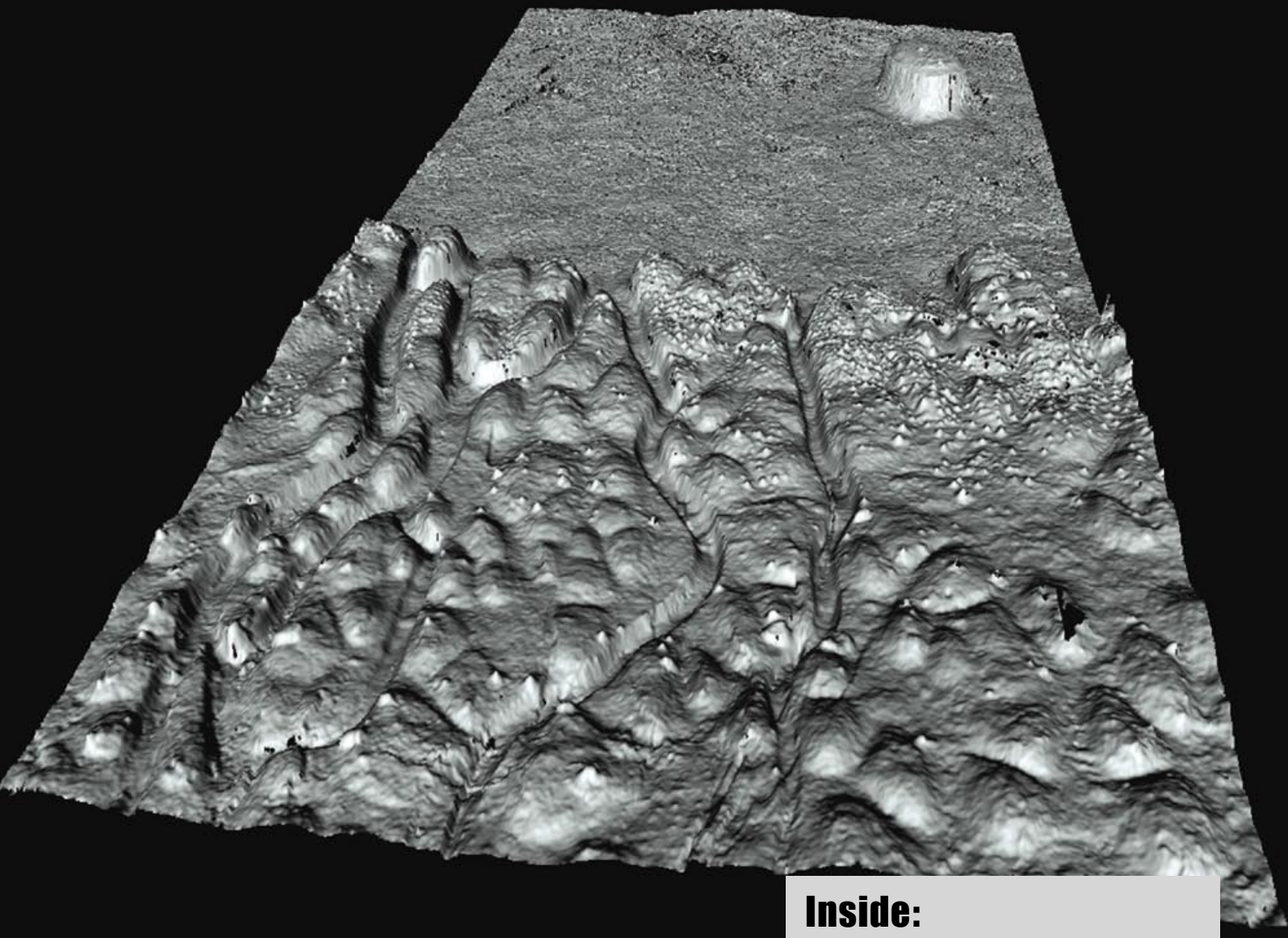


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Geologic processes in sedimentary basins inferred from three-dimensional seismic imaging

Inside:

Geologic processes in sedimentary basins inferred from three-dimensional seismic imaging, RICHARD J. DAVIES AND HENRY W. POSAMENTIER, p. 4

Penrose Conference Report, p. 28

Section Meetings:

Southeastern Section, p. 11

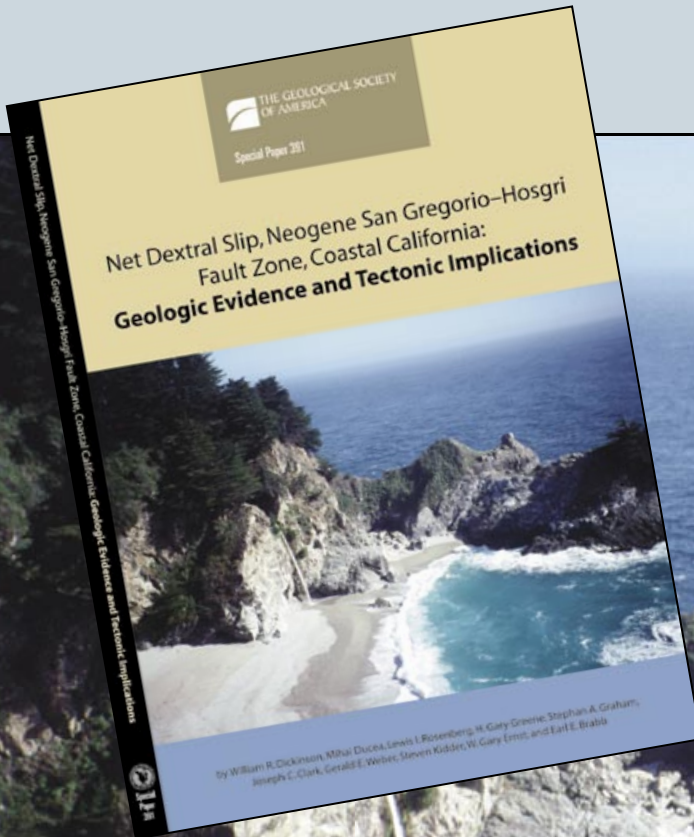
North-Central Section, p. 15

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

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

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

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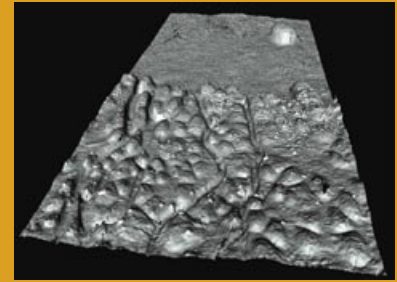
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Cover: Miocene carbonate platform characterized by extensive reef buildup and crosscutting tidal channels. The relief from platform to basin floor is ~200–250 m. The feature toward the top of the image is an isolated outlier buildup ~7 km wide. Data courtesy of PGS Geophysical; permission to publish from BPMIGAS and Anadarko Petroleum Corporation is gratefully acknowledged. See "Geologic processes in sedimentary basins inferred from three-dimensional seismic imaging," by Richard J. Davies and Henry W. Posamentier, p. 4–9.



