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## Beneath Yellowstone: Evaluating Plume and Nonplume Models Using Teleseismic Images of the Upper Mantle

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### ABSTRACT

The Yellowstone hotspot commonly is thought to result from a stationary mantle plume rooted in the lower mantle over which North America moves. Yet Yellowstone's initiation and its association with the "backward" propagating Newberry hotspot across eastern Oregon pose difficult questions to those explaining Yellowstone as a simple consequence of a deep-seated plume. Teleseismic investigations across the Yellowstone topographic swell reveal: (1) the swell is held up by buoyant mantle of two types—partially molten mantle (of low seismic velocity) beneath the hotspot track and basalt-depleted mantle (of high velocity) beneath the rest of the swell; (2) an upwarded 660 km discontinuity beneath the Yellowstone hotspot track, as expected for relatively hot mantle at that depth, and an upwarded 410 km discontinuity, indicative of relatively cool mantle at this depth; and (3) anisotropic mantle with a preferred northeast orientation of olivine *a* axis, consistent with the strain expected for both plate motion and hotspot asthenosphere flow. Imaged mantle velocities can be reconciled with a plume hypothesis only if melt buoyancy within the hotspot asthenosphere drives convection, with melt segregating from the mantle beneath Yellowstone and residuum being deposited adjacent to the upwelling. Once such convection is admitted, an alternative, nonplume explanation for Yellowstone is possible, which has propagating convective rolls organized by the sense of shear across the asthenosphere. This explanation has the appeal that expected asthenospheric shear beneath the northwest United States predicts both the Yellowstone and Newberry hotspots with a single (upper mantle) process.

### INTRODUCTION

Recent teleseismic studies of the upper mantle beneath the Yellowstone

swell provide insight on the origin of hotspots. The upper mantle beneath this swell now is one of the most seismically resolved regions on Earth, and the physical state of the upper mantle is accordingly well understood. However, interpretation of our findings in terms of hotspot processes remains ambiguous. Where once a plume origin seemed natural, we now consider a nonplume explanation to be at least as attractive. Studies currently collect-

ing teleseismic data in the greater Yellowstone area should answer most questions currently deemed important about this hotspot.

Hotspots are defined by their anomalous surface manifestations, in particular, the time-transgressive propagation of volcanism over hundreds of kilometers, often

Beneath Yellowstone *continued on p. 2*

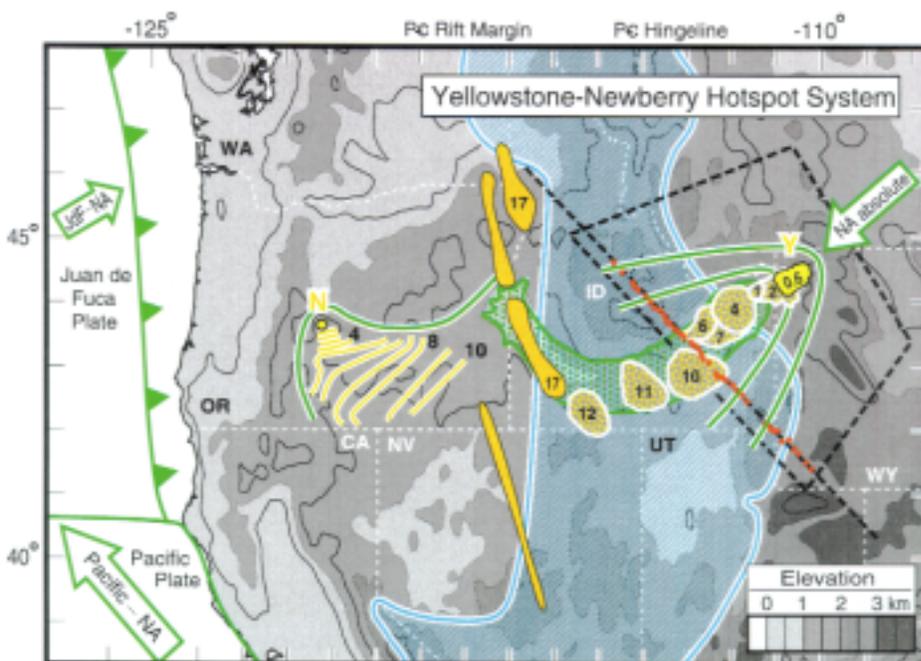


Figure 1. Volcanic-tectonic setting of Yellowstone-Newberry hotspot system. Volcanic elements are shown in gold and yellow (current locations of Yellowstone [Y] and Newberry [N] calderas in yellow), and tectonic elements are shown in blue (for older features) and green (younger features). Arrows indicate North America (NA) absolute motion and oceanic plate relative motions. Transform (solid) and subduction (toothed) plate boundaries are shown near western coastline. This hotspot system initiated 17 Ma from central Nevada rift—Steens Mountains—Columbia River flood basalt fissures (solid gold areas, from Christiansen and Yeats, 1992) located near the latest Precambrian rift margin of North America (western blue line, from Burchfiel et al., 1992). After ~5 m.y. delay, magmatism propagated west-northwest to Newberry (gold lines show initial rhyolitic volcanism in 1 m.y. increments, from MacLeod et al., 1976), constructing the High Lava Plains (north and west margins shown with green line in Oregon), and east-northeast to Yellowstone (major rhyolitic caldera centers shown in gold pattern with ages in m.y.; from Pierce and Morgan, 1992). Yellowstone propagation was rapid across Paleozoic passive margin (blue ruled area), and stalled near Precambrian hingeline (eastern blue line, from Burchfiel et al., 1992). Yellowstone swell occupies Anders et al.'s (1989) "tectonic parabola" (shown with parabolic-shaped green lines) and depressed Snake River Plain (green pattern). Red dots show seismometer locations. Black dashed lines indicate cross section and map area shown in Figure 3.

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**In Memoriam**

Frank C. Canney  
Lakewood, Colorado  
October 7, 2000

William W. Craig  
New Orleans, Louisiana  
September 25, 2000

Edward Barrett  
Valrico, Florida  
October 3, 2000

Albert Ray Jennings  
Abilene, Texas  
November 14, 1999

Robert U. King  
Wheat Ridge, Colorado  
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Beneath Yellowstone *continued from p. 1* with geochemically distinct lavas. Because of their inferred association with Earth's "stable interior," hotspots have played an important role in plate tectonic theory (e.g., Morgan, 1971). Also, their presumed role as the actively ascending part of mantle convection (e.g., Davies, 1993), arising from a lowermost mantle thermal boundary layer (e.g., the core-mantle boundary or a boundary in the lower mantle [Kellogg et al., 1999]), gives hotspots special geodynamic significance.

A mantle plume origin of hotspots is widely accepted, on the basis of the relative fixedness of hotspots, the need for an anomalous heat source, and elevated <sup>3</sup>He/<sup>4</sup>He values thought to represent long-isolated "primordial" mantle (e.g., Kellogg

and Wasserburg, 1990). These observations combine to support the simple and elegant model well known to earth scientists: Conduits rooted deep in the stable lower mantle supply relatively undepleted mantle that feeds the surface expressions of hotspots. In this model, hotspot magmatic activity begins with the impact of a large plume-fed head of hotspot mantle, to which many flood basalts are attributed (Duncan and Richards, 1991), and is followed by supply from the conduit, which constructs a hotspot track leading away from the site of basalt flooding with plate motion. However, the actual deep structure of hotspots, and therefore the actual processes underlying their behavior, are not well understood. Furthermore, an apparent absence of uplift prior to head



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## A Year of Accomplishment and Learning

*"I personally measure success in terms of the contributions an individual makes to her or his fellow human beings."*

Margaret Mead

My first full year as CEO of GSA has been filled with success and learning—for myself, for GSA Headquarters staff members, and for our elected Councilors and Officers. I want to review what we've accomplished this year, share results of goals set forth in my December 1999 Dialogue column, and share some new goals and expectations for the next 12 months and beyond.

## New Business Processes

GSA headquarters continues to evolve toward being a function-based organization, where the form of the organization follows the function of the projects we do for GSA members and the broader geoscience community. Staff efforts are focused in three key areas: providing programs, providing services, and creating products. Efforts in these areas are shaped by goals set forth in GSA's strategic plan.

The focal point of all programs, services, and products is *science*. That's why the chief science officer (CSO), whose role is to provide integration of these areas, shares leadership with the chief executive officer, whose role is to ensure that fiscal and human resources are available to accomplish the GSA vision.

CSO Cathleen May notes, "Headquarters' function is centered on supporting science and the value of science by and for GSA members. The changes in structure allow effective integration of functions within the system. On the staff side, the dedicated professionals at headquarters can work more directly and collaboratively on things that add meaning to their working lives."

Fiscal year 2000 was the first to utilize GSA's new budgeting process. It involves coordinated management of three separate budgets: an operating budget for core programs, services and products; a strategic budget for new initiatives derived from the strategic plan; and a capital budget for maintaining GSA facilities. This fiscal year, all three will come in at or under projected costs.

This new budgeting process allows for significant participation by GSA's elected leaders in reviewing and prioritizing projects in the strategic budget. The Programmatic Overview Committee (POC) reviewed nine business plans this year, ranging from electronic publishing to globalization. A total of \$1.275 million is set aside for strategic spending over the next 18 months.

A change in GSA's fiscal year in 2001–2002 from a calendar year to a 12-month year that begins July 1 will concentrate revenue-generating activities in the first two quarters. Should we miss our projected revenues, we would then have two additional quarters to make adjustments.

## Strategic Partnerships

Expanding our external focus, we initiated a partnership with The Geological Society (London). Our first joint activity, a global meeting in Edinburgh, Scotland, is scheduled for June 2001. The theme of this meeting is Earth System Processes, emphasizing the integrated nature of our science and the need for enhanced collaboration between geoscience disciplines and the related sciences we use to interpret earth system problems. Ian Fairchild and Ian Dalziel have set a unique technical program for this meeting, which you can see in the November issue of *GSA Today* or on the Web at [www.geosociety.org](http://www.geosociety.org).

In July we began discussions with the Geological Society of Australia on joint publications and a second global meeting in 2003.

GSA holds a unique position within the geoscience community. We have an imperative to expand our external focus and use our fiscal strength to pursue our collective vision for the geosciences. It has been a great year at GSA, with successful projects and new ventures. We couldn't have achieved these successes without the dedication, contribution, and sacrifice of GSA staff, and I thank each one of them. I'm looking forward to the year ahead, and wish you all a safe and prosperous new year.

impact and the unusual circumstances under which hotspot magmatism often initiates (e.g., Anderson, 1999; Czamanske et al., 1998) are difficult to incorporate into a plume model. As a result, alternative hotspot hypotheses have been suggested with an upper mantle origin (e.g., Anderson, 1994) or a dominance of upper-mantle processes (Saltzer and Humphreys, 1997).

Of the hotspots investigated seismically, Iceland and Yellowstone are the two most thoroughly studied. A plume origin is argued for Iceland based on tomograms of the upper mantle (Wolfe et al., 1997) and imaged deflection of the temperature-sensitive 410 km and 660 km seismic discontinuities (Shen et al., 1998). However suggestive, an absence of seismic informa-

tion from adjoining regions near Iceland provides little context in which to interpret the imaged structures. The Yellowstone hotspot offers the advantage of broad accessibility compared to oceanic hotspots, but teleseismic arrivals travel through the relatively complicated continental crust. The resulting tradeoff is that, compared with oceanic hotspots, the geometry of the ray set is superior for deep and regional imaging, but the data are degraded by greater amounts of crust-generated noise.

In most ways, Yellowstone is a typical hotspot. Figure 1 shows the Yellowstone-Newberry volcanic-tectonic system in the context of the western United States. Yellowstone is characterized by a magmatic track and a southwest-widening topo-

graphic swell left in the wake of the north-east-propagating (relative to North America) hotspot. The topographic swell is thought to result from plume flattening beneath the southwest-moving lithosphere (Anders and Sleep, 1992), as conceptualized in Figure 2. The swell's margins have been termed the "seismic parabola" (Anders et al., 1989) for their seismicity (see Fig. 3). The magmatic track is the eastern Snake River Plain, which trends near the symmetry axis of the swell; it is a topographic depression because basaltic intrusions have loaded the crust, causing subsidence (Anders and Sleep, 1992). For Yellowstone, as for some other hotspots, relatively high  $^3\text{He}/^4\text{He}$  values (Hearn et al., 1990) are thought by

Beneath Yellowstone *continued on p. 4*

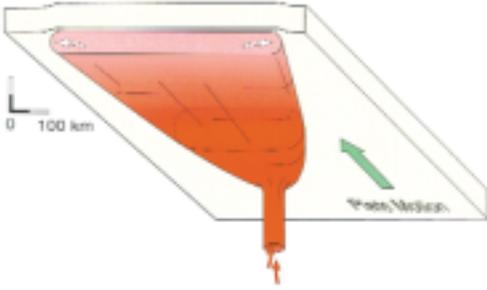


Figure 2. Simple hotspot model showing flattening plume beneath moving plate. Modeled after Ribe and Christensen, 1994.

### Beneath Yellowstone *continued from p. 3*

many to represent a lower mantle source.

The Yellowstone hotspot also is characterized by a strange initiation and a close association with another propagating continental hotspot, Newberry (Fig. 1). Yellowstone-Newberry magmatism began vigorously ca. 17 Ma with the eruptions of the central Nevada rift, Steens Mountains, and Columbia River flood basalts (Christiansen and Yeats, 1992). While often attributed to an impact of a plume head, there is no obvious indication of expected uplift preceding initial magmatism. Furthermore, these magmas erupted from a narrow set of fissures extending roughly north-south for ~700 km along the late Precambrian rift margin of North America (Fig. 1). Magmatic activity continued in this vicinity until ca. 12 Ma before propagating (irregularly) northeast toward Yellowstone and west-northwest toward Newberry. With a west-northwest direction of propagation, the Newberry hotspot cannot be connected to a stationary deep-seated plume

### TELESEISMIC INVESTIGATION

In teleseismic seismology, the distortion of seismic waves is analyzed to infer the structure of the upper mantle and crust through which the waves propagated as they arrive from distant earthquakes to an array of seismometers. To address the structure beneath the Yellowstone swell, we deployed a seismic array occupying ~50 sites in a line trending across the width of the swell (Figs. 1 and 3). Our work follows that of Evans (1982), who imaged upper mantle P-wave velocity structure by making use of traveltime delays of the first arriving waves recorded on 1 Hz vertical-motion seismometers. Our three-component broadband seismometers enabled receiver function imaging for crust and upper mantle interfaces, S-wave splitting analysis for upper mantle anisotropy, and P- and S-wave tomographic imaging of upper mantle velocity variations—methods now routine in teleseismic seismology.

### Receiver Function Imaging of Crustal and Mantle Interfaces

A P wave partially converts to an S wave as it travels across an interface. At Earth's surface, the time delay of the converted S wave relative to the (faster traveling) P wave is proportional to the depth of the interface, and the magnitude of the S wave depends on the seismic contrast of the interface. Using these principals, the receiver function technique was used to image crustal and upper mantle discontinuities beneath our array. Combined with previous reflection-refraction investigations (Sparlin et al., 1982), receiver function analysis allowed Peng and Humphreys (1998) to image the crustal structures shown in Fig. 3: (1) a mid-crustal basalt sill across the width of the Snake River Plain, (2) an ~5 km thick partially molten lowermost crust across the width of the plain, and (3) a Moho that is approximately flat across the width of the seismic parabola but which thickens rapidly southeast of the swell. P-wave velocities (from Sparlin et al., 1982) suggest that the basalt sill is about half basalt and half

the granitic country rock that comprises the upper crust away from the eastern Snake River Plain. The ~10 km thickness of the basalt sill therefore implies ~5 km of basalt added to the upper crust across the width of the eastern plain, and the partially molten lower crust suggests an underplating of probably 5 or more km of gabbroic crust. This crustal inflation is not reflected by a greater Moho depth, suggesting that lower crust was squeezed from beneath the eastern Snake River Plain to adjoining regions.

Perhaps the most important result of crustal imaging is the information it provides to model crustal density structure, which allows us to calculate mantle buoyancy across the width of our array. Mantle buoyancy holds the swell about 1 km higher than would normal mantle (e.g., eastern U.S. seaboard mantle), whereas mantle southeast of the swell is of more normal density (Peng and Humphreys, 1998). The highly (and uniformly) buoyant mantle across the width of the swell and the isostatic balance of the crust above it are consistent with standard thoughts on hotspots (e.g., Fig. 2).

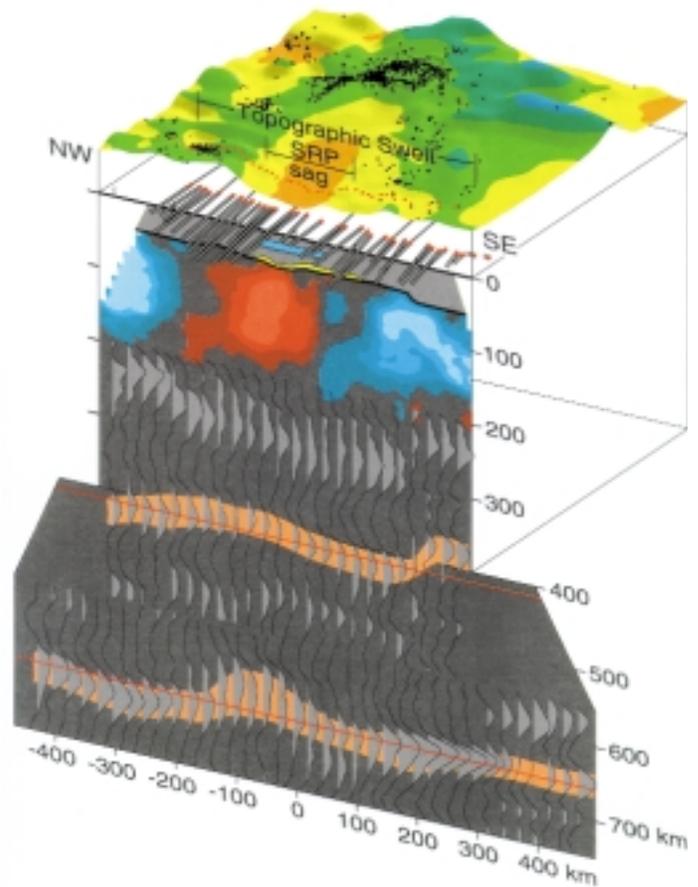


Figure 3. Seismic structure beneath Yellowstone swell. View is to north. High topography (green) correlates with local seismicity (black dots) and defines hotspot swell. Teleseismic studies derived from data collected by seismometers crossing swell (red dots) image: (1) crust that is not greatly thickened beneath Snake River Plain (SRP) (Moho shown with heavy line near 40 km depth), in spite of intrusion of high-velocity mid-crustal basalt sill (blue) and partially molten underplate (yellow); (2) high-velocity mantle (blue) beneath higher elevations and low-velocity mantle (red) beneath depressed SRP (contour level is 1% in P-wave velocity); (3) split SKS waves indicating anisotropic mantle with a fast-axis orientation oriented to the southwest (black and white bars show split times of 0.6–1.6 s; black bars show unsplit arrivals that were naturally polarized in the direction of the bar); and (4) undulatory 410 km and 660 km interfaces (highlighted in salmon color). These imply: (1) that mantle is approximately uniformly buoyant across entire swell; (2) upper 200 km of mantle is partially molten beneath SRP and depleted of basaltic component elsewhere beneath swell; (3) upper few hundred km of mantle has been simply sheared with a southwest-northeast finite extension direction; and (4) mantle beneath SRP is anomalously hot beneath SRP at 660 km, but appears to be cool at 410 km.

Yellowstone swell defines a coherent, simple, and distinctive upper mantle anisotropy domain.

There are two reasonable ways to interpret the observed upper mantle anisotropy. In the first, buoyant mantle beneath the swell is simply sheared by North America as it moves over a more stable interior (causing the *a* axis of olivine to align preferentially in the direction of plate transport. Another possibility is that a plume supplies buoyant mantle at a high rate, and this buoyant mantle flows to the southwest accommodated by deformation in the previously deposited low-viscosity hotspot asthenosphere (see Fig. 2). In this model, the southwest orientation of the finite elongation direction results from mantle flow driven by the local pressure gradient, and not by passive shear driven by plate motion. The similarity of results from different processes highlights the difficulties in understanding the mechanisms responsible for the mantle structure.

### Tomographic Imaging of the Upper Mantle Velocity Variations

Figure 3 shows an image of the upper mantle P-wave velocity structure (Saltzer and Humphreys, 1997). Red and blue areas represent areas where waves propagate relatively slowly (red) and quickly (blue). The blue areas have a seismic velocity that is about average for mantle beneath continents. The low-velocity anomaly is about as wide as the Snake River Plain, and is much narrower than the swell. The prominence of the relatively high-velocity mantle beneath the high-standing swell seems at odds with simple plume models, which have buoyant mantle distributed beneath the entire swell (as in Fig. 2). A nearly universal relation is that seismically fast rock is dense, yet the mantle is highly buoyant across the width of the swell (as discussed in the "Receiver Function" section). The only reasonable explanation for mantle that is both buoyant and relatively fast is that it is significantly depleted in basaltic components. Such depletion decreases density while increasing seismic velocity (Jordan, 1979), and this is one of the few cases where density and velocity correlate inversely. There is only one reasonable explanation for the

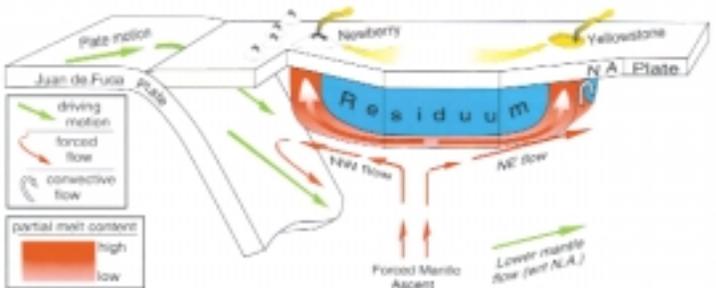


Figure 5. Forced mantle flow and decompression melting resulting from local plate motions. Far from subduction zone, a northeast-directed forced shear across upper mantle (right red arrow) results from northeast motion of stable lower mantle relative to southwest-moving North America (NA). Near the subduction zone upper mantle is forced to flow northwest (left red arrows) because of corner flow driven by subducting plate. Yellowstone and Newberry magmatism follows these trends as fertile mantle flows past residuum and ascends (red-to-white arrows). Decompression melting causes convection (white arrows) and magmatism, creating new residuum at ends of residuum body (Fig. 4 shows details of process). Diverging upper mantle flow evacuates asthenosphere from central area, forcing mantle ascent.

imaged upper mantle structure: The slow mantle is partially molten and the fast mantle has been depleted of basaltic melt and currently is essentially devoid of significant melt. The observed ~7% contrast in P-wave velocity across the width of the swell requires melt fractions of up to ~2% in the red areas. The

Beneath Yellowstone *continued on p. 6*

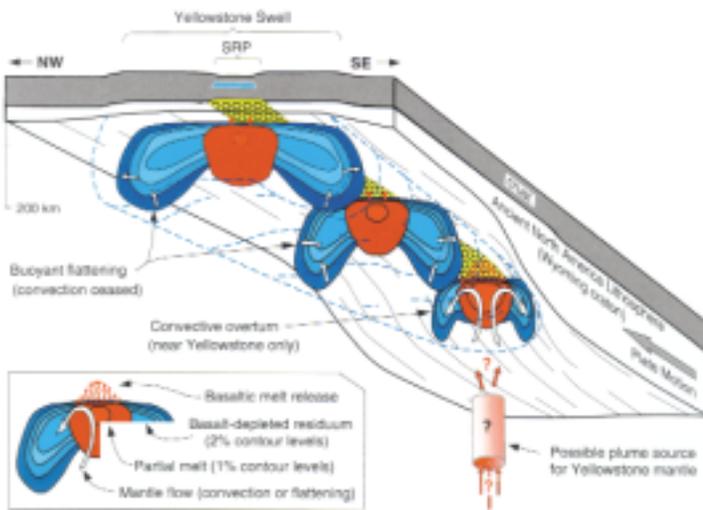


Figure 4. Schematic of mantle processes active within asthenosphere beneath Yellowstone swell. Buoyant and fertile mantle ascends beneath area of active hotspot magmatism, possibly supplied by mantle plume (see Fig. 5 for alternative model). Melt buoyancy drives convection in this mantle (large white arrows). Melt is expelled at top of convective roll (wavy red lines) and depleted residuum (blue areas) is pushed to sides, where it accumulates. When residuum buoyancy equals melt buoyancy, convective overturn ceases, leaving partially molten core (red areas). Buoyant mass then flattens (small white arrows) as it is carried southwest by North America plate motion. Effects of hotspot on North America are (1) magmatic modification of Snake River Plain (SRP) (basaltic underplating of crust, shown in yellow, and intrusion of basalt into midcrust, shown with blue tabular body), which loads and depresses SRP crust, and (2) uplift of region underlain by buoyant mantle (within the blue envelope), creating Yellowstone swell. With plate motion, Yellowstone encounters increasingly thick lithosphere of Wyoming craton.

Dueker and Sheehan (1997) used P-to-S conversions from the 410 km and 660 km seismic discontinuities to assess if locally hot mantle (e.g., plume-affected mantle) deflects these interfaces. Making use of the fact that interface deflection is of opposite sign on these interfaces for a given temperature anomaly (Bina and Helffrich, 1994), the observed thinning of the intervening layer by ~20 km (Fig. 3) beneath the Snake River Plain suggests a thermal anomaly there of 150–200 °C. This result, however, is entirely a consequence of the upwarp in the 660 km discontinuity; the upwarped 410 km discontinuity implies cooler temperatures at this depth beneath the plain.

### S-wave Splitting and Upper Mantle Anisotropy

Upper mantle strain via olivine dislocation creep tends to align the olivine *a* axis in the finite elongation direction, and even moderate strains (one or more) can create a significant fabric in this orientation (Ribe, 1992). Much like light traveling through a crystal, an S wave passing through anisotropic upper mantle will split into two orthogonally polarized waves, with the faster traveling wave vibrating parallel to the direction of the *a* axis. The polarization of SKS waves in a known direction makes them ideal for anisotropy studies. Figure 3 shows the results of split SKS waves recorded by our array (from Schutt et al., 1998). The fast-wave polarizations trend approximately N65E, which is nearly aligned with the hotspot track and North America absolute plate motion. Waves that were naturally polarized with this orientation are not split, indicating that anisotropy of a different orientation does not exist at greater depth. The region of nearly uniform anisotropy orientation ends near the southeast margin of the swell, and most of the western United States has orientations not aligned with North America absolute plate motion (Savage and Sheehan, 2000). Thus the asthenosphere beneath the

inferred compositional buoyancy of the blue mantle results from 5%–10% basalt segregation, and this compositional buoyancy accounts for much of the swell's high elevation (Saltzer and Humphreys, 1997).

### ASSESSING YELLOWSTONE'S ORIGIN

Imaged seismic structures and calculated mantle buoyancy beneath the Yellowstone swell imply that the swell mantle is anomalously hot to depths of  $\geq 200$  km, is not anomalously hot at 410 km, and is hot again at 660 km. The red mantle beneath the Snake River Plain in Figure 3 is 1%–2% partially molten, and the blue mantle beneath the adjoining swell is 5%–10% depleted of basaltic components. Mantle is anisotropic beneath the swell, with finite extension oriented approximately N65E, and this orientation does not vary with depth. This anisotropy is unique to the Yellowstone swell; it contrasts with the western U.S. mantle away from the swell, which is more complexly strained in different orientations.

Plume or no plume, we can make sense of these results only if we include local convection beneath Yellowstone, as illustrated in Figure 4 (Saltzer and Humphreys, 1997). A source of hot and fertile mantle is needed to produce significant basaltic melt upon adiabatic ascent, and the melt buoyancy drives convection (as modeled by Tackley and Stevenson, 1993). Melt release occurs when melt migration rates exceed convective flow rates (probably at melt fraction of  $\sim 2\%$ ). The escaping melt underplates and intrudes the crust. Convection ceases when the buoyancy of accumulating residuum equals that of the partially molten core. This mantle overturn occurs beneath the active caldera system (currently at Yellowstone). Then, the entire buoyant mass flattens as it is transported by plate motion away from the site of magma release, creating the southwest-widening swell. Mantle strain occurs primarily through southwest-northeast-directed simple shear. This could result from plate motion over a more stable interior, or by flow of Yellowstone asthenosphere away from Yellowstone and confined to the low-viscosity volume of hotspot asthenosphere previously deposited. These conclusions are sound in that they explain the peculiar seismic and density structure observed beneath our array, and they account for the magmatism. They do not specify a source for hot and fertile mantle. In particular, they permit the plume hypothesis for Yellowstone (but require convection to occur within the flattening hotspot asthenosphere).

