Some of the textures we will see and evaluate in granite include hypidiomorphic

granular, linear or cusped patterns of quartz and feldspar, orbicular, pegmatitic, granophyric, spherulitic, miarolitic. Those in gabbro include lamination (trachytic/compaction) and ophitic and heteradcumulate textures. Min.: 5; max.: 20. Cost: US\$60, includes transportation, lunch, snacks, and a field guide.

5. **Stratigraphy and Paleontology of the Upper Mississippian Barnett Shale of Texas and the Caney Shale of Southern Oklahoma.**

Fri.–Sun., 3–5 Mar. (three-day field trip). Darwin Boardman, Oklahoma State University, amm0001@okstate.edu, +1-405-744-6358, fax +1-405-744-7841.

The purpose of this field trip is to examine the stratigraphy and paleontology of the Upper Mississippian shale formations of the southern mid-continent (Barnett Shale of Texas, Caney Shale of Oklahoma). The Barnett Shale has become the largest nontraditional gas play in the United States yet detailed lithologic and paleontologic analysis remains to be completed. Additionally, the Caney Shale (roughly Barnett equivalent) is equally lacking in detailed analysis. This field trip will focus on lithic analysis along with ammonoid and conodont biostratigraphy. Min.: 10; max.: 40. Cost: US\$300, includes transportation, two nights lodging, two breakfasts, and guidebook. Participants are responsible for lunches and dinners.

6. **Facies Architecture of a Middle Pennsylvanian Incised Valley Fill: The Bluejacket (Bartlesville) Sandstone of Eastern Oklahoma.**

Fri.–Sun., 3–5 Mar. (3-day trip). Dennis Kerr, University of Tulsa, dennis-kerr@utulsa.edu, +1-918-631-3020, fax +1-918-631-2091.

Participants will examine Bluejacket lowstand and transgressive systems tract facies architecture in a distal to proximal outcrop traverse through the fill of an ancient incised valley. Outcrop observations will be related to the important Bartlesville petroleum reservoir in terms of petrophysical properties and improved reservoir exploitation strategies. Min.: 20; max.: 30. Cost: US\$125, includes transportation, two lunches, snacks, and guidebook. Participants are responsible for other meals and motel reservations; student sponsorships are being sought. Contact Dennis Kerr for further information.

During Meeting

7. **OU Campus Walking Tour.**

Mon., 6 Mar., ~4:30 p.m. Stan Krukowski, Oklahoma Geological Survey, skrukowski@ou.edu, +1-405-325-3031, fax +1-405-325-7069.

This walking tour will focus on earth resources materials used to build structures on the University of Oklahoma (OU) campus and showcase the various classical architectural styles. The campus tour is designed as an example of an educational or outreach activity on college campuses, city centers, or historical sites. Free; no participant number limit.

STUDENT ACTIVITIES

Roy J. Shlemon Mentor Programs in Applied Geoscience. Sponsored by *GSA Foundation*. Mon., 6 Mar., 11:30 a.m.–1 p.m.; location available at GSA's on-site registration desk. Karlon Blythe, GSA, kblythe@geosociety.org. This is a chance for students to discuss career opportunities and challenges with professional geoscientists from multiple disciplines. Students will receive a FREE LUNCH ticket in their registration packet to attend the Shlemon program. However, space is limited: first come, first served. For further information, contact kblythe@geosociety.org.

John Mann Mentors in Applied Hydrogeology Program. Sponsored by *GSA Foundation*. Mon., 6 Mar., 5–6:30 p.m.; location available at GSA's on-site registration desk. Karlon Blythe, GSA, kblythe@geosociety.org; Todd Halihan, Oklahoma State University, halihan@okstate.edu. This early evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with interest in applied hydrogeology or hydrology as a career to interact and network with practicing hydrogeologic professionals. This program is a focused, small-scale event that features a free pizza dinner for participants. Students will receive a ticket to attend the Mann Program event in their registration packets, but space is limited: first come, first served. For further information, contact kblythe@geosociety.org.

STUDENT SUPPORT

Travel grants are available from the South-Central Section in cooperation with the GSA Foundation for students who are presenting oral or poster papers. To be eligible, students must be GSA Student Members or Student Associates. Please visit www.geosociety.org/sectdiv/southc/index.htm#travel for details regarding application instructions. For more information, contact Matthew W. Totten, Sr., mtotten@ksu.edu.

SOCIAL ACTIVITIES

Welcoming Party and Registration. Sun., 5 Mar., 5:30–7 p.m. East Atrium, Sarkeys Energy Center, OU Campus.

Sam Noble Oklahoma Museum of Natural History. "Behind-the-scenes" tours. Limited number, small group; sign-up required at registration desk.

Bizzell Library History of Science Collections. Tours. Limited number, small group; sign-up required at registration desk.

EXHIBITORS

Exhibit booths will be available for universities, government agencies, and companies at the meeting. Those providing information on graduate school or employment opportunities are especially encouraged to attend and exhibit.

BUSINESS MEETINGS

South-Central Section Management Board Meeting. Mon., 6 Mar., 5 p.m. Location: TBA.

South-Central Section GSA Business Meeting. Mon., 6 Mar., 6:30 p.m. Location: TBA.

CONTACT INFORMATION

Local organizing committee co-chairs: Neil Suneson, nsuneson@ou.edu, +1-405-325-3031; Rick Lupia, rlupia@ou.edu, +1-405-325-7229.

Call for Geological Papers

2006 GSA Section Meetings

SOUTH-CENTRAL SECTION

6–7 March 2006

University of Oklahoma, Norman, Oklahoma

Abstract Deadline: 6 December 2005

Information: Neil Suneson, Oklahoma Geological Survey, University of Oklahoma, 100 E Boyd St., Rm N131, Norman, OK 73019-0628, +1-405-325-3031, nsuneson@ou.edu

NORTHEASTERN SECTION

20–22 March 2006

Radisson Penn Harris Hotel and Convention Center
Camp Hill/Harrisburg, Pennsylvania

Abstract Deadline: 13 December 2005

Information: Noel Potter, Dickinson College, Dept. of Geology, Carlisle, PA 17013-2896, +1-717-245-1340, pottern@dickinson.edu

SOUTHEASTERN SECTION

23–24 March 2006

Marriott Hotel, Knoxville, Tennessee

Abstract Deadline: 5 January 2006

Information: Claudia Mora, University of Tennessee, Dept. of Earth and Planetary Sciences, 1412 Circle Drive, Knoxville, TN 37996-1410, +1-865-974-5499, cmora@utk.edu

NORTH-CENTRAL SECTION

20–21 April 2006

Student Center, University of Akron, Akron, Ohio

Abstract Deadline: 25 January 2006

Information: John Szabo, Dept. of Geology, University of Akron, Akron, OH 44325-4101, +1-330-972-8039, jpszabo@uakron.edu

CORDILLERAN SECTION

(Joint Meeting with PSAAPG and SPE-A)

8–10 May 2006

University of Alaska, Anchorage, Alaska

Abstract Deadline: 7 February 2006

Check future issues of *GSA Today* for more information.

ROCKY MOUNTAIN SECTION

17–19 May 2006

Western State College, Gunnison, Colorado

Abstract Deadline: 21 February 2006

Information: Rob Fillmore, Western State College, Dept. of Natural and Environmental Sciences, Gunnison, CO 81231-0001, +1-970-943-2092, rfillmore@western.edu

STUDENTS—Mark Your Calendars!

Plan now to attend a Shlemon Mentor Program in Applied Geoscience and/or a Mann Mentor Program in Applied Hydrogeology at your 2006 Section Meeting to chat one-on-one with practicing geoscientists. These volunteers will answer your questions and share insights on 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.

FREE lunches will be served (students only) at the **Shlemon Mentor Programs**. Students will receive a free lunch ticket with their registration badge to attend each

Shlemon Program. However, space is limited: first come, first served.

FREE pizza suppers will be served (students only) at the **Mann Mentor Programs**. Students will receive a free pizza supper ticket with their registration badge to attend the Mann Program. The Mann Program is geared toward careers in hydrogeology or hydrology. Whether you've already decided to head down the hydro career path or whether you just would like to know more about these career options, this meeting is for you! However, space is limited: first come, first served.

Mentor Programs for 2006 Section Meetings

For program locations, ask at the Section Meeting registration desk.

SOUTH-CENTRAL SECTION MEETING

University of Oklahoma, Norman, Oklahoma

Shlemon Mentor Program Luncheon:

Mon., 6 March, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Program:

Mon., 6 March, 5–6:30 p.m.

NORTH-CENTRAL SECTION MEETING

Student Center, University of Akron, Akron, Ohio

Shlemon Mentor Program Luncheons:

Thurs.–Fri., 20–21 April, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Program:

Thurs., 20 April, 5–6:30 p.m.

NORTHEASTERN SECTION MEETING

Radisson Penn Harris Hotel and Convention Center

Camp Hill/Harrisburg, Pennsylvania

Shlemon Mentor Program Luncheons:

Mon.–Tues., 20–21 March, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Program:

Mon., 20 March, 5–6:30 p.m.

CORDILLERAN SECTION MEETING

University of Alaska, Anchorage, Alaska

Shlemon Mentor Program Luncheons:

Mon.–Tues., 8–9 May, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Program:

Tues., 9 May, 5–6:30 p.m.

SOUTHEASTERN SECTION MEETING

Marriott Hotel, Knoxville, Tennessee

Shlemon Mentor Program Luncheons:

Thurs.–Fri., 23–24 March, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Program:

Thurs., 23 March, 5–6:30 p.m.

ROCKY MOUNTAIN SECTION MEETING

Western State College, Gunnison, Colorado

Shlemon Mentor Program Luncheons:

Wed.–Thurs., 17–18 May, 11:30 a.m.–1 p.m.

Mann Mentors in Applied Hydrogeology Program:

Wed., 17 May, 5–6:30 p.m.

UPCOMING DEADLINES

Medals and Awards

Nominations Due 1 February 2006

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 GSA Distinguished Service Award. For details on the awards and nomination procedures, see the October 2005 issue of *GSA Today*. For the new online nomination form, go to www.geosociety.org/aboutus/awards/, or call +1-303-357-1028. Materials and supporting information for any of the nominations may be sent to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

GSA Fellows

Nominations Due 1 February 2006

The Committee on Membership requests nominations of members to be elevated to GSA Fellow status. Any GSA Fellow may nominate up to two members per election cycle for this honor. Two other supporting letters in addition to the online nomination form are needed. For details on nomination procedures, see the October 2005 issue of *GSA Today*, visit www.geosociety.org/members/fellow.htm, call +1-303-357-1028, or e-mail awards@geosociety.org.

2006 Subaru Outstanding Woman in Science Award (Sponsored by Subaru of America, Inc.)

Nominations Due 1 February 2006

This award is given to a woman who has made a major impact on the field of the geosciences, based on her Ph.D. research. For details on the award and nomination procedures, see the October 2005 issue of *GSA Today*. For the new online nomination form, go to www.geosociety.org/aboutus/awards/ or call +1-303-357-1028. Send nominations and supporting material to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

John C. Fry Environmental Geology Award Nominations Due 31 March 2006

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 2005 issue of *GSA Today*, visit www.geosociety.org, or call +1-303-357-1028. Nominations must be sent to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

Student Research Grants 2006

Online submission must be completed by Wednesday, 1 February 2006, at 11:59 p.m. (MST).

The GSA student research grant application process is available **only** online. No paper applications or letters will be accepted.

In an effort to fund more GSA Student Members, students may now only receive GSA graduate student research grant money once at the master's level and once at the Ph.D. level. This policy affects all GSA research grantees retroactively. Those who have applied for grant funding but who did not receive a grant are welcome to apply again.

For further information on the 2006 Research Grant Program, see the October 2005 issue of *GSA Today*, visit www.geosociety.org/grants/gradgrants.htm, call +1-303-357-1028, or e-mail awards@geosociety.org.

Congressional Science Fellowship Applications Due 1 February 2006

For application information for the 2006–2007 GSA–U.S. Geological Survey Congressional Science Fellowship, visit www.geosociety.org/science/csf/ or contact Ginger Williams, GSA Headquarters, +1-303-357-1040, gwilliams@geosociety.org.

National Awards

Nominations Due 30 April 2006

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 2005 issue of *GSA Today*. Nominations should be sent to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

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CALL FOR APPLICATIONS:

Planetary Geology Division's Stephen E. Dworkik Student Paper Award

THE AWARD

Planetary geologist Stephen E. Dworkik established this award in 1991 to provide encouragement, motivation, and recognition to outstanding future scientists. Two awards are given annually, one for the best oral presentation, the other for the best poster presentation; each winner receives a citation and US\$500. The program is administered through the Planetary Geology Division of the Geological Society of America. The GSA Foundation manages the award fund.

CRITERIA

The Dworkik Student Paper Award applies to papers presented at the annual Lunar and Planetary Science Conference held each March in Houston. Student applicants must be (1) the senior author of the abstract (the paper may be presented orally or in a poster session); (2) a U.S. citizen; and (3) enrolled in a college or university,

at any level of their education, in the field of planetary geosciences. Papers will be judged on the quality of the scientific contributions, including methods and results; clarity of material presented; and methods of delivery, oral or display.

TO APPLY

The application form and instructions are found in the call for papers for the 37th Lunar and Planetary Science Conference, to be held 13–17 March 2006 at the South Shore Resort and Conference Center, League City, Texas.

Please visit www.lpi.usra.edu/meetings/upcomingmeetings.shtml for more information.

GSA Offers Awards in Geomorphology and Micropaleontology



Two of GSA's most prestigious awards supporting research are made possible by the generosity of the late W. Storrs Cole. Qualified GSA Members and Fellows are urged to apply. The Gladys W. and W. Storrs Cole Award funds are managed by the GSA Foundation.

The **Gladys W. Cole Memorial Research Award** provides support for the investigation of the geomorphology of semiarid and arid terrains in the United States and Mexico. GSA Members and Fellows between the ages of 30 and 65 who have published one or more

significant papers on geomorphology are eligible for the award. While the funds may not be used for work that is already finished, recipients of previous awards may reapply if they need additional support to complete their work. The 2006 award is for US\$8,200.

The **W. Storrs Cole Memorial Research Award** supports research in invertebrate micropaleontology. For 2006, this award carries a stipend of US\$7,500 and will go to a GSA Member or Fellow between the ages of 30 and 65 who has published

one or more significant papers on micropaleontology.

2006 application forms are available at www.geosociety.org/grants/postdoc.htm. For more information, contact Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140, awards@geosociety.org, or call +1-303-357-1023.

Applications must be received via post on or before 1 February 2006.

Medlin Scholarship Award Offered

by GSA Coal Division

GSA's Coal Geology Division announces the availability of the Antoinette Lierman Medlin Scholarship in Coal Geology for the 2006–2007 academic year. The scholarship provides 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 US\$2,000 will be available for the 2006–2007 scholarship award. In addition, the recipient of the scholarship may be provided with a stipend to present the results of the research at the 2007 GSA Annual Meeting.

For the academic year 2006–2007, 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 his or her study at the 2007 GSA Annual Meeting.

A panel of coal geoscientists will evaluate proposals for the scholarship and the field study award. Students 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 that includes a statement of financial need and the amount and nature of other available funding for the research project.

Send the material to: Gretchen Hoffman, New Mexico Bureau of Geology, 801 Leroy Place, Socorro, NM 87801, USA, gretchen@gis.nmt.edu, fax +1-505-835-6333.

The proposal and letter of recommendation must arrive no later than **15 February 2006**. Applicants will be notified of the scholarship committee's decision by 1 April 2006.

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 of the Antoinette Lierman Medlin Scholarship fund, which is managed by the GSA Foundation.



Changes to GSA Graduate Student Research Grant Eligibility Beginning 2006

In an effort to fund more GSA Student Members, students may now only receive GSA graduate student research grant money once at the master's level and once at the Ph.D. level. This policy affects all GSA research grantees retroactively.

Those who have applied for grant funding but who did not receive a grant are welcome to apply again.

To apply, please go to www.geosociety.org/grants/gradgrants.htm. **Online applications are due by Wed., 1 February 2006, at 11:59 p.m. (MST).**

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A Category 5 Adventure

*Sarah K. Noble, 2004–2005 GSA–U.S. Geological Survey
Congressional Science Fellow*



It has been quite a year working with the House Science Committee's Space Subcommittee, one that seems to have both started and ended amidst hurricanes. In fact, maybe that's a good symbol for the whirlwind adventure that was my past year as Congressional Science Fellow.