SCIENCE ARTICLE

- 4 **Geologic processes in sedimentary basins inferred from three-dimensional seismic imaging** RICHARD J. DAVIES AND HENRY W. POSAMENTIER
-
- 10 **Public Forum: Saturn & Its Moons: A Ring-Side View from Cassini-Huygens**
- 11 **Preliminary Announcement and Call for Papers: Southeastern Section Meeting**
- 14 **Call for Geological Papers: 2006 GSA Section Meetings**
- 15 **Preliminary Announcement and Call for Papers: North-Central Section Meeting**
- 18 **John Mann Mentors in Applied Hydrogeology Programs**
- 20 **What Happens at the Shlemon Mentor Programs?**
- 22 **Call for Nominations: 2006 GSA Awards and Medals**
- 25 **Call for Nominations: John C. Frye Environmental Geology Award**
- 25 **Call for Nominations: National Awards for 2008**
- 26 **Grants Update**
- 26 **Call for Applications: 2006–2007 GSA–USGS Congressional Science Fellowship**
- 28 **Penrose Conference Report: Kinematics and geodynamics of intraplate dextral shear in eastern California and western Nevada**
- 30 **GSA Foundation Update**
- 33 **Classified Advertising**
- 37 **Journal Highlights**
- 39 **GeoMart Geoscience Directory**

Geologic processes in sedimentary basins inferred from three-dimensional seismic imaging

Richard J. Davies, 3D Lab, School of Earth, Ocean and Planetary Sciences, Main Building, Park Place, Cardiff University, Cardiff CF10 3YE, UK, richard.davies@earth.cf.ac.uk; **Henry W. Posamentier**, Anadarko Canada Corporation, 425 1st Street SW, Calgary, Alberta T2P4V4, Canada, Henry_Posamentier@anadarko.com

ABSTRACT

Three-dimensional seismic reflection data are now being used to understand a range of fundamental geological processes. However, like most geological investigative tools, it is the *products* of geological processes that are revealed by these data rather than the *processes* themselves; processes inevitably need to be inferred. We outline how the interpretation of three-dimensional seismic data is undertaken in sedimentary basins and then describe selected examples of recent applications of these data with the objective of showing how sedimentary basin processes can be unraveled from seismic imagery. These examples cover the diverse disciplines of (1) geomorphology and process sedimentology, (2) diagenetic processes, (3) magma intrusion into the upper continental crust, and (4) fluid flow in sedimentary basins.

INTRODUCTION

As a byproduct of the search for hydrocarbons, the earth science community has advanced the frontiers of earth science through the development and refinement of the equivalent of the medical world's computed tomography (CAT) scan. Three-dimensional seismic reflection technology enables the geoscientist to image volumes of Earth's subsurface much in the same way CAT scans image the human body. These types of data have long been used in the hydrocarbon industry (e.g., Bally, 1987; Weimer and Davis, 1996; Brown, 1999; Davies et al., 2004) and increasingly in the past decade have been revealing the three-dimensional form of a host of new geological phenomena in sedimentary basins. Three-dimensional

seismic reflection profiling is now shedding light on fundamental geologic processes that span a surprisingly wide range of earth science disciplines, from structural geology to geomorphology to fluid migration through strata within sedimentary basins.

Like its medical counterpart, three-dimensional seismology is a form of remote sensing, a means of imaging the interior of a solid object in a noninvasive way. The transmission of seismic energy and the return of energy back to the surface by reflection and refraction allows for some of the fabric and texture of Earth to be imaged, digitally enhanced, and evaluated. The resultant images capture snapshots of the subsurface at a moment in time, and analysis of a series of images facilitates the reconstruction of the geological evolution of the subsurface. The scale of such analysis ranges from whole Earth (e.g., Grand et al., 1997) to the relatively shallow parts of the crust examined in this contribution.

DATA AND INTERPRETATION

Three-dimensional reflection seismology began to be developed in the 1970s. Rather than acquiring parallel seismic line data separated by kilometers, as was the norm with two-dimensional seismic acquisition, acoustic data from multiple closely spaced rectilinear lines were collected (at first every 100 m, then every 50 m, and now commonly every 25–12.5 m), providing regular, grid-like, data point spacing. These data pass through various operations during seismic processing (Yilmaz, 2001) that ultimately aim to increase the signal-to-noise ratio and resolution of the subsurface reflections. The result

is a three-dimensional cube of seismic reflections that can be interrogated using a wide range of interpretation software. Three-dimensional seismic coverage in mature hydrocarbon provinces can cover entire sedimentary basins, and global coverage is increasing as acquisition, processing, hardware, and software costs are decreasing. The sheer vertical and lateral extent of data coverage means that tens of meters to basin-scale phenomena can be analyzed.

The interpretation methodology is riddled with buzzwords, many of which are specific to the growing number of software products that can be employed to interpret and visualize these data. *Seedpicking*, *autopicking*, *voxbodies*, and *reflection attributes* are a few of the terms that have become part of the seismic interpreter's vocabulary (e.g., Brown, 1999). With specialized software, however, basic interpretation procedures are straightforward. Like any geologic mapping campaign, interpretation usually starts with a phase of reconnaissance. Because the distance between seismic lines is so close (e.g., 12.5 m or 25 m), the data can be viewed as a contiguous earth cube. By panning through tens, hundreds, and thousands of seismic lines over a matter of seconds and minutes, the subsurface can be animated, and the geology "comes alive." Panning through multiple, closely spaced seismic sections represents the equivalent of viewing an outcrop in a quarry wherein layer upon layer of vertical or horizontal sections are stripped away; the observer witnesses the changes in geology in three-dimensional space. This panning process involves digital manipulation and therefore can be done at any orientation, from vertical to horizontal, and any angle in between. This is informally referred to as "slicing and dicing," and provides unique insights into the stratigraphic and structural architecture of Earth's upper crust.

Thousands of square kilometers of data can be examined quickly, and key features or areas of interest are readily identified. Within these areas, reflections on individual seismic lines are then traced (so-called "picking"). These

reflections are low-resolution proxies for individual bedding planes (Vail et al., 1977). Most interpretation software allows the investigator to interpret a small part (spatially) of a specific reflection (these would be called “seeds”) and then instruct the computer to automatically pick the remaining area (so-called “autopicking”). A reflection that covers thousands of square kilometers can be autopicked in as little as a few minutes. Small, complex geologic features with random noise or seismic reflections that are dim or discontinuous represent a greater challenge. They require significant numbers of lines to be examined and more laboriously picked. Because each location within the generated grid (e.g., with an X and Y value) has a unique characteristic (e.g., two-way travel time [Z], horizon dip, seismic amplitude), once the reflection has been picked, the interpreter, again employing specialist software, can quickly calculate what are collectively referred to as “seismic attributes” (Figs. 1 and 2) (see Brown, 1999). The success of subsequent interpretations depends upon an interpreter’s ability to visualize in three dimensions, recognize geologically significant patterns, and integrate a broad range of geologic disciplines including stratigraphy, geomorphology, structural geology, diagenesis, and magmatism.

DEPOSITIONAL SYSTEMS ANALYSIS

The original seismic stratigraphic methodologies outlined in Payton (1977) were developed on two-dimensional seismic cross sections of sedimentary basin fills. No imaging of the planform of the depositional systems and how they stacked was available. Low resolution seismic facies maps, based on qualitative descriptions of seismic reflection amplitude and continuity, as well as reflection architecture (e.g., oblique, sigmoid) and reflection terminations (e.g., toplap, downlap), captured planview distributions of depositional elements. With the advent of three-dimensional seismic data, the analysis of buried landforms became possible; *seismic geomorphology* (Posamentier, 2000) was the logical next step in the seismic analysis of depositional systems. Three-dimensional seismic data, particularly the first second of data (typically the upper 800–1000 m of geology) where the resolution is best, are well suited not only for the static analyses of landscapes and seascapes, in other words the study of “snapshots” of Earth’s surface at a moment in time, but also for the dynamic analyses of these landforms (i.e., how they evolve through time) (e.g., Posamentier, 2001). For example, successive horizontal slices through deposits of a deepwater