However, once local upper mantle convection is recognized, there is potential

to interpret Yellowstone entirely as an upper mantle phenomenon. Our model for this incorporates the flow interaction of asthenosphere with the volume of residuum created by prior melt release. Because this residuum is buoyant and relatively viscous, it tends to attach itself to the North America plate and move with this plate. The residuum protects the overlying plate by inhibiting subsequent magmatism, and as it is dragged along, asthenosphere flows beneath it and up as it passes the leading edge of the residuum body (as illustrated in Fig. 5). Melting occurs with ascent, driving the local convection that produces focused magmatism (as in Fig. 4) and adds to the residuum body.

Magmatic propagation therefore can be seen as a natural upper mantle process when hot, fertile mantle is subjected to shear, as in plate transport. Schmelling (2000) is producing such propagating melt-driven convective instabilities in computer simulations. An especially attractive feature of this model is that to the west, near the plate margin, upper mantle flow and shear directions probably are directed west-northwest, in the direction of Newberry propagation, as a result of subduction-driven corner flow (Fig. 5). Hence, both Yellowstone and Newberry magmatism can be explained by a single (upper mantle) mechanism. Furthermore, the divergence of upper mantle flow drives mantle ascent between Newberry and Yellowstone (Fig. 5) that can account for the initiation of magmatism over an elongate region. This could occur if unusually hot or fertile mantle were drawn up in a zone parallel to the subducting plate, or if the ascending mantle were focused on an area of fertile North America lithosphere, such as the Precambrian rift margin (where fertile asthenosphere "froze" onto North America during Paleozoic downwarping of this margin). And the observed  $^3\text{He}/^4\text{He}$  anomaly can be attributed to drawing up some primordial lower mantle.

One can ask why other Yellowstones and Newberrys are not distributed around the western United States. In fact, there are other magmatic trends oriented northwest (most western Great Basin magmatism) and northeast (e.g., Jemez, St. George) with associated low-velocity mantle trends (Humphreys and Dueker, 1994). The relative vigor of Yellowstone magmatism may result from its tectonic setting (adjacent to the Cascadia subduction zone and where focused northeast-oriented extension occurs), or perhaps it may simply represent the activity of an unusual lithospheric trend (Iyer and Healey, 1972) or relatively hot mantle.

### ACKNOWLEDGMENTS

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National Science Foundation grants supporting work across the Yellowstone swell (EAR 9206565 and 9628474), the adjoining Wyoming and Colorado lithosphere (EAR 9418252 and 9614647) and greater Yellowstone area (EAR 9725598). Don Anderson, Norm Sleep, and Karl Karlstrom provided useful reviews.

### REFERENCES CITED

- Anders, M.H., Geissman, J.W., Piety, L.A., and Sullivan, J.T., 1989, Parabolic distribution of circumeastern Snake River Plain seismicity and latest Quaternary faulting: Migratory pattern and association with the Yellowstone hotspot: *Journal of Geophysical Research*, v. 94, p. 1589–1621.
- Anders, M.H., and Sleep, N.H., 1992, Magmatism and extension: The thermal and mechanical effects of the Yellowstone hotspot: *Journal of Geophysical Research*, v. 97, p. 15,379–15,393.
- Anderson, D.L., 1994, The sublithospheric mantle as the source of continental flood basalts: The case against the continental lithosphere and plume head reservoirs: *Earth and Planetary Science Letters*, v. 123, p. 269–280.
- Anderson, D.L., 1999, A theory of the Earth: Hutton and Humpty Dumpty and Holmes, in Craig, G.Y., and Hull, J.H., eds., James Hutton, present and future: Geological Society [London] Special Publication 150, p. 13–35.
- Bina, C.R., and Helffrich, G., 1994, Phase transition Clapeyron slopes and transition zone seismic discontinuity topography: *Journal of Geophysical Research*, v. 99, p. 15,853–15,860.
- Burchfiel, B.C., Cowan, D.S., and Davis, G.A., 1992, Tectonic overview of the Cordilleran orogen in the western United States, in Burchfiel, B.C., et al., eds., The Cordilleran orogen: Geology of North America, Conterminous U.S.: Boulder, Colorado, Geological Society of America, v. G-3, p. 407–479.
- Christiansen, R.L., and Yeats, R.S., 1992, Post-Laramide geology of the U.S. Cordilleran region, in Burchfiel, B.C., et al., eds., The Cordilleran orogen: Geology of North America, Conterminous U.S.: Boulder, Colorado, Geological Society of America, v. G-3 (plates).
- Czamanske, G.K., Gurevitch, A.B., Fedorenko, V., and Simonov, O., 1998, Demise of the Siberian plume: Paleogeographic and paleotectonic reconstruction from the prevolcanic and volcanic record, north-central Siberia: *International Geology Review*, v. 40, p. 95–115.
- Davies, G.F., 1993, Cooling the core and mantle by plume and plate flows: *Geophysical Journal International*, v. 115, p. 132–146.
- Dueker, K.G., and Sheehan, A.F., 1997, Mantle discontinuity structure from midpoint stacks of converted P to S waves across the Yellowstone hotspot track: *Journal of Geophysical Research*, v. 102, p. 8313–8327.
- Duncan, R.A., and Richards, M.A., 1991, Hotspots, mantle plumes, flood basalts, and true polar wander: *Reviews of Geophysics*, v. 29, p. 31–50.
- Evans, J.R., 1982, Compressional wave velocity structure of the upper 350 km under the eastern Snake River Plain near Rexburg, Idaho: *Journal of Geophysical Research*, v. 87, p. 2654–2670.
- Hearn, E.H., Kennedy, B.M., and Truesdell, A.T., 1990, Coupled variations in helium isotopes and fluid chemistry: Shoshone Geyser Basin, Yellowstone National Park: *Geochimica et Cosmochimica Acta*, v. 54, p. 3103–3113.
- Humphreys, E.D., and Dueker, K.G., 1994, Physical state of the western U.S. upper mantle: *Journal of Geophysical Research*, v. 99, p. 9635–9650.
- Iyer, H.M., and Healey, J.H., 1972, Teleseismic residuals at the Lasa-USGS extended array and their interpretation in terms of crust and upper-mantle structure: *Journal of Geophysical Research*, v. 77, p. 1003–1027.
- Jordan, T.H., 1979, Mineralogies, densities, and seismic velocities of garnet lherzolites and their geophysical implications, in Boyd, F.R., et al., eds., The mantle sample: Inclusions in kimberlites and other volcanics: Proceedings of the 2nd International Kimberlite Conference, Volume 2: Washington, D.C., American Geophysical Union, p. 1–14.

Karato, S.-I., 1992, On the Lehmann discontinuity: *Geophysical Research Letters*, v. 51, p. 2255–2258.

Kellogg, L.H., Hager, B.H., and Van der Hilst, R.D., 1999, Compositional stratification in the deep mantle: *Science*, v. 283, p. 1881–1884.

Kellogg, L.H., and Wasserburg, G.J., 1990, The role of plumes in mantle helium fluxes: *Earth and Planetary Science Letters*, v. 99, p. 276–289.

Morgan, W.J., 1971, Convection plumes in the lower mantle: *Nature*, v. 230, p. 42–43.

MacLeod, N.S., Walker, G.W., and McKee, E.H., 1976, Geothermal significance of eastward increase in age of upper Cenozoic rhyolitic domes in southeastern Oregon, in *Second United Nations Symposium on the Development and Use of Geothermal Resources*: Washington, D.C., U.S. Government Printing Office, v. 1, p. 465–474.

Peng, X., and Humphreys, E.D., 1998, Crustal velocity structure across the eastern Snake River Plain and the Yellowstone swell: *Journal of Geophysical Research*, v. 103, p. 7171–7186.

Pierce, K.L., and Morgan, L.A., 1992, The track of the Yellowstone hotspot: Volcanism, faulting, and uplift: *Geological Society of America Memoir* 179, p. 1–53.

Ribe, N.M., and Christensen, U.R., 1994, Three-dimensional modeling of plume-lithosphere interaction: *Journal of Geophysical Research*, v. 99, p. 669–682.

Ribe, N.M., 1992, On the relation between seismic anisotropy and finite strain: *Journal of Geophysical Research*, v. 97, p. 8737–8747.

Saltzer, R.L., and Humphreys, E.D., 1997, Upper mantle P wave velocity structure of the eastern Snake River Plain and its relationship to geodynamic models of the region: *Journal of Geophysical Research*, v. 102, p. 11,829–11,841.

Savage, M.K., and Sheehan, A.F., 2000, Seismic anisotropy and mantle flow from the Great Basin to the Great Plains, western United States: *Journal of Geophysical Research*, v. 105, p. 13,725–13,734.

Schutt, D., Humphreys, E.D., and Dueker, K., 1998,

Anisotropy of the Yellowstone hotspot wake, eastern Snake River Plain, Idaho: *Pure and Applied Geophysics*, v. 151, p. 443–462.

Schmelling, H., 2000, Partial melting and melt segregation in a convecting mantle, in Bagdassarov, N., et al., eds., *Physics and chemistry of partially molten rocks*: Dordrecht, Kluwer Academic Publishers, p. 141–178.

Shen, Y., Solomon, S.C., Bjarnason, I.T., and Wolfe, C.J., 1998, Seismic evidence for a lower-mantle origin of the Iceland Plume: *Nature*, v. 395, p. 62–65.

Sparlin, M.A., Braile, L.W., and Smith, R.B., 1982, Crustal structure of the eastern Snake River Plain determined from ray trace modeling of seismic refraction data: *Journal of Geophysical Research*, v. 87, p. 2619–2633.

Tackley, P.J., and Stevenson, D.J., 1993, A mechanism for spontaneous self-perpetuating volcanism on the terrestrial planets, in Stone, D.B., and Runcorn, S.K., eds., *Flow and creep in the solar system: Observations, modeling and theory*: Norwell Massachusetts, Kluwer Academic Press, p. 307–322.

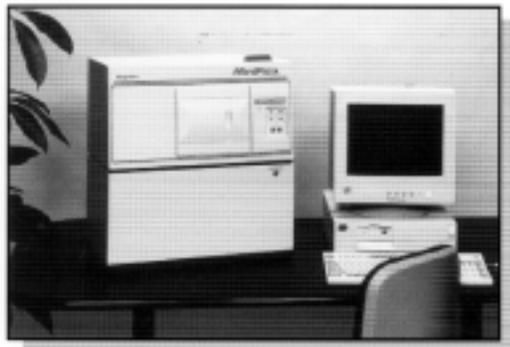
Wolfe, C.J., Bjarnason, I.T., VanDecar, J.C., and Solomon, S.C., 1997, Seismic structure of the Iceland mantle plume: *Nature*, v. 385, p. 245–247.

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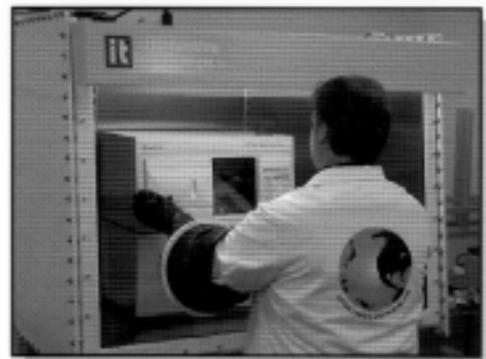
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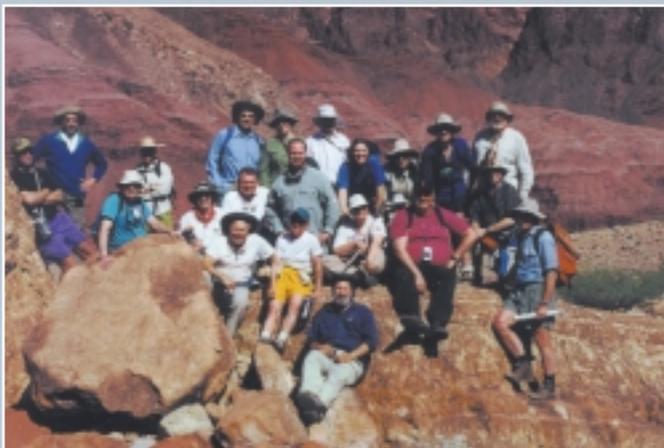
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# GeoVentures *Range Across the West*



GeoTrip: Geology of the Grand Canyon—Lee's Ferry to Pierce Ferry. April; 18 participants. Leader: Ivo Lucchitta, U.S. Geological Survey, Flagstaff, Arizona. "Ivo was incredible, very patient with answering my questions. The impact of the trip is still affecting me; I think I'm incredibly lucky to have gone on this trip and I hope I get to do it again!" wrote Shan Stuart, Aspen, Colorado. Photo by David Kirchner.



GeoHostel: Geology of Southern Utah—Valley of Fire in Southern Nevada, Zion and Bryce Canyon National Parks of Southern Utah. June; 18 participants. Leaders: Spence Reber, Chevron USA (retired), and Janice Higgins, Dixie College, St. George, Utah. "Leaders were excellent! Spence wrote the book!" said Mel Weidner, Mesa, Arizona. Photo by Frank Kresse.



GeoHostel: Geology of the Lewis and Clark Expedition: Lost Trail Pass to the Columbia River. July; 33 participants. Leaders: Robert Thomas and Sheila Roberts, Western Montana College, Dillon, Montana. "Great leaders—very knowledgeable. Their styles complemented one another. I liked the way Rob elicited comments and speculation from the group," wrote Bea Mayes, Salt Lake City, Utah. Photo by Rob Thomas.



Frank Kresse in southern Utah on his eighth GeoVenture. Photo by Edna Collis.

## *and to Argentina in 2000*

**T**he 2000 GSA GeoVentures Program offered four programs unrelated to the annual or section meetings. The total of 84 participants, ranging in age from 34 to 80, represented a wide range of interests and backgrounds.

This educational program serves professionals who enjoy their geology and the company of other geologists in a field setting. GeoVentures are a special benefit created for members, but are open to guests and friends also.

GeoVentures is the overall name for adult educational and adventure experiences of two kinds: GeoHostels and GeoTrips. Both are known for superior scientific leadership. Fees are moderate (relative to the destination, length, time of year, and number of participants). GeoHostels are usually five-day, campus-based programs. GeoTrips are anywhere from one to three weeks in length, and the itinerary covers a wide variety of destinations.



GeoTrip: Deformation, Dinosaurs, and Darwin. July–August; 15 participants. Leaders: James Reynolds, Brevard College, Brevard, North Carolina, and Dorothy L. Stout, Cypress College, Cypress, California. "Jim's knowledge is superior! We enjoyed his humor and expertise. Dottie is a legend in her own time!" wrote Sandy Jewett and Peter Weigand, Granada Hills, California. Photo by Imelda Cragin.

Boston 2001:

# A Geo-Odyssey

Now that you're home from Reno, it's time to start thinking about booking your trip to Boston for A Geo-Odyssey, GSA's Annual Meeting and Exposition in November 2001.

You are invited to submit proposals for topical sessions and Pardee Keynote Symposia for this important earth science summit. Proposals are due by January 8, 2001, and must be submitted electronically at [www.geosociety.org](http://www.geosociety.org).

Boston is not only a magnificent city with world-class meeting facilities, myriad fine dining and entertainment choices, and fascinating historical sites and tours, it's a showcase for varied geology. Highlights include the crystalline rocks of the northern Appalachians, Pleistocene and coastal sediments and geomorphology, hydrological and environmental reclamation sites such as nearby Woburn of "A Civil Action" fame, and downtown Boston's current ambitious highway engineering wonder, the Big Dig. (See the November issue of *GSA Today* for more on Boston.)

## Program Opportunities

Whether this will be your first trip to a GSA Annual Meeting or your twenty-first, you'll find that the program's mixture of invited and volunteered papers and varying session formats allow for an effective, dynamic, and flexible lineup.

Joint Technical Program Committee (JTPC) representatives play a large role in program decisions. Descriptions of the various program options and guidelines are available at [www.geosociety.org](http://www.geosociety.org). Since modifications are made from year to year, please read the guidelines carefully before submitting a proposal. Two types of sessions can be proposed:

Topics for *Pardee Keynote Symposia*, made possible by a grant from the Joseph T. Pardee Memorial Fund, should be of broad interest to the geoscience community, be on the leading edge in a scientific discipline or area of public policy, address broad fundamental problems, be interdisciplinary, or focus on global problems. Selection is on a competitive basis; the primary criterion is excellence. Four to eight half-day, nonconcurrent sessions will be offered. All speakers will be invited.

*Topical Sessions* promote the exchange of timely or state-of-the-art information on a central topic and allow scheduling of interdisciplinary talks on a specific topic. Organizers (advocates) may invite specific papers to ensure a successful

and excellent session, but must include volunteered abstracts, which are solicited in *GSA Today* for all approved topical sessions. A maximum of four invited speakers may be allowed, although advocates may request more invitations. Advocates may request considerations such as a special format. All requests are reviewed by the JTPC for approval. To be part of the technical program, all sessions must receive a minimum of 12 abstracts. Advocates are encouraged to submit proposals as poster sessions to accommodate the growth of the technical program and the limitations of meeting space.

## Oral and Poster General Sessions

The number of abstracts received determines the number of general sessions (consisting entirely of volunteered papers) in each discipline. The goal of the Technical Program Committee (TPC) and the JTPC representatives is to provide presenters the best possible opportunity for communicating new scientific information rather than to dictate what can or will be presented. (The rejection rate for recent GSA Annual Meetings has been less than 5%.) Expanded poster sessions allow presentation of more papers. An effort will be made to avoid scheduling poster sessions concurrently with oral sessions in the same discipline to allow for well-attended, dynamic sessions.

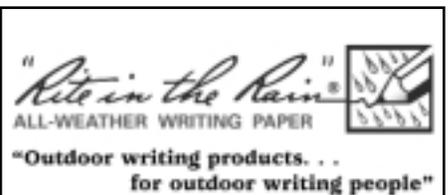
## Hot Topics Spice up the Lunch Hour

These hour-long lunchtime forums differ from technical sessions in that they focus on discussion and audience participation. A debate format is recommended; panels are discouraged. Each session must have a moderator, and titles should be catchy and provocative. If you are interested in organizing a session or in being a Hot Topics Chair, contact Technical Program Co-Chair Rob Young.

If you have any questions or concerns regarding the program, please call or e-mail one of the following people:  
Rob Van der Voo, Annual Program Chair (2000-2001), (734) 764-8322; [voo@umich.edu](mailto:voo@umich.edu).  
Rob Young, Technical Program Co-Chair, (828) 227-3822; [ryoung@wcuvox1.wcu.edu](mailto:ryoung@wcuvox1.wcu.edu).  
David Bush, Technical Program Co-Chair, (770) 836-4597; [dbush@westga.edu](mailto:dbush@westga.edu).

## 2001 Schedule

January 8	Proposals due. <i>Firm deadline; electronic submissions required.</i>
April	Electronic abstracts form available at <a href="http://www.geosociety.org">www.geosociety.org</a> for active submissions.
July 17	Paper-copy original and 5 copies due at GSA. <i>Firm deadline.</i> No paper abstracts accepted after this date— <i>no exceptions.</i>
July 24	<i>Electronic abstracts deadline.</i> Electronic copies accepted until midnight (MST).
August 17	Program schedule finalized.
September 4	Accepted abstracts appear on <a href="http://www.geosociety.org">www.geosociety.org</a> .



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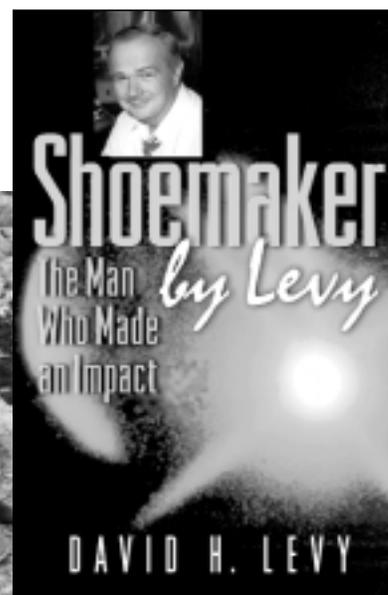
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# NORTHEASTERN SECTION, GSA 36th Annual Meeting

Burlington, Vermont, March 12–14, 2001  
[www.geosociety.org/sectdiv/northe/01nemtg.htm](http://www.geosociety.org/sectdiv/northe/01nemtg.htm)

The hosts for the 2001 meeting of the GSA Northeastern Section are geologists from the University of Vermont, Middlebury College, Norwich University, Vermont State Colleges at Johnson, Lyndonville, and Castleton, the State University of New York at Plattsburg, the Vermont Geological Society, and the Vermont Geological Survey. Meeting in conjunction are the Eastern Section of the Society for Sedimentary Geology (SEPM), the Northeastern Section of the Paleontological Society (NEPS), the Eastern New England Sections of the National Association of Geology Teachers (NAGT), the Association for Women Geoscientists, and the council on Undergraduate Research Geology Division. The meeting will be held at the Sheraton Conference Center, 870 Williston Road, Burlington, VT 05403.

## REGISTRATION

Preregistration deadline:  
February 2, 2001

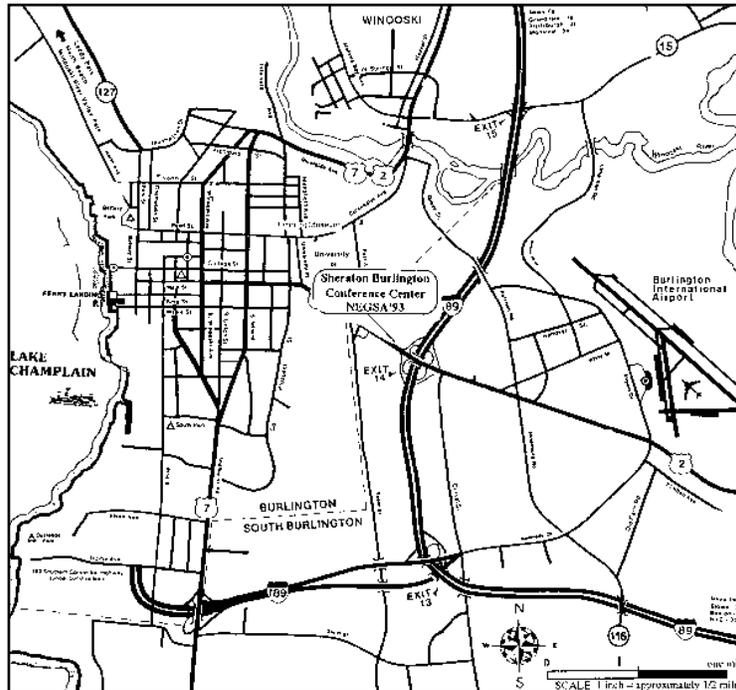
Registration will be handled by GSA Headquarters. To obtain lower registration fees and to assist planning by the local committee, please preregister online at [www.geosociety.org](http://www.geosociety.org), or use the preregistration form found on page 14.

Preregistration discounts are given to members of GSA and the associated societies listed on the preregistration form. Students and K–12 teachers must send or show a *current ID* in order to obtain these rates. Preregistration forms must be received by GSA no later than *February 2, 2001*. Register only one professional or student per form and retain a copy for your records. If you preregister, your badge will be mailed to you approximately two weeks prior to the meeting. For detailed information, visit the Web site given above.

## CANCELLATIONS, CHANGES, AND REFUNDS

All requests for additions, changes, and cancellations must be made in writing and received by *February 9, 2001*. There

will be NO refunds for on-site registration, Abstracts with Programs and ticket sales. Members pay less. You can join now or at the meeting. Contact GSA Headquarters at (303) 447-2020 for further information.



## ON-SITE REGISTRATION SCHEDULE

Sheraton Conference Center, Lobby area	
Sunday, March 11	4–8 p.m.
Monday, March 12	7 a.m.–4:30 p.m.
Tuesday, March 13	7 a.m.–4:30 p.m.
Wednesday, March 14	7–10 a.m.

## ACCESSIBILITY FOR REGISTRANTS WITH SPECIAL NEEDS

The GSA Northeastern Section is committed to making every event at its 2001 meeting accessible to all people interested in attending. If you have special requirements (such as an interpreter or wheelchair accessibility), indicate this on the meeting registration form, or contact Char Mehrtens, Department of Geology, University of Vermont, Burlington, VT 05405, (802) 656-3396, fax 802-656-0045, [cmehrtens@zoo.uvm.edu](mailto:cmehrtens@zoo.uvm.edu). Please let us know your needs by *February 2, 2001*.

## LOCATION AND DIRECTIONS

Meeting registration, technical sessions, poster sessions, and exhibits will be in the Sheraton Conference Center, 870 Williston Road (Route 2), Burlington, VT. See accompanying map or the GSA Web site. The Burlington area is located on the eastern shore of Lake Champlain, which is bordered to the east by the Green Mountains and to the west by the Adirondack Mountains. The metropolitan area of approximately 120,000 is conveniently located near many of the major ski areas. Temperatures during March range from the 30s to the 50s. The area is conveniently served by several major airlines, while rail and an excellent highway system connect with central and southern New England, New York, and eastern Canada.

## TECHNICAL PROGRAM

Oral sessions will normally include 15 minutes for presentation and five minutes for questions and discussion. Two 35 mm projectors, two screens, and one overhead projector will be provided in each of the oral sessions. Speakers are encouraged to bring their slides already loaded into carousel trays.

## Speaker Ready Room

The Kingsland room at the Sheraton Conference Center will be available Sunday, March 11, 6–10 p.m., Monday and Tuesday, March 12 and 13, 7 a.m.–9 p.m., and Wednesday, March 14, 7 a.m.–noon for previewing slides. Additional carousel trays may be signed out from the speaker ready room. For those wishing additional technical services, please contact Paul Bierman, Department of Geology, University of Vermont, Burlington, VT 05405, (802) 656-3396, fax 802-656-0045, [pbierman@zoo.uvm.edu](mailto:pbierman@zoo.uvm.edu).

## Poster Sessions

Poster sessions will allow three hours of display time; the authors must be present for two hours. Two 4 x 4 foot and one 4 x 8 foot boards will be provided for each U-shaped booth. Access to electrical outlets and furniture for poster sessions must be requested well in advance. Contact Barry Doolan, Department of Geology, University of Vermont, Burlington, VT 05405, (802) 656-0248, fax 802-656-0045, [bdoolan@zoo.uvm.edu](mailto:bdoolan@zoo.uvm.edu).

Northeastern Section *continued on p. 12*

## ABSTRACTS

Abstracts Deadline:  
December 5, 2000

Abstracts for all sessions must be submitted on-line, at the GSA Web site. If you are unable to submit your abstract electronically, please contact the GSA Technical Program Coordinator, Nancy Carlson, (303) 447-2020, ext. 161, ncarlson@geosociety.org. Only one volunteered paper may be presented by an individual; however a person may be a coauthor on other papers. Also, those invited for symposia may present additional papers.

## SYMPOSIA

Symposia will include invited papers and selected volunteered papers. Prospective authors are encouraged to contact individual conveners directly. Address requests for general information regarding symposia to Tracy Rushmer, or Andrea Lini, Department of Geology, University of Vermont, Burlington, VT 05405, (802) 656-3396, fax 802-656-0045, trushmer@zoo.uvm.edu; alini@zoo.uvm.edu.

1. Caledonian Magmatism: Cross-Atlantic Connections. John Hogan, (573) 341-4618, jhogan@umr.edu; Calvin G. Barnes (806) 742-3106, Cal.Barnes@ttu.edu; Øystein Nordgulen, oystein.nordgulen@ngu.no; A.K. Sinha, pitlab@vt.edu.
2. Fault Zone Evolution and Convergent Tectonics—A Symposium in Honor of Rolfe Stanley. Keith Klepeis, (802) 656-0246, kklepeis@zoo.uvm.edu; Marjorie Gale, (802) 241-3608, MARJIEG@dec.anr.state.vt.us.
3. Glacial Processes in New England: A Symposium in Honor of Fred Larsen. Stephen Wright, (802) 656-4479, swright@zoo.uvm.edu; Laurence R. Becker, (802) 241-3273, larryb@dec.anr.state.vt.us.
4. Multidisciplinary Research Topics: Lake Champlain Basin. *Sponsored by the Northeast Section of SEPM.* Pat Manley, (802) 443-5430, manley@middlebury.edu; Tom Manley, (802) 443-3114, tmanley@middlebury.edu.
5. Thermochronology from Apatite to Monazite: Deciphering Poly-metamorphic Terranes. Mary Roden-Tice, (518) 564-4032, mary.rodentice@plattsburgh.edu; Bob Wintsch, (812) 855-4018, wintsch@indiana.edu.
6. Environmental Records from Large Estuaries along the Northeastern U.S. Seaboard. *Sponsored by the Northeast Section of SEPM.* Johan C. Varekamp and Ellen Thomas, (860) 685-2248, jvarekamp@wesleyan.edu.
7. Early and Middle Paleozoic Sequence Stratigraphy—Tectonic

and Eustatic Signatures in Eastern Laurentia. *Sponsored by the Northeast Section of SEPM.* Ed Landing, (518) 474-5816, elanding@mail.nysed.gov; Carlton E. Brett, (513) 556-4556, brettce@email.uc.edu.