Stormy Weather

The first storm I encountered on this journey was the remnants of a hurricane whose name I can no longer remember. It reached Rhode Island just as I was loading the last of my belongings into the moving-truck; I was lucky that almost everything stayed dry. I arrived at my new home in Washington, D.C., just as the remnants of another storm (that I also can't remember the name of) hit. For the second time in a week, I lucked out and managed to get almost everything inside just as the rain started to fall.

A few weeks later, I was reminded just how lucky I was when I tried to interview in the office of Senator Bill Nelson (Dem.-Fla.). I was asked to call back in a few months when they would have time to deal with something besides hurricane relief. Clearly, my experience of the hurricane season of 2004 was mild compared to that of the citizens of Florida. Of course, now even those devastating hurricanes have been overshadowed by Hurricane Katrina. Katrina is a name I am not likely to forget, and neither is Rita.

It's interesting how in this town everything happening in New Orleans and along the Gulf Coast seems to be both closer and farther away. Closer, because it affects members of Congress like Rep. Charlie Melancon, a member of my committee, whose southeastern Louisiana district was devastated by Katrina and hit again by Rita. I spent a good portion of my Labor Day weekend volunteering in Melancon's office, where I got a close-up view of the situation. As personal as that experience was, in some ways the whole tragedy

seemed so far away because everything here is distorted through a weird political lens. From the minute Katrina made landfall, I could hear the buzz in this town: How will this affect my poll numbers? Can we use this to push for higher fuel efficiency standards? In D.C., everything is political, all the time.

I have even found myself looking through that political lens, trying to figure out how Katrina will affect the Space Subcommittee. How much damage was there at the two National Aeronautics and Space Administration (NASA) facilities in Katrina's path? How will that affect the launch schedule for the next shuttle? Where will the money for repairs come from? How long will this distract the Senate from finding time to pass that NASA bill? I guess it's an occupational hazard.

Shouting into the Wind

In the wake of Katrina, I cringed to hear President Bush and others say that they had been caught off guard, that they were surprised the levees broke. How is that possible? Scientists and engineers had been warning for years that New Orleans was in danger, and yet it appears that their warnings fell on deaf ears. Why weren't they listened to? Indeed, it often feels like scientists are shouting into the wind.

In my last article, I talked about how useful it can be to establish and maintain a relationship with your Congress members and their staff, providing your

opinion and expertise when appropriate. However, it has become increasingly clear to me this year that simply having access to experts isn't enough.

Here is where I think sometimes we as scientists fail to have an impact: we are, by nature, logical. We assume that all we have to do is explain things to people and they will see the logic, jump on board, and do the logical thing. Things don't work that way in D.C. Logic isn't the only driver in this town. In fact, logic is pretty far down the list. Politics, economics, and a million other factors go into every decision that our lawmakers consider.

I have witnessed the phenomenon of the logical scientist firsthand many times this year when scientists have come in to talk about various projects. They bring in cool pictures. They talk about the exciting science results they are hoping to find. And they think that's enough. But it's only the start. They need to go further, to put the science into context, to justify it.

Congress members want to know what's in it for them and their constituents. Will it provide jobs? Bring money or prestige to a university or facility in their district? Is there an outreach program or some sort of student involvement? Will there be technology spinoffs? These are the kinds of considerations that can make your science relevant. No matter how fabulous your project is, without context, you're just one more person asking for money.

In The Eye of the Storm

Despite that advice, I don't think that anyone could argue that lack of relevance can account for the lack of action to secure New Orleans. I really don't have an answer for that. I wish I did. Perhaps our government officials just closed their eyes, crossed their fingers, and hoped that New Orleans would continue to be lucky. Or maybe the 14-billion-dollar price tag on the proposed Louisiana Coastal Area Ecosystem Restoration Project gave them sticker shock. (Isn't it funny how suddenly \$14 billion over 30 years seems like chump change when compared to cleanup and rebuilding costs?) There are numerous investigations under way in Congress and the rest of the government to search for those answers; maybe they'll even find some.



Whatever the excuses, my sincere hope is that we can all learn from this tragedy. I hope, in particular, that our government understands that ignoring the scientific community doesn't make the problem go away. The optimist in me would like to think that we can learn from our mistakes and that, next time, the voices of the scientists will be heard. So, ultimately, my advice is: keep shouting.

After the Rain

The Gulf Coast will forever be changed by the hurricanes. Homes and lives will be rebuilt, but things will never be exactly the way they were before. For so many, a line has been drawn across the timeline of their lives. Their memories will now be filed as either before Katrina and Rita or after.

In some small measure, I feel the same way about my time in Washington. My life will forever be changed by this fellowship. Part of that change is the friendships and connections that I have made here, but a lot of it is because "Congress" and "The Government" are no longer black boxes to me. I understand much more clearly

now how it all works (or doesn't, as the case may be). That understanding has changed my perspective. I no longer feel helpless. You won't ever catch me sitting around wondering why "someone doesn't do something about that," but rather, I'll be thinking, "What can I do about that?" As scientists, we all know that knowledge is empowering, and I have gained an unbelievable amount of knowledge this year.

Public Service Message

Speaking of empowering knowledge: One of the projects that I worked on this year, and that I'm very proud of, is our brand new committee Web site, <http://sciencedems.house.gov>. There you can find all kinds of information about what is happening in the science committee, information on bills and investigations, transcripts from hearings, member speeches, and more. The resources on this site can keep you informed and educated about the complex goings on of science policy.

In addition to science committee information, there is also a section titled "Science Education & You." This is my main contribution to the site. These

pages are designed as a clearinghouse of federal educational resources for K-16 math and science teachers. By providing access to science and math lesson plans, internship information, summer program opportunities, and countless other resources, our hope is that this site will become a valuable tool for students and educators across the country.

I hope that you will find some time to explore the site and send your comments and suggestions to the committee staff. If you find the site useful, please pass it on to your friends and colleagues.

This manuscript is submitted for publication by Sarah Noble, 2004-2005 GSA-U.S. Geological Survey Congressional Science Fellow, with the understanding that the U.S. government is authorized to reproduce and distribute reprints for governmental use. The one-year fellowship is supported by GSA and by the U.S. Geological Survey, Department of the Interior, under Assistance Award No. 02HQGR0141. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government. Noble can be reached at sarah.noble@mail.house.gov.

Call for Applications

Apply for the GSA-USGS Congressional Science Fellowship for 2006-2007

Opportunities to serve as a Congressional Science Fellow are rare, unique experiences. This position may be a good fit for you. It will enable you to work directly with national leaders and put your expertise and experience to work helping shape science and technology policy on Capitol Hill.

The Congressional Science Fellow will be selected from top competitors early in 2006. Prospective candidates should be GSA Members with a broad geoscience background and excellent written and oral communication skills.

Minimum requirements are a master's degree with at least five years professional experience or a Ph.D. at the time of appointment.

If you possess this professional background, have experience in applying scientific knowledge to societal challenges, and share a passion for helping shape the future of the geoscience profession, GSA invites your application.

The fellowship is open to U.S. citizens or permanent U.S. residents.

Deadline to apply: 1 February 2006

For application information, visit www.geosociety.org/science/csf/
or contact Ginger Williams, GSA Headquarters +1-303-357-1040, gwilliams@geosociety.org.



Planned Giving Options Give Donors the Ability to Give Generously Today and in the Future

At this time of the year, thoughts turn to planned giving and tax benefits. The following are several ways you can include the GSA Foundation in your plans. Current tax laws encourage charitable giving as a way to reduce income taxes for those who itemize on their returns.

Planned Giving Options and Benefits

Cash Gifts are the easiest and most effective way to give to GSA Foundation. Subject to certain tax limits, you can receive a full tax deduction for the amount of your cash gift in the year you make your gift. The higher your tax bracket, the more potential for tax savings.

Gifts of Stocks, Bonds, Mutual Funds, and Real Estate that have appreciated in value and have been owned for more than one year can result in triple tax savings. You may receive an income tax deduction on the market value, not the original price, of the securities or real estate, and you bypass any capital gains tax on the gain or growth since the time of purchase. Opportunities for state capital gains tax savings may also exist.

Bequests provide a way for you to remember GSA Foundation in your will and can reduce your inheritance taxes. Your will can designate gifts of cash, securities or other property, or a percentage of the remainder of your estate. The suggested legal wording is as follows:

For specific bequest: *I leave [dollar amount] to the Geological Society of America Foundation, Inc., P.O. Box 9140, Boulder, CO 80301, USA, to be used for general purposes.*

For residual bequests: *All the rest, residue, and remainder of my estate, real and personal, I give, devise, and bequeath to the Geological Society of America Foundation, Inc., P.O. Box 9140, Boulder, CO 80301, USA.*

Gifts of Life Insurance can be made in the form of a new policy or an existing policy. Premiums paid by the donor on a donated life insurance policy qualify for charitable tax

deductions. If an existing policy is paid in full, your charitable contribution is generally the replacement value or the cost basis of the policy.

Gifts of Retirement Plan Assets can be arranged through naming GSA Foundation as a beneficiary of your retirement plan or IRA. This option is especially effective in minimizing estate taxes. Retirement assets can also be placed in charitable trusts, maximizing your financial and estate planning benefits.

Life Income Gifts can be made through charitable remainder trusts, charitable lead trusts, charitable gift annuities, and pooled income funds. These arrangements offer substantial tax savings while providing an annual income to you, your family, or others. When appreciated assets or property are placed in these arrangements, the assets are reinvested and diversified and may produce a greater yield for the donor or beneficiaries.

To receive a complimentary copy of *A Guide to Creative Planned Giving*, please contact Donna Russell, director of operations, GSA Foundation, drussell@geosociety.org, +1-303-357-1054.

Don't Forget!

Make sure your 2005 contributions to the Foundation are postmarked by 31 December 2005.



Most memorable early geologic experience:

I was fortunate to have been mentored by the late Vincent C. Kelley at the University of New Mexico in the early 1960s. He stressed the importance of field mapping, a quality that I have tried to imprint on my own students. He accompanied me during the early phases (1963) of mapping on my dissertation project, the Sierra Blanca Volcanic Field in South-Central New Mexico. Rather than answering directly, he asked questions that made me arrive at plausible interpretations to field sites. That approach to field work is critical in training young geologists.

—Tommy Thompson



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Call for Field Trip Proposals



The Pursuit of Science

Geological Society of America

Annual Meeting & Exposition • Philadelphia, Pennsylvania

Technical Program • 22–25 October 2006

FIELD TRIP CHAIR

Frank J. Pazzaglia,
Dept. of Earth
and Environmental Sciences
Lehigh University
31 Williams Drive, Bethlehem, PA 18015
+1-610-758-3667, fax: +1-610-758-3677, fjp3@lehigh.edu

The GSA Annual Meeting's return to the east brings with it many opportunities for great field trips throughout the area. We are interested in proposals for half-day, single-day, and multi-day field trips beginning or ending in or near Philadelphia and dealing with all aspects of the geosciences. While the planning for some trips is already under way, many more areas and topics are still open; we are looking for leaders to take these trips and give them a personal touch.

Take a look at the suggested topics and areas below (or propose a different one) and let Field Trip Chair Frank Pazzaglia (+1-610-758-3667, fjp3@lehigh.edu) know you are interested.

Due Date for Field Trip Proposals: 15 January 2006.

LEAD ONE OF THESE TRIPS AT THE 2006 GSA ANNUAL MEETING:

- A Geologic Transect of New England
- Geology of the Hudson Valley and Taconic Highlands, New York
- Geology, Glaciers, Landscape Evolution, and Active Tectonics of the Susquehanna River basin, Pennsylvania (Frank Pazzaglia and Duane Braun)
- A Geologic Transect along the Potomac River
- Geology and Tectonics of the Blue Ridge
- Coastal Plain Stratigraphy and Paleontology
- Ecology and Hydrology in the Chesapeake Bay Watershed
- Milankovitch Cyclicality, Sedimentology, and Stratigraphy of the Newark Supergroup

- The K-T Boundary in New Jersey
- Coastal Processes and Beach Communities
- Quaternary Geochronology of the Middle Atlantic Coastal Plain
- Urban Geology Walking Tours of Fall Zone Cities—New York, Philadelphia, Baltimore, and Washington, D.C.
- History and Geology of Revolutionary and Civil War Battlefields

2006 PROPOSED FIELD TRIPS

Watch for more information on the following trips in upcoming issues of *GSA Today*.

Devonian Fossil Fish of Central Pennsylvania

One day; Ted Deschler, Philadelphia Academy of Science
Proposed to be held in conjunction with a technical session.

Haddonfield Dinosaur Site

One day; Jan Twitchell, HATCH Dinosaur Sculpture Committee

Historical Geology of the American Philosophical Society, Academy of Natural Sciences, and Franklin Institute

One day; Sally Newcomb and Gary Rosenberg, History of Geology Division

Metamorphic Rocks in the Philadelphia Area

One to three days; Hal Bosityshell, West Chester University

Metamorphic History of the Honey Brook Upland and its Paleozoic Cover

One day; Joe Pyle, Rensselaer Polytechnic Institute

A Tour of the Peach Bottom Slate—Once the Best Building Slate in the World

One day; Jeri Jones, Jones Geological Services

Building on a Foundation of Discovery

ANNOUNCEMENTS.....

MEETINGS CALENDAR

2006

- | | |
|-----------------|--|
| 5–8 March | Earth & Space 2006, 10th International Conference on Engineering, Construction and Operations in Challenging Environments, League City, Texas, USA. American Society of Civil Engineers, Aerospace Division. Information: www.asce.org/conferences/space06 . |
| 2–7 April | EGU 2006, General Assembly of the European Geosciences Union, Vienna, Austria. Information: http://meetings.copernicus.org/egu2006/ . |
| 3–7 April | Backbone of the Americas—Patagonia to Alaska, Mendoza, Argentina. Co-convened by Asociación Geológica Argentina and GSA. Information: Deborah Nelson, dnelson@geosociety.org , +1.303.357.1014, www.geosociety.org/meetings/06boa/ . |
| 8–12 May | First International Conference on Impact Cratering in the Solar System, Noordwijk, The Netherlands. Information: European Space Agency, Postbus 299, 2200 AG, Noordwijk, The Netherlands, +31-71-5653613, agustin.chicarro@esa.int , www.rssd.esa.int/ . |
| 8–14 June | Lockne 2006: Impact craters as indicators for planetary environmental evolution and astrobiology, Östersund, Sweden. Information: Jens Ormö, ormo@inta.es , www.geo.su.se/Lockne2006 . |
| 13–15 June | 5th European Congress on Regional Geoscientific Cartography and Information Systems—Earth and Water, Barcelona, Spain. Information: www.icc.es/econgeo2006/home.html . |
| 2–7 July | Australian Earth Sciences Convention 2006, Geological Society of Australia 18th Australian Geological Convention and Australian Society of Exploration Geophysicists 18th International Geophysical Conference and Exhibit, Melbourne, Australia. Information: www.earth2006.org.au . |
| 16–21 July | Zeolite'06: The 7th International Conference on the Occurrence, Properties, and Utilization of Natural Zeolites, Socorro, New Mexico, USA. Information: Robert S. Bowman, New Mexico Institute of Mining & Technology, bowman@nmt.edu , www.ees.nmt.edu/Zeolite06 . |
| 26–27 August | 4th International Gemological Symposium, GIA Gemological Research Conference, San Diego, California, USA. Information: James E. Shigley, +1.760.603.4019, gemconference@gia.edu , www.symposium.gia.edu/ . |
| 11–14 September | HydroEco2006, International Multidisciplinary Conference on Hydrology and Ecology: The Groundwater/Ecology Connection, Karlovy Vary (Carlsbad), Czech Republic. Information: Conference Secretariat HydroEco2006, c/o ITC Travel & Conference, Konevova 41, CZ-13000 Prague, Czech Republic, +420-222-580-079, fax +420-222-582-282, hydroeco2006@itctravel.cz . |

2007

- | | |
|------------|---|
| 18–22 June | Alluvial Fans 2007, Banff, Alberta, Canada. Information: http://husky1.smu.ca/~pgiles/AF2007/AlluvialFans2007.htm . |
|------------|---|

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

About People

The Antarctic geological drilling program (ANDRILL), led in the U.S. by GSA Fellow **Ross Powell** and GSA Member **David Harwood**, has received nearly \$12 million in funding from the National Science Foundation. Harwood is the director of the ANDRILL Science Management Office; Powell serves as co-chief scientist for ANDRILL and fellow U.S. co-leader with Harwood.