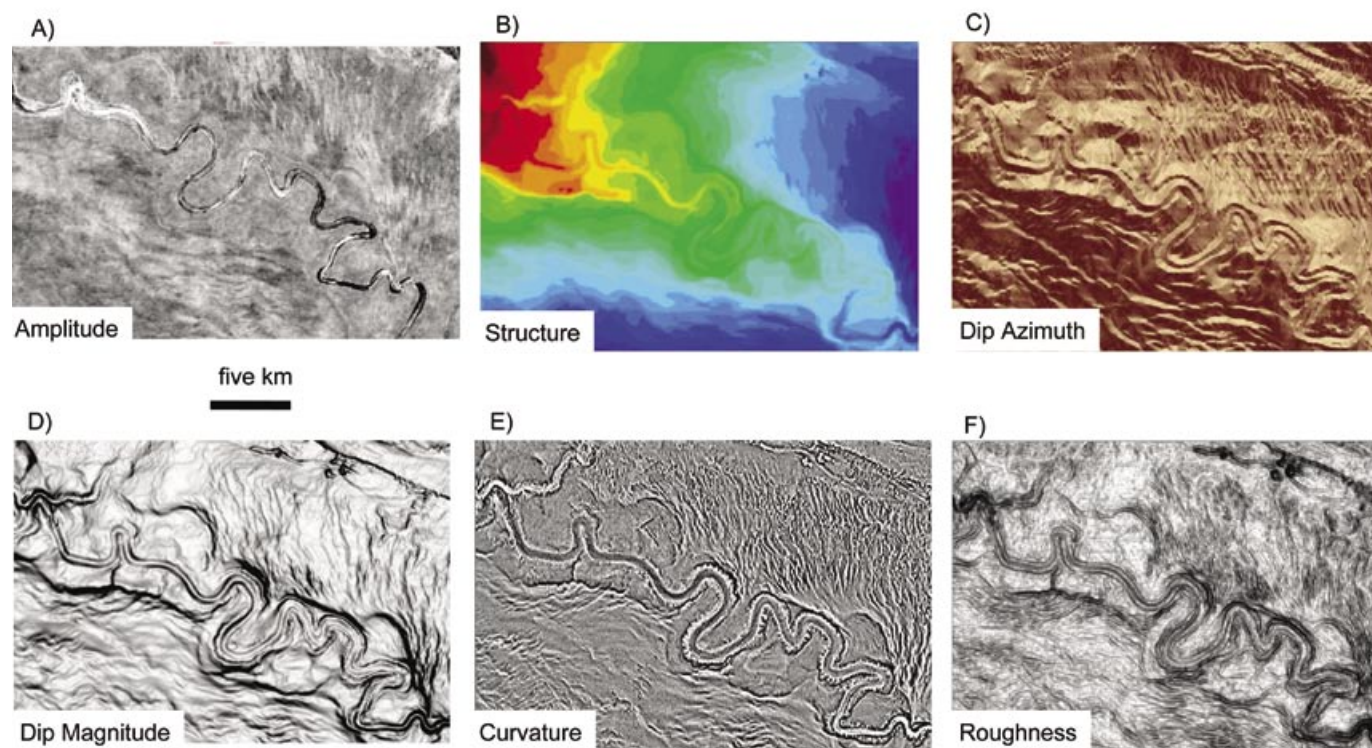


Figure 1. Deepwater Pleistocene channel, DeSoto Canyon area, Gulf of Mexico. (A) Reflection amplitude map showing amplitude strength of the upper bounding surface of the channel and surrounding area. The channel thalweg stands out because it is sand filled and therefore has a higher acoustic impedance than the mud dominated overbank environment. Dark gray—high seismic amplitude; light gray—low seismic amplitude. (B) Time structure map—the channel belt stands structurally higher than the flanking overbank area in response to aggradation of the levees and associated channel belt fill above the basin plain. Red—structurally high; blue—structurally low. (C) Dip azimuth map (combination of dip and azimuth attributes). The channel thalweg appears to stand higher than the channel belt of which it is a part because of differential compaction of the sand-filled channel contrasted with the more mud-prone overbank. Note also the sediment waves present in the overbank areas flanking the channel belt. (D) Dip magnitude map—the channel belt is more apparent in this depiction. It is elevated relative to the flanking overbank because of differential compaction and consequently represents an inversion of topography. Dark gray—high dip; light gray—low dip. (E) Curvature map. This map highlights local variations in curvature (a measure of the magnitude of deviation from a straight line) and brings to light such subtle features as the small slump scars located on the inner levees adjacent to the channel thalweg. (F) Roughness map. Roughness variations across the area highlight the channel thalweg as well as the sediment waves in the overbank area. After Posamentier (2005).

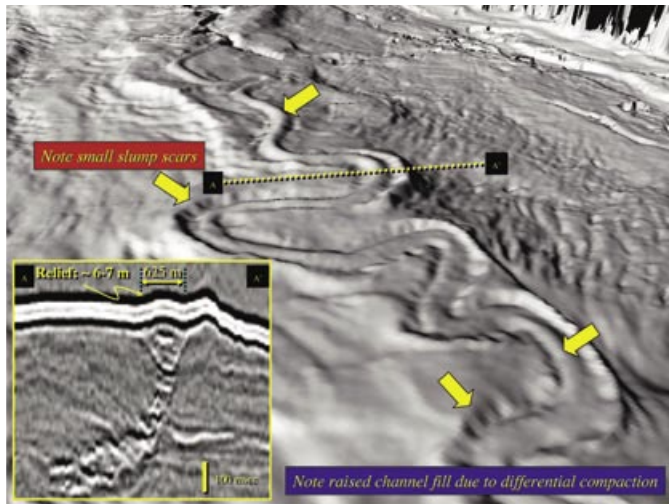


Figure 2. Illuminated and perspective view of the surface shown in Figure 1. The elevated aspect of the channel thalweg with its associated levees becomes quite apparent. The inset depicts a cross section through the channel showing that the thalweg is associated with high reflection amplitude, indicative of a higher acoustic impedance relative to the surrounding mud and therefore suggesting the presence of sand. After Posamentier (2003) and Posamentier (2004).

channel-overbank system illustrate the origin and progressive evolution of a crevasse splay from initially poorly organized sediment waves to better organized distributive channels (Fig. 3). Again, this sheds light on processes sedimentologically relevant to the development of deepwater deposition.

As exemplified above, a depositional setting that has benefited particularly from the study of three-dimensional seismic data is the deepwater environment. Deepwater deposits were not well understood in the past for a variety of reasons, including (1) their largely inaccessible location, which made study of these deposits at their deposition sites difficult; (2) the fact that most deepwater settings are not currently areas of active sedimentation; and (3) the fact that even those systems that are active are difficult to study because of the high energy involved in the deepwater sedimentation process. However, over the past 10 years, reservoirs on continental

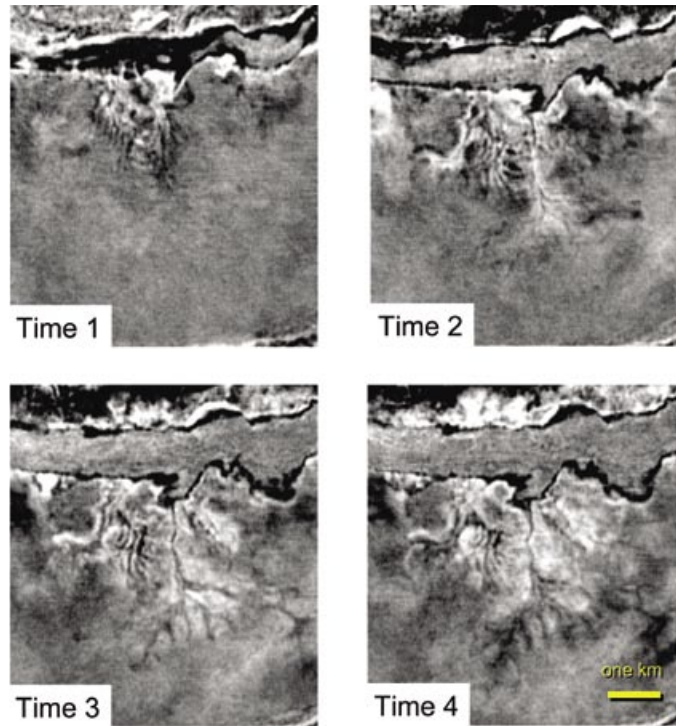


Figure 3. Four time slices through a crevasse splay associated with a Plio-Pleistocene channel in the deep water of the eastern Gulf of Mexico. The splay at Time 1 is disorganized and characterized by subtle transversely oriented sediment waves. Gradually, over Times 2–4, the splay becomes more organized until it is characterized by a well-developed distributive network.