## THEME SESSIONS

1. Terrestrial Records of Late Pleistocene and Holocene Climate Change. Paul Bierman, (802) 656-4411, pbierman@zoo.uvm.edu.
2. Paleolimnological Records of Holocene Climate Change. Andrea Lini, (802) 656-0245, alini@zoo.uvm.edu; Mark Abbott (413) 545-0229, mabbott@geo.umass.edu.
3. Slope Stability in New England Environments. Kyle Nichols, (802) 656-3398, knichol@zoo.uvm.edu; Paul Bierman, (802) 656-4411, pbierman@zoo.uvm.edu.
4. Deformation, Metamorphism, and Melting: Interactions in the Crust. Tracy Rushmer, (802) 656-8136, trushmer@zoo.uvm.edu; Gayle Gleason, (207) 872-3248, ggleaso@colby.edu; Michael Brown, mbrown@umd.edu.
5. Geologic Evolution of the Northern Appalachians: The Quebec-Vermont Connection. Barry Doolan, (802) 656-0248, bdoolan@zoo.uvm.edu; Jonathan Kim, (802) 241-3469, jonk@dec.anr.state.vt.us; Sebastien Castonguay, (418) 654-2566, scastong@nrncan.gc.ca; Alain Tremblay, (418) 654-2568, atremblay@inrs.quebec.ca.
6. Carbonate Geology with a Focus on the Trenton-Black River and Beekmantown. *Sponsored by the Northeast Section of SEPM.* Gerald Friedman, (518) 273-3247.
7. Geologic Aspects of Environmental Problems in the Northeast. Jamie Shanley, (802) 828-4466, jshanley@usgs.gov; Scott W. Bailey, (603) 726-8902, swbailey@fs.fed.us.
8. Paleocology and Paleobiology of Oxygen-Controlled Faunas. Christopher McRoberts, (607) 753-2925, mcroberts@corland.edu; David Lehmann, (814) 641-3602, lehmann@juniata.com.
9. K-16 Education: Earth and Environmental Science. Christine Massey, (802) 656-1344, cmassey@zoo.uvm.edu; Leslie Kanat, (802) 635-1327, kanatl@badger.jsc.usc.edu.
10. Undergraduate Research. *Sponsored by the Geology Division of the Council on Undergraduate Research.* (Poster) David G. Bailey, (315) 859-4142, dbailey@hamilton.edu.

## SHORT COURSES

The STELLA and GIBBs short courses will be held in Perkins Hall, Computer Laboratory, University of Vermont. Contact instructors for further information.

1. System Dynamic Modeling of Natural Environments: An Introduction to STELLA. Sunday, March 11, 9 a.m.–5 p.m. Al Cassell, ecassell@zoo.uvm.edu, School of Natural Resources; Jim Hoffman, Dept. of Botany; and Jack Drake, Dept. of Geology, University of Vermont. Cost: \$40 Professional, \$20 Student. Max.: 18. Min.: 5.
2. New Advances in XRF Spectroscopy and Their Applications to the Geological Sciences. Sunday, March 11, 9 a.m.–noon. David Coler, david.coler@philips.com, and Christina Hoffmann, Christina.hoffmann@philips.com, Applications Specialists, Philips Analytical, 12 Michigan Drive, Natick, MA 01760. Shelburne Room, Sheraton Conference Center. Free. Max.: 30.
3. Full-Pattern Rietveld Analysis Applied to Poly-Mineralic Phase Identification in Geology: A More Accurate Alternative to the Traditional Single Line Approach. Sunday, March 11, 1:30–4 p.m. Christina Hoffmann, Christina.hoffmann@philips.com, and David Coler, david.coler@philips.com, Applications Specialists, Philips Analytical, 12 Michigan Drive, Natick, MA 01760. Shelburne Room, Sheraton Conference Center. Free. Max.: 30.
4. Thermodynamic Modeling of Mineral Reactions: An Introduction to GIBBs. Monday, March 12, 6–9 p.m. Frank Spear spear@rpi.edu. RPI, Troy, NY. Cost: \$20 Professional, \$15 Student. Max.:18.

## WORKSHOP

Roy Shlemon Mentor Program in Applied Geology. Monday, March 12, 11:30 a.m.–1:30 p.m. Valcour Room, Sheraton Conference Center. Practical advice for graduate and undergraduate students with career interests in consulting. This is a workshop on professional opportunities and challenges in the applied geosciences. Cost: \$5, lunch provided. Max.: 20. *Preregistration is required; however, meeting registration is not required to attend this workshop.*

## FIELD TRIPS

The field trip coordinator is Stephen Wright, Department of Geology, University of Vermont, Burlington, VT 05405; (802) 656-4479, swright@zoo.uvm.edu. The trips will run depending on weather. Contact leaders listed below for further information.

### Sunday, March 11.

1. The Stanley Outcrops. 9 a.m.–5 p.m. Barry Doolan, bdoolan@zoo.uvm.edu, and Keith Klepeis, kklepeis@zoo.uvm.edu. Meet at the Sheraton Conference Center parking

- lot. Lunch provided. Cost: \$30 Professional, \$20 Student.
- Teaching Hydrology in the Winter, a Hands-On Field Trip. 7:30 a.m.–5 p.m. Paul Bierman, pbierman@zoo.uvm.edu, and Kyle Nichols, knichols@zoo.uvm.edu. Meet at the Perkins Building, University of Vermont. Lunch Provided. Cost: \$30 Professional, \$20 Student.

### Monday, March 12, and Tuesday, March 13

- The Champlain Thrust at Lone Rock Point. University of Vermont staff; 2–3 hour trip, morning or afternoon. Further details will be available at the registration desk.

### Monday, March 12, and Wednesday, March 14.

- The Salmon Hole–Redstone Quarry. University of Vermont staff; 2–3 hour trip, morning or afternoon. Further details will be available at the registration desk.

### STUDENT AWARDS AND TRAVEL ASSISTANCE

The GSA Northeastern Section will give awards for the best oral paper and best poster session presented by students. Designate papers to be submitted for this award on the abstract form. The Northeastern Section is also awarding travel grants to students who are presenting papers at the Burlington meeting. The section is providing \$3,000, which will be matched by \$2,000 from the GSA Foundation, making an aggregate fund of \$5,000. The awards are open to both graduate and undergraduate students. To apply, please contact the Northeastern Section GSA Secretary-Treasurer, Kenneth N. Weaver, 2300 St. Paul St., Baltimore, MD 21218, (410) 554-5532, fax: 410-554-5502, kweaver438@aol.com.

The Northeastern Section also announces availability of undergraduate research grants: Students in the Northeastern Section who are juniors in the 2000–2001 academic year are eligible to apply for a research grant. Applications are available from Ken Weaver at the above address, and the deadline for completed applications is February 12, 2001.

### EXHIBITS

Exhibits will be located in the Champlain Room of the Sheraton Convention Center; snacks and refreshments will be continuously available for exhibit visitors. Deadline for reserving space is March 1, 2001. The cost of standard booths will be \$300 for commercial exhibitors and \$200 for educational or nonprofit groups or institutions. For further information and space reservations, contact the Exhibits

Coordinator, Barry Doolan, Dept. of Geology, Perkins Geology Hall, University of Vermont, Burlington, Vermont 05405, (802) 656-0248, bdoolan@zoo.uvm.edu.

### SPECIAL EVENTS

GSA Northeastern Section Management Board Meeting. Sunday, March 11, 5–7 p.m. Sheraton Conference Center, Diamond II Room.

Welcoming Reception. Sunday, March 11, 6–9 p.m. Sheraton Conference Center, Emerald Ballroom.

Paleontological Society Northeastern Section, Luncheon. Monday, March 12, noon–1:30 p.m. Sheraton Conference Center, Shelburne Room. Professionals \$27, Students \$15. Preregistration required. Limit 30.

Eastern Section of SEPM Business Meeting and Reception. Monday, March 12, 5–7 p.m. Sheraton Conference Center, Valcour Room.

University of Vermont Perkins Geology Museum Open House. Monday, March 12, 5–7 p.m. Perkins Geology building, University of Vermont. Contact Christine Massey, Dept. Geology, University of Vermont, Burlington, Vermont 05405, (802) 656-1344; cmassey@zoo.uvm.edu.

Map Blast IV. Monday, March 12, 7:30–9:30 p.m. An informal session for display and discussion of newly published, unpublished, or in-progress geologic maps of any sort. Contact Stephen Wright, Department of Geology, University of Vermont, Burlington, VT 05405, (802) 656-4479, swright@zoo.uvm.edu.

Association for Women Geoscientists Breakfast Buffet. Tuesday, March 13, 6–8:30 a.m. Sheraton Conference Center, Valcour Room. Professionals \$15, Students \$10. Preregistration required. Limit 40.

Northeastern Section of NAGT Luncheon and Business Meeting. Tuesday, March 13, noon–1:30 p.m. Sheraton Conference Center, Shelburne Room. Professionals \$27, Students \$15. Preregistration required. Limit 30.

GSA Northeast Section Reception and Banquet. Tuesday, March 13, 6–9 p.m. Sheraton Conference Center, Emerald Ballroom. Professionals \$25–35, Students \$20–25. Preregistration is required for the banquet.

### ACCOMMODATIONS

Meeting participants will get special rates at the Sheraton in Burlington, 1-800-677-6576, fax 802-865-6670. Single \$95 plus tax; double \$100; triple \$105 plus tax; quad \$110 plus tax. Reservation deadline is *February 1, 2001*. When making reserva-

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tions by phone, state that you are attending the Geological Society of America Northeastern Section Meeting.

### GUEST ACTIVITIES AND EVENTS

Additional guest activities and events will be listed on the Web site as they become available.

Fun Run. Monday, March 12, and Tuesday, March 13, mornings. Information available at the registration desk.

Ski Day—Smugglers Notch. Sunday, March 11. For reservations and information, see the Web site.

### CHILD CARE

Child care is available through Home-sitting Service, (802) 879-1336.

### DETAILED INFORMATION

For further information, see [www.geosociety.org](http://www.geosociety.org) or contact General Chair Tracy Rushmer, Dept. of Geology, University of Vermont, Burlington, VT 05405, (802) 656-8136, trushmer@zoo.uvm.edu, or Technical Program Chair Andrea Lini, Dept. of Geology, University of Vermont, Burlington, VT 05405, (802) 656-0245, alini@zoo.uvm.edu. ■

# PREREGISTRATION FORM

**GSA Northeastern Section • Burlington, Vermont • MARCH 12-14, 2001**

Preregistration deadline: February 2, 2001 Cancellation deadline: February 9, 2001  
 You can also register online at [www.geosociety.org](http://www.geosociety.org).

Please print clearly • THIS AREA IS FOR YOUR BADGE

\*  Male  Female

First Name/Nickname (as it should appear on badge) \_\_\_\_\_ Last Name \_\_\_\_\_

Employer/University (affiliation as it should appear on badge) \_\_\_\_\_

Mailing address Is this a permanent address?  Yes  No Is this home  or work

City \_\_\_\_\_ State or Province \_\_\_\_\_ ZIP or Postal Code \_\_\_\_\_ Country \_\_\_\_\_

E-mail \_\_\_\_\_ Business Phone \_\_\_\_\_ Fax \_\_\_\_\_ Home Phone \_\_\_\_\_

Spouse/Guest First Name/Nickname (as it should appear on badge) \_\_\_\_\_ Last Name \_\_\_\_\_ \*  Male  Female

\* Needed for field trip lodging.

 Do you or your guest require any special considerations?  Yes  No

Preregistration Fees (US\$)	Full Meeting	One Day	Qty	Column A US\$ Amt.
Professional Member*	(10) \$ 70	(1) \$ 45	1	\$
Professional Member 70 & Older	(12) \$ 30	(13) \$ 25	1	\$
Professional Nonmember	(14) \$ 95	(15) \$ 60	1	\$
Student Member or Associate Member*	(30) \$ 27	(31) \$ 22	1	\$
Student Nonmember	(32) \$ 37	(33) \$ 32	1	\$
Guest or Spouse**	(90) \$ 20	N/A	1	\$
K-12 Professional	(60) \$ 35	(61) \$ 20	1	\$
Field Trip Only	(95) \$ 5	N/A	1	\$

Check member affiliation(s) (to qualify for registration member discount):  (a) GSA Mbr # \_\_\_\_\_  
 (b) AWG  (c) CUR  (d) NAGT  (e) PS  (f) SEPM

\*Member fee applies to any current Professional OR Student Member of GSA or Associated Societies listed above. Discount does not apply to guest registrants.  
 \*\*Guest or Spouse registration fee does not allow access to technical sessions.

Total Column A \$ \_\_\_\_\_

**FAX TO: 303-443-1510 or 303-447-0648**  
**MAIL TO: GSA NORTHEASTERN MEETING,**  
**P.O. BOX 9140**  
**BOULDER, CO 80301-9140**

Remit in U.S. funds payable to 2001 GSA Northeastern Section Meeting  
 (All preregistrations must be prepaid. Purchase Orders not accepted.)

Payment by (check one):  Check # \_\_\_\_\_  American Express  VISA  MasterCard  
 Discover  Diners Club

Card Number \_\_\_\_\_ Expires \_\_\_\_\_

Signature \_\_\_\_\_

## TICKETED EVENTS

1. Paleontological Society Luncheon—Monday, March 12

Professional	Student	Qty	Column B Amount
(301) \$ 27	(301) \$ 15	_____	\$ _____

2. AWG Breakfast Buffet—Tuesday, March 13

Professional	Student	Qty	Column B Amount
(302) \$ 15	(302) \$ 10	_____	\$ _____

3. NAGT Luncheon—Tuesday, March 13

Professional	Student	Qty	Column B Amount
(303) \$ 27	(303) \$ 15	_____	\$ _____

4. GSA Northeastern Section Reception and Banquet—Tuesday, March 13

Prime Rtb	Chicken Marsala	Ravioli Pesto	Qty	Column B Amount
<input type="checkbox"/> (304) \$ 35	<input type="checkbox"/> (305) \$ 25	<input type="checkbox"/> (306) \$ 25	_____	\$ _____
<input type="checkbox"/> (304) \$ 25	<input type="checkbox"/> (305) \$ 20	<input type="checkbox"/> (306) \$ 20	_____	\$ _____

## FIELD TRIPS

1. The Stanley Outcrops—Sunday, March 11 (9 a.m.–5 p.m.)

Professional	Student	Qty	Column B Amount
(401) \$ 30	(401) \$ 20	_____	\$ _____

2. Teaching Hydrology in the Winter:

A Hands-On Field Trip—Sunday, March 11 (7:30 a.m.–5 p.m.)

Professional	Student	Qty	Column B Amount
(402) \$ 30	(402) \$ 20	_____	\$ _____

## SHORT COURSES

1. System Dynamic Modeling of Natural Environments:

An Introduction to STELLA—Sunday, March 11 (9 a.m.–5 p.m.)

Professional	Student	Qty	Column B Amount
(501) \$ 40	(501) \$ 20	_____	\$ _____

2. New Advances in XRF Spectroscopy—Sunday, March 11 (9 a.m.–noon)

Professional	Student	Qty	Column B Amount
(502) Free	(502) Free	_____	FREE

3. Full-Pattern Rietveld Analysis—Sunday, March 11 (1:30–4 p.m.)

Professional	Student	Qty	Column B Amount
(503) Free	(503) Free	_____	FREE

4. Thermodynamic Modeling of Mineral Reactions:

An Introduction to GIBBS—Monday, March 12 (6–9 p.m.)

Professional	Student	Qty	Column B Amount
(504) \$ 20	(504) \$ 15	_____	\$ _____

## WORKSHOP

1. Roy Shlomo Mentor Program in Applied Geology

Student Workshop—Monday, March 12 (11:30 a.m.–1:30 p.m.)

Professional	Student	Qty	Column B Amount
(601) \$ 5	(601) \$ 5	_____	\$ _____

(Meeting registration is not required to attend this workshop.)

Total Column B \$ \_\_\_\_\_

Total Column A \$ \_\_\_\_\_

**TOTAL FEES REMITTED \$ \_\_\_\_\_**

## SOUTHEASTERN SECTION, GSA 50th Annual Meeting

Raleigh, North Carolina, April 5–6, 2001

[www.meas.ncsu.edu/segsa/](http://www.meas.ncsu.edu/segsa/)

or [www.geosociety.org/sectdiv/southe/01semtg.htm](http://www.geosociety.org/sectdiv/southe/01semtg.htm)

The 50th Annual Meeting of the Southeastern Section of GSA (SEGSA), hosted by the Department of Marine, Earth and Atmospheric Sciences at North Carolina State University, in conjunction with the North Carolina Geological Survey and the North Carolina Museum of Natural Sciences, will be held Thursday and Friday April 5–6, 2001, in Raleigh, North Carolina.

### LOCATION AND TRANSPORTATION

Raleigh, North Carolina's state capital, is located where U.S. Highway 1, U.S. Highway 64, and Interstate 40 come together. Shuttle service from Raleigh-Durham International Airport (RDU) to downtown Raleigh (about 20 minutes away) is available from R & G Airport Shuttle for \$20 one way. Maps of various scales are available at [www.raleighcvb.org/maps.html](http://www.raleighcvb.org/maps.html).

### REGISTRATION

Preregistration deadline:  
February 23, 2001

Cancellation deadline:  
March 2, 2001

Please preregister to qualify for lower fees and to assist the local committee in preparing. Online preregistration at [www.geosociety.org/sectdiv/southe/01semtg.htm](http://www.geosociety.org/sectdiv/southe/01semtg.htm) is strongly encouraged. You may also use the form that accompanies this announcement. Full payment **MUST** accompany your preregistration.

Registration is required for all who attend technical sessions, guest activities, or the exhibit hall. Guest registrants (nongeologist spouses or friends) must be accompanied by either a registered professional or student. Students and K–12 educators must show a current ID for reduced rates. If you preregister, your badge will be mailed to you two weeks prior to the meeting. All registrations received after March 2 will be held for on-site processing and charged the on-site rates.

All requests for registration additions, changes, and cancellations must be made in writing and received by March 2, 2001. There will be no refunds for cancellations made after this date.

### ON-SITE REGISTRATION SCHEDULE

Sheraton Capital Center, the third-floor mezzanine, adjacent to the Oak

Forest Ballroom.

Wednesday, April 4, 2001, 4:30–7:30 p.m.

Thurs., April 5, 2001, 7:30 a.m.–4:30 p.m.

Friday, April 6, 2001, 7:30 a.m.–noon

### ACCESSIBILITY FOR REGISTRANTS WITH SPECIAL NEEDS

We are committed to making the meeting accessible to all people. Please indicate any special needs on your registration form.

### ACCOMMODATIONS

Hotel accommodation deadline:  
February 23, 2001

The Sheraton Capital Center Hotel in downtown Raleigh (421 S. Salisbury St., Raleigh, NC 27601) will be the meeting headquarters; meeting facilities will be on the third floor of the adjacent Hannover Tower. A block of rooms is reserved at the Sheraton and a special rate of \$85 per night (double or king) is available. Attendees should make their own reservations with the Sheraton by calling (919) 834-9900 or 1-800-325-3535, or by visiting their Web site at [www.sheratoncapital.com](http://www.sheratoncapital.com). Additional rooms are available a few blocks away at the Holiday Inn—State Capital, 320 Hillsborough St., Raleigh, NC 27603, for the same rate of \$85 per night (double or king); call (919) 832-0501, 1-800-HOLIDAY, or visit [www.holiday-inn.com](http://www.holiday-inn.com) to reserve a room. When making your reservations, be sure to mention that you are with the SEGSA in order to qualify for the reduced rates.

### WELCOMING PARTY

Wednesday, April 4, 6–8:30 p.m.  
North Carolina Museum of Natural Sciences, [www.naturalsciences.org](http://www.naturalsciences.org).

Enjoy an informal tour of the museum's exhibits, including a wonderful walk through time featuring Willo, the dinosaur with a heart, and the world's only complete *Acrocanthosaurus*. Museum staff will be on hand and hors d'oeuvres and drinks will be available. You must be registered for the meeting to attend the Welcoming Party.

### FIELD TRIPS

Preregistration deadline:  
February 23, 2001

Cancellation deadline:  
March 2, 2001

Address general questions to Charles W. Hoffman, Field Trip Chair, (919) 733-7353, ext. 25, [bill.hoffman@ncmail.net](mailto:bill.hoffman@ncmail.net). Address specific questions to the field trip leaders listed below. See the meeting Web site ([www.meas.ncsu.edu/segsa/](http://www.meas.ncsu.edu/segsa/) or at [www.geosociety.org](http://www.geosociety.org)) for full field trip descriptions and updated information. Unless otherwise noted, trips depart from and return to the Sheraton Capital Center Hotel.

Field trip participants must register for the meeting. A \$5 field-trip-only registration option is available.

### Premeeting

1. Framing the Piedmont Zone in North Carolina and Southern Virginia. Jim Hibbard, North Carolina State University, [jhibbard@ncsu.edu](mailto:jhibbard@ncsu.edu), (919) 515-7242; Kevin Stewart, University of North Carolina, Chapel Hill, [kgstewar@email.unc.edu](mailto:kgstewar@email.unc.edu); and Bill Henika, Virginia Department of Mines, Minerals and Energy, and Virginia Tech, [henika@vtvm1.cc.vt.edu](mailto:henika@vtvm1.cc.vt.edu). April 2–4; min. 15, max. 20; trip starts in Spruce Pine, NC, and ends at the meeting site;

Southeastern Section *continued on p. 16*



Downtown Raleigh. Solid triangles indicate public parking lots. Note the abundance of one-way streets!

- cost of \$210 includes guidebook, transportation, three nights lodging (April 1–3), and lunches during trip. *Registrants needing transportation from Raleigh to Spruce Pine should contact leader.*
2. Depositional and Structural Framework of the Deep River Triassic Basin, North Carolina. Tyler Clark, North Carolina Geological Survey, tyler.clark@ncmail.net, (919) 733-2423; Pamela Gore, Georgia Perimeter College, pgore@gpc.peachnet.edu; and Mary Watson, North Carolina Geological Survey, mary.watson@ncmail.net. This regional overview will set the stage for the detailed Triassic field trip scheduled the following day (Trip 3). April 3; min. 10, max. 25; cost of \$38 includes guidebook, transportation, lunch and snacks. *Trip is cosponsored by SE-SEPM, SE-NAGT, and SE-GSA Education committee. Registrants who also register for Trip 3 will receive a rebate of \$10 (the cost of a 2nd guidebook).*
  3. Structural Features Exposed in Triassic Sedimentary Rocks near the Proposed Low-Level Radioactive Waste Disposal Site, Southwestern Wake County. Rick Wooten, North Carolina Geological Survey, rick.wooten@ncmail.net, (919) 733-2424; Jerry Bartholomew, University of South Carolina, jbarth@esri.esri.sc.edu; and Peter Malin, Duke University, pem@geo.duke.edu. We will visit exposures in borrow pits and discuss how recent detailed mapping relates to recently completed 7.5-minute quadrangle mapping and regional geology seen during Trip 2. April 4; min. 10, max. 25; cost of \$35 includes guidebook, transportation, lunch and snacks. *Registrants who also register for Trip 2 will receive a rebate of \$10 (the cost of a 2nd guidebook).*
  4. North-South Transect of the Goochland Terrane and Associated A-type Granites, Virginia–North Carolina. Stewart Farrar, Eastern Kentucky University, glyfarr@acs.eku.edu, (859) 622-1279; and Brent Owens, College of William and Mary, beowen@wm.edu. April 3 and 4; min. 20, max. 44; trip starts in Richmond, VA, and ends at the meeting site; cost of \$125 includes guidebook, transportation, one night lodging (April 3), and lunches during trip. *Registrants needing transportation from Raleigh to Richmond should contact leader.*
  5. Cape Fear River Transect: The Cretaceous Cape Fear, Black Creek, and Peedee Formations of Southeastern North Carolina and the Overlying Tertiary Section. Kathleen M. Farrell, North Carolina Geological Survey, kathleen.farrell@ncmail.net, (919) 733-2423; Lauck B. Ward, Virginia

- Museum of Natural History, lwward@vmnh.org; and S. Duncan Heron Jr., Duke University, heron@eos.duke.edu. April 3–4; min. 15, max. 20; trip starts and ends in Fayetteville, NC; cost of \$185 includes guidebook, transportation, one night lodging (April 3), and lunches during trip. *Trip is cosponsored by Southeast Section SEPM and Paleontological Society. Registrants needing transportation to/from Raleigh should contact leader.*
6. Coastal Processes, Habitats, and Evolution of the Cape Lookout Cuspate Foreland. Steve Snyder, North Carolina State University, sws@ncsu.edu, (919) 515-7912; John T. Wells, University of North Carolina, Chapel Hill, John\_Wells@unc.edu. April 1–4; min. 15, max. 25; trip starts in Morehead City, NC, and ends at the meeting site; cost of \$240 includes guidebook, boats, ground transportation, four nights lodging (March 31; April 1–3), and lunches during trip. *Registrants needing transportation from Raleigh to Morehead City should contact leader. Registrants who opt for dormitory lodging will receive a rebate of \$60.*

#### During the Meeting

7. Building Stone Use in Historical and Modern Architecture of Downtown Raleigh, North Carolina—A Walking Tour. Al Carpenter, N.C. Geological Survey (retired), alvalcarp@mindspring.com, (919) 553-4572. Half-day walking tour in downtown Raleigh area. Afternoon of April 6, or morning of April 7; min. 10, max. 30; cost of \$10 includes guidebook. *See also Trip 11.*
8. Inquiry-Based Field Trip to Outstanding Geological Sites in the Triangle—For all Educators (Especially Secondary). Lynne Gronback, lgronback@mindspring.com, (919) 644-2681, Rob Greenberg, antares8@mindspring.com, and Ruben Giral, dcuben@mindspring.com, all at McDougale Middle School, Chapel Hill; and Mary Watson, N.C. Geological Survey, mary.watson@ncmail.net. April 6; min. 15, max. 30; cost of \$20 includes guidebook, transportation, lunch and snacks. *Trip is cosponsored by SE-NAGT, NCSTA, and SEGSA Education Committee.*

#### Postmeeting

9. A Temporal View of Terranes and Structures in the Eastern North Carolina Piedmont. Dave Blake, University of North Carolina at Wilmington, blaked@uncwil.edu, (910) 962-3387; Tyler Clark, N.C. Geological Survey, tyler.clark@ncmail.net; and Matt Heller, North Carolina Ground Water Section, matt.heller@ncmail.net. April 7; min. 15, max. 25; cost of \$40 includes

guidebook, transportation, lunch and snacks.

10. The Tate-Marble Hill Window in the Marble Belt of Northern Georgia. Mike Higgins, mhiggins@mindspring.com, (770) 641-1268, and Ralph Crawford, Applied Mapping Systems, Inc.; Tim La Tour and John Costello, Georgia State University; Bill Grant, Applied Mapping Systems, Inc.; Mike Linkous, J.M. Huber, Corp.; and Tonya Edwards, Georgia State University. April 7–8; min. 15, max. 24; trip starts and ends in Atlanta, GA; cost of \$140 includes guidebook, transportation, one night lodging (April 7), and lunch on both days. *Note: Those interested in attending this trip but not the meeting in Raleigh may use the \$5 field-trip-only registration category.*
11. Building Stone Use in Historical and Modern Architecture of Downtown Raleigh, North Carolina—A Walking Tour. Morning of April 7. See Trip 7 description.

#### ABSTRACTS

Abstract deadline:  
January 2, 2001

Abstracts for all sessions should be submitted online through the GSA Web site. If you are unable to submit your abstract electronically, contact GSA Technical Program Coordinator Nancy Carlson, (303) 447-2020, ext. 161, ncarlson@geosociety.org. Late abstracts or abstracts sent by e-mail or fax will not be accepted. Only one volunteered paper may be presented by an individual; however, a person may be a coauthor on other papers. Those invited for symposia may present additional papers.

#### TECHNICAL PROGRAMS

For additional information, contact Technical Program Chair Ron Fodor, rfodor@ncsu.edu, (919) 515-7177, or the conveners of specific sessions.

#### SYMPOSIA

1. 50th Anniversary Symposium: History of Geology in the Southeastern Section. (*Sponsored by the SEGSA Education Committee and the History of Geology Division.*) Gary Russell, University of Southern Mississippi, Gary.Russell@usm.edu, (601) 266-4077; Heather Macdonald, College of William and Mary; Bob Hatcher, University of Tennessee, Knoxville, and Oak Ridge National Lab; and Bill Thomas, University of Kentucky.
2. Groundwater Conditions in Coastal Aquifer Systems: Past, Present, and Future. Richard Spruill, East Carolina University, spruillr@mail.ecu.edu, (252) 328-4399.