GSA Fellow **Molly F. Miller** has been awarded the 2005 Association for Women Geoscientists Foundation Outstanding Educator Award. The award was bestowed at the AWG breakfast on 17 Oct. 2005 at the GSA Annual Meeting in Salt Lake City, Utah.

GSA Senior Fellow **Gerald M. Friedman** is the recipient of the American Geological Institute's 2005 Legendary Geoscientist Award. This award is presented to scientists who demonstrate a long history of scientific achievement and exceptional service to the geoscience profession. Friedman is also GSA's 2005 Mary C. Rabbitt History of Geology Awardee.

GSA Honorary Fellow Sir **Nicholas Shackleton** has been awarded the Founders Medal of the Royal Geographical Society (London, UK) for advancing international understanding of paleoceanographic and Quaternary environmental change.

AGI Names New Officers

GSA Fellow **Ernest A. Mancini** has been named president of the American Geological Institute (AGI). He was inducted into office on 18 October 2005 at the Friends of AGI reception at the GSA Annual Meeting in Salt Lake City, Utah. AGI also appointed three new officers: GSA Senior Fellow **Gail M. Ashley** will serve as president-elect to AGI; GSA Member **Richard M. Powers** is AGI's new member-at-large, and GSA Fellow **James C. Cobb** will serve as AGI's treasurer.

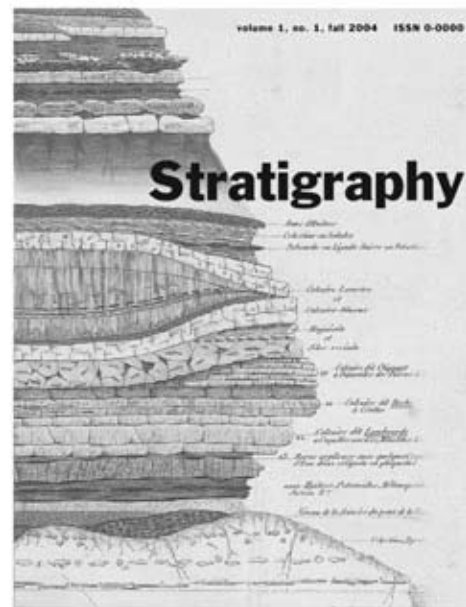
Publication Pipeline to Aid Hurricane Area Universities

In the November issue of *GSA Today* (p. 23), an article by GSA Fellow **George D. Klein** (gdkgeo@earthlink.net) on the AAPG Publication Pipeline Committee solicited donations of books and journals for educational use in developing countries. The committee is now working with GSA to donate needed books and journals to geology departments that were in the paths of Hurricanes Katrina and Rita. The committee is awaiting word from the universities affected (Tulane University, University of New Orleans, University of Southern Mississippi, and Lamar University), which will come once the university faculty are able to return to campus and can assess the damage to their collections. For more information, contact the AAPG Publication Pipeline Committee Chairman, Rick Wall, at rwall@sampson.com or rwall1@hotmail.com.

Dr. A.H. Heineken Prize for Environmental Sciences 2006: Nominations Requested

These international prizes reward outstanding scientific achievement in various fields, including environmental science. The Royal Netherlands Academy of Arts and Sciences (KNAW) selects the winners of the Heineken Prizes on the basis of nominations received from both institutes and individual researchers. For more information, go to www.knaw.nl/. The deadline for nomination is 1 January 2006; laureates will be announced in April 2006.

"Stratigraphy explains geology" – Y. Gladenkov



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Call for Proposals:

Professional Development Short Courses and K–12 Education Workshops

The GSA Committee on Professional Development invites those interested in proposing a short course or workshop to contact GSA Headquarters for proposal guidelines. This invitation is extended to K–12 teachers, teacher trainers, preservice educators, and undergraduate educators to submit proposals for K–12 education workshops. Committee members are interested in receiving course proposals for the 2006 GSA Annual Meeting in Philadelphia or the 2007 GSA Annual Meeting in Denver.

Proposals must be received by 1 January 2006. Selection of courses for 2006 will be made by 1 March 2006. We will also consider courses for 2007 during this time.

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

Forensic Geomorphology

Stanley A. Schumm, Mussetter Engineering, Inc., Fort Collins, Colorado, stans@mussei.com

According to Tank (1983, p. 12), geologists have testified as expert witnesses in litigation involving landslides, subsidence, erosion, ground and surface water problems, mineral discovery, mine safety, oil and gas discovery and ownership, environmental disputes, soil conditions, and criminal cases. Engineers are also involved in geomorphic-type forensic activity, especially with regard to the causes and effects of mass movement, river hydraulics, and flooding (Shuirman and Slosson, 1992; Rens, 1997). During the past 35 years, I have been involved as an expert witness in hearings, depositions, and trials that were related to channel incision, river boundaries, bank erosion, island ownership, water rights, and river navigability. This type of activity is considered to be part of the work of forensic geomorphology.

The term *forensic* brings to mind experts testifying during a criminal trial. This is understandable because of the popular mystery novels by Sarah Andrews that involve a criminal forensic geologist and books describing how forensic geologists use mineralogy and sedimentology to locate the sites of criminal activity (Murray, 2004). However, these limit the meaning of forensic, which is much broader. Forensic pertains to legal proceedings or argumentation (Morris, 1981). Black (1979) states that forensic medicine involves the “application of every branch of medical knowledge to the purpose of the law.” If we substitute geomorphic knowledge for medical knowledge, we have a definition of forensic geomorphology that applies to both criminal and civil litigation.

The purpose of this commentary is to encourage my friends and colleagues to become involved as experts in geomorphic litigation (Coates, 1976). In several instances, I have found highly qualified geomorphologists reluctant to be involved in cases in which they clearly could contribute to an appropriate outcome. For example, boundary disputes, where a river forms the boundary, require geomorphic input. Perhaps my fellow geomorphologists are deterred by examples of television program cross-examinations. In reality, a judge would never allow the speechifying that occurs during television trials, and in my experience, cross-examination has always been professional and reasonably civil.

An individual can be qualified as an expert “by knowledge, skill, experience, or education.” The expert may testify in the form of an opinion if “(1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case” (Federal Rules of Evidence, 2004).

There are three phases of litigation that involve expert witnesses. The first is the pretrial deposition, during which opposing counsel questions the expert witness in order to determine what was done and what the expert’s conclusions are. The purpose is to allow the opposition to learn as much as possible about the expert’s activities and opinions and what he or she will testify to in court. In this procedure, the questions are designed to elicit information, and the situation can be informal. Next is direct testimony, during the trial, when the expert’s opinions are expressed during questioning by the expert’s attorney. This is straightforward and professional. The final phase is cross-examination, when opposing counsel attempts to weaken the previous testimony and perhaps to show conflict between testimony in the deposition and testimony during direct examination, which is often referred to somewhat dauntingly as impeachment. This, of course, is the most stressful part of the expert’s involvement. However, if the expert is convinced that his or her testimony is accurate, the response to cross-examination will essentially be a repeat of the deposition and direct testimony.

The following is some helpful advice provided to me by attorneys with whom I have worked:

1. Be truthful—If you lie or are less than straightforward with an answer to a question, you will appear to be biased, and you will lose credibility. If your reputation is damaged, not only will you be damaged, but so will your client.
2. Listen carefully—Answer only the questions asked, and do not guess or speculate. “I do not know” is an appropriate answer. Remember, you can only be questioned in your area of expertise.
3. Provide short answers—Answer as briefly as possible, and do not volunteer information that was not requested.
4. Short but not too short—Do not answer yes or no to a complex question. You can always explain your answer.
5. You can always request a time-out if you are tired or require a break.
6. An appropriate response to an “isn’t it possible” question is “yes, but it is improbable.”
7. Do not joke or be flippant or sarcastic, and do not lose your temper.
8. Avoid jargon and keep explanations simple, especially before a jury.

The reason people hesitate to act as expert witnesses is that they feel that they will be made to appear incompetent or even foolish under cross-examination. That is, they are afraid that some fast-talking, know-it-all lawyer is going to make fools of them. However, most trial lawyers are afraid that some fast-talking, know-it-all witness is going to make

fools of them—or worse, is going to destroy their cases. A seasoned trial lawyer may not appear nervous—but most live with butterflies in their stomachs (Baker, 1983).

Remember, you are on better ground than the questioner. He or she can only ask questions; if you know the answers, you are in control. Often, if the expert has done a thorough and professional job, the opposition will accept defeat, and the case is settled before trial.

Examples of litigation related to river boundary disputes, causes of bank erosion, and the effect of diversions on channel morphology are provided by Bowman (1923), Womack (2001), Schumm, (1994), and Gordon (1995).

A well-trained geoscientist who understands the argument advanced by the opponent and who has done all of the field work, literature review, and data analysis necessary has nothing to fear from cross-examination. Of course, if the expert's investigations reveal that the case is weak or, if in fact, the position of the expert's employer is incorrect, it is the expert's obligation to so inform his employer and his attorney so that a trial can be avoided. Finally, a major obligation of the expert is to educate the attorney regarding the technical aspects of the case and to assist in developing a plan for the presentation of evidence and cross-examination.

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GSA Special Papers

Reconstruction of Pleistocene Ice-Dammed Lake Outburst Floods in the Altai Mountains, Siberia

by Jürgen Herget

In the Altai Mountains, located in southern Siberia, some of the largest floods in Earth's history occurred in Pleistocene times. The floods were caused by ice-dammed lake outburst floods comparable with glacial Lake Missoula events. In this volume, the remnants of the repeated jökulhlaups and key features of the local Pleistocene environment are described in review. The volume also focuses on the paleohydraulic interpretation of the traces of the floods to reconstruct their magnitudes and characteristics. Herget applied several established methods in the study as well as developed and applied new approaches (e.g., hydraulic interpretation of run-up sediments, fluvial gravel dunes and local scour around obstacles).

SPE386, 117 p., ISBN 0-8137-2386-8
\$65.00, member price \$52.00

Coal Systems Analysis

edited by Peter D. Warwick

Coal is an important and required energy source for today's world. Current rates of world coal consumption are projected to continue at approximately the same (or greater) levels well into the twenty-first century. This collection of papers provides an introduction to the concept of coal systems analysis and contains examples of how coal systems analysis can be used to understand, characterize, and evaluate coal and coal gas resources. Coal systems analysis incorporates the various disciplines of coal geology to provide a complete characterization of the resource.

SPE387, 111 p., ISBN 0-8137-2387-6
\$60.00, member price \$48.00

Plates, Plumes, and Paradigms

edited by Gillian R. Foulger, James H. Natland,
Dean C. Presnall, and Don L. Anderson

This beautiful compendium of work on hotspot volcanism documents the development, current state-of-play, and future prospects of all branches of the subject. It contains extensive and indispensable reference resources in the form of hotspot, tectonic, volcano and tomographic maps and cross sections of Earth. Some chapters outline the history of the plume hypothesis and other theories for the genesis of hotspots, and several provide tutorials that will be valuable to students and cross-disciplinary scientists. Other chapters present innovative models and theories for individual localities, volcano genesis processes, and related global observations. Many of these include subject reviews, making them doubly valuable to specialists and non-specialists alike. The book is fully interdisciplinary, encompassing geophysics, geochemistry, noble gases, heat, temperature, tectonics, petrology, mantle dynamics, impacts, and syntheses reconciling several branches of earth science. Included are chapters that advocate the plume model and ones that advocate alternative models. The book will enjoy a long lifetime of usefulness and functions as a reference work for students, scholars, and informed lay people. It is equally valuable for supporting advanced undergraduate or post-graduate courses and research scientists working at the forefront of hotspot science. It is an essential addition to the bookshelves of

every science library, earth science teacher, and research scientist who aspires to understand the frontiers of this exciting subject. With over 150 color plates, it makes a beautiful addition to the library of anyone fascinated by volcanoes—one of nature's most exciting and extraordinary phenomena.

SPE 388, 861 p. plus index, ISBN 0-8137-2388-4
\$180.00, member price \$144.00

Fifth Hutton Symposium: The Origin of Granites and Related Rocks

edited by S. Ishihara, W.E. Stephens,
S.L. Harley, M. Arima, and T. Nakajima

Granitic rocks are the most important component of Earth's upper continent crust, but their origin remains a topic of considerable debate. Recent developments have underscored the importance of modeling physical and chemical processes as well as the application of field techniques. The Fifth Hutton Symposium on the Origin of Granites and Related Rocks was held in Toyohashi, Japan, in September 2003 to review current thinking on this age-old debate. Some 27 invited papers are collected in this volume and represent all principal areas of research activity. The volume includes papers describing unifying models and new paradigms consistent with recent research, and contributions span the range from anatexis to emplacement and late-stage mineralization. A significant feature of this particular volume is the major contribution by scientists from the Far East both to generic aspects of granite magmatism and to studies of regional importance.

SPE389, 392 p., ISBN 0-8137-2389-2
\$95.00, member price \$76.00

Stone Decay in the Architectural Environment

edited by Alice V. Turkington

Some structures are constantly under threat from natural and human-induced decay processes, yet stone buildings, structures, and works of art remain a permanent feature in our cultural heritage. This volume presents recent research by an international group of geologists and geomorphologists on stone decay in the architectural environment, and it updates the latest theoretical and methodological advances in this field. The volume will be informative to earth scientists concerned with rock weathering in natural and urban locales, and it will be of benefit to those conservators, practitioners, scientists, and students whose interest lies at the interface between research and its application.

SPE390, 61 p., ISBN 0-8137-2390-6
\$45.00, member price \$36.00

Net Dextral Slip, Neogene San Gregorio–Hosgri Fault Zone, Coastal California: Geologic Evidence and Tectonic Implications

by William R. Dickinson, Mihai Ducea, Lewis I. Rosenberg,
H. Gary Greene, Stephan A. Graham, Joseph C. Clark, Gerald E. Weber,
Steven Kidder, W. Gary Ernst, and Earl E. Brabb

The San Gregorio–Hosgri fault is the major subsidiary strand of the San Andreas fault system in coastal California, where its course is partly onshore and partly offshore. Understanding the path and amount of San Gregorio–Hosgri fault displacements is important for understanding the geologic history of California and seismic hazard along the California coast. This Special Paper summarizes evidence for 156 km of net San Gregorio–Hosgri fault slip based on an analysis of onshore and offshore geologic mapping supplemented by reappraisal of key geologic features offset by San Gregorio–Hosgri fault movements.

SPE391, 43 p., ISBN 0-8137-2391-4
\$40.00, member price \$32.00

A Typology of Sculpted Forms in Open Bedrock Channels

by Keith Richardson and Paul Anthony Carling

Bedrock channels are important agents of erosion in mountainous areas, and understanding them is vital to the development of models of landscape evolution. Despite this, erosional sculpted forms in bedrock channels are a neglected area of research and are at present poorly described. This heavily illustrated book provides a comprehensive description and classification of bedforms in bedrock channels over a range of spatial scales and develops a consistent terminology, placing the study of sculpted forms in bedrock on a more rational footing alongside that of depositional bedforms. The authors then use the descriptions to define general principles governing the development of sculpted forms. They also show that erosional features in bedrock provide a wealth of information regarding flow structures, erosion processes and the origins of bedforms.

SPE392, 108 p., ISBN 0-8137-2392-2
\$55.00, member price \$44.00



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**The Mojave-Sonora Megashear Hypothesis:
Development, Assessment, and Alternatives**
*edited by Thomas H. Anderson, Jonathan A. Nourse,
James W. McKee, and Maureen B. Steiner*

This volume provides a comprehensive overview of the idea that a great fault, the Mojave-Sonora megashear, served as the plate boundary of southwestern North America in the Late Jurassic. The volume is organized into three parts to illuminate separate aspects of the megashear controversy. For the first time, the original U-Pb analyses and field observations that led to development of the megashear hypothesis are presented (three articles) along with their detailed geologic context. Seventeen papers included in the assessment section document significant efforts by numerous geoscientists to tackle various aspects of the problem. Finally, to provide a balanced perspective, we include five articles in the alternatives section that argue against existence of the megashear as originally proposed and provide alternative interpretations to explain geologic relations in northern Mexico and the southwestern United States. The volume includes diverse studies that consider the stratigraphy, structure, geochronology, geochemistry, and paleontology of relevant geologic units.