slopes and in deep basinal settings have become increasingly important targets for worldwide exploration as a result of improvements in deepwater drilling technology (e.g., Pettingill, 2001). The infusion of three-dimensional data has literally added a new dimension to the investigation of these deposits (Posamentier and Kolla, 2003). In Figure 4A, for example, a sinuous deepwater channel is shown using a display of the dip azimuth on a reflection marking the top of the channel (Posamentier et al., 2000). The process of thalweg migration within the channel can be recognized using a hori-

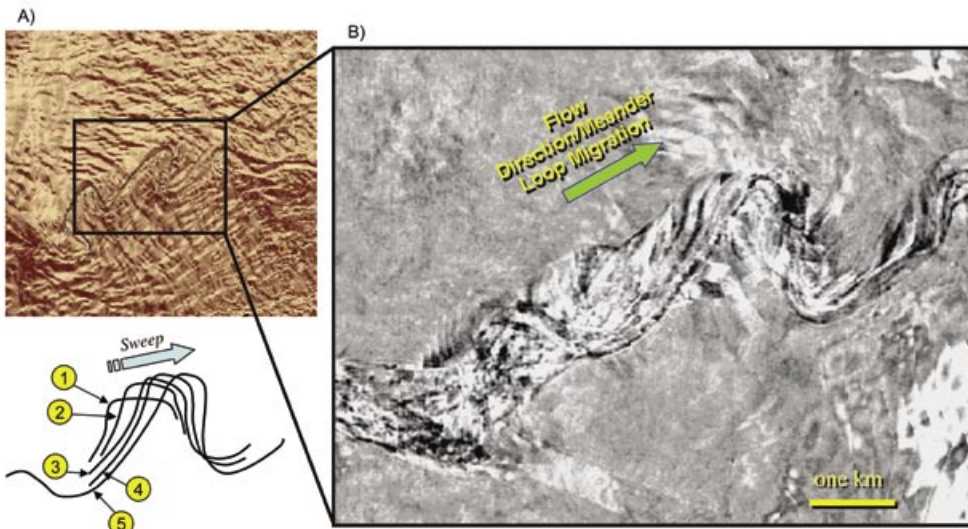


Figure 4. (A) Dip azimuth map on the upper bounding surface of a Pleistocene leveed channel on the deep basin floor in the Makassar Strait, offshore Kalimantan, Indonesia (from Posamentier et al., 2000). Note the extensive sediment waves (corduroy pattern) on either side of the channel. (B) Time slice through this channel illustrating shifted thalweg position through time. Meander loops are observed to migrate in the down-flow direction.

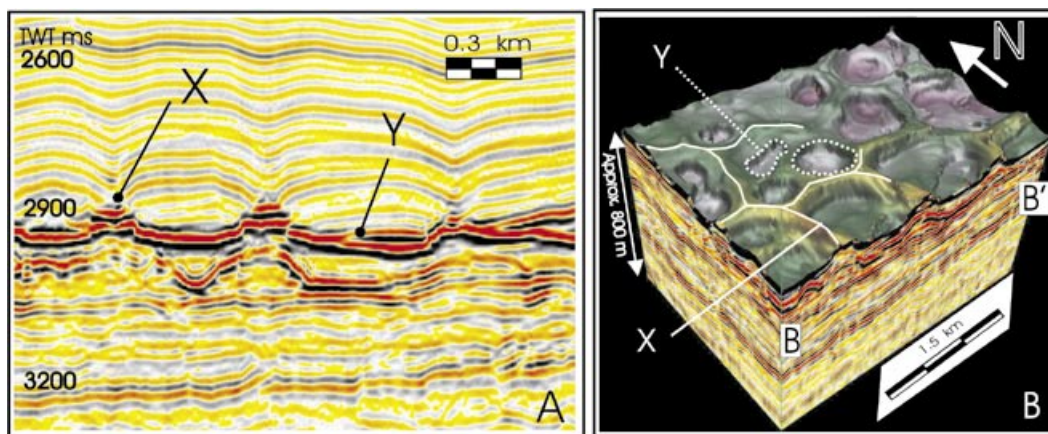


Figure 5. Seismic line and seismic cube revealing an opal A to opal CT boundary from the Faeroe-Shetland Basin, UK. (A) Seismic line B–B' taken from one of the two sides of the seismic cube (B) that face the reader. This seismic line shows that the front developed a series of ridges (marked X) and troughs (marked Y). The opal A–opal CT conversion occurred earlier in the areas that became ridges, leading to compaction and the generation of trough-like depressions. The images show that diagenetic fronts may develop nonplanar forms and cause large-scale deformation in sedimentary basins. After Davies (2005). (B) Seismic cube, one face of which intersects the seismic line in A. The front is buried at a depth of 500–700 m, but the overburden has been stripped away (a process known as “sculpting”) to reveal the planform and relief of the opal A to opal CT diagenetic front. It shows that the ridges have a polygonal planform geometry. Green—high; purple—low.

zontal slice through a seismic volume (a so-called “time-slice”; see Fig. 4B). Figure 2 shows the presence of slumps on the inner walls of the channel-levee systems, a process that could have an important effect on reservoir properties through the generation of impediments to subsurface fluid flow. These types of images and their analysis provide important glimpses into the nature and evolution of generally inaccessible deep-water systems.

DIAGENETIC PROCESSES

It is not surprising that sedimentary bodies that are tens to hundreds of meters thick and many square kilometers in lateral extent can be studied usefully using three-dimensional seismic reflection profiling. Perhaps less expected is the role that this type of geophysical data could have in the study of diagenetic processes, particularly thermochemical reactions, as one could easily assume that the effects of diagenetic processes are discernable only at pore-scale. Some diagenetic reactions, such as the change from biogenic silica (opal A) to a crystalline form (opal CT), can lead to changes in the porosity and cementation of sediment and therefore have an associated change in acoustic impedance, which means that they can be imaged seismically (Hein et al., 1978). “Seismo-diagenetic” analysis breaks the fundamental seismic stratigraphic rule originally outlined in Payton (1977), because diagenetic reflections are not necessarily time lines. We therefore consider the use of seismic data to understand diagenetic processes to be an exciting, new subdiscipline of seismic stratigraphy.

Like other geologic processes discussed here, the actual processes cannot be witnessed, but the morphology of the fronts can be mapped over areas of 10^2 – 10^4 km² of sedimentary basins. This represents a completely different perspective from most conventional diagenetic studies carried out at bed- or pore-scale or limited by two-dimensional seismic data. The three-dimensional shape of opal A to opal CT fronts is starting to yield important clues as to how

diagenetic fronts advance through sediments undergoing burial, as well as the controls on this process. In the example shown here (Fig. 5), an industry borehole (214/4-1) has calibrated the seismic data confirming that a bright continuous reflection that cross-cuts stratigraphy is an opal A to opal CT diagenetic front that has developed a polygonal ridge-depression form (Fig. 5A). Because the host sediments are located above a polygonal fault set, they have a preexisting deformational relief that has been adopted by the diagenetic front. Therefore, a starting pattern of polygonal ridges existed at an early stage of front advancement. For reasons that remain uncertain, the diagenetic conversion occurred at the polygonal ridges prior to adjacent sediments, and because it causes porosity loss (Tada, 1991), compaction and overburden subsidence occurred in these areas. This is a new type of differential compaction mechanism that can cause large-scale deformation in sedimentary basins (Davies, 2005). Furthermore, the development of the differential front morphology in itself provides clues as to what processes are potentially involved in front advancement, such as fracturing and mass transport of silica. With the evaluation of additional data and improved geophysical resolution, perhaps other types of diagenetic conversion may be imaged in years to come. Will it be the illite-smectite transition or dolomitization?