Southeastern Section *continued on p. 17*

- Cenozoic Evolution of the Appalachian Orogen. Jim Knapp, University of South Carolina, knapp@geol.sc.edu, (803) 777-6886; Ray Christopher, Clemson University; and Dave Prowell, U.S. Geological Survey.
- Advances in Geochronology and Thermochronology in the Appalachian Orogen. Brent Miller, University of North Carolina, Chapel Hill, bvmiller@email.unc.edu, (919) 962-6583; and Scott Samson, Syracuse University.
- Great Ideas in Teaching Geoscience—K-16. (*Cosponsored by SE Section NAGT and the SEGSA Education Committee.*) Michael Gibson, University of Tennessee, Martin, mgibson@utm.edu, (901) 587-7435; and David Kopaska-Merkel, Geological Survey of Alabama.
- Earth Science in the High School Curriculum. (*Cosponsored by SE Section NAGT and the SEGSA Education Committee.*) Charles Gardner and Mary Watson, N.C. Geological Survey, Charles.Gardner@ncmail.net, (919) 733-3833.
- Atlantic Coastal Plain Geology: A Symposium in Honor of Gerald H. Johnson. Heather Macdonald, College of William and Mary, rhmacd@mail.wm.edu, (757) 221-2443; and Scott Harris, Coastal Carolina University.
- Beach Nourishment: The Wave of the Future for Erosion Control. Bill Cleary, University of North Carolina, Wilmington, clearyw@uncwil.edu, (910) 256-3721, ext. 251; and Orrin Pilkey, Duke University.
- Terrane Boundaries and Paleosubduction Zones in the Inner Piedmont and Blue Ridge: Where are They and What is Their History? Calvin Miller, Vanderbilt University, millerfc@ctrvax.vanderbilt.edu, (615) 322-2232; and Bob Hatcher, University of Tennessee, Knoxville, and Oak Ridge National Lab.

#### THEME SESSIONS

- Geologic Maps and Digital Geologic Maps. Ralph F. Crawford and Michael W. Higgins, Applied Mapping Systems, Inc., mhiggins@mindspring.com, (770) 641-1268. POSTERS ONLY
- The Stratigraphy of the Southeastern Atlantic Coastal Plain: A Poster Session with Core Samples. Kathleen Farrell, N.C. Geological Survey, Kathleen.Farrell@ncmail.net, (919) 733-2423; and Bill Harris, University of North Carolina, Wilmington. POSTERS ONLY
- Triassic Basins of the Southeastern United States. (*Sponsored by the SE Section SEPM.*) Paul Thayer, University of

North Carolina, Wilmington, Thayer@uncwil.edu, (910) 962-3780; and Dan Textoris, University of North Carolina, Chapel Hill.

- Engineering and Environmental Geology. (*Sponsored by Engineering Geology Division.*) Charles Welby, North Carolina State University, cwwelby@unity.ncsu.edu, (919) 515-7158.
- Great Ideas in Teaching Geoscience—K-16. (*Cosponsored by SE Section NAGT and the SEGSA Education Committee.*) Lynne Gronback, McDougale Middle School, Chapel Hill, lgronback@mindspring.com, (919) 644-2681. POSTERS AND ORAL
- Geologic Linkages between Land and Sea: Estuarine Sediment Dynamics and Deposits. Clark Alexander, Skidaway Institute of Oceanography, clark@skio.peachnet.edu, (912) 598-2329; and John Wells, University of North Carolina, Chapel Hill.
- Hard Rock Hydrogeology: The Occurrence and Movement of Ground Water in the Southern Appalachian Blue Ridge and Piedmont. Matt Heller, Matt.Heller@ncmail.net, (704) 663-1699, and Barbara Christian, North Carolina Ground Water Section; and Charles Daniel, U.S. Geological Survey.
- Granitoid Plutons, Rocks, and Minerals. Loren Raymond, Appalachian State University, raymondla@appstate.edu, (828) 262-2749; and Sam Swanson, University of Georgia.
- Undergraduate Research. (*Sponsored by the Council for Undergraduate Research.*) Brannon Andersen, Furman University, brannon.andersen@furman.edu, (864) 294-3366. POSTERS ONLY
- Terrane Boundaries and Paleosubduction Zones in the Inner Piedmont and Blue Ridge: Where are They and What is Their History? Calvin Miller, Vanderbilt University, millerfc@ctrvax.vanderbilt.edu, (615) 322-2232; and Bob Hatcher, University of Tennessee, Knoxville, and Oak Ridge National Lab.
- Paleoecology of the Paleogene Coastal Plain: An Interdisciplinary Testing Ground. (*Sponsored by the Paleontological Society.*) Steve Hageman, Appalachian State University, HagemanSJ@appstate.edu, (828) 262-6609.
- Terrestrial Vertebrate and Ecosystem Evolution of the Southeast. (*Sponsored by the Paleontological Society.*) Reese Barrick, North Carolina State University, reese\_barrick@ncsu.edu, (919) 515-7648.

#### DISCIPLINE SESSIONS

Volunteered abstracts that are not

included in listed Theme Sessions will be organized into Discipline Sessions.

#### PROJECTION EQUIPMENT

Meeting rooms for the oral presentations will be equipped with two 35 mm slide projectors and an overhead projector. Computer-type projection systems will not be available, nor are they permitted under our AV contract. Speakers should bring their own carousel trays, already loaded with their slides. Slide trays should be labeled with speaker's name, session, and speaker number, and should be delivered to the projectionist immediately prior to the beginning of the session.

#### SPEAKER READY ROOM

The room will be open to preview slides and transparencies Wednesday, April 4, 4:30-7:30 p.m., Thursday, April 5, 7 a.m.-7 p.m., and Friday, April 6, 7 a.m.-2:30 p.m. A limited number of carousel trays will be available to check out from the Speaker Ready Room.

#### POSTER SESSIONS

Poster presentations allow extended discussion, and permit more effective presentation of some types of visual material such as maps. Theme Sessions 1, 2, and 9 are poster-only format; in other cases, please indicate your preference for a poster session when you submit your abstract. Each poster will be displayed on one 4 x 8 foot board; bring your own push pins for mounting your display.

#### KEYNOTE ADDRESS

Thursday, April 5, 5:15 p.m.  
Hannover Ballroom

The Geology of Mars—From Far and Near. Harry Y. (Hap) McSween Jr., University of Tennessee, Knoxville. New insights on the geologic history of Mars from Martian meteorites and recent spacecraft missions, plus plans for exploration.

#### STUDENT PROGRAMS

Undergraduate Student Research. A special poster session is sponsored by the Council for Undergraduate Research. Contact Brannon Andersen, Furman University, at (864) 294-3366 or brannon.andersen@furman.edu.

Roy Shlemon Mentors in Applied Geology Student Workshop. This GSA-sponsored program acquaints advanced undergraduate and graduate students with careers in applied geoscience. The mentor provides real-world information and insight students may not be exposed to in academic experiences. Watch for updates in *GSA Today* as details become available. The \$3 cost includes lunch. Friday, April 6, 12 noon-1:30 p.m. *Meeting registration is not*

Southeastern Section *continued on p. 18*

Southeastern Section *continued from p. 17*  
*required to attend this workshop.*

Exhibits. Exhibitors will include companies, agencies, and academic departments, providing students with the opportunity to discuss potential jobs or graduate school opportunities.

## STUDENT TRAVEL GRANTS

The Southeastern Section awards travel grants to students who are presenting papers at the meeting. All eligible students will receive some support, with the amount depending on the number of applicants. For the application form visit [www.geology.ecu.edu/geology/segas/travel.html](http://www.geology.ecu.edu/geology/segas/travel.html). Applications must be postmarked no later than March 1, 2001. Contact Donald Neal, (252) 328-4392, [neald@mail.ecu.edu](mailto:neald@mail.ecu.edu) for more information.

## K-12 PROGRAMS

Several of the technical programs should be of interest to those in pre-college education. Speakers in Symposium 6 will discuss aspects of the recent changes made in the science curriculum of the North Carolina Department of Public Instruction, including the history and approval process of the changes and their impact on the earth science community. Symposium 5 and Theme Session 5 will give K-16 educators an opportunity to share ideas on effective teaching. The poster-format theme session Thursday afternoon will highlight K-12 teaching, while the Friday morning

oral session is designed for all levels, including college teaching. Symposium 1 may also be of interest to K-12 educators.

Field Trips. Field Trip 7, all day Friday, is specifically designed by and for K-12 teachers. Field Trips 2, 6, and 10 may also be of interest.

The workshop Earth Science and Environmental Science Education—Meeting the New North Carolina Teaching Standards, held Saturday, April 7, will be led by the staff of The Science House, North Carolina State University, [Science\\_House@ncsu.edu](mailto:Science_House@ncsu.edu), (919) 515-6118. This hands-on workshop lets Earth and Environmental Science educators (grades 6-12) explore learning activities for the new North Carolina Earth and Environmental Science Requirement. The Science House is located on N.C. State University's Centennial Campus, just minutes from the Sheraton. (*Cosponsored by NSF Science and Technology Center for Environmentally Responsible Solvents and Processes and the N.C. Department of Public Instruction.*) Cost: \$5 if not attending meeting; free if attending meeting.

## BUSINESS MEETINGS

GSA Southeastern Section Management Board Meeting. Wednesday, April 4, 4:30-6 p.m. Larry Woodfork, [woodfork@geosrv.wvnet.edu](mailto:woodfork@geosrv.wvnet.edu).

GSA Southeastern Section Campus Liaison Breakfast. Thursday, April 5, 6:30-8 a.m. Steve Lenhart, [slenhart@radford.edu](mailto:slenhart@radford.edu).

Paleontological Society Southeastern Section Business Meeting and Luncheon. Thursday, April 5, noon. Steve Hageman, [HagemanSJ@appstate.edu](mailto:HagemanSJ@appstate.edu).

GSA Southeastern Section Student Support Committee Meeting. Thursday, April 5, noon. Jonathan Mies, [Jonathan-Mies@utc.edu](mailto:Jonathan-Mies@utc.edu).

GSA Southeastern Section Education Committee-NAGT Southeastern Section Business Meeting and Breakfast. Friday, April 6, 6:30 a.m. Pamela Gore, [pgore@gpc.peachnet.edu](mailto:pgore@gpc.peachnet.edu).

GSA Southeastern Section Ph.D.-Granting Earth Science Chairs Breakfast. Friday, April 6, 7-8:30 a.m.

SEPM Southeastern Section Business Meeting and Luncheon. Friday, April 6, noon. John Anderson, [janderso@gpc.peachnet.edu](mailto:janderso@gpc.peachnet.edu).

## GUEST PROGRAMS

Group tours must be arranged in advance. Even though admission to State Museums is free, we need people to sign up early so we can have the minimum number. Registration fee includes round-trip transportation from the Sheraton, plus admission if applicable. For full descriptions, see Web sites. If you would like more information, contact Chris Tacker, [Christopher.Tacker@ncmail.net](mailto:Christopher.Tacker@ncmail.net),

(919) 715-5646, ext. 722.

North Carolina Museum of Art ([www.ncartmuseum.org](http://www.ncartmuseum.org)). Thursday, April 5, 9:30 a.m. Cost \$2.

J.C. Raulston Arboretum at N.C. State University. Thursday, April 5, 2 p.m. Cost \$2.

Exploris ([www.exploris.org/](http://www.exploris.org/)). Tickets are \$4/person for a group of 10 or more. Purchase your admission at the discounted rate with your registration. Transportation will be provided for a museum visit Friday, April 6, at 9 a.m., or visit the museum at any time during the meeting.

North Carolina Museum of History (<http://nchistory.dcr.state.nc.us/museums/>). Friday, April 6, 1:30 p.m. Cost \$1.

## SPECIAL EVENTS

Thursday, April 5, noon. Special Colloquium: Geoscience Education: Challenges and Opportunities. Presentation by Marilyn J. Suiter, National Science Foundation. \$10 for professionals and \$5 for K-12 educators and students; Cost includes box lunch. *Subsidized by the Association for Women Geoscientists. Cosponsored by AWG, SE-NAGT, and SEGSA Education Committee.*

Thursday, April 5, 8 p.m. The Best of Broadway Series presents *Annie* at Raleigh Memorial Auditorium. For a group of 20 or more, tickets are \$15.50 (last three balcony rows), \$24.50 (all other balcony seats), \$33.50 (mezzanine seats) and \$42.50 (orchestra). Seating charts and information at [www.bestofbroadway.net/](http://www.bestofbroadway.net/). Indicate your interest in attending the Thursday performance on your registration, and we'll contact you. (Additional performances: Tuesdays-Saturdays, 8 p.m., and Saturday, 2 p.m.)

## STAYING OVER?

Please visit [www.meas.ncsu.edu/segas/](http://www.meas.ncsu.edu/segas/) or [www.geosociety.org/sectdiv/southe/01semtg.htm](http://www.geosociety.org/sectdiv/southe/01semtg.htm) for information on area activities and sites of interest.

## EXHIBITOR INFORMATION

Exhibition space is available in the Oak Forest Ballroom, adjacent to the Poster Session and Registration areas. Exhibits are welcome from commercial enterprises, governmental and nonprofit agencies, colleges and universities. For more information or to reserve a space, contact Tyler Clark (919) 733-2423, [tyler.clark@ncmail.net](mailto:tyler.clark@ncmail.net).

## OTHER INFORMATION

For more information, contact General Chair Edward F. (Skip) Stoddard, Department of MEAS, N.C. State University, Raleigh, NC 27695-8208, [skip\\_stoddard@ncsu.edu](mailto:skip_stoddard@ncsu.edu), (919) 515-7939, or visit [www.geosociety.org](http://www.geosociety.org). Request a printout of the announcement from GSA Meetings, P.O. Box 9140, Boulder, CO 80301-9140 or (303) 447-2020, ext. 113. ■

## Needed: Officer and Councilor Nominations

The GSA Committee on Nominations requests your help in compiling a list of GSA members qualified for service as officers and councilors of the Society. The committee requests that each nomination be accompanied by basic data and a description of the qualifications of the individual for the position recommended (vice president, treasurer, councilor). Nominations are due by February 1, 2001.

Please send nominations and back-up material to Administrative Services Dept., GSA, P.O. Box 9140, Boulder, CO 80301-9140.

# PREREGISTRATION FORM

**GSA Southeastern Section • Raleigh, North Carolina • April 5-6, 2001**

**Preregistration Deadline: February 23, 2001 Cancellation deadline: March 2, 2001**  
**You can also register online at [www.geosociety.org](http://www.geosociety.org).**

**Please print clearly • THIS AREA IS FOR YOUR BADGE**

\*  Male  Female

First Name/Nickname (as it should appear on badge) \_\_\_\_\_ Last Name \_\_\_\_\_

Employer/University (affiliation as it should appear on badge) \_\_\_\_\_

Mailing address Is this a permanent address?  Yes  No Is this home  or work

City \_\_\_\_\_ State or Province \_\_\_\_\_ ZIP or Postal Code \_\_\_\_\_ Country \_\_\_\_\_

E-mail \_\_\_\_\_ Business Phone \_\_\_\_\_ Fax \_\_\_\_\_ Home Phone \_\_\_\_\_

Spouse/Guest First Name/Nickname (as it should appear on badge) \_\_\_\_\_ Last Name \_\_\_\_\_ \*  Male  Female

\* Needed for field trip lodging.

 Do you or your guest require any special considerations?  Yes  No

Preregistration Fees (US\$)	Full Meeting	One Day	Qty	US\$ Amt.
Professional Member*	(10) \$ 80	(1) \$ 55	1	\$
Professional Member 70 & Older	(12) \$ 40	(13) \$ 30	1	\$
Professional Nonmember	(14) \$ 90	(15) \$ 55	1	\$
Student Member or Associate Member*	(30) \$ 30	(31) \$ 20	1	\$
Student Nonmember	(32) \$ 35	(33) \$ 20	1	\$
Guest or Spouse**	(90) \$ 25	N/A	1	\$
K-12 Professional	(60) \$ 30	N/A	1	\$
Short Course or Field Trip Only	(95) \$ 5	N/A	1	\$

Check member affiliation(s) (to qualify for registration member discount):  (a) GSA Mbr # \_\_\_\_\_  
 (b) AAPG  (c) AEG  (d) AIH  (e) AIPG  (f) AWG  (g) AWRA  (h) CUR  
 (i) NAGT  (j) NGWA  (k) PS  (l) SEG  (m) SEPM  (n) SME

\*Member fee applies to any current Professional OR Student Member of GSA or Associated Societies listed above. Discount does not apply to guest registrants.  
 \*\*Guest or Spouse registration fee does not allow access to technical sessions.

Total Column A \$ \_\_\_\_\_

**FAX TO: 303-443-1510 or 303-447-0648**

**MAIL TO: GSA SOUTHEASTERN SECTION MEETING  
 P.O. BOX 9140  
 BOULDER, CO 80301-9140**

**Remit in U.S. funds payable to 2001 GSA Southeastern Section Meeting**

(All preregistrations must be prepaid. Purchase Orders not accepted.)

Payment by (check one):  Check # \_\_\_\_\_  American Express  VISA  MasterCard  
 Discover  Diners Club

Card Number \_\_\_\_\_ Expires \_\_\_\_\_

Signature \_\_\_\_\_

GUEST PROGRAM	Qty	Amount
1. North Carolina Museum of Art..... April 5	(101) \$ 2	\$
2. J.C. Raulston Arboretum..... April 5	(102) \$ 2	\$
3. Exploris..... April 6	(103) \$ 4	\$
4. North Carolina Museum of History..... April 6	(104) \$ 1	\$

## SPECIAL EVENTS

- Geoscience Education: Challenges and Opportunities (Luncheon) April 5  
 Professional (201) \$ 10 \_\_\_\_\_  
 K-12 Educators and Students (201) \$ 5 \_\_\_\_\_
- Best of Broadway Series..... April 5  (202)  
 (Check box if interested and someone will contact you with more information.)

## LUNCHEONS

(Check box if interested and someone will contact you with more information.)

- GSA Southeastern Section Education Committee-NAGT SE Business Meeting and Breakfast..... April 6  (301)
- SEPM SE Section Business Meeting and Luncheon..... April 6  (302)
- Paleontological Society SE Section Business Meeting & Luncheon. April 5  (303)

## FIELD TRIPS

	Qty	Amount
1. Framing the Piedmont Zone..... April 2-4	(401) \$ 210	\$
2. Depositional and Structural Framework..... April 3	(402) \$ 38	\$
3. Structural Features Exposed in Triassic Sedimentary Rocks..... April 4	(403) \$ 35	\$
4. North-South Transect of the Goochland Terrane..... April 3-4	(404) \$ 125	\$
5. Cape Fear River Transect..... April 3-4	(405) \$ 185	\$
6. Cape Lookout Cuspate Foreland..... April 1-4	(406) \$ 240	\$
7. Building Stone Use in Historical and Modern Architecture..... April 6	(407) \$ 10	\$
8. Outstanding Geological Sites in the Triangle..... April 6	(408) \$ 20	\$
9. A Temporal View of Terranes and Structures..... April 7	(409) \$ 40	\$
10. Tate-Marble Hill Window..... April 7-8	(410) \$ 140	\$
11. Building Stone Use in Historical and Modern Architecture..... April 7	(411) \$ 10	\$

## WORKSHOPS

- Roy Shlemmon Mentor Program in Applied Geology Student Workshop..... April 6 (601) \$ 3 \_\_\_\_\_
- Earth Science/Environmental Science Education if not attending the meeting..... April 7 (602) \$ 5 \_\_\_\_\_  
 or free if attending the meeting..... April 7 (602) Free \_\_\_\_\_ FREE

Total Column B \$ \_\_\_\_\_  
 Total Column A \$ \_\_\_\_\_

**TOTAL FEES REMITTED \$ \_\_\_\_\_**

# GSA Foundation Update

By Morris W. Leighton, Chair, Foundation Board of Trustees

## Supporting Your Science, Your Profession, Your Society

As GSA members, you probably already know that the Second Century Fund Campaign was successfully concluded last year. It raised some \$10.9 million over an eight-year period, well over the \$10 million goal. These funds provided significant support for GSA programs and activities, including research grants for students, publications, annual meetings, internships, mentorships, the Institute for Earth Science and the Environment, education, seminars and forums, Penrose Conferences, travel grants, distinguished awards, and the GSA building in Boulder. Much of the money went out the door in direct support of these programs and activities, as well as those of the Sections and Divisions. Nevertheless, the Foundation's net assets still grew from \$2.1 million at the end of 1992, the year the campaign began, to \$6.6 million at the end of 1999, the close of the campaign. With appropriately managed investments, some 5% to 6% of the net assets can be made available to spend each year while still preserving capital and allowing the endowment to grow.

All of this is good news, except that from an analysis of data, four points have become clear. I believe these warrant the consideration of GSA's members, who constitute most of our donors.

First, much greater emphasis is needed on contributions to the Unrestricted Fund. Only 8% of the funds raised were unrestricted; the rest were designated for special purposes—commonly, special awards for Divisions and Sections. While these contributions are helpful for the purposes intended, we're finding that this has led to some neglect of GSA's core programs. That is, we're falling short in support for research grants, publications, and meetings, and for new strategic scientific, educational, and outreach programs that will better position GSA for this century.

Incidentally, the National Science Foundation grant to GSA for partial support of the Research Grants program is scheduled to end in 2001. There is no guarantee of renewal. That would mean finding an additional \$130,000/year to augment this program, long a keystone of GSA's support to students. Since the program began in 1932, some \$7.2 million has gone to 6,800 recipients—an impressive figure and an indication of substantial support to our profession.

Increasing the Unrestricted Fund will help put money where it is needed. Research grants for students is one good example—the GSA Foundation Board of Trustees approved an additional \$40,000 from the Unrestricted Fund for this purpose this year. Another example is the approval by the board of \$27,000 from the Unrestricted Fund for matching Student Travel Grants.

Don't forget—your contributions to the Foundation must be postmarked by December 31, 2000, to be allowed as a tax deduction for this year.

Second, I want to urge members to increase their participation in supporting their Society and their profession. Less than 8% of the members contributed this past year. We could do better. I'm sure more loyal GSA members would enjoy the feeling of involvement and ownership of our Society through becoming a donor. Adding new contributors is essential to GSA's future.

My third point is that building on what each of us contributes annually is also vital when we realize that the Second Century Fund is completed—it's done! For the eight-year campaign, only about 50% of all the contributions came from the annual campaign and planned giving. The remainder came as direct support of the Second Century Fund. For the annual campaign and planned giving to make up the difference, we'd like to see current contributors entertain the idea of not only continuing to give what they gave to the Second Century Fund, but also increasing their contributions. This would help significantly to maintain and grow GSA programs.

My fourth point is this: We ask members to think of including the GSA Foundation as one of the charitable institutions they support annually, as well as in their estate planning. Remember, annual gifts are tax deductible, and planned giving can result in significant benefits to the programs of the Society and sizable tax advantages for your estate. I encourage you to contact the Foundation for more information about planned giving programs that best meet your needs.

Please help to get the word out. GSA needs your help to continue and improve its support of geoscience programs. ■

### Digging Up the Past

*Most memorable early geologic experience*

Watching a nickel being pressed into molten lava from a vent on Mount Vesuvius, Italy, in the summer of 1939.

—John L. Snyder



## GSA Foundation

3300 Penrose Place  
P.O. Box 9140  
Boulder, CO 80301-9140  
(303) 447-2020  
drussell@geosociety.org

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

Please credit my contribution to the:

- Unrestricted Fund  
 Other: \_\_\_\_\_ Fund  
 I have named GSA Foundation in my will.

PLEASE PRINT

Name \_\_\_\_\_

Address \_\_\_\_\_

City/State/ZIP \_\_\_\_\_

Phone \_\_\_\_\_



— Attention GSA Exhibitors and Advertisers —

# EXPAND

Y O U R M A R K E T

**WHO:** GSA advertising and exhibiting supporters who want to ...

**WHAT:** Reach those who attended the GSA 2000 Annual Meeting in Reno AND remind the membership of your presence at the show!

**WHERE:** The February 2001 issue of *GSA Today* will feature a full-color wrap up of the Annual Meeting. Bonus distribution issue!

**WHEN:** Reserve your space now! Space reservations Feb. issue: Dec. 20 (art due Jan. 5).

**WHY:** For less than a penny per reader you can remind meeting attendees and *GSA Today* readers about your products and services.

**HOW:** Contact GSA Advertising Coordinator, Ann Crawford: 1-800-472-1988 x153 by e-mail to: [acrawford@geosociety.org](mailto:acrawford@geosociety.org)

Exhibitor/Advertisers: Call to learn about how you can receive a 10% discount on space rates.

## 2001 GSA Section Meetings

### NORTHEASTERN SECTION

March 12–14, 2001  
Sheraton Burlington Hotel  
Burlington, Vermont

**Abstract Deadline:**  
December 5, 2000

For meeting information:

Tracy Rushmer  
Dept. of Geology  
University of Vermont  
Perkins Hall  
Burlington, VT 05405-0122  
(802) 656-8136  
[trushmer@zoo.uvm.edu](mailto:trushmer@zoo.uvm.edu)

### SOUTHEASTERN SECTION

April 5–6, 2001  
Sheraton Capital Center  
Raleigh, North Carolina

**Abstract Deadline:**  
January 2, 2001

For meeting information:

Edward Stoddard  
Dept. of Marine, Earth &  
Atmospheric Sciences  
North Carolina State University  
Raleigh, NC 27695-8208  
(919) 515-7939  
[skip\\_stoddard@ncsu.edu](mailto:skip_stoddard@ncsu.edu)

### CORDILLERAN SECTION

April 9–11, 2001  
Sheraton Universal Hotel  
Universal City, California

**Abstract Deadline:**  
December 20, 2000

For meeting information:

Peter W. Weigand  
Dept. of Geological Sciences  
California State  
University–Northridge

18111 Nordhoff Street  
Northridge, CA 91330-8266  
(818) 677-2564  
[peter.weigand@csun.edu](mailto:peter.weigand@csun.edu)

### NORTH-CENTRAL SECTION

April 23–24, 2001  
Bone Student Center  
Normal, Illinois

**Abstract Deadline:**  
January 17, 2001

For meeting information:

Robert S. Nelson  
Illinois State University  
Dept. of Geography–Geology  
Campus Box 4400  
Normal, IL 61790-4400  
(309) 438-7808  
[rsnelso@ilstu.edu](mailto:rsnelso@ilstu.edu)

### ROCKY MOUNTAIN AND SOUTH-CENTRAL SECTIONS

April 30–May 2, 2001  
Sheraton Old Town Hotel  
Albuquerque, New Mexico

**Abstract Deadline:**  
January 24, 2001

For meeting information:

John Geissman  
University of New Mexico  
Dept. of Earth & Planetary  
Sciences  
203 Northrop Hall  
Albuquerque, NM 87131-  
1116  
(505) 277-3433  
[jgeiss@unm.edu](mailto:jgeiss@unm.edu)

## Reminder:

## Call for Nominations

Nominations are due soon for the following medals and awards for 2001. Don't miss this chance to recognize your deserving colleagues for their contributions to the geosciences and to GSA. Make a note of the deadlines for nominations and send them in!

For details on the awards and nomination procedures, see the October 2000 issue of *GSA Today*, go to our Web site at [www.geosociety.org](http://www.geosociety.org), or call GSA at (303) 447-2020, ext. 137. Materials and supporting information for any of the nominations may be sent to Administrative Services Dept., GSA, P.O. Box 9140, Boulder, CO 80301-9140.

### National Awards

Nominations for the William T. Pecora Award, the National Medal of Science, the Vannevar Bush Award, and the Alan T. Waterman Award are due April 30, 2001. Nominations for these awards should be sent to GSA External Awards Committee, P.O. Box 9140, Boulder, CO 80301-9140.

Penrose Medal  
Deadline:  
February 1, 2001

Day Medal  
Deadline:  
February 1, 2001

Honorary Fellows  
Deadline:  
February 1, 2001

Young Scientist Award  
(Donath Medal)  
Deadline:  
February 1, 2001

GSA Public Service  
Award  
Deadline:  
February 1, 2001

Distinguished Service  
Award  
Deadline: March 1, 2001

John C. Frye  
Environmental  
Geology Award  
Deadline: March 31, 2001

## Call for Applications!

**Looking to expand  
your professional horizons?**

**Believe in serving society through  
science?**

**Ready for a unique challenge?**



### Apply for GSA's Congressional Science Fellowship 2001-2002

Put your expertise and experience to work helping shape science and technology policy on Capitol Hill. Work directly with national and international leaders.

The Congressional Science Fellow will be selected from top competitors early in 2001. Successful candidates are GSA members who possess either a Ph.D. in the earth sciences or a related field, or a master's degree in the earth sciences or a related field with at least five years of professional experience. 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 residents of the U.S. The deadline to apply is February 2, 2001.

To learn more about the Fellow experience, contact David Verardo, 1997-1998 GSA Congressional Science Fellow, at (703) 625-6105 or [dverardo@geosociety.org](mailto:dverardo@geosociety.org).

For application information, check our Web site at [www.geosociety.org/science/csf/scifello.htm](http://www.geosociety.org/science/csf/scifello.htm) or contact Karlon Blythe, Program Officer, GSA Headquarters, (303) 447-2020, ext. 136, or [kblythe@geosociety.org](mailto:kblythe@geosociety.org).