SPE393, 712 p. plus index, CD-ROM, plates, ISBN 0-8137-2393-0
\$140.00, **member price \$112.00**

Caribbean-South American Plate Interactions, Venezuela
edited by Hans G. Avé Lallemant and Virginia B. Sisson, 2005

Rocks in plate boundary zones are generally strongly deformed. Rocks in the Mesozoic-Cenozoic Caribbean-South American plate boundary zone in Venezuela are no exception. The first of four major deformation events occurred in Jurassic to Early Cretaceous time and is expressed by normal faults recognized in seismic reflection lines and by extensional mylonites in the Tinaquillo alpine-type peridotite. Subsequently, Early Cretaceous subduction created high-pressure-low temperature mélanges that were exhumed in the Late Cretaceous to Eocene. Next, north-south contraction resulted in an Eocene fold and thrust belt. The final event from Eocene to Recent resulted in west to east diachronous, right-oblique convergence and collision of the Leeward Antilles arc. All of this is documented with new geochronology, geochemistry, petrology, sequence stratigraphy, structural geology, and reflection seismology.

SPE394, 331 p. plus index, plates, ISBN 0-8137-2394-9
\$80.00, **member price \$64.00**

Isotopic and Elemental Tracers of Cenozoic Climate Change
edited by Germán Mora and Donna Surge

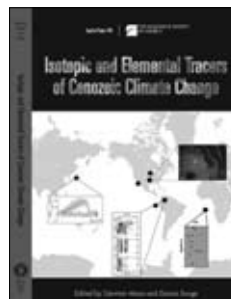
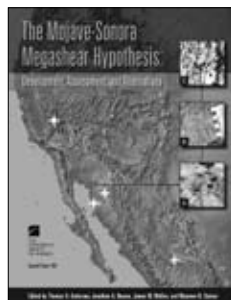
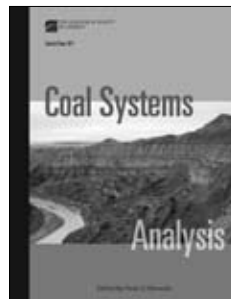
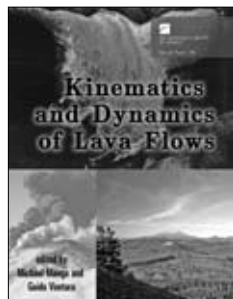
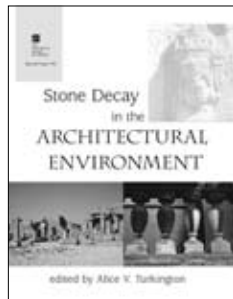
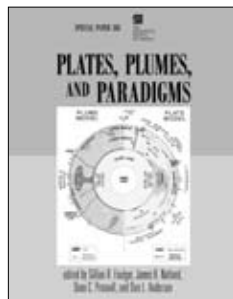
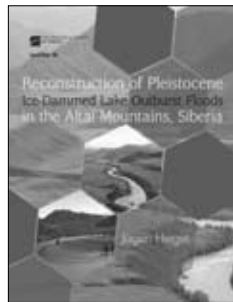
This volume contains a series of papers focusing on the utilization of isotopic and bulk-chemical techniques to interpret past changes in climate. Chapters cover marine, coastal, and terrestrial settings, thus providing a broad range of ideas in terms of the versatility of these techniques. The authors are all experts in the field of geochemistry, with diverse backgrounds and wide-ranging expertise. Consequently, their contributions provide illustrative examples of the applicability of geochemical techniques to paleoclimatology by exploring theoretical and practical frameworks used to analyze and interpret isotopic and elemental data from marine and terrestrial materials. This publication also contains innovative interpretations that improve proxy records in the fields of oceanography, limnology, hydrology, aquatic ecology, and pedology.

SPE395, 70 p., ISBN 0-8137-2395-7
\$35.00, **member price \$28.00**

Kinematics and Dynamics of Lava Flows
edited by Michael Manga and Guido Ventura

The vast majority of erupted magmas are emplaced as lava flows. Although not as devastating as large explosive eruptions, lava flows may cause significant damage. Understanding the physical and thermal processes that govern the flow and emplacement of lava (the dynamics) and the inference of the emplacement and flow history from features preserved in flows (the kinematics) are the subjects of this compilation of papers. The volume provides an overview of the current understanding of the physical, thermal, and chemical processes that govern the flow of lavas and the interpretation of prehistoric flows. The chapters encompass volcanological, petrological, and structural studies; approaches include numerical and experimental modeling, field studies, remote sensing, and hazard assessment using geographic information systems. An outstanding feature of this volume is the multidisciplinary content of the presented topics.

SPE396, 218 p., ISBN 0-8137-2396-5
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Positions Open

IGNEOUS PETROLOGY/VOLCANIC HAZARDS CALIFORNIA STATE UNIVERSITY, LOS ANGELES

The Department of Geological Sciences seeks to fill a tenure-track position in igneous petrology, volcanology, or volcanic hazards at the assistant professor level, with a starting date of September 2006 and at an initial salary commensurate with qualifications and experience. A Ph.D. in geology from an accredited institution of higher education is required. The successful applicant must demonstrate a potential for or a record of research, scholarly and/or creative activity involving students whenever possible, and a potential for effective teaching using a variety of methodologies. A demonstrated ability and/or interest in working in a multi-ethnic, multicultural environment and proficiency in oral and written communication are also required. Duties will include teaching at the undergraduate and graduate level. Teaching responsibilities will include igneous/metamorphic petrology, optical mineralogy, introductory courses, and advanced courses in applicant's area of expertise. We seek applicants capable of integrating laboratory and field instruction. Maintaining an active research program, mentoring and advising students at the undergraduate and graduate level, and participating in University service are expected. Applicant documentation should include a statement of teaching and research interests, a detailed curriculum vita, three letters of recommendation, and transcripts from institutions awarding highest degree. Employment is contingent upon proof of eligibility to work in the United States and completion of the University's Application for Academic Employment form. Review of applications began on November 14, 2005, and will continue until the position is filled. Address applications, required documentation and/or requests for information to: Dr. Kim Bishop, Search Committee Chair, California State University, Los Angeles, 5151 State University Drive, Los Angeles, CA 90032-8203, kbishop@calstatela.edu, (323) 343-2409. Department Web Page: <http://www.calstatela.edu/dept/geology>.

NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY DIRECTOR OF CAVE & KARST

The Director will serve as manager and chief executive officer of the Cave & Karst Research Institute. The Director will comply with and advance the purposes of the National Cave & Karst Research Institute (NCKRI) Act of 1998 and will build the institute to further the science of speleology; centralize and standardize speleological information; foster interdisciplinary cooperation in cave and karst research programs; promote public education; promote national and international cooperation in protecting the environment for the benefit of cave and karst landforms, and promote and develop environmentally sound and substantial resource management practices. The Director will create an agenda encompassing research, education, and information management initiatives based on strategic vision developed in coordination with the Board of Directors and with other appropriate advisory boards/ Together with the Board of Directors, the Director will develop a staffing plan that integrates the available professional expertise and resources of the organization. Responsible for supervising the NCKRI staff located in Carlsbad, the Director will also work indirectly with the staff of NMT. Other duties

will include responsibility for the daily management of the Institute including fiscal accountability and ensuring the sustainability of the organization, and satisfying the strategic initiatives of the Board of Directors. The Director will actively communicate NCKRI activities to the Board and other interested parties. As the interface of NCKRI with the public, the Director is responsible for fundraising activities, and for promoting, identifying and nurturing relationships within the C&K community and representing the Institute in public venues. This position will be reviewed annually for adequacy of performance, and continuation of position beyond initial appointment is contingent upon availability of funds. Earned doctorate degree coupled with (3) years experience managing substantial scientific projects required OR other postgraduate level education coupled with significant (5 years) experience managing substantial scientific projects. Transcripts are required. Excellent interpersonal, presentation, and communication skills are essential. Experience with professional management tools and procedures required. Experience with the domestic cave and karst community and the interpersonal cave and karst community strongly desired. Successful track record in obtaining funds and experience in fundraising is highly desirable. Applicants should send a resume, transcripts, and the names, email addresses and phone numbers of three employment references to: New Mexico Institute of Mining and Technology, 801 Leroy Pl., Human Resources Wells Hall Box 154A, Socorro, NM 87801. For information about New Mexico Tech, visit our web page <http://www.nmt.edu/>. E-mail applications **NOT** accepted. AAEOE

COAL GEOLOGY SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE

The Department of Geology at Southern Illinois University Carbondale invites applications for a tenure-track position in coal geology at the rank of assistant professor with a start date of Aug. 16, 2006. Post-doctoral experience is preferred. The applicant should demonstrate the existence of, or potential for developing, an internationally recognized, externally funded research program. We prefer a coal geologist who will advance our long-standing, internationally recognized coal petrology program (<http://mccoyle.lib.siu.edu/projects/crelling/>; <http://mccoyle.lib.siu.edu/projects/crelling2/atlas/>). The successful applicant is expected to teach courses in introductory geology and undergraduate and graduate courses in their area of expertise. Normal teaching load is one to two courses per semester. Applicants must hold a Ph.D. or show that they will complete all degree requirements by the time of appointment.

Review of applications will begin January 15, 2006, and continue until the position is filled. Applicants should submit a curriculum vitae, a statement of teaching and research interests, and the names and addresses of at least three referees to: Dr. Jack Crelling, Search Committee Chair, Department of Geology, Mailcode 4324, Southern Illinois University Carbondale, 1259 Lincoln Drive, Carbondale, IL 62901. Fax: (618) 453-7393. E-mail: jcrelling@geo.siu.edu.

Southern Illinois University Carbondale is a large, research-oriented institution situated in a pleasant small-town setting southeast of St. Louis. SIUC is seeking to enhance interdisciplinary research as it strives to be a top 75 public research university (<http://news.siu.edu/s150/>). The Geology Department has a full-time faculty of 10 with about 40 undergraduate and 30 graduate students and offers Bachelor and Master degree programs in geology and participates in the interdisciplinary Environmental Resources and Policy Ph.D. program. SIUC has energy programs and facilities that provide opportunities for collaborative research including the Coal Research Center, the Center for Advanced Friction Studies, and the Mining and Mineral Resources Program.

For further information, please visit our comprehensive website www.science.siu.edu/geology. SIUC is an affirmative action/equal opportunity employer that strives to enhance its ability to develop a diverse faculty and staff and to increase its potential to serve a diverse student population. All applications are welcomed and encouraged and will receive consideration.

HYDROLOGY FACULTY POSITION UNIVERSITY OF VIRGINIA

The Department of Environmental Sciences at the University of Virginia invites applications for a faculty position in the hydrological sciences. We expect to hire at the Assistant Professor level, but exceptional candidates at a higher level will be considered. The department is an interdisciplinary community of process-oriented scientists representing hydrology, ecology, geosciences and the atmospheric sciences.

The Department seeks candidates with clear interest and potential for advancing our understanding of surface or subsurface hydrological processes in coastal

and estuarine environments. In particular, we seek to strengthen our well-established research program in coastal ecosystems. Specific research areas could include hydrological linkages with biogeochemistry, vegetation dynamics, and process geomorphology. Regardless of specialization, the ideal candidate will have a significant field research component in their work and an interest in and capacity for interdisciplinary research.

The successful candidate will be expected to develop outstanding programs in research and teaching at both the undergraduate and graduate levels. Applicants must show demonstrated excellence in their research and a strong commitment to quality teaching. Candidates should have a Ph.D. in the hydrological sciences or closely related discipline.

Send statements of research and teaching interests, curriculum vitae, and the names and addresses of three referees to: Joseph C. Ziemann, Professor and Chair, Department of Environmental Sciences, University of Virginia, 291 McCormick Road, PO Box 400123, Charlottesville, VA 22904-4123.

For immediate review, applications must be received by 6 January 2006; however, the position may remain open until filled. We especially encourage applications from underrepresented groups. For additional information see the department web site at <http://www.evsc.virginia.edu/>.

The University of Virginia is an Equal Opportunity/Affirmative Action Employer.

TURNER POSTDOCTORAL FELLOWS THE UNIVERSITY OF MICHIGAN

The Department of Geological Sciences invites applications for Turner Postdoctoral Fellows, which are positions of two-year duration that are open to any area in the Geological Sciences. We offer a competitive compensation package that includes benefits and a travel/research fund. Applicants are encouraged to collaborate with existing researcher(s) at the University of Michigan or to propose an independent research project. Salary is cost-shared with other sources involving research and/or teaching responsibilities. Visit our Department web pages for more information on faculty and research (<http://www.lsa.umich.edu/geo/>); contact Profs. Eric Essene (essene@umich.edu), Becky Lange (becky@umich.edu) or Lynn Walter (lmwalter@umich.edu) for additional information. Please submit a curriculum vitae, a brief research proposal (3 pages or less), and names of at least three references by January 23, 2006, to: turner-pdf@umich.edu or Turner Postdoctoral Committee, Dept. of Geological Sciences, 1100 North University Ave., Univ. of Michigan, Ann Arbor, MI 48109-1005. The University of Michigan is an affirmative action/equal opportunity employer.

MULTIPLE TENURE-TRACK FACULTY POSITIONS DEPARTMENT OF GEOSCIENCES GEORGIA STATE UNIVERSITY ATLANTA, GEORGIA, USA

A recent restructuring of the geography and geology programs at Georgia State University has resulted in the creation of the Department of Geosciences, which will have a broad focus that includes geography and geology. We are searching for colleagues to fill up to four tenure track lines this year at the rank of assistant professor to strengthen this department. These positions are available beginning fall semester 2006. We are particularly interested in applicants whose research and instructional interests are within the following areas:

- Urban Geography: A human geographer whose research interests include urban geography and urban environmental issues.
- Biogeography: A geographer or geologist whose research interests include landscape ecology, long-term biological responses to environmental change, and biological climate proxy data and interpretation.
- Sedimentology: A geologist or geographer whose research interests include the sources, transport, and deposition of clastic or chemical sediments, environmental sedimentology, or anthropogenic effects on sedimentary systems.
- Hydrology or Geomorphology: A geographer or geologist whose research interests include surface water hydrology or groundwater hydrogeology, or the development and evolution of surface landforms.

Each faculty member in Geosciences is expected to teach introductory courses to majors and non-majors, upper division courses that support the department's B.S. degree program, and a graduate course in her/his areas of specialty. In addition, all faculty members are expected to maintain active research programs, seek internal and external funding, and supervise graduate students. A Ph.D. in geography, geology, or a related field is required at the time of appointment.

The Geosciences Department will offer a B.S. in

Geosciences with tracks in geology, geospatial information science, and geography, and an M.S. in Geosciences with concentrations in geology and geography. The department will also offer advanced certificates in GIS and in Hydrogeology, and collaborate with the Chemistry Department to offer a Ph.D. in Chemistry with Geology Specialization.

Georgia State University is located in the heart of downtown Atlanta, the core of a rapidly growing metropolitan area with a population of over four million with a rich cultural history. Georgia State University is one of the country's leading urban research universities, with nearly 30,000 undergraduate and graduate students. The student body is richly diverse, with students hailing from every state in the nation and from 145 other countries. Further information on the primary components of geography and geology is available at <http://monarch.gsu.edu/> and <http://www.gsu.edu/geology/>. To apply please submit a letter of application, curriculum vitae, statement of research and teaching interests, evidence of teaching effectiveness (if available), and full contact information for three or more references to the following: Chair, Geosciences Search Committee, Department of Geology, Georgia State University, Atlanta, GA 30303-3082. Questions regarding procedural details, or about the scope of the search are welcome; please direct them to the committee at the address above, or by e-mail to ejkrogstad@gsu.edu. Review of applications will begin on 15 December 2005 and continue until the positions are filled. Georgia State University is an Equal Opportunity, Affirmative Action employer.