MAGMA INTRUSION IN THE UPPER CRUST

The study of igneous intrusions has a research history spanning nearly 200 years. In outcrop, only partial exposure of exhumed sills is common, limiting the totality and consequently the accuracy of the mapping that can be carried out. Insights into how sills propagate and link with each other are therefore limited and rely largely on mechanical models. Two-dimensional seismic data commonly have imaged igneous intrusions and magma bodies (e.g., Joppen and White, 1990; Makovsky and Klempner, 1999), but the lack of three-dimensional coverage does not allow for evaluation of intrusion processes. Because volcanic continental margins

are important hydrocarbon provinces, extrusive and intrusive rocks can be imaged using three-dimensional seismic data (Davies et al., 2002; Hansen et al., 2004; Trude, 2004). The true three-dimensional form of dikes and sills can easily be ascertained because igneous rocks have high acoustic contrasts relative to the host sedimentary strata. Sill geometries and seismic attributes such as the amplitude and dip of a reflection from the top of a sill can reveal features that are diagnostic indicators of flow directions (e.g., Thomson and Hutton, 2004). Figure 6 shows a series of finger-like protuberances that are interpreted on the basis of industry borehole calibration in the basin to be part of a dolerite sill that has been intruded into Tertiary-aged siltstones and claystones. Because the sill has much higher seismic amplitudes than the surrounding country rock, processing software uses a technique termed “opacity rendering” to render the country rock transparent, revealing the form of the sill. The interpretation of this data set suggests that primary and secondary magma tubes feed secondary and tertiary flow units (Thomson and Hutton, 2004). Although flow direction criteria can be found in outcrops of sills, this example shows that seismic imaging can have an important future role to play in the study of magma intrusion in the upper crust. Such intrusions are of interest to the petroleum geologist because they cause contact metamorphism within adjacent sediments and may result in the expulsion of fluids. Both processes are likely to degrade associated reservoir quality.

FLUID FLOW IN SEDIMENTARY BASINS

Fluid transport pathways can be detected on some three-dimensional seismic data, at least at a macro scale, because the fluids can change the acoustic properties of the host sediments. Indeed, this geophysical response has historically been a major clue in the hunt for hydrocarbons, as geophysicists

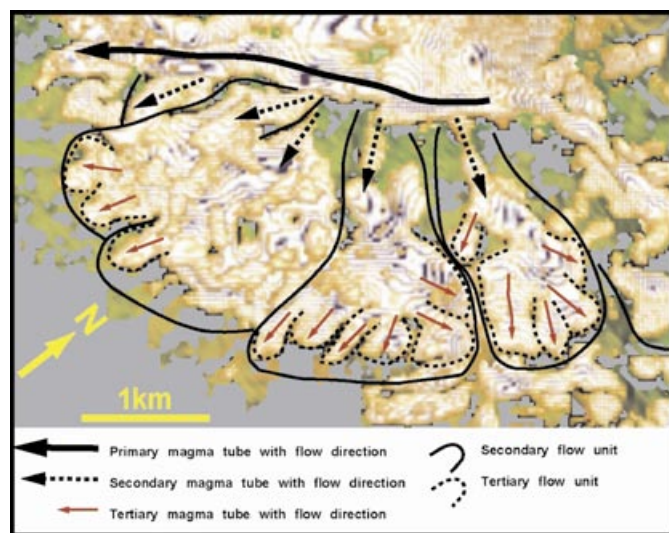


Figure 6. Plan view of a dolerite sill in which the low amplitude country rock has been made transparent (using an “opacity” technique). The fingers represent magma tubes that have hierarchical organization. Secondary magma tubes are fed from a primary magma tube. These feed secondary flow units that in turn feed the finger-like tertiary flows (after Thomson and Hutton, 2004).

have been able to use seismic “bright spots” on two-dimensional seismic data as hydrocarbon indicators (Allen and Peddy, 1993). Understanding fluid flow pathways is another theme that is critical for hydrocarbon exploration and production and has received much attention. Potential fluid flow pathways can be determined by several indirect means using three-dimensional seismic data, including the use of specialist processing. For example, the red coloration in a seismic line from a three-dimensional volume in the North Sea, UK (Fig. 7), indicates the probability of vertical discontinuities representing gas migration pathways, also known as chimneys. The fault on the left of the seismic line shows evidence of being an active gas migration pathway, whereas faults in the center of the line show no evidence of gas migration. The processing software highlights vertical disturbances in the seismic data and assesses the likelihood that they are related to fluid migration pathways. It is critical for hydrocarbon exploration to understand which potential hydrocarbon conduits are active and which are not. From an academic standpoint, this type of analysis has great value in that it can be used to show how sedimentary basins de-gas and how fluids and fluid-sediment mixes enter the atmosphere or hydrosphere. Again, seismic data is not a panacea in this regard, but a tool that can be used in conjunction with other techniques.

OTHER RESEARCH AVENUES

There are a plethora of additional avenues of research, which we have not the space to address, to which three-dimensional seismic reflection data sets have made great contributions (Cartwright and Huuse, 2005). Structural geology has benefited just as significantly as the disciplines discussed above. It is not surprising, therefore, that three-dimensional seismic data have allowed extensive study of how faults grow and link, for example (Mansfield and Cartwright, 2001; Walsh et al., 2003). It has also led to the discovery of a new type of fault system, polygonal faults, which were first recognized in three-dimensional seismic data sets from the Tertiary of

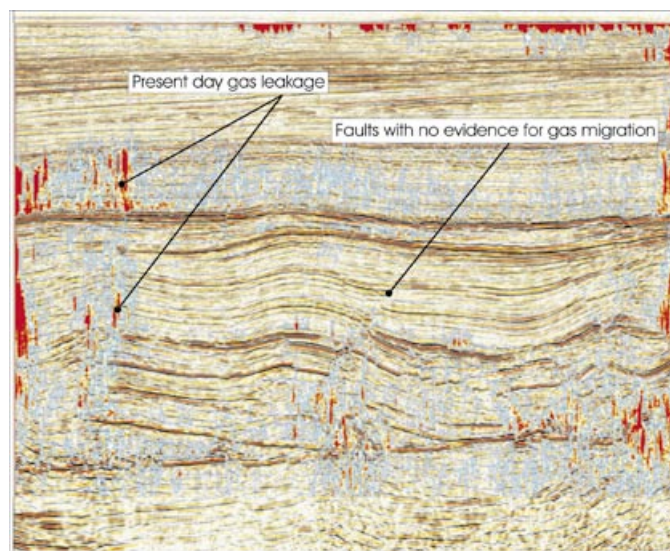


Figure 7. Image of gas migration pathways on seismic data from the North Sea, UK. Red marks gas migration pathways along faults.

the North Sea (Cartwright, 1994) and now have been recognized in many other basins worldwide (Cartwright and Dewhurst, 1998). Subsurface imaging of meteorite impact craters using three-dimensional reflection data offers new avenues for bolide impact research (Stewart and Allen, 2002) beyond the results derived from two-dimensional experiments (Morgan and Warner, 1999). For research into soft sediment deformation, numerous km-scale sediment intrusions have been revealed within the Paleogene of the North Sea, UK (e.g., Huuse et al., 2004). The subsurface plumbing of giant volcanoes is also now being elucidated (Davies and Stewart, 2005). Three-dimensional seismic reflection data have also been used to examine and further refine our understanding of plate boundaries (Davies et al., 2005). This list of opportunities will no doubt continue to grow in the next decade, particularly given the recent academic funding in the United States for a three-dimensional seismic acquisition vessel.