## CALENDAR

### 2001 Meetings

#### March

March 4-7, Environmental and Engineering Geophysical Society (EEGS) Annual Meeting: Symposium on the Application of Geophysics to Environmental and Engineering Problems, Denver, Colorado. Information: Mark Cramer, (303) 771-2000, [mrcramer@expomasters.com](mailto:mrcramer@expomasters.com), [www.sageep.com](http://www.sageep.com).

#### May

May 19-25, 6th Workshop of the ESF-IMPACT Programme: Impact Markers in the Stratigraphic Record, Granada, Spain. Information: Francisca C. Martinez-Ruiz, Instituto Andaluz de Ciencias de la Tierra (CSIC-UGR), Fac. Ciencias, Fuentenueva s/n, 18002 Granada, Spain, fax 34-958-243384, [fmruiz@ugr.es](mailto:fmruiz@ugr.es), [www.ugr.es/~impact/](http://www.ugr.es/~impact/).

#### September

September 2-6, Environmental and Engineering Geophysical Society (EEGS) Annual Meeting 2001, Birmingham, England. Information: Helen Wilson, [helen.wilson@geolsoc.org.uk](mailto:helen.wilson@geolsoc.org.uk), Michael Stephens, [michael.stephens@geolsoc.org.uk](mailto:michael.stephens@geolsoc.org.uk), [www.geolsoc.org.uk/template.cfm?name=eegs](http://www.geolsoc.org.uk/template.cfm?name=eegs).

September 4-6, ERES 2001: Third International Symposium on Earthquake Resistant Engineering Structures, Malaga, Spain. (Abstract deadline: January 3, 2001.)

September 11-13, River Basin Management 2001, Cardiff, United Kingdom. (Abstract deadline: January 9, 2001.)

September 11-13, Water Pollution 2001: Sixth International Conference on Modelling, Measuring and Prediction of Water Pollution, Rhodes, Greece. (Abstract deadline: January 16, 2001.) Information: Susan Hanley, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK, 44 (0) 238-029-3223, fax 44 (0) 238-029-2853, [shanley@wessex.ac.uk](mailto:shanley@wessex.ac.uk), [www.wessex.ac.uk/conferences/2001/](http://www.wessex.ac.uk/conferences/2001/).

September 24-26, Water Resources Management 2001, Halkidiki, Greece. Information: Sally Walsh, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK, 44 (0) 238-029-3223, fax 44 (0) 238-029-2853, [swalsh@wessex.ac.uk](mailto:swalsh@wessex.ac.uk), [www.wessex.ac.uk/conferences/2001/](http://www.wessex.ac.uk/conferences/2001/). (Abstract deadline: January 23, 2001.)

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

## Coal Division Offers Medlin Award

The Coal Geology Division of GSA announces the availability of the Antoinette Lierman Medlin Scholarship in Coal Geology for the 2001-2002 academic year. The scholarships provide full-time students who are involved in research in coal geology (origin, occurrence, geologic characteristics, or economic implications of coal and associated rocks) with financial support for their project for one year.

Scholarship funding can be used for field or laboratory expenses, sample analyses, instrumentation, supplies, or other expenses essential to the successful completion of the research project. Approximately \$2000 will be available for the 2001-2002 scholarship award. In addition, the recipient of the scholarship may be provided with a stipend of up to \$750 to present results of the research at the 2002 GSA Annual Meeting. For the academic year 2001-2002, the Coal Geology Division is also offering a field study award of \$1500. The recipient of this award will also be eligible to receive up to \$750 in travel funds to present results of their study at the 2002 GSA Annual Meeting.

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

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

Send the material to: Peter D. Warwick, Chairman, A. Lierman Medlin Scholarship Committee, U.S. Geological Survey, 956 National Center, Reston, VA 20192, (703) 648-6469, [pwarwick@usgs.gov](mailto:pwarwick@usgs.gov).

The proposal and letter of recommendation must arrive no later than February 15, 2001. Applicants will be notified of the Scholarship Committee's decision by April 1, 2001.

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

## Engaging “My Neighbor” in the Issue of Sustainability Part XII: We Have the Option of Choice: The Future is Up to Us

*E-an Zen, Reston, VA, A.R. Palmer, Boulder, CO, and P.H. Reitan, Buffalo, NY*

In this series of essays, we have focused on key elements that comprise the issue of sustainability—the central issue that faces humanity in the 21st century. It should be abundantly clear that to continue as if the world has unlimited resources to support an expanding economic system, and unlimited space for all life forms in addition to humans, is to invite the calamity of a ruined environment and exhaustion of many key resources, which would affect the ecosystem of which we are an integral part. Because we all share the global commons, we will also all share the consequences of such a calamity (Hardin, 1968; Palmer, 2000).

Our future thus hangs in the balance. But we humans have one thing going for us: We are sentient and reasoning beings; we have the gifts of vision, of imagination, and of social structures that allow concerted action. Unlike other life forms that inhabit Earth, we can choose to make a difference in our future. We can choose to change the focus of our value systems and emphasize stewardship rather than exploitation of the global commons. Collectively, we humans can significantly improve our prospect for an enduringly habitable world.

How to bring about the necessary changes? This series of articles has advocated that we and “our neighbors” should become aware of the major issues of sustainability, and consider constructive action. Social changes, to be beneficial and sustainable, must be carefully evaluated and made, in our political system, by common consent. They should be reversible, lest things do not go as intended; they should probably be locally based, so as to improve communication among stakeholders and reduce the risk of failure through lack of understanding and support (AtKisson, 1999; National Research Council, 1996).

To do that, however, we must agree on the needed changes in the way we think and conduct our lives, and we must act on our resolutions on the basis of both enlightened self-interest and altruism (Palmer, 2000; Zen, 2000; Fisher, 2000; Meadows et al., 1992; Kates, 2000; Earth Charter, 2000). Here, we suggest a need to reexamine some of our entrenched values and attitudes, such as:

- economic growth as an innate virtue

and as an adequate index of social health;

- indefinite extension of human life expectancy as a virtue even though it aggravates the population problem;
- conspicuous consumption, rather than frugality, as the socially desirable norm of behavior;
- equating change with human progress, with its corollary that what humans *can* change, humans *should* change;
- equating a more opulent material life with an intrinsic improvement in the standard of living;
- assuming that science and technology are adequate to fix the problem for society; and
- assuming that humans have a license to exploit and use the non-human world with little or no ethical restraint.

Wise homeowners maintain their houses in such a way as to minimize the risk of fire. They do not wait until after their home burns before buying a fire insurance policy. A faulty electrical system in a home may be a real fire hazard; repairing the system immediately may prevent a catastrophe. Working toward sustainability—preservation of the global ecosystems—is analogous to reducing the fire hazard. For sustainability, however, the insurance policy is to prevent or mitigate damage rather than to indemnify victims after the damage.

A year ago, the world engaged in a large-scale exercise to verify compliance of computer codes with the “Y2K” turnover so as to prevent a massive collapse of systems of electronic information, data storage, and services that people perceive as useful to their ways of living. Although the consequences of such a failure would be miniscule compared to the consequences of failing to achieve sustainability, stakeholders invested billions, perhaps hundreds of billions of U.S. dollar equivalents to ensure Y2K compliance, by and large willingly.

Choosing to pursue a sustainable future through stewardship of the global commons will at times require us to give up some cherished ways of doing things and may be personally painful. Sustainable human societies cannot be brought about through coercion, but through people seeing a need and willingly acting upon it. In our political system, this will mean having informed citizens who by

their votes and their buying power will support courageous political and business leadership in this transformation (Ashby, 1993).

To be motivated to move toward new and sustainable patterns of behavior requires recognition that the danger is real but the goals and aspirations of individuals and of societies can be moderated. Because sustainable human societies are inseparable from healthy earth systems, humans must accord value to the nonhuman world as well. Science, environmental philosophies, and religions (Fisher, 2000), though different in many ways, can come together in support of stewardship of the earth system. We need to seek out common ground and cultivate ways to work together toward this enterprise of global sustainability. Surely this work will constitute the most important insurance policy we could ever buy.

### References Cited

- Ashby, E., 1993, Foreword: Environmental dilemmas, ethics, and decisions: R.J. Berry, ed., London: Chapman & Hall, p. xiv–xxi.
- AtKisson, A., 1999, *Believing Cassandra*: White River Junction, Vermont: Chelsea Green, 236 p.
- Earth Charter, 2000: International Secretariat of The Earth Charter Campaign, [www.earthcharter.org/draft/charter.htm](http://www.earthcharter.org/draft/charter.htm).
- Fisher, G.W., 2000, Sustainable living: Common ground for geology and theology: in Schneiderman, J.S., ed., *The Earth around us: Maintaining a livable planet*: New York, W.H. Freeman, p. 99–111.
- Hardin, G., 1968, The tragedy of the commons: *Science*, v. 162, p. 1243–1248.
- Kates, R.W., 2000, Population and consumption: What we know, what we need to know: *Environment*, v. 42, no. 3, p. 10–19.
- Meadows, D.H., Meadows, D.L., and Randers, J., 1992, *Beyond the limits*: White River Junction, Vermont: Chelsea Green, 300 p.
- National Research Council, 1996, *Understanding risk: Informing decisions in a democratic society*: Washington D.C., National Academy Press, 249 p.
- Palmer, A.R., 2000, What do we mean by the global commons?: *GSA Today*, v. 10, no. 1, p. 8.
- Zen, E-an, 2000, What do we mean by a sustainable world?: *GSA Today*, v. 10, no. 10, p. 40.

*Note: This series of essays, with some enhancements for teachers, is now available through a link on GSA's Web site, [www.geosociety.org](http://www.geosociety.org). From either Public Interest or the “Related Links” area of Geoscience Initiatives, click “Sustainability” then “Toward a Stewardship of the Global Commons.”*

## POSITION ANNOUNCEMENTS *(from employers using GSA's Employment Service at the 2000 Annual Meeting)*

### **JUNIATA COLLEGE, HUNTINGDON, PA ASSISTANT PROFESSOR OF GEOLOGY**

The Department of Geology at Juniata College invites applications for a full-time, tenure-track position in structural geology at the rank of Assistant Professor. Candidates should have a Ph.D. in geology and significant field experience. Teaching duties will include structural geology, hydrogeology, and other courses at the introductory and advanced level that will complement existing departmental strengths. The candidate should have strong field and applied skills and is expected to mount a student-centered research program that exploits our advantageous setting in the Valley and Ridge Province. The Department consists of three full-time faculty and about 30 majors, of whom an unusually high proportion go on to graduate school. The department is well equipped, with petrographic microscopes, powder XRD, a rock preparation laboratory, and access to much additional field and laboratory equipment. Juniata College is a co-educational, liberal arts college with an enrollment of 1,300 in rural central Pennsylvania, highly regarded for academic excellence. It has long had an outstanding reputation of educating young scientists. Juniata is committed to gender and cultural diversity and encourages applications from women and minorities. Send letter of application; curriculum vitae; three letters of recommendation; transcripts; and a concise statement of current and long-term teaching, research and career goals by December 20 to: Mrs. Gail Leiby Ulrich, Director of Human Resources, Juniata College, Huntingdon, PA 16652. AA/EOE.

### **ASSISTANT PROFESSOR OF GEOLOGY INDIANA STATE UNIVERSITY, TERRE HAUTE**

The Department of Geography, Geology, and Anthropology at Indiana State University invites applications for a tenure-track position at the assistant professor level in paleontology beginning August 2001. Candidates must have a Ph. D. at time of appointment. Research focus should complement existing departmental strengths in geology and physical geography and anthropology. See the department's Web page at <http://www.indstate.edu/gga/geol> for more information. Preference will be given to individuals with research interests in one or more of the following areas: evolutionary theory, paleoecology, paleobiogeography, paleoclimatology, geobiology, and quaternary paleontology. Integrative modeling of paleoenvironments will strengthen the application as will the incorporation of GIS technology in research. The successful applicant will be required to: (1) teach courses in introductory geology, paleontology, oceanography, and one or more courses in their area of specialization; (2) supervise undergraduate and master's level research projects, (3) maintain an active research program, and develop and submit external grant proposals. Qualified candidates should send a letter of application, a statement of teaching and research interests, curriculum vitae, names and addresses of three references, and statement of U.S. citizenship or eligibility for U.S. employment by January 15, 2001, to: Prodig Dutta, Chair, Geology Search Committee, Department of Geography, Geology, and Anthropology, Indiana State University, Terre Haute, IN 47809. Screening of applications will begin January 16, 2001. Indiana State University is an EO/AA employer and committed to diversity within its academic community.

### **DYNAMICS AND EVOLUTION OF IGNEOUS AND METAMORPHIC MATERIALS AND TERRANES GEOLOGICAL SCIENCES FLORIDA STATE UNIVERSITY**

The Department of Geological Sciences at Florida State University invites applications and nominations for a tenure-track faculty position (starting August 2001) in the general field of petrology, emphasizing the dynamics and evolution of igneous and/or metamorphic materials/terranes. We welcome applications from individuals pursuing theoretical, experimental, and/or field-based research. While it is anticipated that this position will be filled at the level of assistant professor, applicants who have established an internationally recognized research program may be considered for a position at the associate professor level. More information about this position and opportunities in Geosciences at FSU can be found at <http://www.fsu.edu/advert/ad.html>. Applications should include a curricula vita, statement of research and teaching interests, and names, e-mail addresses, and telephone numbers of at least four references. Applications may be submitted by e-mail (preferably attached in pdf format) to: [search@gly.fsu.edu](mailto:search@gly.fsu.edu) or sent via normal mail to: Search Committee, Department of Geological Sciences, Florida State University, Tallahassee, Florida 32306-4100. Closing date is Jan. 8, 2001. Department representatives will be at the GSA Meeting in Reno and AGU Meeting in San Francisco. Florida State University is an EO/AA Employer.

### **GEOSCIENCE EDUCATION BOWLING GREEN STATE UNIVERSITY**

The Department of Geology invites applications for a tenure-track position at the Assistant Professor level beginning August 2001. The position requires a faculty member with a primary interest in geoscience education. Preference will be given to candidates with a disciplinary specialization in vertebrate paleontology who can participate in our nationally recognized undergraduate program in paleobiology through course offerings and/or supervision of student research. The Department of Geology has a commitment to excellence in teaching. We are seeking a creative individual with a high level of enthusiasm for teaching undergraduate courses at the introductory level and the desire to teach pedagogy at the graduate level. The successful applicant will be expected to establish/continue a productive research program in some area of geoscience education such as curriculum design, assessment, integration of technology, distance learning, or community outreach. Research collaborations with the department's faculty, other science faculty, and faculty in BGSU's School of Education are strongly encouraged. Evidence of success in research might include externally funded grants in geoscience education, peer-reviewed publications, or development of successful community outreach programs. 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 and original letters of recommendation to: Chair, Faculty Search Committee, Department of Geology, 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, 2001. Bowling Green State University is an Equal Employment Opportunity/Affirmative Action employer and encourages applications from women, minorities, veterans, and persons with disabilities. Additional information regarding the Department of Geology may be found at <http://geosrv01.bgsu.edu>.

### **FACTORY POSITION IN GEOPHYSICS DEPARTMENT OF PHYSICS TRINITY COLLEGE**

The Department of Physics at Trinity College in Hartford, Connecticut, is seeking applicants for a tenure track faculty position at the level of Assistant Professor with instructional duties jointly in physics and geophysics beginning in the fall term, 2001. We seek applicants with a strong commitment to undergraduate teaching who will maintain an active program of research providing the opportunity for undergraduate involvement. A doctorate in geophysics is required. The successful candidate will be a major contributor to the creation of the College's new interdisciplinary Environmental Science Program, will develop and teach general and advanced courses in geology and geophysics, and will teach courses in elementary physics. Qualified applicants should submit a curriculum vita, a description of research and teaching interests, a list of publications, and have three letters of recommendation sent to: Prof. Barbara Walden, Search Committee Chair, Department of Physics, Trinity College, 300 Summit St., Hartford CT, 06106. Telephone: (860) 297-5324; FAX: (860) 987-6239; e-mail: [barbara.walden@mail.trincoll.edu](mailto:barbara.walden@mail.trincoll.edu). To facilitate communication, please include your e-mail address. Consideration of applications will begin on Dec. 1, 2000, and the search will remain open until the position is filled. Women and members of minority groups are particularly encouraged to apply. Trinity College is an Equal Opportunity / Affirmative Action Employer.

### **ENVIRONMENTAL GEOLOGIST/GEOMORPHOLOGIST FORT LEWIS COLLEGE, DURANGO, CO**

Department of Geosciences, Fort Lewis College, Durango, CO. Asst. Professor, tenure track position, Ph.D. required. See <http://geo.fortlewis.edu>. Send letter of application, resume, official transcripts, and 3 current letters of recommendation, to: Dr. James D. Collier, Chair, Department of Geosciences, Fort Lewis College, 1000 Rim Drive, Durango, CO 81301-3999, postmarked by January 15, 2001. FLC is an AA/EOE employer.

### **ASSISTANT PROFESSOR, GEOLOGY UNIVERSITY OF ALASKA ANCHORAGE**

Tenure-track position, teaching, research and service workload, to begin August 2001. Ph. D. required. Must demonstrate excellence in teaching and be able to teach introductory and upper level courses in environmental geology. Other specialties may include hydrology, soils, geochemistry. Northern experience preferred. Commitment to high-quality undergraduate teaching essential. Candidates need to have interest in building a small department, directing

undergraduate research, and supporting the environmental program. Review of applications will begin Nov. 10. For more information see our Web page at [www.finsys.uaa.alaska.edu/uaahrs](http://www.finsys.uaa.alaska.edu/uaahrs) or contact Dr. Kristine J. Crossen, (907) 786-6838. Send letters of application, resume, transcripts, and names, addresses, and phone numbers of at least 4 references to: Human Resource Services, University of Alaska Anchorage, 245 Administration Bldg., 3211 Providence Dr., Anchorage, AK 99508. UAA is an AA/EO Employer and Educational Institution.

### **ASSISTANT PROFESSOR—GLOBAL CHANGE UNIVERSITY OF AKRON**

Applications are invited for one tenure-track position at the level of Assistant Professor (open specialty) in the Department of Geology, University of Akron. Qualifications include a Ph.D., a proven record of obtaining external funding, recent refereed publications, and a desire to teach and conduct research at the undergraduate and graduate (Masters) level. The department seeks to add an exceptional individual who can increase graduate student enrollment by establishing an energetic, externally funded research program. Candidates are preferred whose research is closely related to our interdepartmental and external research theme built around investigations of the "Terrestrial Record of Quaternary Environmental and Climatic Change." Applicants are encouraged to review faculty profiles at <http://www.uakron.edu/geology> to ensure their specialty will augment rather than duplicate existing faculty research and teaching strengths. Candidates should submit a curriculum vitae, one page statement of research and teaching interests, and the names of three references (with e-mail and telephone number) to: Dr. David Steer, Department of Geology, University of Akron, Akron, OH 44325-4101. Email inquiries are welcome and should be directed to [steer@uakron.edu](mailto:steer@uakron.edu). Applicants must possess a Ph.D. at the time of application. Application deadline is 5 p.m. EST, January 2, 2001. The University of Akron is an equal opportunity/affirmative action employer.

### **CLIMATE-HYDROSPHERE-LANDSURFACE INTERACTIONS**

The Department of Earth Sciences at Boston University (B.U.) invites applications for a tenure track faculty position at the Assistant Professor level, to begin September 1, 2001. The successful applicant will have research interests quantitatively addressing landsurface, hydrologic, or biogeochemical processes and their interactions and feedbacks with respect to climate change in terrestrial or marine realms at any timescale. Potential emphases include climate-tectonic linkages; paleoclimatic and paleoceanographic reconstructions from terrestrial, ice, or marine records; shoreline response to climate change; mass and energy exchange within or between the landsurface, atmosphere, and ocean; groundwater-surface water interaction; or the interaction between climate change and biogeochemical cycling. Research approaches may include field or laboratory experiments, numerical simulations, or elemental and isotopic geochemistry and geochronology. The successful applicant will complement existing departmental strengths in geochemistry, quantitative geomorphology, hydrology, paleoceanography and marine geology, geodynamics, and tectonics. The faculty member will be expected to supervise graduate work in M.A. and Ph.D. programs, maintain an externally funded research program, and teach at all levels in the Earth Sciences curriculum. For more information about the department, 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](mailto:earth@bu.edu). Review of applications will begin January 12, 2001. Boston University is an equal opportunity/affirmative action employer.

### **ASSISTANT PROFESSOR STRUCTURAL GEOLOGY**

The Department of Geology at Bryn Mawr College invites applications for a full-time, tenure-track position at the rank of Assistant Professor, beginning Semester I, 2001. Areas of preferred expertise are structural geology and/or tectonics. Candidates could also be interested in fields such as neotectonics, geophysics, fluid flow, remote sensing, GIS, and/or modeling, to complement our existing programs in paleontology, petrology/mineralogy, sedimentology and Quaternary geology. The individual is expected to contribute to our interdisciplinary Environmental Sciences Concentra-

Positions *continued on p. 26*

## Positions continued from p. 25

tion and add depth to our joint graduate program with the University of Pennsylvania. The person will direct undergraduate and graduate research projects and conduct an active research program. Teaching responsibilities will include structural geology and an introductory physical geology course, as well as undergraduate and graduate courses in the candidate's field(s) of expertise. Demonstrated teaching ability and a Ph.D. at the time of appointment are required. Applications should include a curriculum vitae, statement of research and teaching interests, and at least 3 letters of recommendation. Applications should be sent to Structure Search, Maria Luisa Crawford, Department of Geology, Bryn Mawr College, 101 N. Merion Avenue, Bryn Mawr, PA 19010. Preliminary interviews will be conducted at the GSA annual meeting in Reno. Review of applications will begin Dec. 10, 2000. Bryn Mawr College is an equal opportunity, affirmative action employer. Members of underrepresented groups are especially encouraged to apply. For more information about the position, the Department and the College, visit [www.brynmaur.edu/academics/Geo](http://www.brynmaur.edu/academics/Geo).

### ENVIRONMENTAL GEOLOGY DEPAUW UNIVERSITY

The Department of Geology and Geography at DePauw University invites applications for a tenure-track position in Environmental Geology at the rank of Assistant (Instructor for ABD) or Associate Professor to begin August 15, 2001. We desire a person who is broadly trained in the geosciences with expertise in hydrogeology and/or geochemistry. The successful applicant will teach a variety of courses for undergraduate students including Physical Geology, Physical Geography, Geochemistry, and Applied Hydrogeology; will develop research projects for undergraduate students; and will possess excellent field and/or computational skills. DePauw University is a nationally ranked, selective liberal arts university. We offer nationally competitive faculty salaries, an excellent faculty development program to support teaching and research initiatives, and a pre-tenure sabbatical leave program. Rank and salary will be commensurate with experience. Applicants should send a letter describing their teaching pedagogy and research interests, vita, transcripts of all academic work, and three letters of

recommendation to Dr. Frederick M. Soster, Chair, Department of Geology and Geography, DePauw University, Greencastle, IN 46135. Closing date for applications is December 15, 2000. DePauw University is an affirmative action, equal opportunity employer. Women and minorities are especially encouraged to apply.

### PALEONTOLOGY, ASSISTANT PROFESSOR THE UNIVERSITY OF KANSAS

The Department of Geology of The University of Kansas invites applications for a tenure-track Assistant Professor in paleontology. The position will be available August 18, 2001, or January 1, 2002, depending upon funding, with a later start date possible. Primary consideration will be given to applicants whose interests are specimen based and who use fossil invertebrates or microfossils to explore paleoecology or paleoclimatology. For application information contact Anthony W. Walton, Dept. of Geology, Univ. of Kansas, 120 Lindley Hall, Lawrence, KS 66045 (tel: (785) 864-2726; e-mail: [TWalton@UKans.edu](mailto:TWalton@UKans.edu)). Review of completed applications will begin December 20, 2000, and continue until the position is filled. EO/AA employer. The University is committed to increasing the ethnic and gender diversity of its faculty, and we strongly encourage women and minority candidates to apply.

### UNIVERSITY OF PUGET SOUND ASSISTANT PROFESSOR OF GEOLOGY

Full-time, tenure-line position; begins fall term 2001. Teach undergrad courses in mineralogy, igneous and metamorphic petrology, and intro course in Physical Geology, Environmental Science, or Oceanography. Teach one interdisciplinary Science in Context course (team-taught with Humanities or Social Sciences faculty) each year. Develop successful research program involving undergrads. Write/submit external grant proposals. Ph.D. in Geology (ABD considered) with specialization in any area of igneous and metamorphic petrology/geochemistry. Experience in two or more of the following areas strongly preferred: x-ray diffractometry, x-ray spectrometry, scanning electron microscopy (including x-ray microanalysis), and computer applications in geology. Demonstrated excellence in teaching at undergrad level; strong commitment to developing a quality undergrad centered research program in areas of specialization; and ability to cross disciplinary boundaries in

teaching/research. Send statement of teaching and research interests, curriculum vitae, and three reference letters to: Geology Search, University of Puget Sound, P.O. Box 7297, Tacoma, WA 98406.

### THE UNIVERSITY OF TEXAS AT SAN ANTONIO

The Division of Earth and Physical Sciences invites applications for two tenure-track positions as Assistant Professor of Geology. The positions have starting dates of September 1, 2001, pending budget approval. Responsibilities include teaching geology courses at both the graduate and undergraduate level at either the UTSA Downtown Campus or the Main Campus, supervise undergraduate and graduate research, and pursue an active research program. Required Qualifications: A Ph.D. in Geology is required. STRATIGRAPHY/PALEONTOLOGY PREFERRED QUALIFICATIONS: Candidate will have expertise in stratigraphy and paleontology. Application: Letter of application and supporting materials must be received with a postmark date of no later than January 8, 2001. Applicants who are not current U.S. citizens must state their current visa or residency status. Applicants must submit original signed letter of application and current curriculum vita including the names and addresses of three references, to Chair, Geology Search Committee, Division of Earth and Physical Sciences, The University of Texas at San Antonio, 6900 North Loop 1604 West, San Antonio, Texas 78249-0663. HYDROGEOLOGY/ENGINEERING GEOLOGY PREFERRED QUALIFICATIONS: Candidate will have expertise in hydrogeology or engineering geology with an emphasis in hydrogeology. Application: Letter of application and supporting materials must be received with a postmark date of no later than January 5, 2001. Applicants who are not current U.S. citizens must state their current visa or residency status. Applicants must submit original signed letter of application and current curriculum vita including the names and addresses of three references, to Chair, Hydrogeology Search Committee, Division of Earth and Physical Sciences, The University of Texas at San Antonio, 6900 North Loop 1604 West, San Antonio, Texas 78249-0663. The University of Texas at San Antonio is an Affirmative Action/Equal Employment Opportunity Employer. Women and Minorities are encouraged to apply. Further information about the department and UTSA is available on our Web page: <http://www.utsa.edu/eps/>.

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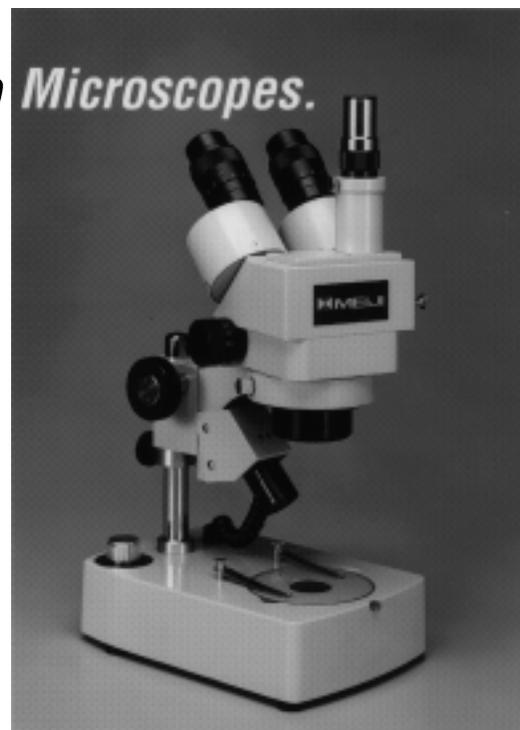
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## LETTERS

My compliments to Bottjer et al. (2000) for their thoughtful and stimulating discussion of changes in level-bottom fossil communities near the Proterozoic-Cambrian transition! However, in addition to the changes on or in siliciclastic substrates enumerated by them, there was another contemporaneous substrate revolution involving: (a) increased diversity of reef-building taxa; part of the well-documented "Cambrian explosion" of skeletal metazoans; and (b) a switch in growth habit and/or direction and growth forms and/or shapes among reef-building taxa from mostly subhorizontal, microbial mats or sheets (stromatolites) to densely packed skeletal tubules (*Epiphyton*), coccoids (*Renalcis*) and erect cups or bowls and sticklike cylinders or cones of the early Archaeocyatha.

In contrast to the frameless Precambrian reefs built exclusively by soft-bodied microbes, the Cambrian reef revolution "produced the earliest reefs with skeletal frameworks (Kruse et al., 1995). The nearly simultaneous appearance of weakly skeletonized *Epiphyton*, *Renalcis* (both calcimicrobes), and Archaeocyatha (Porifera) characterized the abundant and diverse Early Cambrian fossil reef communities.