**LOYOLA MARYMOUNT UNIVERSITY
ASSISTANT PROFESSOR**

EARTH SYSTEM SCIENCE/SCIENCE EDUCATION

The Natural Science Department within the College of Science and Engineering invites applications for a full-time, tenure-track position in the earth sciences. The successful candidate will make a strong commitment to science education and will develop and teach undergraduate science courses both for elementary and secondary pre-service teachers as well as students enrolled in the environmental science program. The development of an active research program and participation in teacher education are expected and will be supported. An earned doctorate in a geoscience field or in science education and undergraduate teaching experience are required.

Loyola Marymount, founded in 1911, is a comprehensive university in the mainstream of America Catholic higher education. Located on the west side of Los Angeles overlooking the Pacific, LMU is one of the nation's 28 Jesuit colleges and universities and five Marymount institutions. It serves 5400 undergraduates and over 2500 graduate students in the Colleges/Schools of Liberal Arts, Science and Engineering, Business Administration, Communication and Fine Arts, Film and Television, Education, and Law.

Loyola Marymount seeks professionally outstanding applicants who value its mission and share its commitment to academic excellence, the education of the whole person, and the building of a just society. (Visit www.lmu.edu for more information.)

LMU is an equal opportunity institution actively working to promote an intercultural learning community. Women and minorities are encouraged to apply.

Please submit a letter of application, a current vita, statements of teaching and research philosophies, and three letters of reference by **December 30, 2005**, to: Dr. Carolyn Viviano, Chair of Search Committee, Department of Natural Science, Loyola Marymount University, 1 LMU Drive, MS 8160, Los Angeles, CA 90045-2659.

**TRINITY UNIVERSITY
GERTRUDE AND WALTER PYRON
PROFESSOR OF GEOSCIENCES**

The Department of Geosciences at Trinity University invites applications for the Gertrude and Walter Pyron Professor of Geosciences. Appointment to this endowed position is at the rank of Professor with tenure. Demonstrated success in and dedication to undergraduate education are required. We seek candidates whose research program is widely recognized, extramurally funded, and provides opportunities for meaningful involvement of undergraduates. The successful candidate will have a research specialty that complements existing faculty specializations in igneous petrology, Quaternary geology, sedimentology and earthquake seismology and will be expected to teach a course related to petroleum geology and contribute to the department and university core curricula. Further information about the department and search can be found at <http://www.trinity.edu/departments/geosciences/>.

Applications or letters of nomination should be sent to **Dr. Glenn Kroeger, Department of Geosciences,**

Trinity University, One Trinity Place, San Antonio, Texas 78212-7200. Completed applications must include a cover letter, curriculum vitae, a detailed statement of undergraduate teaching experience and philosophy, documentation and/or evaluations of teaching effectiveness, a description of research plans, and the names and contact information of four professional references. Electronic applications will be accepted at geosearch@trinity.edu with the subject line "Pyron." Review of completed applications will begin January 4, 2006. Women and minority candidates are strongly encouraged to apply. Trinity University is an Equal Opportunity Employer.

**HYDROGEOLOGIST-GEOHYDROLOGY
SECTION-KANSAS
GEOLOGICAL SURVEY
THE UNIVERSITY OF KANSAS, LAWRENCE.**

Full-time position at faculty-equivalent rank of assistant or associate scientist, depending on qualifications, for modeler of subsurface hydrologic processes. Requires Ph.D. with hydrogeology emphasis, research/publications on modeling of flow and transport in porous media, and scientific leadership potential. Background in stream-aquifer interactions is desirable. Individual expected to develop research program of national stature and relevance to Kansas. The Geohydrology Section has 9 full-time professionals with additional support personnel. Emphasis on state-of-the-science field studies and complementary theoretical research. Sabbatical-eligible position. Complete announcement/application instructions at www.kgs.ku.edu/General/jobs.html. First consideration deadline: Jan. 13, 2006. For further information contact Jim Butler at jbutler@kgs.ku.edu. KU is an EO/AA employer. Paid for by KU.

**TENURE TRACK ASSISTANT/ASSOCIATE
PROFESSOR
IGNEOUS PETROLOGY: PHYSICS AND
CHEMISTRY OF MAGMATIC PROCESSES
DEPARTMENT OF GEOLOGICAL SCIENCES
BROWN UNIVERSITY**

The Department of Geological Sciences at Brown University (see <http://www.geo.brown.edu>) invites applications for a tenure track position in the general area of physics and chemistry of magmatic processes. Preference will be for an Assistant Professor. Research interests might include, but are not limited to, melt generation, segregation, and transport; magma chamber and volcanic eruption processes; diffusion, phase equilibria, and mass transfer processes in minerals and at grain boundaries. Analytical, experimental, and theoretical/computational approaches, preferably some combination of the three, to describing geological observations and processes are of interest. Candidates with research interests in Earth and planetary problems are encouraged to apply. Preference will be given to candidates whose strengths complement existing departmental research directions and who demonstrate a commitment to excellence in undergraduate and graduate education. A Ph.D. degree or equivalent is required, and postdoctoral experience is considered important.

Applicants should forward a curriculum vita, descriptions of research and teaching interests, and a list of at least three potential referees. These materials may be submitted either by mail (to: L. Peter Gromet, Chair, Search Committee, Department of Geological Sciences, Box 1846, Brown University, Providence, RI 02912-1846) or e-mail (geosearch@brown.edu). Inquiries and other communications may be directed to the same addresses.

Applications received by February 1, 2006, will receive full consideration, but the search will remain open until the position is closed or filled. The anticipated start date of the position could be as early as July 1, 2006.

Brown University is an equal opportunity/affirmative action employer. We welcome applications from minority or female candidates.

**GEOLOGY FACULTY POSITION
UNIVERSITY OF TEXAS-PAN AMERICAN**

The Department of Physics and Geology at the University of Texas-Pan American invites applications for a tenure track assistant/associate professor position in geology [F05/06-100] beginning in the fall of 2006. Required qualifications include a Ph.D. in the Geological/Earth Sciences, in hand at the time of appointment, and a demonstrated commitment to undergraduate education/research. College-level teaching experience is preferred, as is a broad background in Geology, Geophysics and/or Hydrology. The integration of GIS/Remote Sensing into undergraduate coursework and research is an asset, and assisting with Geology Field trips to Mexico and North Texas is expected. To apply: send application form (<http://www.utpa.edu/>

<http://www.utpa.edu/humanresources/employment/FACULTY.HTML>), cover letter and contact information of three references, CV, transcripts, statement of research interests, and teaching philosophy to: Geology Search, Dept. of Physics and Geology, University of Texas - Pan American, 1201 W University Drive, Edinburg, TX 78541-2999. For best consideration application materials must be received by **January 15, 2006**, however, applications will be accepted until the position is filled. Review of applications will begin immediately. Further information about the department can be found at <http://www.panam.edu/dept/physci/home.html>. The University is located in the Tropical Lower Rio Grande Valley of South Texas and has 16,900 students, the majority of whom are of Hispanic origin. UTPA is an Affirmative Action/Equal Opportunity employer. Women and minorities are encouraged to apply. This position is security-sensitive as defined by the Texas Education Code §51.215(c) and Texas Government Code §411.094(a)(2).

**TWO TENURE TRACK POSITIONS AT
UNC-CHAPEL HILL
IN GEOLOGICAL OCEANOGRAPHY
AND SEDIMENT DYNAMICS**

The Marine Sciences Program of the University of North Carolina at Chapel Hill seeks to fill two (2) tenure-track faculty positions: one in Geological Oceanography (MASC) and one in Sediment Dynamics (IMS).

Department of Marine Sciences (MASC) Position: All aspects of geological oceanography/marine geology will be considered. We encourage applicants whose research complements existing strengths in the Department and/or cuts across traditional disciplinary boundaries (see www.marine.unc.edu/MASC.html for further information). The candidate filling the MASC position will be expected to teach courses at the undergraduate and graduate levels.

Institute of Marine Sciences (IMS) Position: IMS seeks an individual investigating physical processes of sediment transport either in estuaries or the nearshore zone (see www.marine.unc.edu/IMS.html for more information). The IMS position carries no formal teaching requirement, although undergraduate and graduate teaching opportunities exist.

The selected individuals will be expected to develop externally funded research programs, publish in peer-reviewed journals, and direct graduate students. Qualifications include a Ph.D. in Geological Oceanography, Marine Geology, Geology, Engineering or a related field. Post-doctoral experience is preferred. The positions will be filled at the Assistant Professor level. Nine months salary support will be provided for each position.

Applicants should submit a CV, a statement of research interests, and a statement of teaching interests (for MASC only). Also, arrange to have four reference letters sent to: for the MASC position - Chair, Geological Oceanography Search Committee, UNC-Chapel Hill, Dept. of Marine Sciences, Venable Hall CB #3300, Chapel Hill, NC 27599; for the IMS position - Chair, Sediment Dynamics Search Committee, UNC-CH Institute of Marine Sciences, 3431 Arendell St., Morehead City, NC 28557. We will consider applications beginning January 2, 2006. The University of North Carolina at Chapel Hill is an equal opportunity employer.

**TENURE-TRACK ASSISTANT PROFESSOR
GEOSCIENCES
UNIVERSITY OF ARKANSAS-FAYETTEVILLE**

The Department of Geosciences, University of Arkansas-Fayetteville invites applications for a 9-month appointment tenure-track assistant professor position with an anticipated start date of August 2006. We are seeking an outstanding individual with expertise in geochemistry to take advantage of newly funded low and high resolution ICPMS at UA, with emphasis on analysis of terrestrial and extra-terrestrial materials. The applicant must demonstrate ability for independent research and potential for collaboration with existing research programs in the Department of Geosciences (www.uark.edu/depts/geology/) and the Arkansas Center for Space and Planetary Sciences (<http://spacecenter.uark.edu>). The successful applicant is expected to develop an externally funded research program, and teach courses within the Department of Geosciences and the Space and Planetary Sciences Program.

Review of applications will begin January 15, 2006, and will continue until the position is filled. Applicants should submit their curriculum vitae, statement of research and teaching interests, official college transcripts, and names, addresses and contact information for at least three professional references to: Dr. Ralph K. Davis, Search Committee Chair, Department of Geosciences, 113 Ozark Hall, Fayetteville, AR 72701.

The University of Arkansas is a nationally competitive student-centered research university located in

Fayetteville, Arkansas. The Department of Geosciences offers baccalaureate and masters degrees in geology and geography, and is a primary participant in two interdisciplinary graduate programs, Space and Planetary Sciences and Environmental Dynamics, providing opportunity for supervision of PhD and MS students. Fayetteville, nestled in the Ozarks of Northwest Arkansas, is a metropolitan area of about 350,000 people that retains its small college town atmosphere. It is the sixth fastest growing metropolitan area in the U.S. spurred by opportunities with national companies including Wal-Mart, Tyson, Inc., and J.B. Hunt trucking. The quality of life is high and it's a great place to work, play and raise a family.

The University of Arkansas is an Affirmative Action/Equal Opportunity Employer and applications will be accepted without regard to age, race, color, sex, or national origin. Applicants must have proof of legal authority to work in the United States at the time of the appointment. Women and minorities are encouraged to apply.

STABLE ISOTOPE GEOCHEMISTRY UNIVERSITY OF MANITOBA

The Department of Geological Sciences at the University of Manitoba invites applications for a full-time tenure-track faculty position in stable isotope geochemistry at the rank of Assistant Professor. This position, which is subject to final budgetary approval, is to commence July 1, 2006, or as soon thereafter as is mutually agreeable. Minimum qualifications are a Ph.D. in Geology and evidence of strong teaching and research potential. The ideal candidate will have experience in stable isotope geochemistry and analysis; complementary experience in geofluids, mineralogy, petrology or mineral deposits would be considered an asset. Closing date for applications is January 9, 2006. Further information may be obtained from <http://www.umanitoba.ca/employment/academic>.

Visit our website at: http://www.umanitoba.ca/faculties/science/geological_sciences/

HARVARD UNIVERSITY DEPARTMENT OF EARTH AND PLANETARY SCIENCES

The Department of Earth & Planetary Sciences at Harvard University seeks to fill a faculty position at the Assistant or Associate Professor level (untenured) in the broadly defined area of Geobiology. The individual may bring strength to the department in the area(s) of paleontology, microbial biology, evolutionary biology, Earth history, and/or geochemistry, but the search is not limited to these sub-disciplines. This new position is part of a broad initiative for growth in the Department of Earth and Planetary Sciences and may be coordinated with allied departments such as Organismic and Evolutionary Biology, the Division of Engineering and Applied Sciences, or with the new Microbial Sciences Initiative. Applicants should send (by mail or email) a statement of research and teaching interests, curriculum vitae, and the names and contact information, including email addresses, of three references to: Geobiology Search Committee, c/o Jason Miller, Department of Earth & Planetary Sciences, Harvard University, 20 Oxford Street, Cambridge, MA 02138 USA, Email: miller@eps.harvard.edu.

Applications will be reviewed beginning December 15, 2005. We particularly encourage applications from women and minorities. Harvard University is an Affirmative Action/Equal Opportunity Employer. For more information about the Department, please visit our web site at www.eps.harvard.edu.

DEPARTMENT OF GEOLOGICAL SCIENCES COLLEGE OF ARTS AND SCIENCE UNIVERSITY OF SASKATCHEWAN

The Department of Geological Sciences, College of Arts and Science, University of Saskatchewan, is accepting applications for a tenure-track position at the Assistant Professor level in the broad area of geodynamics. The department seeks a versatile researcher who takes an integrative approach to elucidating the structure, dynamics and evolution of the solid Earth.

The successful candidate will be expected to develop a vigorous, externally funded research program, and participate broadly in undergraduate and graduate student teaching and research. He/she must be able to teach introductory structural geology, along with other relevant geology courses and field schools. Candidates must hold a Ph.D. when appointed, which is expected to be July 1, 2006.

The University of Saskatchewan is a leading Canadian medical-doctoral research university with thirteen colleges and an extensive array of programs. Its College of Arts and Science is the largest of the university and is its historic and intellectual core.

The Department of Geological Sciences has 16 full-time

faculty, including two Canada Research Chairs and two endowed research chairs, and excellent geochemical and isotopic analytical facilities and computing infrastructure for seismology and numerical modeling. We encourage candidates who could interact with existing research programs on the evolution of the Earth's climate and sedimentary environments, crust and mantle seismology and geophysics, and the fate of metals in the lithosphere, hydrosphere, and biosphere. For detailed information about the Department, the applicants are encouraged to visit www.usask.ca/geology/.

Applications, including résumé, statement of research interests and teaching philosophy, and three letters of reference, should be sent to: Geodynamics Search Committee, Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, SK S7N 5E2, Canada, Email: kevin.ansdell@usask.ca, Fax: 306-966-8593

We will begin reviewing applications after 15 February 2006

The University of Saskatchewan is committed to increasing representation of equity groups (women, people of aboriginal ancestry, visible minorities and/or people with disabilities). Applicants from these groups are encouraged to self-identify in their applications. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

TENURE TRACK APPOINTMENT BOISE STATE UNIVERSITY

The Department of Geosciences at Boise State University, as part of a planned expansion of its Ph.D. programs, invites applications for a new tenure-track (Assistant Professor) faculty position in the fields of Paleocology and Paleoclimatology, with an emphasis in applying stable isotopic and other tools to understanding geosphere-biosphere-hydrosphere-atmosphere interactions and their expression in both the recent and deep-time (pre-Quaternary) stratigraphic record. A demonstrated ability to also address modern processes and problems will be considered an asset.

This new position will complement our existing strengths in biostratigraphy and geochronology, orogenic systems science, hydrological sciences and tectonic processes, and shallow subsurface geophysics. The successful candidate will develop a nationally-recognized research program supported by extramural funding and contribute strongly to the continued growth of the Department. We seek a colleague eager to establish collaborative research efforts, participate in developing analytical facilities, and provide both coursework and research opportunities for undergraduate and graduate students. A Ph.D. in an Earth Science discipline is required at the time of appointment; previous teaching and/or post-graduate research experience will be considered strong assets.