CONCLUSIONS

Three-dimensional seismic reflection profiling has emerged as a fundamental tool in sedimentary basin analysis. Although the processes cannot be witnessed, their products can have diagnostic geophysical attributes and three-dimensional geometry that provide important clues. The diversity of earth science disciplines benefiting from these data is increasing; however, the costs of such data remain quite prohibitive for academic research. Consequently, because most of these data are acquired by the hydrocarbon industry, academic studies will rely largely on collaboration with this industry. We are truly at the start of the scientific journey; the advances made thus far are dwarfed by future potential.

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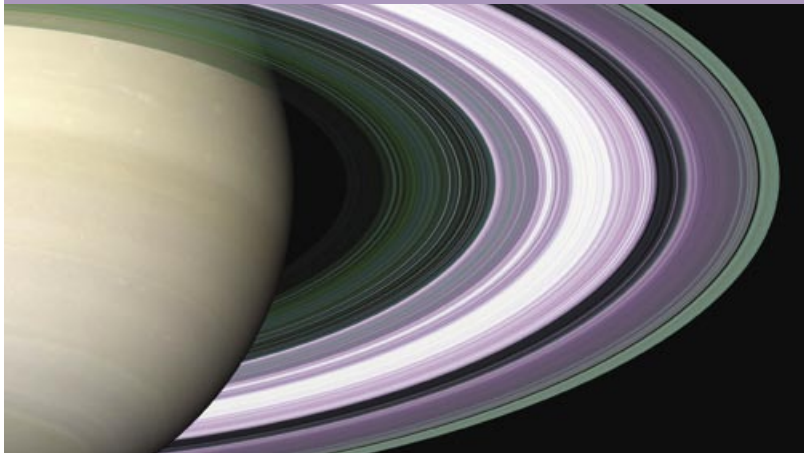


Image Courtesy of NASA/JPL

See, listen to, and ask questions of top mission scientists:

Torrence Johnson, chief scientist for the Solar System Exploration Programs Directorate at NASA's Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif.

Rosaly Lopes, principal scientist at NASA's Jet Propulsion Laboratory, lead scientist for Geophysics and Planetary Geosciences, and

investigation scientist for the Cassini Titan Radar Mapper, Pasadena, Calif.

Alfred McEwen, member of the Cassini Imaging team and professor, Department of Planetary Sciences, University of Arizona, Tucson, Ariz.

Carolyn Porco, leader of the Cassini Imaging science team and director of the Cassini Imaging Central Laboratory for Operations (CICLOPS), Space Science Institute, Boulder, Colo.

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

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

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

ACCOMMODATIONS

Hotel Registration Deadline: 28 February 2006

A block of rooms has been reserved at the Marriott Hotel at \$99 per night for 1–4 occupants. For reservations, please call the Marriott reservation line at +1-800-836-8031 and request a reservation under SE GSA 2006. The Marriott Hotel is located at 500 Hill Avenue SE in Knoxville. It's a 20-minute drive from McGhee-Tyson Airport, 45 minutes from Great Smoky Mountains National Park, and a short walk to the University of Tennessee, the Women's Basketball Hall of Fame, and the Tennessee River riverfront walk. The Marriott has high-speed

Internet capabilities, an on-site fitness center, an outdoor swimming pool, and two restaurants. Additional restaurants (Regas, Tennessee Grill, Calhoun's) are located a short walk from the hotel.

Transportation

Knoxville is located at the intersection of Interstates 75 and 40 in eastern Tennessee and has air transport through the McGhee-Tyson Airport. McGhee-Tyson receives more than 75 incoming flights a day and is served by Delta, American Eagle, United, Northwest Airlines, Continental, US Airways, and Independence Air. Car rental is available through Alamo, Avis, Budget, Enterprise, Hertz, National, and Thrifty. Taxi service is also available (~\$25 one way to the university and downtown hotels).

CALL FOR PAPERS

Abstract Deadline: 5 January 2006

Papers are invited from students and professionals for oral and poster presentations in general discipline sessions, theme sessions, and symposia. Abstracts must be submitted online at the GSA Web site, www.geosociety.org. An abstract submission fee of \$10 will be charged. Only one volunteered paper may be presented by an individual; however, a person may be a co-author on other papers. Individuals invited to participate in symposia may present an additional volunteered paper.

REGISTRATION

Standard Registration Deadline: 20 February 2006

Cancellation Deadline: 27 February 2006

GSA Headquarters will handle meeting registration, and details will be published in the December issue of *GSA Today*. Registration will also be available online at the GSA Web site, www.geosociety.org. On-site registration will be available at the Marriott Hotel during the meeting.

TECHNICAL PROGRAM

Symposia, theme sessions, and field trips scheduled as of 25 July are listed in this announcement. Additional events may be accommodated. If you are interested in proposing an additional session, please contact technical and field trip program co-chairs Robert D. Hatcher Jr., bobmap@utk.edu; Linda C. Kah, lckah@utk.edu; or Theodore C. Labotka, tlabotka@utk.edu. Updated session listings will be posted on the GSA Web site.

Symposia

1. **New Geochronologic and Isotopic Approaches to Constraining Appalachian Tectonics.** Sponsored by *GSA Structural Geology Division*. Bob Tracy, Virginia Polytechnical Institute, rtracy@vt.edu; Calvin Miller, Vanderbilt University, calvin.miller@vanderbilt.edu; Brent Miller, Texas A&M University, bvmiller@geo.tamu.edu.
2. **Frontiers of Appalachian Tectonics.** Sponsored by *GSA Structural Geology Division*. Robert D. Hatcher Jr.,

University of Tennessee at Knoxville, bobmap@utk.edu; William A. Thomas, University of Kentucky, geowat@uky.edu.

3. **Grenville Terranes of the Appalachians and their Boundaries.** Sponsored by *GSA Structural Geology Division*. Mervin J. Bartholomew, University of Memphis, jbrthlm1@memphis.edu; Carl E. Merschat, North Carolina Geological Survey, carl.merschat@ncmail.net.
4. **Impacts in the Field.** Cosponsored by *Planetary Geoscience Institute; GSA Planetary Geoscience Division*. Keith A. Milam, University of Tennessee at Knoxville, kmilam@utk.edu.
5. **Paleontological Perspectives: A Symposium in Honor of Frank K. McKinney.** Sponsored by *Paleontological Society*. Steven J. Hageman, Appalachian State University, hagemansj@appstate.edu.
6. **Symposium in Honor of Donald C. Haney.** John Kiefer, Kentucky Geological Survey, kiefer@uky.edu; James Cobb, Kentucky Geological Survey, cobb@uky.edu.