Furthermore, the nearly coincident increase in packing density of calcimicrobes and clonal Archaeocyatha provided sufficient skeletal volume and rigidity to build the initial self-supporting reef framework. Accompanying this truly revolutionary increase in morphologic diversity, skeletonization, packing density and erect clonal growth, there also was a progressive increase in the complexity of reef guild structures from the Precambrian through the Early Cambrian (Fagerstrom, 1986, p. 325-331).

In summary, the Cambrian substrate experienced revolutions on or in siliciclastic detrital sediments as well as in the building of small, topographically elevated carbonate reefs with skeletal frameworks. The appearance of skeletal reef substrates was at least as profound as the revolution described by Bottjer et al. (2000).

### References Cited

Bottjer, D.J., Hagadorn, J.W., and Dornbos, S.Q., 2000, The Cambrian substrate revolution: *GSA Today*, v. 10, no. 9, p. 1-7.

Fagerstrom, J.A., 1986, *The evolution of reef communities*: New York, John Wiley & Sons, 600 p.

Kruse, P.D., Zhuralev, A.Y., and James, N.P., 1995, Primordial metazoan-calcimicrobial reefs: Tommotian (Early Cambrian) of the Siberian Platform: *Palaios*, v. 10, p. 291-321.

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*Bottjer et al. reply:* In our paper we outlined the changes in seafloor character that occurred due to the evolution of increasing vertically directed bioturbation. Thus, shallow seafloors in the late Neoproterozoic which had been microbial mat-dominated were largely replaced in the Cambrian and post-Cambrian by seafloors with a surface mixed layer, a change that has been called the agronomic revolution. This change in benthic substrates strongly impacted metazoans adapted to mat-dominated seafloors and yielded profound long-term evolutionary and ecological effects that we have termed the Cambrian substrate revolution.

Fagerstrom has aptly summarized contemporaneous changes that were occurring in carbonate buildups. These were largely due to changes in microbial communities and inclusion of skeletal metazoans. Yet, still more work is needed to understand the response by early metazoans to the change from substrates largely physically structured by microbial mat-forming communities to those altered by the activity of other metazoans. For example, the earliest crustaceans are hypothesized to have evolved in the late Neoproterozoic and were likely relatively small (Walossek, 1999). Thus, one can ask, How did interacting with a seafloor structured by microbial mats affect the early evolution of the Crustacea, and how did they later respond as part of the Cambrian substrate revolution? Where appropriate, similar questions must be asked of other early metazoan clades.

Until recently we had only begun to scratch the surface on understanding the evolutionary and environmental context for the early evolution of metazoans. However, a variety of pieces of the puzzle are falling into place, making this one of the most exciting fields of inquiry in geobiology today.

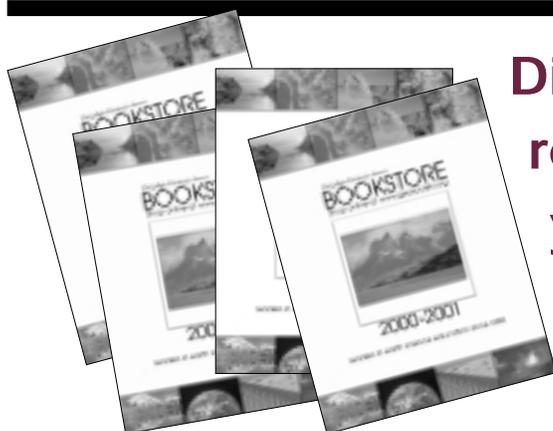
### References Cited

Walossek, D., 1999, On the Cambrian diversity of the Crustacea, in Schram, F.R., and von Vaupel Klein, J.C., eds., *Crustaceans and the biodiversity crisis*: Leiden, Netherlands, Brill, p. 3-27.

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# Executive Director

Division of Hydrologic Sciences  
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Las Vegas and Reno, Nevada

DRI, an internationally recognized environmental research institution and a component of the University and Community College System of Nevada (UCCSN), invites applications for the position of Executive Director for our Division of Hydrologic Sciences (DHS). Reporting to the President, the Division Director promotes the needs of DHS faculty; serves as faculty mentor and collaborator; facilitates teaching and research with related departments at UCCSN's two teaching campuses and interacts with current and potential sponsors to further the strategic goals of DHS and the Institute.

The Executive Director we are seeking will bring to DRI a strong scientific background, with proven leadership, communication, administrative, and personnel skills. The Director will identify and pursue research opportunities relevant to the interests and capabilities of the faculty; represent the research of the faculty to constituencies both within and external to the Institute; develop, in close collaboration with the faculty, a research vision and science plan; work with the Vice President of Academic Affairs to facilitate teaching opportunities for the Division's faculty; and foster interdisciplinary research across the three divisions and two interdisciplinary centers of DRI, with the other campuses of the UCCSN, and other organizations.

With campuses in Las Vegas and Reno, DHS has 50 faculty and support staff, 37 graduate research assistants and hourly employees, and an annual research budget from contracts and grants of ~\$6M. The Division's diverse research, basic and applied, includes integrating physical, chemical, and biologic processes in emerging disciplines such as global environmental hydrology, climate change, and complex watersheds; as well as traditional disciplines including groundwater hydrology and hydraulics; hydraulic engineering and surface water hydrology; contaminant transport in both surface and subsurface systems; geochemistry; and snow, ice, and unsaturated zone hydrology.

DHS research includes a cross-disciplinary science and engineering contract with the DOE office in Las Vegas, and grants and contracts from NSF, other federal agencies, state and local governments, and foundations.

For a complete description of the Director's responsibilities, and the application requirements and process, please visit us at [www.dri.edu](http://www.dri.edu).

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Pursuant to Colorado Open Records Law, written materials in a search process may be open for inspection by the public. The Metropolitan State College of Denver is an equal opportunity employer.

### ENVIRONMENTAL GEOLOGY LYNCHBURG COLLEGE

The School of Sciences at Lynchburg College in Virginia invites applications for the position of Assistant/Associate Professor, tenure track. Teach/develop upper level geology/environmental courses, teach jointly freshman earth/environmental science course, supervise student research projects, and develop external consulting projects. Strong knowledge of Virginia geology, soils, and ground-water issues is desirable. Ph.D. in Geology, Environmental Science, or related discipline required and teaching experience preferred. Please visit Web site: <http://www.lyncburg.edu/sciencepositions> for more detailed information. Send letter of application; curriculum vitae; teaching philosophy and experience; plans for continued professional development; and a list of three references, along with their e-mail addresses, mailing addresses, and telephone numbers to: Lynchburg College, Attn: James E. Carico, Dean, School of Sciences, 1501 Lakeside Drive, Lynchburg, VA 24501 USA. Review of applications will begin immediately and continue until position is filled. Lynchburg College is an Equal Opportunity Employer.

### MINERALOGY OR CARBONATE GEOLOGY NORTHERN ILLINOIS UNIVERSITY

The Department of Geology and Environmental Geosciences solicits applications for one tenure-track assistant professor position, with specialization either in carbonate geology or in mineralogy, to begin in August 2001. Candidates in carbonate geology should have interests in sedimentology, stratigraphy, and/or records of global environmental/climatic change. We encourage applications from those with interests in sequence stratigraphy or geochemistry and geochronology, with applications in the petroleum or environmental-consulting industries, or in records of environmental change. For the mineralogy position, we are particularly interested in a mineralogist or biomineralogist who would utilize the Advanced Photon Source at nearby Argonne National Laboratory and who will develop multidisciplinary research that integrates with any of our existing

programs in environmental geochemistry/hydrogeology, petrology, or global change. The successful applicant will be expected to establish a vigorous externally funded research program, supervise Ph.D. and M.S. students, and have a commitment to excellence in teaching at both the undergraduate and graduate levels. A Ph.D. in geosciences is required at the time of appointment. The Department offers programs leading to the B.S., M.S., and Ph.D. degrees, and currently has 14 faculty members whose research and teaching interests are described on our Web site at <http://jove.geol.niu.edu>. Applicants must submit a letter of application, curriculum vitae, statement of teaching and research interests, and names, addresses, and e-mail addresses of at least three referees to: J.H. Berg, Chair, Department of Geology and Environmental Geosciences, Northern Illinois University, DeKalb, IL 60115. Preference will be given to completed applications received by January 17, 2001; however, applications will be accepted until position is filled. Women and minorities are especially encouraged to apply. NIU is an equal employment opportunity/affirmative action institution.

### VACANCY: GEO-MICROBIOLOGIST U.S. GEOLOGICAL SURVEY, RESTON, VA 20192

The U.S. Geological Survey seeks applicants for a Ph.D. geo-microbiologist position to work on the roles of microorganisms in the cycling of metals in near-surface environments, and to conduct research in the broad area of metal-organic matter interactions and aqueous-metal release. We desire applicants who are broadly interdisciplinary and will establish linkages between geo-microbiology and a broad range of geological sciences. Present focus is on providing research linkages with active areas of multidisciplinary work on acid-mine drainage and toxic metal cycling processes (As, Hg). The ideal candidates would have experience in biogeochemical and bio-mineralogical reactions, be able to identify microorganisms in geological materials and determine microorganism abundance, diversity, and mineral association involved with metal release, transport, and fixation processes. Candidates will also examine the role of microorganisms in the formation of weathering products in near-surface environments. Successful candidates will utilize molecular biological approaches to identify and examine microorganisms from these environments.

Applicants are sought with skills and experience in the following areas: (a) microbiology and molecular biological techniques and diagnostic bacterial methods, including microbiologic field methodologies and established laboratory techniques; (b) geochemistry, mineralogy, organic geochemistry, and hydrology; (c) techniques for isolation of microorganisms from geological materials; and (d) microbial remediation techniques and how geologic systems support microorganisms.

This a permanent position, with starting salary at \$51,204.

Additional information and application procedures for vacancy number ER-O1-5 I 7 can be obtained on our Web site: <http://www.usajobs.opm.gov>.

This vacancy opens December 1, 2000, and closes January 2, 2001.

Contact: Office of Personnel 703-648-6131.

The U.S. Geological Survey is an equal-opportunity employer.

### HYDROLOGIST/HYDROGEOLOGIST SOUTHERN CONNECTICUT STATE UNIVERSITY

The Earth Science Department at Southern Connecticut State University (<http://www.scsu.ctstateu.edu>) invites applications for a new tenure track position at the assistant professor level, beginning August 2001. A Ph.D. is required at the time of appointment. We seek a broadly educated, collegial, field-based geoscientist with specialization in hydrology/hydrogeology and a strong commitment to undergraduate education. Teaching responsibilities may include introductory geology lecture and laboratory, hydrology, groundwater, and environmental geology. Candidates with interests in encouraging undergraduate research are particularly suitable. A willingness to participate in a potential summer field program and to teach occasional evening courses is also desirable. The Earth Science Department is a comprehensive earth sciences department with five full-time faculty who support a broad-based curriculum with concentrations in geology, oceanography, meteorology, environmental earth science, mineral resources, and earth science education. Southern Connecticut State University is part of the four-campus Connecticut State University system and hosts 11,500 students in the urban setting of New Haven, Connecticut. To apply, please send a curriculum vitae, a statement of teaching and research interests and experience, copies of transcripts, and letters from three ref-

erees by February 15 to John W. Drobynk, Chairman, Earth Science Department, Southern Connecticut State University, 501 Crescent Street, New Haven, CT 06515. SCSU is an EEO/AA Employer. Women and members of minority groups are encouraged to apply.

### UNIVERSITY OF FLORIDA

The Department of Geological Sciences invites applications for a tenure-track assistant professor position to begin with the 2001-2002 academic year in the general area of low-temperature geochemistry. Preference will be given to individuals who will develop a vigorous, innovative research program focusing on organic, aqueous and/or sedimentary systems from a geochemical perspective. Possible specialties include biogeochemistry, organic geochemistry, geochronology, environmental geochemistry, and other areas which complement existing departmental strengths (see [web.geology.ufl.edu](http://web.geology.ufl.edu) for information on the department and its programs). The successful candidate will also be committed to excellence in undergraduate and graduate education. A letter of interest, including a statement of research and teaching goals, a curriculum vitae, and the names and addresses of three referees should be sent to: Dr. Jonathan B. Martin ([jmartin@geology.ufl.edu](mailto:jmartin@geology.ufl.edu)), University of Florida, Department of Geological Sciences, 241 Williamson Hall, Box 112120, Gainesville, FL 32611-2120. Ph. (352) 392-2231; fax (352) 392-9294. Candidates are urged to apply before 15 December 2000, and no applications can be accepted after 15 January 2001.

The University of Florida is an equal opportunity employer; qualified women and minorities are especially encouraged to apply.

### TENURE-TRACK ASSISTANT PROFESSOR UNIVERSITY OF ARKANSAS AT LITTLE ROCK

The Department of Earth Sciences at the University of Arkansas at Little Rock invites applications for a tenure-track position at the rank of Assistant Professor to begin August 15, 2001, contingent upon funding. A Ph.D. in geoscience is required at the time of appointment. We desire a person who is broadly trained in the geosciences with expertise in Environmental/Cenozoic Geology or Geoscience Education. Experience in GIS/remote sensing is desirable but not required. The successful applicant will provide evidence of commitment to undergraduate teaching, develop a research program that involves undergraduate students, possess excellent field and/or computational skills, and have a commitment to community outreach. Teaching responsibilities will include Physical Geology, Historical Geology, and upper-level courses in the applicant's specialty. There is opportunity for faculty to teach and advise M.S. and Ph.D. students through the Integrated Science and Applied Science programs.

Screening of applications will begin immediately and continue until the position is filled. Applicants should include a description of their teaching philosophy and research interests, curriculum vitae, copies of transcripts of all academic work, and names and addresses of at least three references by January 15, 2001, to: Dr. Jeffrey Connelly, Chair, Department of Earth Sciences, University of Arkansas at Little Rock, Little Rock, AR 72204-1099.

The University of Arkansas at Little Rock is committed to the policy of providing equal opportunity for all persons and will not discriminate in admissions, age, race, national origin, color, disability, or religion. In carrying out this commitment, the University follows the principles of Affirmative Action and operates within federal laws and executive orders prohibiting discrimination. Under Arkansas law, all applications are subject to disclosure. Persons hired must have proof of legal authority to work in the United States.

### GEOGRAPHIC INFORMATION SYSTEMS POSITION CLARION UNIVERSITY OF PENNSYLVANIA

Tenure-Track Position, beginning August 2001. The Department of Anthropology, Geography and Earth Science at Clarion University seeks an individual with teaching and research specialization in the field of Geographic Information Systems. Expertise in the use of ARC/INFO software running on Windows NT system is essential; experience with UNIX operating systems is highly desirable. Responsibilities include: administering the department's GIS/Remote Sensing laboratory, securing additional funding through grant proposals, and developing a cooperative relationship with various government agencies and local industry, teaching introductory and advanced courses in GIS and additional courses in Anthropology, Geography or Geoscience, depending on background. Ph.D. preferred, ABD candidates are encouraged to apply. Ph.D. is required for appointment as Assistant Professor, continuing appointment and tenure. Successful completion of an on-campus interview is required. Salary and benefits are competitive.

Classifieds continued on p. 30



## Three Faculty Positions UNIVERSITY OF TEXAS AT AUSTIN

The Department of Geological Sciences at the University of Texas at Austin seeks applicants for three tenure-track positions at the level of Assistant Professor.

**GLOBAL CHANGE/EARTH SYSTEM SCIENCE.** This position is the first of three anticipated faculty hires in Global Change/Earth System Science in the areas of climate/paleoclimate modeling, remote sensing, climate analysis, and field experimentation. This first hire will be in climate/paleoclimate modeling, but exceptional candidates in the other areas are encouraged to apply. Areas of expertise may include, but are not limited to, climate variability and dynamics over geologic and/or human time scales, land-surface processes and biosphere-atmosphere interaction, and the global water and/or carbon cycles. Opportunities exist to interact with existing strengths on campus, including modeling and remote sensing of the land-ocean-atmosphere-ice system, and the geologic and ecological records of global change. Additional opportunities for collaboration exist through the UT Institute for Geophysics, and the newly-formed, interdisciplinary Environmental Science Institute.

**IGNEOUS PETROLOGY.** Two faculty positions are anticipated in the area of petrology and high-T geochemistry. For this first hire, we seek an igneous petrologist who integrates field-based investigations and modern analytical methods in the study of igneous processes and their relation to fundamental geologic problems. This person will complement existing strengths in metamorphic petrology, isotope geochemistry, and structural geology. The Department houses superb analytical facilities, including a new multicollector LA-ICP-MS; a high-resolution X-ray CT scanner; modern electron microprobe, SEM and XRD facilities; and clean labs and instrumentation for stable and radiogenic isotope geochemistry.

**EXPLORATION GEOPHYSICS.** This faculty position is part of our initiative to establish a premier program in exploration geophysics. Most graduates of this program enter careers in the petroleum exploration and production industry. Collaboration is expected with the UT Institute of Geophysics, the Bureau of Economic Geology, and the Texas Institute of Computational and Applied Mathematics. New facilities supporting the exploration geophysics program include the 3D Seismic Interpretation Laboratory with state-of-the-art interactive workstations and a high-speed storage area network for examining very large volumes of three-dimensional seismic data. Facilities and programs at BEG and UTIG include multi-component land seismic capabilities, multi-channel marine 3-D seismic capabilities, and extensive geological, geophysical and reservoir engineering projects all over the world.

Successful candidates will join a large, diverse and active geoscience department with superb research support and strong ties to allied organized research units at the University. They will be enthusiastic teachers of introductory courses and courses for undergraduate and graduate majors, direct the research of MS and PhD students, and conduct vigorous externally funded research programs. The anticipated starting date for all positions is August 2001; a Ph.D. is required at the time of appointment. Please see <http://www.geo.utexas.edu/facultysearches> for additional information.

To apply, please send a curriculum vitae, statements of research and teaching interests, and the names and contact information for five references to:

Faculty Searches, Department of Geological Sciences,  
The University of Texas at Austin, Austin, Texas 78712.

Review of applications will begin December 1, 2000, and will continue until positions are filled. The University of Texas at Austin is an Equal Opportunity/Affirmative Action employer.

Classifieds *continued from p. 29*

Send letter of application, vitae, transcripts (copies acceptable) and three current letters of recommendation to: Dr. Paul Ryberg, Chair, GIS Search Committee, AGES Department, Clarion University, Clarion, PA 16214.

Review of complete applications will begin January 31, 2001, and will continue until the position is filled. Clarion University is building a diverse academic community and encourages minorities, women, veterans, and persons with disabilities to apply. AA. EOE.

### TEXAS A&M UNIVERSITY TENURE TRACK FACULTY POSITION

#### SILICICLASTIC SEDIMENTOLOGIST/STRATIGRAPHER

The Department of Geology and Geophysics at Texas A&M University invites applications for a tenure-track appointment at the Assistant Professor level in siliciclastic sedimentology/stratigraphy. Review of applicants will begin on 15 January 2001, with an anticipated starting date of August 2001.

The successful candidate is expected to teach at both graduate and undergraduate levels and will develop and conduct an externally funded research program. A Ph.D. is required by the time employment begins.

The specific research field of the successful candidate is open, although experience in petrographic and facies analyses, modern stratigraphic studies, and basin-scale studies is desirable. The ideal candidate should be interested in developing ties with the petroleum industry. Expertise with quantitative approaches to sedimentologic/stratigraphic analysis is also desirable. We seek an individual who will complement existing departmental programs in basin studies, environmental studies, global change and paleoclimate, petroleum geosciences, reservoir characterization, sedimentary geochemistry, seismic interpretation, sequence stratigraphy, and tectonics and sedimentation. Significant opportunities also exist for the successful candidate to interact with colleagues in the Departments of Petroleum Engineering, Geography, and Oceanography and geoscientists at the Ocean Drilling Program. For additional information about the Department of Geology & Geophysics at TAMU and research facilities, please check our Web site at <http://geoweb.tamu.edu>.

Submit a curriculum vitae, selected reprints, a statement of research and teaching interests, and a list of at least three references with postal addresses, phone and fax numbers, and e-mail addresses to: Dr. Steven L. Dorobek, Chair, Siliciclastic Search Committee, Department of Geology & Geophysics, Texas A&M University, College Station, TX 77843-3115. Women and members of minority groups are especially encouraged to apply.

Texas A&M University is an affirmative action/equal opportunity employer committed to diversity.

### UCLA

#### MINERAL PHYSICS FACULTY POSITION

The Department of Earth and Space Sciences (ESS) and Institute of Geophysics and Planetary Physics (IGPP) at the University of California Los Angeles (UCLA) invite applications for a ladder faculty position in mineral physics, including such specialties as flow laws, equations of state, phase relations, anisotropic elasticity, and/or thermal and electrical conductivity. Consideration will be given to both experimental and computational approaches. Necessary qualifications include the Ph.D., demonstrated intellectual leadership and teaching skill, and laboratory or computational experience. The abilities to conduct investigations at high pressure and/or on multicomponent rocks are desirable. The level of appointment will be commensurate with experience and distinction but a junior appointment is preferred. Joint appointment to the IGPP can be made for scientists involved in novel research fields that cross traditional disciplinary boundaries. The applicant should enclose a curriculum vitae, publication list, short statement of teaching and research objectives, and names and addresses of three potential references. Applications should be directed to: Mineral Physics Search Committee, Department of Earth and Space Sciences, University of California, P.O. Box 951567, Los Angeles, CA 90095-1567.

Applications will be accepted on a continuing basis, but consideration of dossiers will commence January 15, 2001. UCLA is an equal opportunity/affirmative action employer; women and minority candidates are particularly encouraged to apply.

### ASSISTANT PROFESSOR/PETROLOGIST SAN DIEGO STATE UNIVERSITY

The Department of Geological Sciences at San Diego State University invites applications for a tenure-track Assistant Professor position in the general area of petrology starting Fall 2001. A Ph.D. is required at the time of appointment. We seek outstanding applicants with the potential to establish vigorous, externally-funded research programs involving M.Sc. and B.S. students. We are particularly interested in multidisciplinary scientists with field-based interests who can collaborate with other research programs in the department. Prior teaching experience, research grant activity, and familiarity with operation and maintenance of analytical instrumentation is desirable. Teaching responsibilities will include both lower and upper division courses in petrology/mineralogy as well as graduate courses in the individual's field of expertise. Starting salary range is \$40,464 to \$51,010 depending on experience.

Classifieds *continued on p. 32*

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## Classifieds *continued from p. 30*

The Department offers a wide range of instrumentation including a VG Sector 54 TIMS and electron microscope facility. We are currently in the process of purchasing several new instruments including an ICP-MS, an XRF, and an XRD that will be housed in a new science laboratory building that opens in February 2001. Excellent computing facilities support GIS and remote sensing studies. You may visit the department at <http://www.geology.sdsu.edu>.

Send a letter of application describing teaching and research interests, curriculum vitae, and the names, addresses, and telephone numbers of three references to David L. Kimbrough, Department of Geological Sciences, San Diego State University, San Diego, CA 92182-1020 by January 15, 2001. Inquiries may be e-mailed to [dkimbrough@geology.sdsu.edu](mailto:dkimbrough@geology.sdsu.edu).

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### ENVIRONMENTAL GEOSCIENCE UNIVERSITY OF PENNSYLVANIA

The Department of Earth and Environmental Science at the University of Pennsylvania invites applications for a tenure-track faculty position in environmental geoscience. The candidate may join established research programs in paleoclimatology, biogeochemistry, terrestrial geobiology, marine ecology and paleoecology, and/or geologic engineering, or may pursue some other aspect of environmental geoscience.

The successful candidate will be expected to maintain an active research program while teaching graduate courses in his/her research specialty to Ph.D. candidates and to degree candidates in a professional Master of Environmental Studies (MES) curriculum; and undergraduate courses to majors in environmental studies, geology, paleobiology, and/or oceanography.

The successful candidate will be expected to assume, over the next few years, administrative responsibility for BA and MES programs in Environmental Studies; thus, this appointment will be made at the level of Associate or Full Professor.

Further information about programs in the Department of Earth and Environmental Science at the University of Pennsylvania may be sought at [www.sas.upenn.edu/earth/](http://www.sas.upenn.edu/earth/).

Applicants should submit resumes, statements of research and teaching interests, and a selection of representative reprints to: Robert Giegengack, Environmental Geoscience Search Committee, Department of Earth and Environmental Science, University of Pennsylvania, Philadelphia, PA, 19104-6316 USA. [earth@sas.upenn.edu](mailto:earth@sas.upenn.edu).

The Search Committee will begin to evaluate applications in December 2000; the search will remain open until the position is filled.

The University of Pennsylvania is an equal-opportunity employer. Women and minorities are encouraged to apply.

### DEPARTMENT OF GEOLOGICAL SCIENCES UNIVERSITY OF TEXAS AT EL PASO ASSISTANT PROFESSOR

The Department of Geological Sciences at the University of Texas at El Paso invites applications for an appointment at the rank of Assistant Professor to begin September 2001. A Ph.D. and a strong commitment to teaching and research at both the undergraduate and graduate levels are required.

We seek candidates with research and teaching interests that complement existing programs in Geological Sciences and Interdisciplinary programs in Environmental Science. Preference will be given to candidates with demonstrated expertise in Geographic Information Systems (GIS). The successful applicant would be expected to teach introductory courses in geology or geography as well as upper division undergraduate and graduate courses in his/her specialty.

El Paso, located on the Mexican border within the Rio Grande rift, provides one of the most diverse and striking geological settings in the world. The University of Texas at El Paso is a doctoral/research institution with a student population of over 15,000. The department is housed in an attractive, 90,000 sq. ft. building that contains faculty and student offices, laboratory and classroom space with analytical facilities that include: electron microprobe, DCP, ICPMS, INAA counter, XRD, geophysical field equipment & extensive computing facilities. More information about the activities and facilities in the department can be found at our Web site: <http://www.geo.utep.edu>.

Applicants should send a CV, short description of teaching and research interests and the names of three people willing to provide professional references to: Kate C. Miller, Chair, Department of Geological Sciences,

University of Texas at El Paso, El Paso, Texas 79968-0555, phone:915-747-5424, fax915-747-5073, e-mail:[miller@geo.utep.edu](mailto:miller@geo.utep.edu).

We will begin reviewing applications on January 15, 2001, and will accept applications until the position is filled. The University does not discriminate on the basis of race, color, national origin, sex, religion, age, or disability in employment or the provision of services.

### FACULTY POSITION ASSISTANT PROFESSOR—TENURE TRACK VANDERBILT UNIVERSITY

The Department of Geology at Vanderbilt University invites applications to fill a tenure-track faculty position to begin in the fall of 2001. Applicants should be individuals whose interests are in the general area of surface processes but with expertise to teach and do research in one or more of the specialized areas of environmental geology/low-temperature geochemistry/hydrogeology. The Ph.D. is required by the time of appointment. We are seeking an energetic and creative individual who can enthusiastically engage students in the classroom and in research. The successful applicant will be expected to develop and maintain an active, externally funded research program involving undergraduates and graduate students (Masters) and to collaborate, where possible, with other faculty members in the department and with appropriate faculty in other departments. Vanderbilt is a major research university with a small but active geology program. For more information about the department and university visit our Web site at: <http://geo.cas.vanderbilt.edu/>.

The deadline for receiving applications is January 10, 2001. Women and minorities are especially encouraged to apply. Applicants should send resume (including statements of teaching and research interests) and transcripts, and should arrange to have three letters of recommendation sent to: John C. Ayers, Department of Geology, Box 35-1805 Station B, Vanderbilt University, Nashville, TN 37235; phone: (615) 322-2158; fax: (615) 322-2138, e-mail: [john.c.ayers@vanderbilt.edu](mailto:john.c.ayers@vanderbilt.edu).

Vanderbilt University is an Affirmative Action-Equal Opportunity Employer.

### TENURE-TRACK POSITION MCMMASTER UNIVERSITY JOINT APPOINTMENT: SCHOOL OF GEOGRAPHY AND GEOLOGY/DEPARTMENT OF CHEMISTRY

The School of Geography and Geology and the Department of Chemistry invite applications for a full-time joint tenure-track appointment at the Assistant Professor level to start July 1, 2001. Preference will be given to candidates with research interests involving the application of physical, analytical, and/or modeling techniques in areas such as the aquatic geochemistry, geochemical interactions of water-rock systems, and interfacial geochemistry. Research in interdisciplinary environmental applications with a focus on a mechanistic understanding of major processes affecting natural systems is particularly welcome. Teaching and administrative responsibilities will be balanced between the two departments. The ability to teach courses at all levels of the undergraduate and graduate curriculum in analytical and/or physical chemistry and in geochemistry would be considered a strength for the candidate. The successful candidate will join a dynamic group of researchers with strengths in analytical chemistry, geochemistry, hydrology, and environment and health. The successful candidate will hold a Ph.D., preferably with relevant postdoctoral experience, and will be expected to develop a strong research program and to participate in teaching at both the undergraduate and graduate levels.

Applications, including a curriculum vitae, statements of research and teaching interests, and letters from three referees should be sent no later than January 5, 2001, to the following address. The review and selection of candidates will begin in late November 2000.