Boise State University is a growing institution (>18,000 students) serving Idaho's metropolitan center. As the State's capital and business, financial and cultural center, Boise is recognized as one of America's best places to live. A favorable cost of living, coupled with moderate climate and a wide variety of cultural and recreational opportunities, contribute to an outstanding quality of life for our faculty. A vibrant intellectual community draws from scientists at the University, regional high-tech industries, and numerous state and federal agencies; the Department of Geosciences benefits from collaborative activities with partners across this spectrum. 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 at least three referees to: Search Committee, Department of Geosciences, Boise State University, 1910 University Drive, Boise, ID 83725. Review of applicants will begin January 1, 2006, and continue until a qualified applicant pool is established. Email correspondence (questions or submission of application materials) can be sent to markschmiz@boisestate.edu.

FACULTY POSITION IN SEDIMENTOLOGY-STRATIGRAPHY UNIVERSITY OF MASSACHUSETTS-AMHERST

The Department of Geosciences at the University of Massachusetts-Amherst invites applications for a tenure-track faculty position to begin September 2006, pending available funds. The appointment is aimed at the assistant professor level; however, outstanding candidates at all levels will be considered. Rank and salary are commensurate with skills and qualifications.

The ideal candidate will focus on broad, integrative research in sedimentology and physical stratigraphy, such as sequence stratigraphy, basin analysis, seismic stratigraphy, coastal processes, or tectonics and sedimentation. Emphasis will be placed on the applicant's potential to establish a successful, externally funded research program that complements existing strengths in the Department including surficial processes, global change studies, the solid earth, and human dimensions of Earth's integrated systems (www.geo.umass.edu/research). A commitment to excellence in teaching at the undergraduate and graduate levels is also essential, with the picturesque Connecticut River Valley offering a natural teaching laboratory. The Department of Geosciences offers bachelors degrees in Geology, Earth Systems, and Geography, as well as MS (Geosciences, Geography) and PhD (Geosciences) degrees. Candidates must hold a Ph.D. by the time of appointment; post-doctoral experience is preferred. Applicants should send a Curriculum Vitae, a concise statement of research and teaching interests, and contact information (including email addresses) of at least three referees to: Sedimentology-Stratigraphy Search Committee, Department of Geosciences, 611 N. Pleasant St., University of Massachusetts, Amherst, MA 01003-9297 or email application materials to search@geo.umass.edu. Review of applications will begin December 1, 2005, and continue until a successful applicant is identified. The University of Massachusetts is an Equal Opportunity/Affirmative Action Employer; women and members of minority groups are encouraged to apply.

EARTH SCIENCES AT BOSTON UNIVERSITY

The Department of Earth Sciences at Boston University invites applications for one or more tenure-track positions at the Assistant Professor level, to begin September 2006, pending approval.

In the field of **TECTONICS AND DEFORMATION**, we seek applicants whose research emphasizes quantitative studies of the deformation, rheological properties and physical evolution of earth materials at any scale; approaches might include microstructural analysis, rock mechanics, structural geology, and/or large-scale tectonics.

In the field of **SURFACE PROCESSES**, we seek applicants whose quantitative research in geomorphology emphasizes one or more of the following: dynamics of hillslope, fluvial, or coastal systems; soil processes; links among landscape evolution, climate, and tectonics.

The successful applicant will be expected to supervise graduate thesis work in M.A. and Ph.D. programs, maintain an externally funded research program, and teach at all levels in the Earth Sciences curriculum. We seek an applicant whose research complements existing strength in the department and college (see <http://www.bu.edu/ES>). A Ph.D. at the time of appointment is required.

Applicants should send a curriculum vitae, a statement of research and teaching interests, and the names and addresses of at least three referees to: Search Committee Chair, Department of Earth Sciences, Boston University, 685 Commonwealth Ave., Boston MA 02215 USA; email: earth@bu.edu. Review of applications will begin on December 20, 2005.

Women and underrepresented minorities are particularly encouraged to apply. Boston University is an equal opportunity/affirmative action employer.

TENURE-TRACK GEOLOGIST BERRY COLLEGE

Berry College invites applications for a tenure-track position in geology at the assistant professor level. The position will involve teaching introductory and advanced courses in geology and environmental sciences, some of which may be in the applicant's area of specialty. A Ph.D. in geology is required. The specialty area is open, but should lend itself to research with undergraduate students on Berry's 28,000-acre campus in the Appalachian foothills region of northwest Georgia. Send letter, curriculum vitae, copies of transcripts, statement of teaching interests, and three letters of reference to: Dr. Paul Wallace, Department of Physics, Astronomy & Geology, Berry College, Mount Berry, GA 30149-5004, or apply by email to mans@berry.edu. We began reviewing applications on 15 November 2005, and will continue until the position is filled. Please visit our website: <http://www.berry.edu/academic/science/>. Berry College is an independent coeducational college with approximately 2,000 undergraduate and graduate students. The college's mission stresses academic excellence, practical work experience, and an interdenominational religion-in-life program. *EOE*.

**SIMON FRASER UNIVERSITY
DEPARTMENT OF EARTH SCIENCES
ASSISTANT PROFESSORSHIP IN
PETROLEUM GEOLOGY**

The Department of Earth Sciences at Simon Fraser University invites applications for a tenure track Assistant Professorship in Petroleum Geology commencing September 1, 2006. A PhD is required, and previous research, teaching and industry experience is desirable.

We are seeking applications from candidates with a strong background in geology and geological methods relevant to hydrocarbon exploration and reservoir evaluation, rather than specialization in geophysical methods. Expertise in carbonate successions is desired, but this preference will be a minor factor in the final selection of the candidate.

The successful candidate will develop strong collaborative ties with the oil and gas industry and supervise both graduate and undergraduate students. Teaching responsibilities will include an introductory and advanced undergraduate course in Petroleum Geology or some related subset, and a graduate level course in the appointee's field of expertise. Eligibility for registration as a professional geoscientist (P.Geo) with the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) is desirable.

For additional information about this position, see <http://www.sfu.ca/earth-sciences/>

All qualified candidates are encouraged to apply; however, Canadian Citizens and permanent residents will be given priority. Simon Fraser University is committed to the principle of equity in employment and offers equal opportunities to qualified applicants. The position is subject to final budgetary approval by the University.

Under the authority of the University Act personal information that is required by the University for academic appointment competitions will be collected. For further details see: http://www.sfu.ca/vpacademic/Faculty_Openings/Collection_Notice.html

Applicants are requested to submit curriculum vitae, a statement of research and teaching interests, and the names and addresses of three referees. The closing date for applications is February 1, 2006.

Applications or requests for further information should be directed to: Dr. D.A. Allen, Chair, Department of Earth Sciences, Simon Fraser University, 8888 University Drive, Burnaby, BC. V5A 1S6, Phone: 604-291-4657, Email: eaaschair@sfu.ca.

**CHARLES T. MCCORD, JR.
ENDOWED CHAIR OF GEOLOGY**

DEPARTMENT OF GEOLOGY AND GEOPHYSICS, LSU
The Department of Geology and Geophysics at LSU invites nominations and applications for the Charles T. McCord Jr., Endowed Chair of Geology. We seek an individual that will develop a strong externally-funded research program centered around research relevant to petroleum geology, and who will complement existing faculty expertise in sedimentary geology and geophysics. The successful candidate will be expected to further develop LSU's ties with the petroleum industry, supervise graduate student research, publish in highly ranked journals, and teach undergraduate and graduate courses in his or her area of specialization. **Required Qualifications:** Ph.D. in geological sciences or other relevant disciplines; record of published research in topics of relevance to the petroleum industry. **Additional Qualifications Desired:** petroleum industry experience. This appointment would normally be made at the rank of Full Professor. However, exceptional candidates at the Associate Professor level will be considered.

The Department of Geology and Geophysics consists of 21 tenured and tenure-track faculty members covering a wide range of expertise, and offers B.S., M.S., and Ph.D. degrees in geology. The Department has excellent facilities, a strong record in research and graduate training, an ongoing industry-funded M.S. degree program in Applied Depositional Geosystems, and a strong alumni base within the petroleum industry. The successful candidate will have an opportunity to participate in the hiring of three additional endowed chairs in sedimentology, geophysics, and stratigraphic palynology in coming years, and will become part of a broader geosciences community within LSU, which includes faculty within the Department of Petroleum Engineering, the Department of Oceanography and Coastal Sciences, and the Louisiana Geological Survey. For more information, see our web site: <http://www.geol.lsu.edu>.

The review process will begin December 1, 2005, and continue until candidate is selected. Nominations or inquiries should be directed to Professor Mike Blum, McCord Search Committee Chair, at 225-578-5735 or mike@geol.lsu.edu. An offer of employment is contingent on a satisfactory pre-employment background

check. Applicants should send a copy of their curriculum vitae (including e-mail address), a statement of their research and teaching interests, and the names, addresses, phone numbers, and email addresses of at least three references to: McCord Chair Search Committee, Department of Geology and Geophysics, Louisiana State University, Ref: Log #0508, Baton Rouge, LA 70803.

LSU Is An Equal Opportunity/Equal Access Employer

SURFICIAL GEOLOGY

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
The Department of Geology invites applications for a full-time tenure-track assistant professor appointment in the broadly defined area of surficial geology. Specialties of interest include, but are not limited to: geomorphology, neotectonics, Quaternary geology, and paleoclimatology. The successful applicant will have an affiliation with the newly formed interdisciplinary Center for Water as a Complex Environmental System at the University of Illinois (<http://cwaces.geog.uiuc.edu/>). CWACES focuses on fundamental research questions related to water's role in the Earth system. The successful applicant must demonstrate the potential to establish an internationally recognized, externally funded research program, as well as an ability to contribute to excellence in education at the graduate and undergraduate levels. This position will be available for a starting date of August 2006. A Ph.D. is required; salary will be commensurate with experience. Applicants should submit a vita (including a list of publications and a list of research grants), a description of research and teaching interests, reprints or preprints of three publications, and the names of at least three references to: Prof. Thomas M. Johnson, Search Committee Chair, Dept. of Geology, MC-102, University of Illinois, 1301 West Green St., Urbana, IL 61801.

Questions about the position can be directed to Prof. Johnson (217-244-2002; tmjohnsn@uiuc.edu). Electronic submissions are acceptable. Full consideration will be given to applications received by 13 December 2005. The University of Illinois is an Affirmative Action / Equal Opportunity Employer.

**FACULTY POSITIONS
EARTH AND SPACE SCIENCES**

UNIVERSITY OF CALIFORNIA, LOS ANGELES
UCLA solicits applications for two or more tenure-track faculty positions as described below:

1. Earth field within the Earth and Space Sciences. Please see <http://www.ess.ucla.edu/>, for descriptions of our current research and educational programs. Appointments will be considered at all levels. The successful candidate will have completed significant studies at or beyond the Ph.D. level and will have persuasively demonstrated leadership potential in her or his field of specialization. Please direct all correspondence to: ESS Search 05-1 Chair, Department of Earth and Space Sciences, UCLA, Los Angeles, CA 90095-1567, P.O. Box 951567, e-mail: search051@ess.ucla.edu.

2. Earth System Science. We seek candidates in this rapidly growing field dealing with feedback interactions among physical, chemical, and biological processes operating in the solid Earth and its surrounding hydrosphere and atmosphere. Successful candidates may take theoretical, observational, or preferably both approaches to explore fundamental processes that shape Earth's surface and link the solid Earth to atmospheric circulation, environmental changes and biological evolution. Please direct all correspondence to: ESS Search 05-2 Chair, Department of Earth and Space Sciences, UCLA, Los Angeles, CA 90095-1567, P.O. Box 951567, e-mail: search052@ess.ucla.edu.

Apply separately if you wish to be considered for both positions. Applications received by December 15, 2005, will be given full consideration. Applications must include a cover letter addressing how the applicant might fit in with our department, curriculum vitae, complete list of publications, names and addresses of three referees, and electronic copies of up to five significant publications.

The University of California is an equal-opportunity employer

**FLUVIAL GEOMORPHOLOGY OR HYDROGEOLOGY
UNIVERSITY OF MASSACHUSETTS BOSTON**

The Department of Environmental, Earth and Ocean Sciences (EOS) (<http://www.eeos.umb.edu/>) invites applicants for a tenure-track Assistant Professor position (beginning 1 Sept. 2006) in **Fluvial Geomorphology** or **Hydrogeology** (ground or surface water). Competency in GIS is preferred. Applicants must have interests in understanding and managing the effects of natural and human perturbations on linked watershed-coastal or coastal-marine ecosystems, and must have a fundamental commitment to join a multidis-

ciplinary faculty that emphasizes linkages between the social and natural sciences. Preference will be given to candidates with strong quantitative skills, with a sincere commitment to interdisciplinary research who are willing to both initiate and participate in team-based research projects, and whose research complements research by other EOS faculty. Applicants must have a well-conceived research and teaching program, capable of supporting graduate research through external funding. Teaching responsibilities include supervising graduate and undergraduate students and teaching both undergraduate and graduate courses related to their discipline. Qualifications: Ph.D. in a related area, with post-doctoral experience preferred. Send a cover letter that includes statements of interests and goals in research and teaching, c.v., and three letters of reference to: EOS Search, Dean's Office, College of Science and Mathematics, Search 615c, University of Massachusetts Boston, 100 Morrissey Blvd., Boston, MA 02125-3393. Application review will begin on Dec. 27 and continue until position is filled. UMass Boston is an Affirmative Action, Equal Opportunity Title IX employer.

**PETROLEUM GEOLOGISTS AND GEOPHYSICISTS
THE PETROLEUM INSTITUTE
ABU DHABI, UNITED ARAB EMIRATES**

Positions

The Petroleum Geosciences Program of The Petroleum Institute, Abu Dhabi, United Arab Emirates (UAE) is seeking outstanding candidates to begin August 2006. Appointments at Assistant Professor, Associate Professor, and Professor will be considered, depending on qualifications.

Geoscience Educator. Successful candidate will be primarily responsible for coordinating content of multiple sections and teaching introductory geoscience courses, supervising undergraduate laboratories, and teaching other undergraduate courses as needed. Research opportunities exist, but research will not be a main responsibility. Ph.D. in a relevant area of geoscience and five years of university-level teaching are required. Candidates must have strong interpersonal, communication, and organizational skills. A commitment to excellent teaching is required. Petroleum industry experience and a background in sedimentary geology are advantageous.

Successful applicants for the following possible positions 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. Ph.D. in a relevant area of geoscience from a first-rank university is required. Teaching experience and petroleum industry experience are desirable for all positions. Experience with carbonate rock systems is also advantageous.

Reflection Seismology. Candidate must have expertise in seismic acquisition and processing, with skills in advanced processing, seismic inversion, seismic imaging, and multi-component analysis, or in seismic interpretation, including interpretation of seismic attributes.

Petroleum Geoscience. Candidates must have expertise in petroleum exploration, development, and reservoir management, and with modern integrated geoscience software applications. Applicants with experience in geoscience systems computer modeling will be given special consideration.

Petroleum Institute. The Petroleum Institute is a small, highly focused, 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. The Petroleum Institute is four years old and is committed to becoming a world leader in geoscience and engineering education and the premier petroleum-related educational institute in the Middle East. Many laboratories with up-to-date analytical equipment and computer hardware and software exist, and faculty have the ability to equip similar new laboratories to support teaching and research. The graduate program likely will begin in 2006. All classes are in English.

Salaries are competitive, not taxed by the UAE, and are supplemented with an accumulating end-of-service bonus after three years. The compensation package for faculty includes a housing allowance, utilities, a home furnishings loan, an interest-free automobile purchase loan, annual leave travel, educational assistance for dependents, and subsidized medical care.

Abu Dhabi, the capital of the UAE, is a modern, cosmopolitan city of more than 600,000. Theaters, art exhibitions, and music concerts provide cultural opportunities. Citizens comprise a moderate Muslim society with freedom of religion, and women are respected and are free to dress in western clothes without coverings.

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 an application and their résumé to mkassim@pi.ac.ae. Applications from qualified females are particularly invited. Please submit a hardcopy application only if unable to submit electronically to: Faculty Recruitment Coordinator-Petroleum Geosciences Program, Petroleum Institute, P.O. Box 2533, Abu Dhabi, United Arab Emirates.

Candidates are encouraged to submit an application as soon as possible and no later than **15 January 2006**, although applications will be considered until vacant positions are filled.