THEME SESSIONS

Oral Sessions

1. **Burial, Uplift, and Thermal History of the Appalachian Basin.** Sponsored by *GSA Structural Geology Division*. Christopher S. Swezey, U.S. Geological Survey, cswezey@usgs.gov; Elizabeth L. Rowan, U.S. Geological Survey, erowan@usgs.gov.
2. **Recent Advances in Western Blue Ridge Geology.** Sponsored by *GSA Structural Geology Division*. C. Scott Southworth, U.S. Geological Survey, ssouthwo@usgs.gov.
3. **The Brevard Fault Zone: Physical Characteristics and New Perspectives.** Randy Kath, University of West Georgia, rkath@westga.edu; John Costello, Georgia Dept. of Natural Resources, john_costello@dnr.state.ga.us.
4. **Metamorphic Framework of the Southern Appalachians.** Theodore C. Labotka, University of Tennessee at Knoxville, tlabotka@utk.edu.
5. **Geology of the Cambro-Ordovician Section of the Southern Appalachian Basin.** Gary G. Bible, Miller Petroleum, tamia@nxs.net; Jeff Bailey, Tengasco, jbailey@tengasco.com.
6. **Origin, Evolution, and Resource Utilization of Planets and Planetesimals.** Cosponsored by *Planetary Geoscience Institute; GSA Planetary Geoscience Division*. James Day, University of Tennessee at Knoxville, jday13@utk.edu; Eddy Hill, University of Tennessee at Knoxville, ehill10@utk.edu; Yang Liu, University of Tennessee at Knoxville, yangl@utk.edu.
7. **New Views on Old Rocks: Insights on Biospheric Evolution from the Precambrian Sedimentary Record.** Cosponsored by *GSA Sedimentary Geology Division; Eastern Section, Society for Sedimentary Geology (SEPM)*. Linda C. Kah, University of Tennessee at Knoxville, lckah@utk.edu; Chris Fedo, University of Tennessee at Knoxville, cfedo@utk.edu.
8. **Carbonates Then and Now: How Much Has Changed? A Session in Honor of Kenneth R. Walker.** Cosponsored by *Eastern Section, Society for Sedimentary Geology (SEPM); GSA Sedimentary Geology Division*. Bosiljka Glumac, Smith College, bglumac@email.smith.edu.
9. **Developing Approaches to Terrestrial Paleoclimatology.** Sponsored by *GSA Sedimentary Geology Division*. Claudia I. Mora, University of Tennessee at Knoxville, cmora@ut.edu.
10. **Karst Feature Distribution in the Southeastern Region.** Yongli Gao, East Tennessee State University, gaoy@etsu.edu.
11. **Surficial Geology and Geomorphology in the Appalachians: Progress and Applications.** Hugh Mills, Tennessee Tech University, hmills@tntech.edu; Mike Clark, University of Tennessee at Knoxville, clarkgmorph@utk.edu.
12. **Coastal Management and Environmental Lessons from Recent Southeastern U.S. Hurricanes.** David M. Bush, University of West Georgia, dbush@westga.edu; Robert S. Young, Western Carolina University, ryoung@wcu.edu.
13. **Contaminant Transport in Heterogeneous Porous Media.** Ed Perfect, University of Tennessee at Knoxville, eperfect@utk.edu; Larry McKay, University of Tennessee at Knoxville, lmckay@utk.edu.
14. **Paleontology, Paleoecology, and Paleoenvironments of the Gray Fossil Site, Gray, Tennessee.** Sponsored by *Paleontological Society*. Steve Wallace, East Tennessee State University, wallaces@etsu.edu; Blaine Schubert, East Tennessee State University, schubert@etsu.edu.
15. **Hands-on Ichnology and the Union Chapel Track Site.** Cosponsored by *Paleontological Society; Eastern Section, Society for Sedimentary Geology (SEPM)*. Andrew K. Rindsberg, Geological Survey of Alabama, arindsberg@gsa.state.al.us.
16. **Bringing Research into the Undergraduate Classroom.** Sponsored by *National Association of Geoscience Teachers–Southeast Section*. Ben Tanner, Western Carolina University, btanner@utk.edu.
17. **Current Status of K–12 Science Standards and Earth Science Education in the Southeast.** Cosponsored by *National Association of Geoscience Teachers–Southeast Section; GSA Southeastern Section Education Committee*. Michael A. Gibson, University of Tennessee at Martin, mgibson@utm.edu; Doug Haywick, University of Southern Alabama, dhaywick@jaguar1.usouthal.edu.
18. **Geologic Maps, Digital Geologic Maps, and Derivatives from Geologic Maps (Posters).** Sponsored by *GSA Structural Geology Division*. Ralph F. Crawford, The Geologic Mapping Institute, crawford@sprintmail.com; Michael W. Higgins, The Geological Mapping Institute, mhiggins@mindspring.com.
19. **Undergraduate Research in Watershed Assessment (Posters).** Randa Harris, University of West Georgia, rharris@westga.edu; Curtis Hollenbaugh, University of West Georgia, chollaba@westga.edu; Julie Bartley, University of West Georgia, jbartley@westga.edu.
20. **Undergraduate Research (Posters).** Sponsored by *Council for Undergraduate Research*.

Brannon Andersen, Furman University, brannon.anderson@furman.edu; Jeff Ryan, University of South Florida, ryan@chuma.cas.usf.edu.

FIELD TRIPS

Premeeting

1. **Geology of the Middle Proterozoic Basement and Younger Cover Rocks in the West Half of the Asheville 100K Quadrangle, North Carolina and Tennessee—An Updated Look.** Two days. Carl Merschat, North Carolina Geological Survey, carl.merschat@ncmail.net; Bart Cattanaach, North Carolina Geological Survey, Bart.Cattanaach@ncmail.net; Leonard Wiener, North Carolina Geological Survey, retired, thaisw@juno.com; Mark Carter, Virginia Division of Mineral Resources, mark.carter@dmme.virginia.gov.

This field trip focuses on the middle Proterozoic basement map units of the Blue Ridge Mountains of western North Carolina, northwest of Asheville. It addresses their age, mappable characteristics, and relationships with the overlying Ashe–Tallulah Falls and Ocoee Supergroup sequences. Evidence for high-grade Grenville metamorphism and subsequent Paleozoic overprinting deformations will be examined, with emphasis on the Alleghanian.

2. **Geologic Excursion across Part of the Southern Appalachian Foreland Fold-and-Thrust Belt in Northeastern Tennessee.** One day. Peter J. Lemiszki, Tennessee Division of Geology, Peter.Lemiszki@state.tn.us; Martin S. Kohl, Tennessee Division of Geology, Martin.Kohl@state.tn.us.

We will traverse the northeastern part of the Tennessee Valley and Ridge province to examine results from recent STATEMAP geologic quadrangle mapping. Stops will discuss the local structure, stratigraphy, mineral resources, and geohazards in a regional context. The trip is a great opportunity for professional geologists, academics, and teachers looking for an overview of the region's geology.

Postmeeting

3. **The Formation, Denudation, and Natural History of Mount Le Conte, Great Smoky Mountains National Park, Tennessee.** Sponsored by *National Association of Geoscience Teachers*. C. Scott Southworth, U.S. Geological Survey, ssouthwo@usgs.gov; Arthur Schultz, U.S. Geological Survey, aschultz@usgs.gov.

The trip will consist of two or three stops around Mount Le Conte that will highlight the origin of the rocks; when they were structurally deformed and metamorphosed, transported westward, and uplifted to their present position; and the processes that have contributed to the decay of these Appalachian Highlands. K–14 teachers, students, professionals, and guests are invited to participate.

4. **Diverse Mafic and Ultramafic Rock Sequences of the Central Blue Ridge Province, North Carolina–Georgia.** Jeff Ryan, University of South Florida, ryan@chuma.cas.usf.edu; Steve Yurkovich,

Western Carolina University, yurkovich@wcu.edu; Virginia Peterson, Grand Valley State University, petersvi@gvsu.edu.

The focus of the trip will be the varied mafic-ultramafic rock exposures in the south-central Blue Ridge province and their likely origins.

5. **Geotraverse: Geology of Northeastern Tennessee and the Grandfather Mountain Region.** Two days—trip will begin and end in Knoxville. Robert D. Hatcher Jr., University of Tennessee at Knoxville, bobmap@utk.edu.

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

6. **Gray Fossil Site, Gray, Tennessee.** Steve Wallace, East Tennessee State University, wallaces@etsu.edu; Blaine Schubert, East Tennessee State University, schubert@etsu.edu.