Dr. Lee Liaw, Chair, Geochemist Search Committee, School of Geography & Geology, McMaster University, 1280 Main Street West, BSB-311, Hamilton, ON L8S 4K1.

In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. McMaster University is committed to Employment Equity and encourages applications from all qualified candidates, including aboriginal peoples, persons with disabilities, members of visible minorities, and women.

### COLLEGE OF CHARLESTON TENURE-TRACK ASSISTANT PROFESSOR GROUND-WATER HYDROGEOLOGY

The Department of Geology invites applications for a tenure-track assistant professor position beginning August 2001. We are seeking a ground-water hydrogeologist with the following qualifications: (1) a Ph.D. in geology with emphasis in applied ground-water hydrogeology; (2) demonstrated excellence in teaching; (3) commitment to field-based studies; and (4) supervision of graduate and undergraduate

research. The successful applicant will be expected to: (1) teach undergraduate and graduate courses in hydrogeology, ground-water modeling, environmental geology, and other courses in his or her specialty; (2) develop a successful research program, and (3) seek external funding for research. Applicants having research interests in the fields of water resources, regional ground-water modeling, or contaminant hydrogeology are encouraged to apply.

The Department of Geology currently has nine full-time faculty, 60 undergraduate majors, and 10 graduate students. The department supports an interdisciplinary masters program in Environmental Studies and has a strong record of incorporating research into the undergraduate curriculum. For more information, visit our departmental Web site at <http://www.cofc.edu/~geology/> or contact Mitchell Colgan at 843-953-7171; e-mail [colganm@cofc.edu](mailto:colganm@cofc.edu).

Interested persons should send a letter stating their interest in the position, curriculum vitae, statements of teaching philosophy, research interests, unofficial transcripts, and names of three references to: Hydrogeology Search Committee, Department of Geology, College of Charleston, Charleston, SC 29424. Review of applications will begin January 8, 2001, and continue until the position is filled. The College of Charleston is an AA/EQ/ADA employer and does not discriminate in employment or the provisions of services on the basis of disability.

### TENURE TRACK FACULTY POSITION DEPARTMENT OF GEOLOGY, BROOKLYN COLLEGE THE CITY UNIVERSITY OF NEW YORK BROOKLYN, NY 11210

The Department of Geology invites applications for a Tenure Track Assistant Professor position, effective September, 2001, in environmental geology, preferably specializing in any or all of the following: hydrology/groundwater/geomorphology/coastal processes/global warming/pollution/ or any other related branches.

The candidate should show evidence of a strong publication record and an active grant support program in his/her area of specialization. The candidate will be expected to participate in the department's masters and doctoral programs as well.

Brooklyn College is a four-year liberal arts college, offering B.A., B.S., and M.A. degree programs and a Ph.D. degree in conjunction with the Earth & Environmental Sciences Program at the CUNY Graduate Center. Some start-up support is available.

Qualifications: A Ph.D. in geology or another recognized earth science, experience in electronic media and the use of the Web in educational applications essential. Salary \$32,703-\$45,737, commensurate with qualifications and experience. All appointments are subject to financial ability.

Please send applications, including curriculum vitae, three (3) letters of recommendation and copies of published research paper(s) to: Dr. C.E. Nehru, Chairperson, Brooklyn College, CUNY, Department of Geology, Room 3131 N, 2900 Bedford Avenue, Brooklyn, NY 11210

Direct inquiries to: [nehrub@brooklyn.cuny.edu](mailto:nehrub@brooklyn.cuny.edu).

Review of applications began in October 2000 and will continue until position is filled.

The City University of New York is an equal opportunity/affirmative action/IRCA/Americans with Disabilities Act employer.

### POSTDOCTORATE RESEARCHER CONTAMINANT HYDROGEOLOGY UNIVERSITY OF WATERLOO

Post-doctorate positions are available at the University of Waterloo for outstanding candidates who hold recent Ph.D. degrees in hydrogeology, civil, environmental, petroleum engineering, or related disciplines. The successful candidates will use quantitative methods to interpret complex data sets from (1) groundwater field experiments involving solutes and/or dense non-aqueous-phase liquids, and (2) from investigations of contaminated field sites using new monitoring methods. The positions provide opportunities to work as a team member on projects developing a better understanding of the transport and fate of volatile organic contaminants in fractured rock, sand aquifers, and clayey aquitards.

We seek candidates with expertise in one or more of the following areas: contaminant transport, multiphase flow, numerical modeling, monitoring instrumentation design, geologic origins of heterogeneity.

Please submit curriculum vitae, brief description of prior research experience and names and addresses (including e-mail addresses) of three references to Contaminant Hydrogeology Chair, John A. Cherry, Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1. E-mail: [cherryja@sciborg.uwaterloo.ca](mailto:cherryja@sciborg.uwaterloo.ca); fax +1-519-883-0220.

Classifieds *continued on p. 34*



**Brian Seneker** has a degree in biology and is working on a second degree in geology at Montana State University in Bozeman, Montana. He worked with mentor geologist Allen King on the Los Padres National Forest. Seneker used air photos to map landslide-prone areas, assessed and summarized data on abandoned landfills, and developed an interpretive brochure on the geology of the Santa Cruz Trail. King was impressed with Seneker's initiative and ability to take a complex project from an idea to completion. This involved fieldwork, map editing and creative writing, working with multiple groups to acquire funding, and producing the final artwork for the brochure. Of the interpretive brochure, Seneker comments, "I think that the greatest challenge of this project (aside from the time limitations) was to create interesting and correct text for the average hiker to understand and enjoy. I learned much about the working world of geology that cannot be taught in school, and this knowledge has instilled in me the motivation and confidence to pursue a career in the geological sciences."



**Ann Finocchio**, a senior at Radford University in Virginia, worked with Forest Service mentors Alan Gallegos and Jerry DeGraff on the Sierra National Forest. Finocchio collected temperature data at Mono Hot Springs, monitored the Camino Meadow Restoration Project, and developed information for a geology Web site on the Courtright Intrusive Zone Geologic Special Interest Area. Finocchio primarily worked on a project to provide geologic information for the High Sierra Lakes Monitoring Project, researching and determining the bedrock geology for 132 watersheds distributed throughout the Sierra Nevada. Finocchio also acted as a mentor for Ibeth Avila, a recent high school graduate whose dream is to be a geologist. Finocchio and Avila flew in a helicopter to reconnoiter the geology of the American River and rode horseback into the Kaiser Wilderness to collect water samples for the High Sierra Lakes Project. Gallegos and DeGraff were impressed with Finocchio's abilities as a geologist and encouraged her to

# Geology in the Forests

2000 marks the first year of **Geology in the Forests**, an intern and mentor partnership between GSA and the Pacific Southwest Region (Region 5) of the U.S. Department of Agriculture Forest Service. Geology in the Forests pairs GSA student members with practicing Forest Service geologists. In this cooperative program, the Forest Service received high-caliber assistance in accomplishing their work programs. GSA found a source of intern positions in applied geology for student members. And, the interns were able to apply their knowledge of geology to the principles of multiple-use and ecosystem management. This year's interns worked with their respective Forest Service geologist mentors for 10 weeks.

consider a career in the Forest Service. "With only one semester to complete before graduation and little exposure to practical applications of geology, I really wanted an example of how geologists apply their skill in the real world," Finocchio said. "There is an advantage in the Forest Service program in that you work so closely with your mentor the whole summer. Each day is a geological experience, like a constant 10-week answer to the question, What does a geologist do? Interdisciplinary teams are a staple in Forest Service work. I had the chance to work with biologists, archaeologists, engineers, ecologists, botanists, statisticians, and hydrologists on several projects and attend meetings in which they took part. I learned a lot from each of them."



**Todd Gillihan** is a senior at California State University, Chico, where he studies geology and hydrology. He worked on the El Dorado National Forest with mentor Lester Lubetkin and

with Chuck Mitchell and the North Zone Mineral Examiners. Gillihan worked on a Cumulative Watershed Effects Analysis, collecting data on erosion and sedimentation. He also spent many hours assessing the condition of off-highway vehicle trails, and he worked with the minerals staff on a project to validate a claim in which U.S. Pumice is seeking a patented mineral claim. "I soon learned that a Geologist in the Forest involves a multitasked position coordinating with many different departments within the Forest Service," Gillihan said. "I went on two zone mineral geology trips. Both trips were on the east side of the Sierra Nevada where the mountainous terrain rises over 10,000 feet in many places and provides breathtaking views of jagged topography. These trips were two of the highlights of my internship. The reason for the first trip was to perform a surface use determination of an old mining claim. During the second trip, we spent most of the time in the actual pumice mine located on the top of volcanic craters south of Mono Lake."



**Jaime Piver**, a senior at Southern Oregon University, worked with mentors Juan de la Fuente and Polly Haessig on the Klamath National Forest. Piver interpreted aerial photos for the Horse Creek Non-System Road Inventory and the Siskon Mine Tailings Project and interpreted satellite imagery for the 1997 Landslide and Flood Assessment. De la Fuente was impressed with Piver's ability to quickly grasp an assignment and work hard with limited supervision. Piver prepared and interpreted aerial photos for geologic work and learned the value of having geographic information system (GIS) skills to prepare geologic maps. "The Horse Creek project was my first real experience using aerial photos and a stereoscope," Piver said. "It took a couple of days before I was even able to see in stereo, then came the task of trying to identify landslides. This was not an easy task. After mapping was complete, I began to digitize my work. I had taken a GIS class, but I had not worked with Arc Info until this summer. After I finished digitizing, I was able to use a satellite image of the forest to fill in areas where air photos were not available. The satellite image was incredibly interesting to work with and enabled me to draw the required technical conclusions."

Final reports from these interns are posted on GSA's Web site, [www.geosociety.org](http://www.geosociety.org), in the Professional Development section. If you are interested in applying for an intern position for 2001, plan to take a look at the position descriptions available on the site late this month. Applications are due February 1, 2001. For more information, contact Katie KellerLynn, (303) 447-2020, ext. 194, [kkellerlynn@geosociety.org](mailto:kkellerlynn@geosociety.org). See pages 36-38 for more on GSA's internship programs. ■

**ASSISTANT PROFESSOR OF MINERALOGY  
SUNY POTSDAM**

SUNY Potsdam invites applications for a tenure track assistant professor position in the Department of Geology. Responsibilities include teaching undergraduate mineralogy, low- or high-temperature geochemistry or hydrogeology, and participation in our newly developing interdisciplinary science program to train elementary school teachers. Knowledge of GIS is an asset. Scholarly research, with student participation, is expected. Courses taught will complement existing courses in igneous and metamorphic petrology, structural geology, geophysics, sedimentology, paleontology and stratigraphy. Potsdam, in the Grenville terrain of the Adirondack Mountains and St. Lawrence River Valley of northern New York, is ideally located for high-temperature mineralogical and petrologic studies. Field areas abound, and the faculty all actively engage students in their research. The Geology Department, consisting of five full-time faculty, currently has about 50 majors. Additional information on the college and the department may be obtained from the college's Web site: <http://www.potsdam.edu>. Facilities to support teaching and research include a Scanning Electron Microscope, Atomic Absorption, X-Ray Diffraction, electrical resistivity, Strataview R24 for seismic reflection and refraction, a Worden Prospector Gravity Meter, a proton precession magnetometer and minimate seismograph. Applicants must have a Ph.D. by Aug. 15, 2001. Applications should provide evidence of teaching ability. Base salary: \$35,000. Applications should be received by Feb. 2, 2001. Please send curriculum vita, cover letter, and phone numbers/e-mail addresses of at least 3 references to: Search Committee, Dept. of Geology, SUNY Potsdam, Potsdam, NY 13676. SUNY Potsdam is an equal opportunity, affirmative action employer committed to excellence through diversity.

**GLOBAL CHANGE/EARTH SYSTEM SCIENCE  
UNIVERSITY OF TEXAS AT AUSTIN**

The Department of Geological Sciences at the University of Texas at Austin seeks applicants for three tenure-track positions at the level of Assistant Professor.

**Global Change/Earth System Science.** This position is the first of three anticipated faculty hires in Global Change/Earth System Science in the areas of climate/paleoclimate modeling, remote sensing, climate analysis, and field experimentation. This first hire will be in climate/paleoclimate modeling, but exceptional candidates in the other areas are encouraged to apply. Areas of expertise may include, but are not limited to, climate variability and dynamics over geologic and/or human time scales, land-surface processes and biosphere-atmosphere interaction, and the global water and/or carbon cycles. Opportunities exist to interact with existing strengths on campus, including modeling and remote sensing of the land-ocean-atmosphere-ice system, and the geologic and ecological records of global change. Additional opportunities for collaboration exist through the UT Institute for Geophysics, and the newly formed, interdisciplinary Environmental Science Institute.

**Igneous Petrology.** Two faculty positions are anticipated in the area of petrology and high-T geochemistry. For this first hire, we seek an igneous petrologist who integrates field-based investigations and modern analytical methods in the study of igneous processes and their relation to fundamental geologic problems. This person will complement existing strengths in metamorphic petrology, isotope geochemistry, and structural geology. The Department houses superb analytical facilities, including a new multicollector LA-ICP-MS; a high-resolution X-ray CT scanner; modern electron microprobe, SEM and XRD facilities; and clean labs and instrumentation for stable and radiogenic isotope geochemistry.

**Exploration Geophysics.** This faculty position is part of our initiative to establish a premier program in exploration geophysics. Most graduates of this program enter careers in the petroleum exploration and production industry. Collaboration is expected with the UT Institute of Geophysics, the Bureau of Economic Geology, and the Texas Institute of Computational and Applied Mathematics. New facilities supporting the exploration geophysics program include the 3-D Seismic Interpretation Laboratory with state-of-the-art interactive workstations and a high-speed storage area network for examining very large volumes of three-dimensional seismic data. Facilities and programs at BEG and UTIG include multi-component land seismic capabilities, multi-channel marine 3-D seismic capabilities, and extensive geological, geophysical and reservoir engineering projects all over the world.

Successful candidates will join a large, diverse, and active geoscience department with superb research support and strong ties to allied organized research units at the University. They will be enthusiastic teachers of introductory

courses and courses for undergraduate and graduate majors, direct the research of MS and PhD students, and conduct vigorous externally funded research programs. The anticipated starting date for all positions is August 2001; a Ph.D. is required at the time of appointment. Please see <http://www.geotexas.edu/facultysearches> for additional information. To apply, please send a curriculum vitae, statements of research and teaching interests, and the names and contact information for five references to: Faculty Searches, Department of Geological Sciences, The University of Texas at Austin, Austin, Texas 78712. Review of applications will begin December 1, 2000, and will continue until positions are filled. The University of Texas at Austin is an Equal Opportunity/Affirmative Action employer.

**MARINE GEOLOGIST  
UNIVERSITY OF MICHIGAN**

The Department of Geological Sciences intends to fill a tenure-track position at the Assistant Professor level (or in exceptional cases at a higher level) pending final approval. We seek a geoscientist with broad research interests in marine systems and the sedimentary records of oceans and climate. Areas of expertise may include, but are not limited to: micropaleontology, microbial ecology, geochemistry, biogeochemical cycles, and sedimentology. A field component to the candidate's research program is desirable. We expect the applicant to develop a vigorous, externally funded research program and to show a commitment to teaching at both the graduate and undergraduate levels. This includes involvement in our Marine Geology and Geochemistry degree program and in new interdisciplinary initiatives at the University of Michigan. A Ph.D. is required. Interested persons should send a curriculum vitae, brief statements of their research and teaching interests, and the names, addresses, and e-mail addresses of five persons from whom the Department may request letters of recommendation to: Professor David Rea, Search Committee Chair, Department of Geological Sciences, University of Michigan, Ann Arbor, MI 48109-1063 (e-mail: [davidrea@umich.edu](mailto:davidrea@umich.edu)). To ensure a careful evaluation this academic year, applications should be received by December 11, 2000. This search will continue until the position is filled. The University of Michigan is an affirmative action, equal opportunity employer.

**OPEN RANK SEARCH  
W. HILTON JOHNSON PROFESSORSHIP  
IN SURFICIAL GEOLOGY**

**UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN**

The Department of Geology at the University of Illinois, Urbana-Champaign, invites nominations and applications for an open-rank tenured or tenure-track faculty appointment in surficial geology to begin August 21, 2001. A tenured appointment carries the title W. Hilton Johnson Professor or Associate Professor of Geology. Specialties of interest include, but are not limited to geomorphology, neotectonics, glacial geology, glaciology, Quaternary geology, paleoclimatology, remote sensing, geosphere-atmosphere-biosphere interaction, and Earth-system modeling. To be appointed at the tenured level, the successful applicant will have a distinguished record of scholarship and disciplinary leadership in the field. To be appointed at the assistant professor level, the successful applicant will have demonstrated potential to establish a vigorous, internationally recognized research program. The successful candidate, at any rank, must demonstrate an ability to build excellence in educational programs and must hold an earned Ph.D. or equivalent. Rank and salary will be commensurate with experience. Applicants should submit a curriculum vitae, record of research funding, list of publications, description of research and teaching interests, and the names of at least three referees to: Prof. R. James Kirkpatrick, Search Committee Chair, Department of Geology, University of Illinois, 1301 West Green Street, Urbana, IL 61801.

Questions about the position can be directed to Prof. Kirkpatrick (217-333-7414; [kirkpat@uiuc.edu](mailto:kirkpat@uiuc.edu)). Nominations of potential candidates can be transmitted by e-mail. For full consideration, applicants should submit materials no later than January 15, 2001. The University of Illinois is an Equal Opportunity/Affirmative Action employer. Women and minorities are encouraged to apply.

**GEODYNAMICS  
DEPARTMENT OF GEOLOGICAL SCIENCES  
UNIVERSITY OF MAINE**

The Department of Geological Sciences, University of Maine, invites applications for a tenure-track faculty position in geodynamics, beginning September 1, 2001, at the Assistant Professor level. We seek applicants who have a fundamental understanding of geological processes, and the ability to build a vibrant research and teaching program that emphasizes quantitative approaches to evaluating these processes. The Department has four areas of emphasis: crustal/lithospheric processes, marine geology, Quaternary/climate studies, and environmental geology/geochem-

istry. We seek applicants interested in applying geodynamics to crustal/lithospheric processes, but interaction with the other areas of emphasis would be advantageous. The successful applicant will be expected to teach at the undergraduate (particularly our core geophysics course) and graduate levels, supervise graduate research in the M.S. and Ph.D. programs, and establish and maintain a vigorous, externally funded research program. Interactions with faculty in the National Center for Geographic Information and Analysis, the Departments of Computer Science, and Physics and Astronomy, and the Institute for Quaternary Studies will be encouraged. A Ph.D. at the time of appointment is required. Applicants are invited to submit a curriculum vitae, a complete list of publications, up to 3 reprints/preprints of work that exemplifies their scientific methods and interests, a written statement of research and teaching interests, and the names and addresses of at least three references to: Scott E. Johnson, Geodynamics Search Committee Chair, Department of Geological Sciences, 5790 Bryand Global Sciences Center, University of Maine, Orono, ME 04469-5790, USA. E-mail address: [Search\\_Chair@apollo.umenf.maine.edu](mailto:Search_Chair@apollo.umenf.maine.edu); Web site: <http://Gaia.geology.um.maine.edu>. Review of applications will begin January 8, 2001, and will continue until the position has been filled. The University of Maine is an EO/AA employer, and women and minorities are encouraged to apply.

**ASSISTANT PROFESSOR  
SCHOOL OF GEOLOGY  
OKLAHOMA STATE UNIVERSITY**

The Oklahoma State University, School of Geology invites applications for a tenure-track assistant professor position beginning fall 2001. A Ph.D. degree is required at the time of appointment. Preference will be given to a field-oriented hard-rock geologist with prior college teaching and research experience. Applicants must show the ability and commitment for excellence in instruction and research.

Applicants should be well trained in every aspect of hard rock geology including igneous-metamorphic mineralogy, petrography and radiometric age-dating methods. This position is intended to complement the expertise of the faculty at the School of Geology. Therefore, it is also desirable that candidates have expertise in application of igneous-metamorphic geology to one of the following areas: (a) environmental geology; (b) tectonics; (c) numerical modeling and (d) planetary geology. We are seeking an individual who demonstrates the potential for developing a successful research program relating to his/her areas of expertise. Teaching of undergraduate and graduate courses and participation in extension activities related to field classes are also required. The candidates must have published refereed articles in his/her discipline. The successful candidate will be expected to develop a research program that will generate funding to support the program and graduate student involvement. The successful candidate will be teaching introductory geology courses along with courses related to his/her specialty and will be expected to supervise M.S. graduate students. He/she should also be willing to participate in teaching a capstone summer field camp course.

Candidates should submit a letter of application, including a description of research interests and his/her approach to teaching. A curriculum vita, academic transcripts, and the names, addresses, e-mail addresses, and phone numbers of three references are also required. For full consideration, applications must be received by January 10, 2001; however, applications will be accepted until the position is filled.

Please send all materials to: Assistant Professor Search, Hard-Rock Geologist Position, School of Geology, Oklahoma State University, 105 Noble Research Center, Stillwater, OK 74078-3031.

For more information on the OSU School of Geology, please visit our Web site at [www.okstate.edu/geology](http://www.okstate.edu/geology).

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**UCLA  
PLANETARY SCIENCE FACULTY POSITION**

The Department of Earth and Space Sciences (ESS) at the University of California Los Angeles (UCLA) invites applications for a ladder faculty position in planetary science beginning as early as July 1, 2001. Applications are invited for all fields of solar and planetary system studies, and all approaches, including theoretical, observational and experimental. Necessary qualifications include the Ph.D., demonstrated excellence in research, teaching, and intellectual leadership. The ESS Department conducts research and offers undergraduate and graduate courses covering a broad range of Earth and solar system studies. See <http://www.ess.ucla.edu> for more details. The level of appointment will be commensurate with experience and distinction but a junior appointment is preferred. The applicant should enclose a curriculum vitae, publication list, short

statement of teaching and research objectives, and names and addresses of three potential references. Applications should be directed to: Planetary Science Search Committee, Department of Earth and Space Sciences, University of California, P.O. Box 951567, Los Angeles, CA 90095-1567.

Processing of applications will commence on January 15, 2001. UCLA is an (EOA) equal opportunity/affirmative action employer.

**UNIVERSITY OF TORONTO AT SCARBOROUGH  
PHYSICAL SCIENCES DIVISION  
ENVIRONMENTAL SCIENCE**

Applications are invited for a tenure track faculty position in Environmental Science at the University of Toronto at Scarborough, Division of Physical Sciences. The appointment, at the Assistant Professor level, would be effective starting July 1, 2001, or as soon as possible thereafter. A completed Ph.D. is expected. The successful candidate will have teaching and research interests in Soil Science, with ancillary teaching and research interests in one or more of the following: Geomorphology, Soil Chemistry, Soil or Sediment Contamination/Remediation; Soil Mineralogy.

Candidates should send their curriculum vitae, statements of teaching specializations and research interests, and arrange to have letters from three referees forwarded before December 31, 2000, to: Professor James Thompson, Chair, Division of Physical Sciences, University of Toronto at Scarborough, Scarborough, ON, M1C 1A4. Phone: 416-287-7197; fax 416-287-7204; e-mail: jthompson@scar.utoronto.ca.

In accordance with its Employment Equity Policy, the University of Toronto encourages applications from qualified women and men, members of visible minorities, aboriginal peoples, and persons with disabilities.

**VIRGINIA TECH, GEOBIOLOGY**

The Department of Geological Sciences at Virginia Polytechnic Institute and State University invites applications for a tenure-track Assistant Professor in Geobiology. Applicants must hold a Ph.D. degree in Geosciences or Biosciences. Preference will be given to candidates with a strong background in paleontology (including micropaleontology), excellent quantitative skills, and a broad interdisciplinary training. The applicant should have a strong commitment to undergraduate and graduate education.

Interested applicants should send a letter of interest, curriculum vitae, copies of transcripts, names and contact information of three references, statement of anticipated research and teaching interests along with a short essay explaining where the applicant would like to see him/herself within the geosciences in the future. Applicants should send their application package to Professor Fred Read, Geobiology Search Committee, Department of Geological Sciences, Virginia Tech, Blacksburg, VA 24061; Phone: 540-231-6984; Fax: 540-231-3386; email: wilcar@vt.edu. For detailed information about the position and Department, see <http://www.geol.vt.edu>. Review of applications will begin January 8, 2001, and continue until the position is filled.

The College of Arts and Sciences is deeply committed to recruiting, selecting, promoting, and retaining women, persons of color, and persons with disabilities. We strongly value diversity in the college community, and seek to assure equality in education and employment. Individuals with disabilities desiring accommodations in the application process should notify Carolyn Williams at the above address, TTY: 1-800-828-1120 by the application deadline.

**STRUCTURAL GEOLOGY AND TECTONICS  
UNIVERSITY OF ARIZONA**

The Department of Geosciences at the University of Arizona invites applicants for a tenure-track/tenured position in the field of Structural Geology and Tectonics. The position is expected to be filled at the Assistant Professor level, but qualified applicants at other levels are invited to apply, with the final position title based on the qualifications of the selected candidate. We seek applicants interested in carrying out innovative teaching and research on the processes and products of deformation in the Earth's crust. We are especially interested in individuals who employ multidisciplinary approaches to tackle tectonic problems. A Ph.D. or equivalent degree in Geosciences is required. The Department of Geosciences is committed to sustained excellence in tectonics research, to innovation in the geosciences curriculum both at the undergraduate and graduate levels, and to leadership in graduate student training. The selection process will begin January 15, 2001, and will continue until the position is filled. Information about the Department of Geosciences is available at <http://www.geo.arizona.edu>. Interested applicants should submit a curriculum vitae, a statement of research and teaching interests, and a list of at least three references (with addresses, e-mail, phone, and fax numbers) to: Peter G. DeCelles, Chair, Structure Search Committee, Department of Geosciences, The University of Arizona, Tucson, AZ 85721 (520-621-4910, 5200621-2672 (fax), [chair@geo.arizona.edu](mailto:chair@geo.arizona.edu)). Please reference job number

19383. The University of Arizona is an EEO/AA Employer - M/W/D/V.

**EARTH STRUCTURE AND DYNAMICS  
FACULTY POSITION  
RICE UNIVERSITY**

**DEPARTMENT OF GEOLOGY AND GEOPHYSICS**  
The Rice Geology and Geophysics Department is expanding in faculty, staff, and facilities. We are seeking to fill several tenure track positions in Earth Structure and Dynamics, the first of which is available starting July 1, 2001. We are interested in hiring an earthquake/global seismologist, a mineral physicist, and/or a high-temperature geochemist/petrologist. Applications at all levels will be considered; those received by 10 December 2000 are assured of receiving fullest attention.

Please send a resume and names of four or more references to: Chair, Search Committee, Geology and Geophysics Department, MS-126, Rice University, PO Box 1892, Houston, TX 77251-1892.

Information about the department can be found at <http://terra.rice.edu>. Rice is an equal opportunity affirmative action employer.

**EARTH SYSTEMS SCIENCE  
FACULTY POSITION  
RICE UNIVERSITY**

**DEPARTMENT OF GEOLOGY AND GEOPHYSICS**  
The Rice Geology and Geophysics Department is expanding in faculty, staff, and facilities. We wish to fill several tenure track positions in Earth Systems Science, the first of which is available starting July 1, 2001. We are particularly interested in hiring a low-temperature geochemist and a quantitative geomorphologist whose research emphasizes use of remote sensing data. Applications at all levels will be considered; those received by 10 December 2000 are assured of receiving fullest attention.

Please send a resume and names of four or more references to: Chair, Search Committee, Geology and Geophysics Department, MS-126, Rice University, PO Box 1892, Houston, TX 77251-1892.

Information about the department can be found at <http://terra.rice.edu>. Rice is an equal opportunity affirmative action employer.

**TENURE TRACK FACULTY POSITION  
RESERVOIR GEOSCIENCES  
DEPARTMENT OF GEOLOGICAL SCIENCES  
UNIVERSITY OF COLORADO AT BOULDER**

The Department of Geological Sciences at the University of Colorado at Boulder invites applications for a tenure-track faculty position in reservoir geosciences, with consideration to those applying at the assistant or associate professor level. Candidates with research interests in any area of reservoir sedimentology, reservoir geophysics, and petrophysics will be considered. This applied position focuses on the integration and analysis of reservoir databases, and/or modeling efforts. This includes, but is not limited to: reservoir and outcrop sedimentology, numerical modeling/simulation, use of statistics in reservoir modeling, interpretation of 3D and 4D seismic reflection data, reservoir monitoring, borehole geophysics, petrophysical interpretation. Additional information about the position and the local research environment can be obtained at: [www.colorado.edu/GeolSci](http://www.colorado.edu/GeolSci).

Applications will be reviewed beginning January 8, 2001, and will be considered until the position is filled.

The University of Colorado at Boulder is committed to diversity and quality in education and employment.