BOYCE POSTDOCTORAL FELLOWSHIP IN GEOLOGY COLGATE UNIVERSITY

The Department of Geology at Colgate University invites applications and nominations for the Boyce Postdoctoral Fellowship. The fellowship is awarded for one or two years and includes moving expenses and funds for travel and research. The Boyce Fellowship is intended to attract scholars who received the PhD a maximum of four years before the appointment date. The department hopes to attract a candidate whose background will complement, but not overlap, current expertise in the department and whose research could productively use our existing analytical facilities. We are especially interested in geoscientists with experience in new approaches to the study of surface geological systems in the general disciplinary areas of hydrogeology, neotectonics, glacial geology, geomorphology, landscape evolution, hydrology, or related fields. The appointment will begin their in early summer 2006 to permit involvement in our summer field program. The teaching load for the Boyce Fellow will be two courses during the regular academic year. Please visit the Department's website <http://departments.colgate.edu/geology/> for information regarding our facilities, programs and faculty expertise.

Applicants should submit a curriculum vitae including publications, addresses and email addresses of at least three potential referees and a letter describing plans for teaching and research during the Boyce Fellowship appointment. Application materials should be received by January 13, 2006. Materials should be sent to: Boyce Fellowship, Department of Geology, Colgate University, 13 Oak Drive, Hamilton, NY 13346. Contact Bruce Selleck, Chair, Department of Geology at 315-228-7949 or bselleck@colgate.edu Colgate University is an Affirmative Action/Equal Opportunity Employer. Developing and sustaining a diverse faculty and staff further the university's educational mission.

MINERALOGY, PETROLOGY, AND GEOCHEMISTRY MARSHALL UNIVERSITY

The Department of Geology at Marshall University invites applications for a tenure track teaching position beginning August 14, 2006. The position will be filled at the Assistant or Associate Professor level. We seek a student-oriented individual who will teach upper level courses in mineralogy, petrology, and geochemistry as well as services courses in General Geology and/or Physical Geology and Earth Materials Lab. A Ph.D. is required and post secondary teaching experience is preferred. A vigorous, externally supported research program that involves undergraduate research is expected and a research focus on environmental geochemistry is desirable. Departmental resources include an extensive rock and mineral collection, thin and polished section preparation lab, X-ray diffractometer, ICP AA Spectrometer, and SEM with EDS.

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

ENVIRONMENTAL GEOSCIENTIST RUTGERS UNIVERSITY-NEWARK

Rutgers University-Newark will fill an Assistant Professor, tenure-track position in environmental geoscience for fall 2006. We are interested in candidates with expertise in coastal, estuarine, and/or Wetlands sedimentation and/or processes. Excellent opportunities for collaboration with current faculty in environmental geophysics, biogeochemistry and/or ocean-atmosphere interactions. Candidates must have a Ph.D., postdoctoral training, a record of research accomplishment and the ability to develop an externally funded

program of research. Applicants should send a letter of application, CV, and three letters of recommendation to: Dr. A. E. Gates, Chair, Department of Earth and Environmental Sciences, Rutgers University, 101 Warren Street, Newark, NJ 07012 or agates@andromeda.rutgers.edu. by January 15, 2006. For a full description visit <http://geology.newark.rutgers.edu>. **Rutgers University is an equal opportunity/affirmative action employer.**

NEW PH.D. PROGRAM ENVIRONMENTAL AND HEALTH GEOSCIENCE AT JOHNS HOPKINS UNIVERSITY.

Our goal is to train Ph.D. scientists with a passion for studying the interface between the geological and human environment, ready to tackle a new generation of Climate Change and Public Health issues in academic, policy and international spheres. See <http://www.jhu.edu/~eps/faculty/EHG/EHG.html> for program and application information. Closing date: January 15, 2006.

POSITION: ASSISTANT OR ASSOCIATE PROFESSOR (EARTH SYSTEM SCIENCE) GEOLOGICAL SCIENCES UNIVERSITY OF TEXAS AT EL PASO

DESCRIPTION: The Department of Geological Sciences, University of Texas at El Paso, is inviting applications for a full time tenure-track position in earth system science at either the assistant or associate rank, beginning in September 2006. We seek applicants with research and teaching interests that include isotope geochemistry, geobiology, soil science, surface processes, basin analysis or the interactions of lithosphere, hydrosphere, biosphere and atmosphere. We are particularly interested in finding candidates with strong interdisciplinary focus who are also intrigued by the prospect of exploring environmental challenges that stem from urban development in a bi-national arid region. The Department of Geological Sciences supports undergraduate, M.S., and Ph.D. degrees in Geological Sciences as well as interdisciplinary undergraduate, M.S., and Ph.D. programs in Environmental Science and Engineering. The candidates are expected to teach introductory classes as well as upper division and graduate classes that serve both the Environmental and Geological Sciences. The Department is in a spacious building that contains extensive analytical and computing facilities and has excellent capabilities in remote sensing, GIS and environmental geophysics that can be applied to research. In addition, the collaborative research environment on our campus affords easy access to a superb variety of analytical equipment in other departments. For more information about activities and facilities, visit our web site at <http://www.geo.utep.edu>.

QUALIFICATIONS REQUIRED: The candidates must have Ph.D. degrees at the time of appointment. We are seeking candidates capable of building active research programs and who enjoy collaborative research.

APPLICATION PROCEDURE: Candidates should send a letter of application, curriculum vitae, description of teaching and research interests, and the names of three people willing to provide professional references to: Diane Doser, Chair Department of Geological Sciences, The University of Texas at El Paso, El Paso, Texas 79968, doser@geo.utep.edu. Review of applications will begin immediately, but applications received prior to January 10, 2006, will be given the highest consideration.

Underrepresented groups are encouraged to apply. The University is also a recipient of a National Science Foundation ADVANCE Institutional Transformation Award to increase the participation of women in academic science and engineering careers. The ADVANCE initiative includes an active dual career partner program.

GEODYNAMICS, UNIVERSITY OF ROCHESTER

The Department of Earth and Environmental Sciences at the University of Rochester invites applications for a tenure-track assistant professor position in geodynamics to begin in the 2006-2007 academic year. We are interested in a dynamic educator and researcher, who can build an externally funded program within a small research university setting. The field of specialization is open, and includes geodynamic modeling, seismology, geomorphology, geodesy and planetary science. Preference will be given to applicants who can build programs involving undergraduates and graduates that complement our existing strengths in geochemistry, paleomagnetism, petrology, structural geology, sedimentology and tectonics. For more information about the Department, see www.earth.rochester.edu. Applicants should send a curriculum vitae, select reprints, a statement of research and teaching goals, and the names of at least four references to the address below: Chair, Geodynamics Search, c/o Kathy Lutz, Department of Earth and Environmental Sciences, 227 Hutchison Hall,

University of Rochester, Rochester, NY 14627, Ph. (585) 275-5713, FAX (585) 244-5689.

The review of applicants began on October 31, 2005, and will continue until the position is filled. The University of Rochester is an equal opportunity employer.

ASSISTANT PROFESSOR OF ENVIRONMENTAL GEOLOGY TENURE-TRACK

NEW MEXICO HIGHLANDS UNIVERSITY

New Mexico Highlands University Natural Resources Management Division invites applications for a tenure-track Assistant Professor position, effective August 2006, in Environmental Geology. Experience with GIS is essential. The successful candidate will expand upon initiatives to integrate GIS into the curriculum and teach courses related to surficial processes, including Geomorphology, Depositional Environments, and GIS Analysis. We seek a dynamic teacher and broadly trained geologist who can integrate classroom, field, and laboratory approaches to teaching at a small institution in a rural setting. The teaching load is 12 hours per semester. The successful candidate will share in the delivery of introductory geology classes and develop a student-involved research program that focuses in part on New Mexico geology.

Completion or near completion of the Ph.D. is required. Review of applications will begin on January 15 and continue until the position is filled. Applicants must submit a letter of interest, vita, three letters of recommendation, graduate transcripts, a statement of research interests and equipment needs, and a one-page statement describing your teaching philosophy and ability to contribute to New Mexico Highlands University's Strategic Plan (www.nmhu.edu). Send all materials to: Academic Affairs Office, Environmental Geology Search Committee, New Mexico Highlands University, P.O. Box 9000, Las Vegas, New Mexico 87701. NMHU is an AA/EEO Employer. For disabled access or services, call (505) 454-3311 or TDD#(505) 454-3003.

STRUCTURAL GEOLOGY AND ENVIRONMENTAL GEOCHEMISTRY FACULTY POSITIONS

AT THE UNIVERSITY OF TENNESSEE-KNOXVILLE

The Department of Earth and Planetary Sciences (<http://web.eps.utk.edu>) invites applications for **two tenure-track** faculty positions starting fall 2006. Successful candidates are expected to develop strong, externally funded research programs involving graduate and undergraduate student supervision and publication. Post-doctoral experience and the ability to complement one or more existing departmental strengths (crustal structure and seismology, Earth systems history, geochemistry, hydrogeology and environmental science, and planetary geoscience) are desirable.

STRUCTURAL GEOLOGY: Assistant Professor—open to candidates with a PhD in Earth Sciences, Geology or a related discipline, with experience in structural geology, and a strong emphasis on field geology that focuses on almost any aspect of lithospheric deformation and related processes. The successful candidate is expected to teach undergraduate courses, and graduate courses in his/her specialty, as well as participate in field geology course(s) at all levels. Candidates are encouraged to take advantage of the regional geologic setting of the southern Appalachians.

ENVIRONMENTAL GEOCHEMISTRY: Assistant Professor—open to candidates with a PhD in Earth Sciences, Geology, Geochemistry, or a related discipline. We seek an individual with expertise in topics such as organic contaminants, biogeochemistry, aqueous geochemistry, low-temperature geochemistry, isotope geochemistry, or biomarker analysis, with a broad emphasis on environmental problems. The successful candidate is expected to teach undergraduate courses, and graduate courses in his/her specialty. In developing a research program, the individual may take advantage of the Department's strong ties with nearby Oak Ridge National Laboratory and the UT Center for Environmental Biotechnology. This position carries with it the **Jones Environmental Geochemistry Endowment**, which partially supports the candidate's research and teaching program.

UT-Knoxville is the flagship campus for the UT system and is located close to Oak Ridge National Laboratory and the Great Smoky Mountains National Park. The Department comprises an energetic group of tenure-track, research and teaching faculty, post-doctoral researchers, and about 100 graduate and undergraduate students. Instrumentation available for research and teaching includes GC-IRMS, GC-MS, ICP-AES, LC-MS, AFM, XRD, XRF, EPMA, Vibroseis and seismic recording equipment, LANDMARK software license grant for 3D graphics and seismic processing, and other

facilities. The university welcomes and honors people of all races, creeds, cultures, and sexual orientations, and values intellectual curiosity, pursuit of knowledge, and academic freedom and integrity. Applicants should e-mail their résumé, letter describing research and teaching interests, and list of 3 references in .pdf format to Dr. Chris Fedo, Search Committee Chair, Dept. of Earth and Planetary Sciences, University of Tennessee, Knoxville, TN 37996-1410; Phone 865-974-6002; Fax 865-974-2368; E-mail: cfedo@utk.edu. Supplementary materials, such as copies of refereed publications, can be e-mailed or mailed to Dr. Fedo at the above address. Review of applications will begin on December 15, 2005, and will continue until both positions are filled.

The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services.

**FACULTY POSITION IN
EARTH SURFACE PROCESSES
UNIVERSITY OF WISCONSIN-MADISON**

The Department of Geology and Geophysics at the University of Wisconsin-Madison seeks an Earth Surface Processes geoscientist for an assistant professor, tenure-track position. A starting date of August 2006 is anticipated. We are seeking an individual interested in the physical aspects of Earth Surface Processes, in the modern to recent geological record. We are particularly interested in a quantitative and field-oriented geologist. Specialties may include, but are not limited to, glacial geomorphology, Quaternary geology, tectonic geomorphology, submarine geomorphology, and geologic hazards.

A Ph.D. is required at the time of the appointment. The successful candidate is expected to develop an active research program, including supervision of graduate students. Teaching responsibilities include courses at the undergraduate and graduate levels.

Applicants should submit a resume, statement of research and teaching interests, and the names and addresses of at least three references to Dr. Basil Tikoff, Earth Surface Processes Search Chair, Dept. of Geology & Geophysics, University of Wisconsin-Madison, 1215 W. Dayton St., Madison, WI 53706-1692. To ensure full consideration, applications must be received by January 15, 2006.

For additional information, please visit: www.geology.wisc.edu. UW-Madison is an equal opportunity/affirmative action employer and encourages applications from women and minorities. Unless confidentiality is requested in writing, information regarding applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

**TENURE-TRACK ASSISTANT PROFESSOR
ENVIRONMENTAL GEOCHEMISTRY
COLLEGE OF CHARLESTON**

The Department of Geology and Environmental Geosciences at the College of Charleston invites applications for a tenure-track assistant professor position in Environmental Geochemistry beginning in August 2006. Candidates will also be expected to contribute to an interdisciplinary program leading to a Master's degree in Environmental Studies. We also have a strong interest in candidates with a Ph.D. in biogeochemistry, soil chemistry, or geochemistry of water resources who will develop a research program involving environmental applications of geochemistry. The successful candidate will demonstrate a serious commitment to both graduate and undergraduate teaching and research, and have a strong background in field and laboratory methods pertinent to their discipline. The candidate will be expected to: (1) teach an undergraduate-level course in geochemistry, one or more graduate-level courses in environmental geochemistry, and undergraduate introductory geology courses; (2) develop a successful research program that leads to professional publications; (3) supervise Master's student thesis research, and (4) seek external funding for research. For more information about the department, visit <http://www.cofc.edu/~geology/>.

Interested persons should send a letter stating their interest in the position, curriculum vitae, statements of teaching philosophy and research interests, unofficial academic transcripts, and names of three references to: Geochemistry Search Committee, Department of Geology and Environmental Geosciences, College of Charleston, 66 George Street, Charleston, SC 29424. Review of applications will begin January 9, 2006, and continue until the position is filled. The College of Charleston is an AA/EO/ADA employer and does not discriminate in employment or the provision of services on the basis of disability.

**GEOSPATIAL SCIENCE,
BOWLING GREEN STATE UNIVERSITY**

The Departments of Geology and Geography, and



**GRADUATE ASSISTANTSHIPS
Hydrologic Cycle and Its Societal Dimensions**

UNIVERSITY OF NEBRASKA-LINCOLN

The University of Nebraska-Lincoln has graduate fellowships and assistantships available as part of a new campus-wide Water Initiative, "The Hydrologic Cycle and Its Societal Dimensions," which integrates research and education in water science, policy, and law. The Water Initiative includes faculty and research programs from multiple units on campus, including the Departments of Geosciences, Biological Systems Engineering, Civil Engineering, and the School of Natural Resources. Areas of research strength include meteorology/climatology, limnology, water quality, watershed processes, river/stream biogeochemistry, remote sensing, hydrogeology, contaminants & ecotoxicology, water economics, and water use in agriculture. Assistantships are available on a competitive basis, and several Initiative fellowships are available for top-ranked candidates. For more information see individual departmental web sites at the University, <http://www.unl.edu/unlpub/index.shtml>, or contact The Water Center University of Nebraska-Lincoln, 103 Natural Resources Hall, Lincoln, NE 68583-0844; 402-472-3305 (phone), 402-472-3574 (fax); <http://watercenter.unl.edu/> (web).

The University of Nebraska is committed to a pluralistic campus community through affirmative action and equal opportunity and is responsive to the needs of dual career couples. We assure reasonable accommodation under the Americans with Disabilities Act; contact the address and phone above for assistance.



the Center for Environmental Programs invite applications for a tenure-track, Assistant Professor position in Geospatial Science beginning August 2006. We are seeking a person with interdisciplinary interests in GIS/Remote Sensing as applied to areas such as natural resource exploration/management/protection, environmental monitoring/management, emergency response & management, and/or economic development. The appointment will be made in one or more of the three units, depending on the candidate's area(s) of expertise. The candidate will be expected to develop and maintain an active, externally-funded research program that emphasizes interdisciplinary work in GIS/Remote Sensing. The candidate will also be expected to teach undergraduate and graduate courses in one or more of the three units. Salary for the position is competitive and commensurate with peer institution levels for rank and position and in keeping with candidate experience and credentials. The three units have a combined faculty of 22. We are in the process of formalizing an academic structure that will facilitate collaboration in the area of Geospatial Science. Extensive facilities to support research and teaching in GIS/Remote Sensing include: three teaching labs with a total of 40 workstations, ARC IMS servers, large format color plotters, large and small digitizers and scanners, color printers, laser rangefinders, sub-meter GPS receivers, ruggedized tablet and pocket PCs for mobile GIS, portable field spectrometers (300-2500 nanometer and 2-15 micrometer wavelength ranges), and ESRI, ENVI, ERDAS, PCI, and ERMapper site licenses.

Applicants are required to have a Ph.D. at the time of employment.

Candidates should send a letter of application, curriculum vitae, statements of research and teaching interests and goals, and three current letters of recommendation to: Chair, Faculty Search Committee, Department of Geography, Bowling Green State University, Bowling Green, OH 43403. Finalists will be required to provide a transcript for the highest degree.

Applications must be postmarked by January 2, 2006. Bowling Green State University is an Equal Employment Opportunity/Affirmative Action employer and encourages applications from women, minorities, veterans, and persons with disabilities.

**HIGH-TEMPERATURE GEOCHEMIST
UNIVERSITY OF COLORADO AT BOULDER**

The Department of Geological Sciences, University of Colorado at Boulder, invites applications for a tenure-track position in high-temperature geochemistry. We anticipate hiring at the assistant professor level, but applications at other levels will be considered from those who would strengthen the Department's diversity. We seek applicants with a demonstrated potential for innovative research; postdoctoral experience is beneficial. Any applicant specializing in the study of high

temperature Earth processes and whose work complements existing research programs in the Department will be considered. However, applicants in igneous and metamorphic rock geochemistry and geochronology, rock/fluid interaction, and stable isotope geochemistry are preferred. The successful candidate will be expected to contribute to our undergraduate teaching program, including non-major course offerings, and provide graduate level courses in his/her specialty. Information regarding the Department can be found at <http://www.colorado.edu/GeolSci/>.

Applicants should send a current CV, statements of teaching and research interests, and the names of at least three potential references to: Chair, Geochemistry Search, Department of Geological Sciences, University of Colorado, 399 UCB, Boulder, CO 80309-0399.

Inquiries for additional information should be directed to Dr. G. Lang Farmer (farmer@colorado.edu). Review of applications will begin on December 15, 2005. Applications will be accepted until the position is filled. The University of Colorado at Boulder is committed to diversity and equality in education and employment.

**ANALYTICAL/FORENSIC/ENVIRONMENTAL
CHEMISTRY
ARKANSAS STATE UNIVERSITY**

Arkansas State University is an Equal Opportunity/Affirmative Action Employer with a strong institutional commitment to the achievement of excellence and diversity among its faculty and staff.

In support of this commitment, the Department of Chemistry and Physics at Arkansas State University invites applications for a tenure track Assistant Professorship in analytical/forensic/environmental chemistry commencing August 2006. A Ph.D. is required. For more information see <http://chemistryand-physics.astate.edu/facopenings.htm>

**TENURE TRACK GEOLOGY
WASHINGTON & LEE UNIVERSITY**

The Geology Department at Washington and Lee University (geology.wlu.edu) seeks applicants for a new tenure track, Assistant Professor position to begin fall 2006. A Ph.D. is required. The successful candidate will be an excellent teacher and scientist in a specialty that complements and builds on the existing strengths of our faculty. We seek a colleague who is dedicated to diverse teaching approaches, is enthusiastic about teaching intensive major/non-major field geology courses, and will develop a strong research program including collaboration with undergraduates. W&L is a nationally ranked, highly selective liberal arts college. Our department is well equipped for high quality teaching and research, is ideally situated for field studies in the Appalachian Mountains of southwestern Virginia, and is a member of the Keck Geology Consortium. A resume, teaching and research statements emphasizing how the candidate's

methods, interests, and experience will enhance our program, and 3 letters of reference should be sent to David Harbor (harbord@wlu.edu), Geology Department, Washington and Lee University, Lexington, VA 24450. Review of applications will begin immediately and continue until the position is filled. Washington and Lee University is committed to the development of a campus climate that supports equality and diversity. Minorities and women are encouraged to apply. Equal Opportunity Employer.

PLANETARY GEOLOGIST OHIO UNIVERSITY

The Department of Geological Sciences at Ohio University invites applicants for a tenure-track appointment at the assistant professor level in planetary mineralogy to begin September 2006. We are seeking a qualified individual with expertise in the geological processes operating on extraterrestrial planets and active interest in planet and solar system evolution. This position will expand and complement the department's existing strengths in earth and environmental systems and tectonics and allows for collaboration within Ohio University's Astrophysical Institute. Candidates should be able to teach mineralogy/petrology and planetary geology and be familiar with geologic field methods. Excellence in teaching at both the undergraduate and graduate level and supervision of graduate student research must be accompanied by the establishment of a strong research program supported by external funding. The successful candidate will possess a Ph.D. in Geological Sciences or a related discipline.

Applicants should send vitae, a description of research interests, a statement of teaching philosophy, and the names and addresses of three referees to: Search Committee Chair, Department of Geological Sciences, 316 Clippinger, Ohio University, Athens, OH 45701-2979. Applications should be received by December 12, 2005, but will be considered until the position is filled. Ohio University is an affirmative action employer: women and minorities are especially encouraged to apply. Ohio University is a Research-Extensive institution, enrolling 19,500 students on the Athens campus and more than 8,000 students on five regional campuses. For further information concerning the College of Arts and Sciences, the Department of Geological Sciences and the Astrophysical Institute, visit www.cas.ohiou.edu, www.ohiou.edu/geology and www.phy.ohiou.edu/~astro.

ASSISTANT RESEARCH PROFESSOR ENVIRONMENTAL HYDROGEOPHYSICS

The Desert Research Institute's (DRI's) Division of Hydrologic Sciences seeks an Assistant Research Professor of Environmental Hydrogeophysics. This position is designed to be an integral part of an ongoing effort to build strong cross-disciplinary programs linking hydrological, geophysical, and near-surface environmental processes. The successful candidate will be expected to develop and lead multidisciplinary, collaborative projects on the use of geophysical techniques for understanding environmental processes at different spatial scales, potentially up to and beyond the ecosystem level, or down to the micron level. Emphasis for this position is on near-surface interrogation, but we are not fully excluding deep-hole geophysics. Applicants are expected to possess appropriate professional experience, including a Ph.D. with a focus on near surface geophysics, hydrology, soil science, or high resolution imaging. This position will be filled at DRI's Las Vegas Campus. Review of applications will begin in late fall 2005. Specific requirements and application instructions are available at http://jobs.dri.edu/2005/DHS_hydrogeophysics.html or visit www.dri.edu.

Opportunities for Students

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 1/15/06. Oregon State and Portland State Universities are committed to equality in education.

Graduate Fellowships at Indiana University. The Department of Geological Sciences at Indiana University (Bloomington) solicits applicants for at least five graduate fellowships in the following areas: Geobiology/Stratigraphy, Geophysics, Geomorphology, Petroleum Geology, and Clay Mineralogy. The fellowships offer up to \$18,000 per year plus tuition waiver. The duration of the fellowship varies but Ph.D. and M.Sc. students are guaranteed 4 and 2 years of support within the Department, respectively. Applicants for the 2006-2007 academic year should contact: Dr. Mark Person, Director of Graduate Studies, Indiana University, Department of Geological Sciences, maperson@indiana.edu, 812-855-4404.

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, as well as a stipend for a University of Nevada, Reno student.

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, research close to Jonathan's heart. The national scholarship is \$4,000 and the University of Nevada, Reno stipend is \$1,500.

The national scholarship, administered by the Division of Earth and Ecosystem Sciences of the Desert Research Institute, is open to graduate students enrolled in an M.S. or Ph.D. program at any university in the United States. The stipend, also administered by the Division of Earth and Ecosystem Sciences, is open to graduate students enrolled in an M.S. or Ph.D. program at the University of Nevada, Reno. 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 geologic techniques and must be focused on the Great Basin.

Applications should include:

A cover letter explaining how the individual qualifies for the award. Please include your social security number and state whether you are applying for the national scholarship or for the UNR stipend.

A current résumé or vitae.

A two-page, single spaced description of the thesis/dissertation research, which also clearly documents the geological orientation and research significance. Figures, tables, and references do not count against the two-page limit.

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, 2006. Proposal reviews will not be returned to applicants. 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 Student Opportunities in Earth and Planetary Science at UCSC. The Earth Sciences Department at UCSC will have numerous opportunities for students wishing to begin graduate work in fall 2006. Research topics include: earthquake and wave propagation seismology, rock and mineral physics, climate change, structural geology, active tectonics, igneous geochemistry, paleoecology, hydrology and hydrogeology, glaciology, paleomagnetism, geodynamics, and planetary formation and dynamics. The Earth Sciences Department at UCSC has an outstanding reputation; our graduates are leaders in academia, research, and industry. The department currently includes twenty faculty, 57 graduate students, over 100 undergraduate majors and minors, numerous researchers and technical support staff, and excellent facilities on a beautiful campus overlooking Monterey Bay. Fellowships, teaching assistantships, and research assistantships are available. Please visit our web site to learn about specific projects, and contact associated faculty and researchers directly for more information: <http://es.ucsc.edu>.

M.S. and Ph.D. Opportunities at Miami University, Oxford, Ohio. The Miami University Geology Department invites applications to our M.S. and Ph.D. programs.

Numerous grant-funded Research Assistantships and university-funded Teaching Assistantships are available for students starting fall 2006.

The Department maintains active field and laboratory based research programs in geomicrobiology, geomorphology, geophysics, hydrogeology, igneous petrology, isotope geochemistry (stable and radiogenic), low-temperature geochemistry, mineralogy and crystallography, mineral surface geochemistry, sedimentology and stratigraphy, seismology, structural geology, tectonics, and volcanology.

For more information about the application process and graduate student research opportunities, please visit our departmental website (<http://www.muohio.edu/geology>) or contact Cathy Edwards (cathy.edwards@muohio.edu). Prospective students are also encouraged to contact faculty directly to discuss potential research projects.

The application deadline for consideration in first-round funding offers is February 1, 2006.

Graduate Student Opportunities: The Department of Geological Sciences at Case Western Reserve University (<http://www.case.edu>) is seeking qualified students for its graduate program. Current research strengths in the department include: surface processes, soil erosion, sediment transport, geologic sequestration of carbon, geochemistry, planetary materials, planetary geology and geophysics, and high-pressure mineral physics and chemistry. Financial assistance may be available for qualified applicants interested in pursuing M.S. or Ph.D. degrees. For more information, please see <http://geology.case.edu> or contact the department at geo-gradinfo@case.edu.

Applications for graduate study at Case are accepted on a rolling basis, though students requesting financial assistance in fall 2006 are encouraged to apply by February 1, 2006.

Case is committed to diversity and equality. Students from all backgrounds are encouraged to apply.

NASA Planetary Biology Internships. The Marine Biological Laboratory, Woods Hole, Massachusetts, invites applications from graduate students and seniors accepted to graduate programs for rewards of \$2800 plus travel to participate in research in NASA centers and collaborating institutions for approximately 8 weeks. Typical intern programs include: global ecology, remote sensing, microbial ecology, biomineralization, and origin and early evolution of life. Application deadline: March 1, 2006. For information/applications, contact: Michael Dolan, Planetary Biology Internship, Department of Geosciences, Box 3-5820, University of Massachusetts, Amherst, MA 01003-5820. E-mail: pbi@geo.umass.edu. Tel (413) 545-3223. An Equal Opportunity/Affirmative Action Employer.

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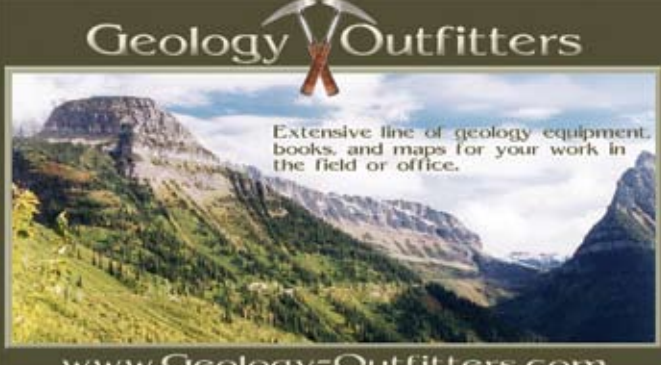
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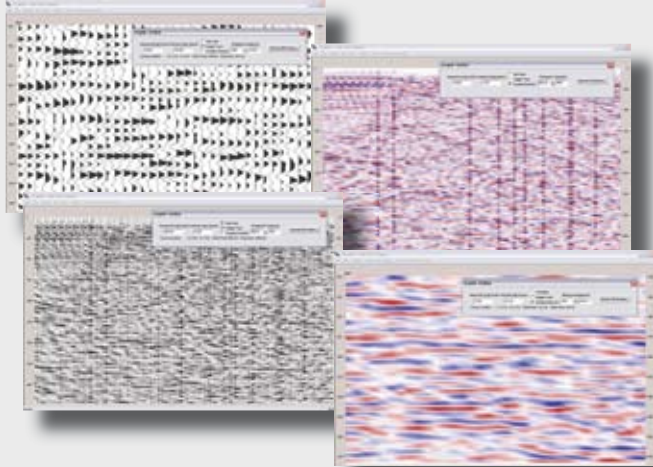
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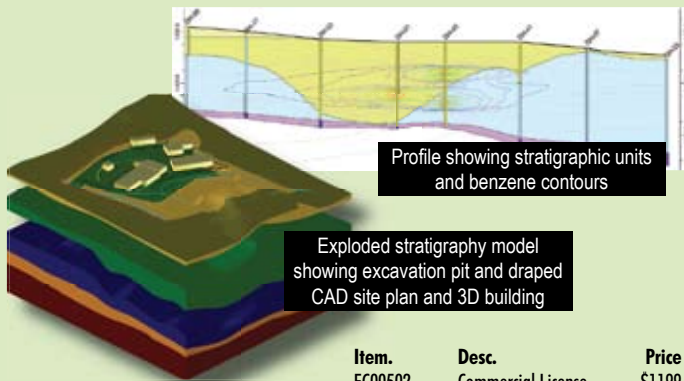


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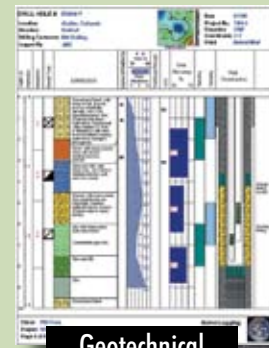


**THE LOG PLOTTING
SOLUTION**

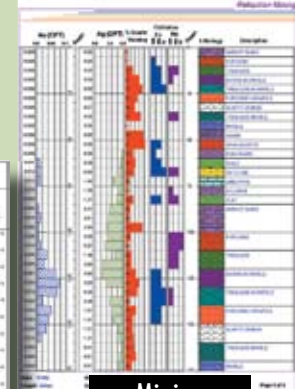
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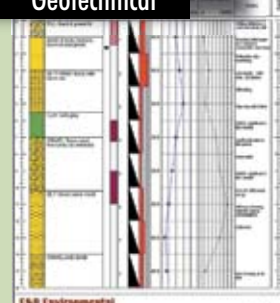
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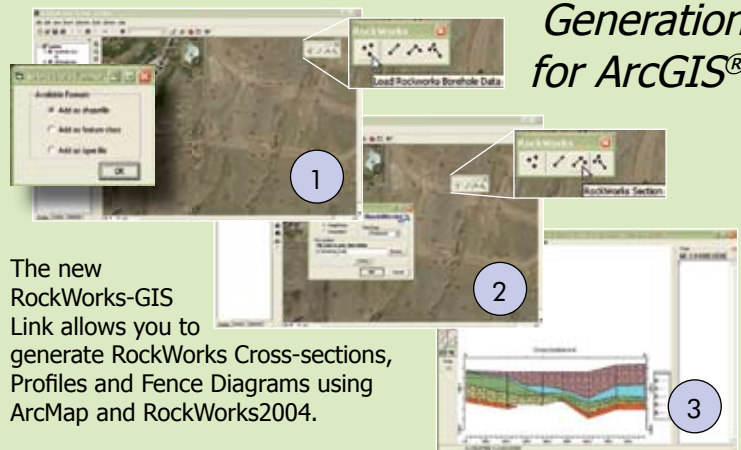


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