**TENURE TRACK FACULTY POSITION  
IN HYDROLOGICAL SCIENCE**

The Department of Environmental Sciences at the University of Virginia invites applications for a tenure-track assistant professorship in the hydrological sciences. The department is an interdisciplinary community of process-oriented scientists representing hydrology, ecology, geosciences and the atmospheric sciences. The department offers B.A., M.S., and Ph.D. degrees.

The Department seeks candidates with clear interest and potential for advancing our understanding of the controls and dynamics of the landscape-scale terrestrial water cycle. In particular, we seek to augment our existing strengths through the addition of a colleague studying terrestrial water reservoirs (either surface or subsurface), possibly involving interaction with changing climate and vegetation communities. We encourage applications from diverse areas of hydrological science (e.g., ground water-surface water interactions in coastal areas, land surface water dynamics inferred through remote sensing, land cover controls on hydrology of large basins, etc.) Regardless of specialization, the ideal candidate will be a process-based scientist working at the landscape scale.

The successful candidate will be expected to develop

## Collections Assistant/Preparator

The Field Museum anticipates hiring a full-time Collections Assistant/Preparator in the Department of Geology. An advanced degree in the geological sciences and laboratory experience in analytical chemistry are highly desirable. The primary responsibility of this position involves the preparation of geological and paleobotanical specimens for chemical and isotopic analysis. Specific duties include, but are not limited to, assisting with the operations and upkeep of the Isotope Geochemistry Laboratory and the Paleobotanical/Palynological Laboratory; management, preparation and analysis of materials from the Physical Geology and Paleobotany collections; and assisting departmental staff with development of new analytical and sample preparation techniques in these laboratories. Salary will be commensurate with experience.

Please send a current résumé, a statement detailing laboratory and/or collections experience, and a list of 3 references (including email and phone information for each) to either Dr. Jennifer McElwain ([jmcElwain@fmmh.org](mailto:jmcElwain@fmmh.org)) or Dr. Meenakshi Wadhwa ([mwadhwa@fmmh.org](mailto:mwadhwa@fmmh.org)) at: Department of Physical Geology and Paleobotany, 1400 S. Lake Shore Dr., Chicago, IL 60605. Review of applications will begin January 1, 2001. Applications received later than this date may be considered until the position is filled. The Field Museum is an equal opportunity employer.

**The Field  
Museum**

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. A Ph.D. in hydrology or related field.

Send statements of research and teaching interests, curriculum vitae, and the names and addresses of three referees to: James N. Galloway, Professor and Chair, University of Virginia, Department of Environmental Sciences, PO Box 400123, Charlottesville, VA 22904-4123.

Evaluation of applications will begin on 15 November 2000. All applications must be received by 01 January 2001. In addition to the printed application, we would appreciate having a PDF file of the application emailed to us at [hydrology@mail.evsc.virginia.edu](mailto:hydrology@mail.evsc.virginia.edu), though this is optional. We especially encourage applications from under-represented groups. For additional information, see the department web site at [www.evsc.virginia.edu](http://www.evsc.virginia.edu). The University of Virginia is an equal opportunity/affirmative action employer.

**TENURE TRACK FACULTY POSITION  
IN THE GEOLOGICAL SCIENCES**

The Department of Environmental Sciences at the University of Virginia invites applications for a tenure-track assistant professor in geological sciences. The department is an interdisciplinary community of process-oriented scientists working in the areas of geosciences, hydrology, ecology, and atmospheric sciences. The Department offers B.A., M.S. and Ph.D. degrees.

The Department seeks candidates with the skills and interest to advance our understanding of geochemical and/or surface processes effective at landscape or larger scales (e.g., coastal environments, hillslopes, watersheds, continental margins). The ideal candidate will embrace the opportunity to work within our interdisciplinary mix of research areas. Ph.D. in Geosciences or related field required.

The successful candidate will be expected to develop outstanding programs in research and teaching at both the undergraduate and graduate levels and to participate in teaching our undergraduate core course in Physical Geology. Applicants must show demonstrated excellence in their research and a strong commitment to quality teaching.

Classifieds continued on p. 39

# Geoscientists on America's Public Lands

One earth science intern in one park interacts with hundreds of visitors. Those visitors are children, parents, students, voters, leaders, business people, consumers, and donors. The intern gets a great experience—maybe even a life- or career-changing experience. The visitors get something they can't—or don't—get from picking up a brochure. They get a personal encounter with a knowledgeable and enthusiastic human being. Other interns work on projects behind the scenes, helping to ease the strain from ever-tightening budgets and aiding the progress of important research.

Internships are popular. GSA gets hundreds of applications for only a handful of spots every year. Internships are needed. For example, the National Park Service has only about 40 geologists in almost 380 National Park areas nationwide, areas that people very often visit BECAUSE of their geological interest. Internships are a great deal. An intern's stipend is minimal when the far-reaching benefits to our public lands are toted up.

That's why GSA is launching GeoCorps America™, a consortium of supporting organizations and sponsors working together to gradually increase the presence of geoscientists on public lands.

## Our Story So Far

GSA's summer internship program with the National Park Service began in 1997 with two interns in two National Parks. In 2000, GSA placed interns in 13 National Parks. In addition, GSA and the U.S. Department of Agriculture Forest Service established Geology in the Forests, a program that pairs interns with practicing geologists. Interns work directly with the geologists in a combination of office and field assignments. GSA also has joined forces with the National Association for Black Geologists and Geophysicists to provide National Park internships for African-American students.

## What GeoCorps Will Bring

GeoCorps America™ will expand this existing program, bringing new combinations of people and places together. It will protect GSA's investment in internship programs to date, while enabling other organizations—associations, foundations, corporations, and governmental agencies—to benefit from a system that is already in place and working.

## Win-Win Internships

Students benefit from the program in much the same way they always have. They can gain know-how in problem solving and communicating effectively with a wide variety of people. They can apply their skills—such as in writing, research, or database management—in real-life situations. And they can solidify their own career objectives.

Career professionals—including earth science teachers—can experience service sabbaticals on public lands, returning with renewed energy to their jobs and renewed enthusiasm for their science.

Experienced retired scientists can stay in the game, bringing their expertise to a new generation of students, visitors to public lands, and staff members.

Sponsoring companies or organizations can enjoy the benefit of positive public relations and a potential boost to their future work forces. In one GeoCorps model, a professional works with a student intern—what better way to get young scientists interested in a company or industry?

America's public lands need help from scientists, particularly geoscientists. Millions visit our parks, forests, and monuments each year, and many are drawn by the geology of the areas. GeoCorps America™ can help by ensuring that more public lands have the scientific resources they need. ■



Jonathan Pennington

Now in its fourth year, GSA's National Park Service (NPS) Internship Program has proven to be a successful partnership with the NPS Geologic Resources Division's Geologist-In-the-Parks (GIP) Program. This collaboration and funding from the John F. Mann Fund, GSA Foundation Minority Fund, Doris Curtis Memorial Fund for Women in Science, and the National Association for Black Geologists and Geophysicists allowed for placement of 13 geoscience students in national parks and the desperately needed transfer of geoscience knowledge and expertise to park visitors and staff. In the words of the NPS interns, here is a summary of the summer of 2000.

### On park geology

"Redwood trees and the spectacular vegetation and wildlife that surround them may not automatically bring to mind geology to park staff and visitors, but that was my job at Redwood National and State Park for the busy summer season. The beautiful and distinct trees, while one of the park's biggest assets, also provide some of the biggest challenges to interpreting the local geology." *Kathryn Roberts, Redwood National and State Park*

"Grand Canyon is a geologist's playground. Nowhere else is arid-land erosion so dramatically displayed, or a rock sequence so clearly exposed. While its record extends back well into the Precambrian Era, the Paleozoic story tells of sea transgressions and regressions, Laramide uplift, and incision of the Colorado River. These resources also make Grand Canyon an interpreter's ideal classroom." *Clifton Koontz, Grand Canyon National Park*

### On responsibilities

"My position was to observe and document the activities of the mining party in order to make sure the project was done according to the court orders agreed upon by the claim's owner and the National Park Service. As a kind of check and balance system, both parties needed to be present while the claims sampling opera-

tion was taking place. My job consisted of detailed note taking, digital photography, videotaping, and assistance to the mining party. Explicit detail and documentation was necessary to aid the Park Service's case against the claim's owner." *Andrew Irvine, Denali National Park and Preserve*

"The biggest portion of my time this summer was spent working in the visitor center, collecting fees, running the bookstore, and answering questions. My other duties included giving 15-minute geology presentations, collecting weather and acid rain data, roving, informal interpretation, and working on various projects." *Christine Wennen, Capulin Volcano National Monument*

### On projects

"I spent countless hours reading about the area's history, geology, and any relevant research I could find that had been done in and around OZAR. After I felt more confident with my knowledge of the area, I completely revised the to-do list. The items OZAR needed were: organizing all of the data already collected on the caves, physically and digitally; updating the Ozark National Scenic Riverways Cave Database; updating the cave inventory and monitoring protocol and data forms; and collecting missing GPS coordinates and several other features for a number of the caves; all while generating reports for my supervisor and taking care of the needs of the rangers while they monitored." *Christina Jan, Ozark National Scenic Riverways*

"I drove, hiked, boated, and kayaked to my outcrops, looked for fossils, and if I found any, would document them with notes, photographs, and a GPS reading. On my 'recovery' days I'd enter my data into the computer and supplement the manuscript with more information that I was getting from papers." *Brooke Swanson, Fossil Buttes National*

### On accomplishments

"I am very proud of the independence I gained, both personal and profes-

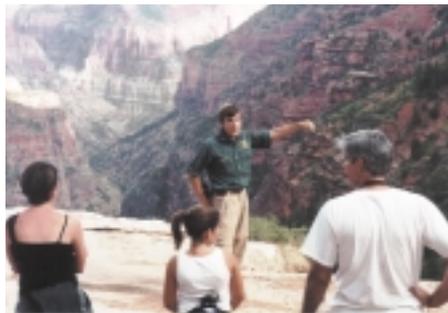


Brooke Swanson

sional, during this internship. I feel much more confident to enter graduate school next year, knowing that I can initiate a project and see it through to completion. I am also impressed with the amount of information I was able to learn about the Pacific Northwest after only having been there for three months. I was able to prove to myself that I can accomplish tasks with difficult people, and I sharpened my people skills by calming irritated visitors who had to wait two hours for a cave tour." *Stephanie Larsen, Oregon Caves National Monument*

"Over the summer, I was able to see how Assateague's geology is the reason for the incredible dynamism of all the island's natural systems, be they terrestrial plant communities, marine animals, migratory birds, or what have you. I then was able to

Park Service Interns *continued on p. 38*



Clifton Koontz



Andrew Irvine



Stephanie Larsen

## In the Words of GSA's National Park Service Interns

Park Service Interns *continued from p. 37*

talk this through with lots of people who thought they knew or cared nothing about geology.” *Amanda Kolker, Assateague Island National Seashore*

### On lessons learned

“This internship has taught me so many more things than I expected. Besides improving my ability to present programs to large, diverse groups, I now feel as if it is second nature to stand in front of people and speak. I know that this will be a tool that I will be able to take with me for the rest of my life. Leading Junior Ranger programs has also sparked a new interest in children for me. Because of my positive experiences, I am considering going into a field of education. I have also learned about the way National Park Service functions, where funding comes from, and countless minor yet irreplaceable duties that a ranger is responsible for. Above all, it has taught me a new respect for diversity of people and learning how to improve myself by interacting with new and different people. I am endlessly thankful for being provided with this opportunity; I have learned so much I will take with me for the rest of my life. By being given this opportunity I have been able to have the best summer of my life.” *Audrey Sherry, Florissant Fossil Beds National Monument*

“This experience exposed me to the challenge of presenting geologic topics in a form that all ages can understand. It has also encouraged me to seriously think about pursuing the field of scientific teaching. I enjoyed the experience for the things it exposed me to and the fun

it was to think up activities to explain geologic processes.” *Brien Park, Bryce Canyon National Park*

### On advice for future interns

“I thoroughly enjoyed the opportunity to exercise my education by doing geology work in Denali, but I loved my summer because I loved where I was. Future interns need to understand that work in Denali means long days, harsh weather and more mosquitoes than one can imagine. Wilderness remains wilderness because it is relatively inhospitable. I happen to enjoy roughing it, which proved to be a great asset over the summer.” *Andrew Irvine, Denali National Park and Preserve*

“My advice to future interns is to be open-minded and willing to roll with whatever an internship such as this offers you. Even though it might not meet your expectations, reap as much knowledge as you possibly can and make the absolute best out of what the situation offers you. Learn from and in turn educate as many employees and visitors as you can. The self-fulfillment will stay with you for the rest of your life. Don't miss an opportunity to meet new people because they could be the greatest things that will ever happen to you.” *Christina Jan, Ozark National Scenic Riverways*

“I have lots of advice for future interns. Some things you should know: This is a very physical job. I spent hours shoveling gravel and transplanting trees. The hike to the Star Dune was exhausting, especially carrying GPS and surveying equipment. That was a 13-hour day. This is not a place for people who don't like to get sweaty and dirty. Also, be prepared to

deal with kids. They love rangers and will ask you a ton of questions. You will be working with the public a great deal. You will be working a cash register and answering the telephone. This is not a job for unsociable people. Also, at this elevation the Sun's radiation is very intense. I was sunburned very badly after only two hours over the 4th of July holiday. Always wear sunscreen.” *Micheal Canerdy, Great Sand Dunes National Monument*

### On contacts

“Every day, hundreds of people visited Dry Falls to do one thing, marvel at the geologic phenomena. They are rarely locals, do not drive there to drink or picnic, or to drive boats or jet skis—they drive there to see geology. This meant that when I walked around and told the visitors that I was the park geological interpreter and that I would be happy to answer any questions they had, I didn't get ignored—I got accosted! In fact, I drew a crowd. It was wonderful!” *Jonathan Pennington, Lake Roosevelt National Recreation Area*

“I contacted every employee and really helped the interpretive staff with geology. Also, many of the summer seasonal staff and Student Conservation Association people came to me with any geology questions that they had.” *Micheal Canerdy, Great Sand Dunes National Monument*

For information on 2001 internship opportunities, contact Katie KellerLynn, (303) 447-2020, ext. 194, [kkellerlynn@geosociety.org](mailto:kkellerlynn@geosociety.org). Applications are due February 1, 2001. ■

## Bulletin and Geology Highlights

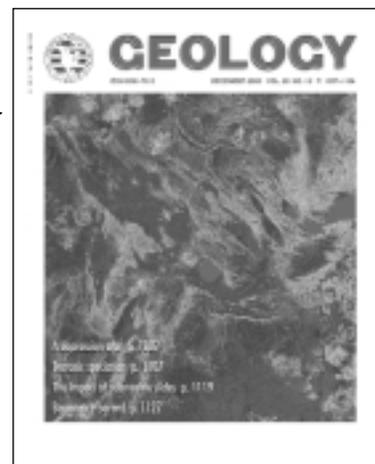
### In December *Bulletin*

Focus on geomorphology and surface processes



### In December *Geology*

A depression afar  
Tectonic speculation  
The impact of submarine slides  
Barometry barred



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For details, contact us at [member@geosociety.org](mailto:member@geosociety.org), 1-888-443-4472, or (303) 447-2020, ext. 774.

## Classifieds continued from p. 35

Send statements of research and teaching interests, curriculum vitae, and the names and addresses of three references to: James N. Galloway, Professor and Chair, University of Virginia, Department of Environmental Sciences, P.O. Box 400123, Charlottesville, VA 22904-4123.

Evaluation of applications will begin on 15 November 2000. All applications must be received by 01 January 2001. In addition to the printed application, we would appreciate having a PDF file of the application emailed to us at geosciences@mail.evsc.virginia.edu, though this is optional. We especially encourage applications from under-represented groups. For additional information, see the department web site at [www.evsc.virginia.edu](http://www.evsc.virginia.edu). The University of Virginia is an equal opportunity/affirmative action employer.

### KENT STATE UNIVERSITY ANNOUNCES THREE TENURE-TRACK FACULTY POSITIONS

**Surface-Water Hydrologist:** The Department of Geology at Kent State University seeks to hire a surface-water hydrologist at the tenure-track Assistant Professor level beginning fall semester, 2001. The successful candidate should possess the Ph.D., have a strong background in the geological sciences, and be able to interface well with other faculty working in a variety of water-related specialties. Specific research interests are open and may include, but are not limited to, such areas as quantitative analysis of fluvial systems; engineering applications; wetlands and groundwater-surface water interaction; vadose-zone hydrology; or coastal processes and engineering. We seek a scientist with experience in numerical modeling as well as interest in pursuing laboratory and field-based problems. Responsibilities will include teaching advanced undergraduate and graduate courses in hydrology; assisting with instruction of the introductory geology course in Environmental Geology; advising M.S. and Ph.D. candidates; and developing a strong, funded research program. The initial course load will be two courses per year, giving the successful candidate time to seek external funding and pursue research.

**Low-Temperature Aqueous Geochemistry:** The Department of Geology at Kent State University seeks to hire a low-temperature aqueous geochemist at the tenure-track Assistant Professor level beginning Fall semester, 2001. The successful candidate should possess the Ph.D., have a strong background in the geological sciences, and be able to interface well with other faculty working in a variety of water-related specialties. Specific research interests are open and may include any of the broad range of water related studies such as the chemistry of water-sediment interactions; trace-element or major-element geochemistry; organic geochemistry; geomicrobiology; environmental geochemistry; or the chemical modeling of natural systems. Responsibilities will include teaching advanced undergraduate and graduate courses in hydrology; advising M.S. and Ph.D. candidates; developing a strong, funded research program, and assisting with instruction of one of the introductory geology courses including Environmental Geology, Physical Geology, or Oceanography. The initial course load will be two courses per year, giving the successful candidate time to seek external funding and pursue research.

**Sedimentary Geologist:** The Department of Geology at Kent State University seeks to hire a "soft-rock" geologist at the tenure-track Assistant Professor level beginning Fall semester, 2001. The successful candidate should possess the Ph.D., have a strong background in the geological sciences, and be able to interface well with other faculty working in a variety of paleontologic, tectonic, and sedimentary specialties. Specific research interests are open and may include such areas as carbonate sedimentology, tectonic evolution of sedimentary basins, sequence stratigraphy, or biostratigraphy. We seek a scientist with experience and interest in pursuing laboratory and field-based problems. Responsibilities will include teaching our basic senior level course in stratigraphy; assisting with instruction of one of the introductory geology courses in Oceanography or Earth History, developing and teaching advanced undergraduate and graduate courses in the discipline; advising M.S. and Ph.D. candidates; and developing a strong, funded research program. Ability and interest in teaching our summer field course is also desirable. The initial course load will be two courses per year, giving the successful candidate time to seek external funding and pursue research.

The Department presently has 10 full-time faculty members, 80 undergraduates and 35 graduate students. Faculty are presently involved in research in tectonics, sedimentary petrology, sedimentology, paleontology, micropaleontology, paleolimnology, limnology, wetlands and surface water-groundwater interactions, hydrogeology, climate change, landform development and geomorphology, slope stability, and engineering geology. The department maintains 22 research laboratories and is well-equipped for both applied and basic geologic research. There are excellent opportuni-

ties for cooperative research and teaching within the Department and with members of the Water Resources Research Institute, which promotes cooperative research among a large, multidisciplinary group of faculty from geology, biology, chemistry, and geography. Review of applications will begin on January 15, 2001. Candidates should send a letter of application, curriculum vitae, transcripts, a statement of research and teaching interests, and three letters of recommendation to Dr. Donald Palmer, Department of Geology, Kent State University, Kent OH 44242. Phone 330-672-2680 or 330-672-0091; fax 330-672-7949, [www.kent.edu:80/geology/](http://www.kent.edu:80/geology/), e-mail [geology@kent.edu](mailto:geology@kent.edu). Kent State is an equal opportunity/affirmative action employer.

### WIESS VISITING PROFESSORSHIP RICE UNIVERSITY

**DEPARTMENT OF GEOLOGY AND GEOPHYSICS**  
We invite applications for the Wiess Visiting Professorship in Earth Sciences. We particularly encourage scientists in fields allied with our department's focus areas: computational geophysics, seismology, tectonics, geochemistry, sedimentology and global change. The visiting professor funds provide one semester of salary for a visitor to conduct research at Rice, and can be used to extend a normal sabbatical leave. A research stipend is also provided. The Professorship is available for the 2000-2001 academic year.

Information on the Department of Geology and Geophysics and the Center for Computational Geophysics can be found at <http://terra.rice.edu>.

Send a resume to Chair, Wiess Visiting Professorship Committee, Department of Geology & Geophysics, MS-126, Rice University, PO Box 1892, Houston, TX 77251-1892.

Rice University is an equal opportunity, affirmative action employer.

## Services & Supplies

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## Opportunities for Students

**The Center for Environmental Chemistry and Geochemistry of The Pennsylvania State University** announces the second year of: THE BIOGEOCHEMICAL RESEARCH INITIATIVE FOR EDUCATION (BRIE). BRIE is an initiative funded by the National Science Foundation/IGERT program to support 30 Ph.D. students, 5 post-docs, and 30 undergraduate summer interns in a multi-year program of biogeochemistry in one of five departments (Agronomy, Biochemistry and Molecular Biology, Civil and Environmental Engineering, Geosciences, and Materials Science and Engineering). Students work in teams investigating the cultivation of extremophiles, physical chemistry of biofilms, biologically enhanced mineral reactivity, bioavailability of organic compounds, and the biogeochemistry of anoxic environments. Interested students at all levels should write L. Spangler, 2217 Earth Engineering Science Bldg., University Park, PA, 16802 ([spangler@essc.psu.edu](mailto:spangler@essc.psu.edu)) or check <http://www.essc.psu.edu/BRIE> for information. The Pennsylvania State University is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

**Research Assistantships/Hydrology/N.M. Tech.** Graduate research assistantships are available for students interested in working on projects related to a NSF Science & Technology Center on Sustainability of SemiArid Hydrology and Riparian Areas (SAHRA), which the Hydrology Program at New Mexico Tech is a lead participant. This center was formed to address the growing problems of increasing water demand and declining water quality in the southwestern United States. The objective of the Center is not only to obtain new scientific insights into the hydrological system, but also to develop and present the scientific results in such a way that they can actually be applied to the resolution of water resources problems in the near future.

We encourage applications from students seeking M.S. or Ph.D. degrees who are interested in the following research topics: Basin-scale water and salinity balance, Influence of climate variability on water resources, Vadose zone processes and groundwater recharge

Research will be focused on the hydrology of the Rio Grande Basin. Interaction with water users and managers in the basin is an important part of the planned research. Model simulations will be completed using the advanced computing facilities at Los Alamos National Lab.

We are currently accepting applications for assistantships beginning in both spring and fall 2001. For addi-

tional information, contact Fred Phillips ([phillips@nmt.edu](mailto:phillips@nmt.edu)) or Eric Small ([esmall@nmt.edu](mailto:esmall@nmt.edu)), Dept. of Earth & Environmental Science, New Mexico Tech, Socorro NM 87801, [www.ees.nmt.edu/Hydro/homepage.html](http://www.ees.nmt.edu/Hydro/homepage.html).

**Grinnell Fellowships, University of Kansas.** The Grinnell Fellowship is a one-year fellowship of up to \$20,000 for a qualified Ph.D. student. Subsequent support for three years as an RA or TA will be offered if reasonable progress toward the degree is made. There are three fellowships to be awarded for the next academic year. Details of research programs and facilities at KU are available on the World Wide Web at <http://www.geo.ukans.edu>. You can contact Dr. Douglas Walker, [jdwalker@ku.edu](mailto:jdwalker@ku.edu), Dept. of Geology, 1474 Jayhawk Blvd., Room 120, Lawrence, Kansas 66045-7613, (785) 864-4974, or the persons listed with each description for further information.

**Thermochronology and Tectonics.** The fellowship recipient will be expected to conduct research in the new (U-Th)/He thermochronology laboratory. Potential research projects include the application of low-temperature thermochronology to regional tectonic problems in the western U.S., Tibet, and Iran and/or the further development of the (U-Th)/He thermochronometer. Contact Dr. Daniel Stockli, 626-395-6177; [stockli@gps.caltech.edu](mailto:stockli@gps.caltech.edu), for further information.

**Organic Geochemistry.** The student selected to receive this fellowship will be expected to do research in the new environmental organic geochemistry laboratory working with gas chromatography and HPLC. Students interested in studying organic reactions with aquifer materials and other reactive solids used in groundwater remediation are encouraged to apply. For further information, Dr. J.F. (Rick) Devlin, Dept. of Geology, 1474 Jayhawk Blvd. Room 120, Lawrence, Kansas 66045-7613, 785-864-4974.

**Biogeochemistry.** The student selected to receive the fellowship will be expected to develop an innovative research project focused on interactions between microorganisms and minerals in subsurface environments. For further information, contact Dr. Jennifer Roberts Rogers, USGS, 3215 Marine St., Boulder, CO 80303, 303-541-3001; [jrogers@usgs.gov](mailto:jrogers@usgs.gov).

**Graduate Assistantship: Mesoproterozoic Plate Reconstructions and Tectonics of Southern Africa.** The Geology Department at Texas Christian University has a graduate assistantship at the M.S. level open for the Spring Semester. Financial aid includes a nine-month stipend for two years, full tuition waiver, and funds to support thesis research. Applicants in all fields of geology are encouraged, but we are particularly looking for someone to participate in field, geochronological, and paleomagnetic studies of Proterozoic mafic rocks in southern Africa. Lab work will be carried out at MIT and UT-Austin. In addition to the nine-month stipend, this individual will receive a three-month summer salary. Contact Richard Hanson at 817-257-7996; [hanson@gamma.is.tcu.edu](mailto:hanson@gamma.is.tcu.edu). Additional information about the department can be found on our Web site at <http://geowww.geo.tcu.edu>.

**Graduate Assistantships.** The Geology Department and Center for Remote Sensing and Energy Research has assistantships available for M.S. students for the spring and fall semesters. Financial aid includes a nine-month stipend for two years, full tuition waiver, and funds to support thesis research. Areas of department expertise include hydrology, remote sensing, environmental geology and geochemistry, carbonate and clastic sedimentology, petroleum geology, paleovolcanology, structure and tectonics, Precambrian geology, and computer applications in geology. Field research is carried out in Scotland, the Sierra Nevada in California, and Africa, as well as Texas and Oklahoma. Contact Dr. R. Hanson at 817-257-7996; [hanson@gamma.is.tcu.edu](mailto:hanson@gamma.is.tcu.edu). Additional information about the department can be found on our Web site at <http://geowww.geo.tcu.edu>.

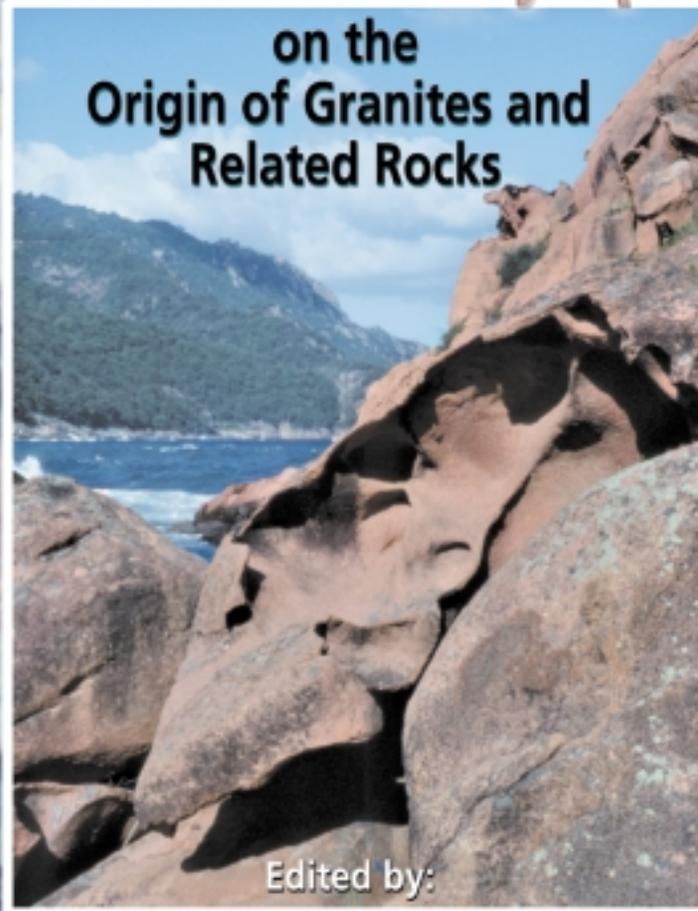
**NASA Planetary Biology Internships.** The Marine Biological Laboratory, Woods Hole, Massachusetts, invites applications from graduate students and seniors accepted to graduate programs for rewards of \$2200 plus travel to participate in research at NASA centers and collaborating institutions for approximately 8 weeks. Typical intern programs include: global ecology, remote sensing, microbial ecology, biomineralization, and origin and early evolution of life. Application deadline: March 1, 2001. 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](mailto:pbi@geo.umass.edu). Tel (413) 545-3223. An Equal Opportunity/Affirmative Action Employer.



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