EXHIBITOR INFORMATION

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

STUDENT ACTIVITIES

Roy J. Shlemon Mentor Program in Applied Geoscience. Sponsored by *GSA Foundation*. Thurs.–Fri., 23–24 March 2006, 11:30 a.m.–1 p.m. Meeting location information available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real life issues including professional opportunities and challenges that await students after graduation. Plan to attend both free luncheons to hear different presenters each day. Students will receive FREE LUNCH tickets in their registration packet to attend both Shlemon Programs, but space is limited: first come, first served.

The John Mann Mentors in Applied Hydrogeology Program. Sponsored by *GSA Foundation*. Thurs., 23 March 2006, 5–6:30 p.m. Meeting location information available at GSA's registration desk. Karlon Blythe, kblythe@geosociety.org. This early evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with interest in applied hydrogeology or hydrology as a career to interact and network with practicing hydrogeologic professionals. This program is a focused, small-scale event that features Free Pizza for participants. Every student will receive a FREE PIZZA DINNER ticket in his or her registration

packet to attend the Mann Program, but space is limited: first come, first served.

STUDENT TRAVEL GRANTS

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

ACCOMMODATIONS FOR REGISTRANTS WITH SPECIAL NEEDS

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

ADDITIONAL INFORMATION

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

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Call for Geological Papers

2006 GSA Section Meetings

SOUTH-CENTRAL SECTION

6–7 March 2006

University of Oklahoma, Norman, Oklahoma

Abstract Deadline: 6 December 2005

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

NORTHEASTERN SECTION

20–22 March 2006

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

Abstract Deadline: 13 December 2005

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

SOUTHEASTERN SECTION

23–24 March 2006

Marriott Hotel, Knoxville, Tennessee

Abstract Deadline: 5 January 2006

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

NORTH-CENTRAL SECTION

20–21 April 2006

Student Center, University of Akron, Akron, Ohio

Abstract Deadline: 25 January 2006

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

CORDILLERAN SECTION

(Joint Meeting with PSAAPG and SPE-A)

8–10 May 2006

University of Alaska, Anchorage, Alaska

Abstract Deadline: 2 February 2006

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

ROCKY MOUNTAIN SECTION

17–19 May 2006

Western State College, Gunnison, Colorado

Abstract Deadline: 21 February 2006

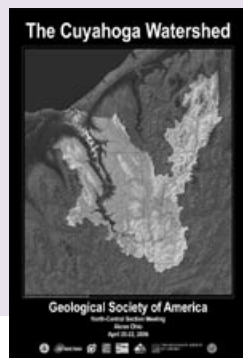
Information: Rob Fillmore, Western State College, Dept. of
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NORTH-CENTRAL

40th Annual Meeting
North-Central Section, GSA
Akron, Ohio

20–21 April 2006

[www.geosociety.org/sectdiv/
northc/06ncmtg.htm](http://www.geosociety.org/sectdiv/northc/06ncmtg.htm)



The Department of Earth and Environmental Sciences and the Office for Terrestrial Records of Environmental Change of the University of Akron, in conjunction with the Ohio Department of Natural Resources Division of Geological Survey, the Cleveland Museum of Natural History, and the Northern Ohio Geological Society, will host the 2006 Annual Meeting of the North-Central Section of the Geological Society of America. The meeting will be held Thurs.–Fri., 20–21 April, at the Gardner Student Center on the campus of the University of Akron in Akron, Ohio. Up-to-date information about meeting arrangements is available on the GSA Web site, www.geosociety.org/sectdiv/Northc/06ncmtg.htm.

ENVIRONMENT

Akron, Ohio, is located on a continental divide about 30 miles south of Lake Erie; the high upland, from which Akron derives its name, separates drainage that eventually flows to the St. Lawrence River from drainage that empties into the Mississippi River. The city is built on the Sharon Formation, the basal unit of the Pennsylvanian in the area, and is situated on the northwestern edge of the Allegheny Plateau east of the Central Lowlands.

Akron played an important role in transportation and manufacturing during the nineteenth and twentieth centuries. The Ohio & Erie Canal, employing a sequence of many locks, crossed the divide at Akron. As a consequence, the city was a major stopping point for travelers as canal boats transited the locks. Agricultural implement manufacturers took advantage of available transportation links and set up factories in the city. Quaker Oats located a major processing facility in Akron; some of you may reserve a room in one of their former grain silos, now incorporated into the Crowne Plaza Hotel. The canal competed with the railroads during the latter half of the nineteenth century until many of its locks were blown up to release waters from a powerful 1913 flood. At the turn of the century, several local entrepreneurs such as the Firestones and Goodyears took advantage of the advent of the automobile and began manufacturing tires. This prompted a wave of immigrants, causing tremendous growth of the city and a need for water that resulted in the creation of a large sur-

face-water reservoir system on the upper Cuyahoga River. The rubber industry moved south and overseas during the last quarter of the twentieth century and was succeeded by smaller polymer-based industries. The southern part of the downtown area has become a major restaurant and nightclub area over the past decade, with restored lengths of the Ohio & Erie Canal, and we hope that you take advantage of your stay to visit this area.

The valley of the lower Cuyahoga River between Akron and Cleveland remained rural until the mid-1970s when the National Park Service created what is now known as the Cuyahoga Valley National Park. This area had remained rural because of low-yield aquifers, large local relief of 200 ft, and low-permeability soils that defied septic system designs. The national park contains over 30,000 acres of wooded ravines and overgrown farmland and was the third most visited national park in the nation in 2004. Hiking trails abound; the crown jewel is the towpath trail that runs from the city limits of Cleveland, south through Akron, eventually ending near Zoar, Ohio, 30 miles south of Akron.

REGISTRATION

Standard Registration Deadline: 20 March 2006

Cancellation Deadline: 27 March 2006

GSA Headquarters will handle meeting registration. Please register online at www.geosociety.org. On-site registration will be available during the meeting at the Gardner Student Center on the University of Akron campus. Register in advance to qualify for lower rates.

STUDENT TRAVEL

The North-Central Section and the GSA Foundation have made travel assistance grants available for Student Members and Associates of GSA to attend the North-Central Section Meeting. The assistance will be offered with priority given to students presenting oral or poster papers. For more information, visit the North-Central Section Web site.

STUDENT AWARDS

Awards will be given for the best student (undergraduate and graduate) oral and poster presentations. To be eligible, students must be lead authors and presenters, and they should be capable of answering detailed questions about their research.

CALL FOR PAPERS

Abstract Deadline: 25 January 2006

If you wish to participate in a particular symposium or theme session or would like more information on these symposia and sessions, please contact one of the individuals responsible for the specific symposium or session. Symposia participants must contact the organizer(s) listed for an invitation. Volunteered papers will be considered for any general discipline session as listed on the GSA abstracts form. An

individual may be a presenter for only one volunteered paper for either a theme session or a general discipline session (symposia papers are excepted), but may co-author any number of abstracts. Abstracts for all sessions must be submitted online at www.geosociety.org/secdiv/northc/06ncmtg.htm. An abstract submission fee of \$10 will be charged. If you cannot submit your abstract electronically, contact Nancy Carlson, +1-303-357-1061, ncarlson@geosociety.org.

TECHNICAL PROGRAM

Symposia

1. **Carboniferous Sedimentology and Stratigraphy.**

Sponsored by *Great Lakes Section, Society for Sedimentary Geology (SEPM)*. Elizabeth Gierlowski-Kordesch, Ohio University, gierlows@ohio.edu; Ronald Martino, Marshall University, martinor@marshall.edu.

2. **A Tribute to the Life and Work of Barry Miller.**

Rodney Feldmann, Kent State University, rfeldman@kent.edu; Michael Tevesz, Cleveland State University, tevesz@urban.csuohio.edu.

3. **Cultural Geology: Building Stones, Gravestones, Cement, Gemstones, and Terrain.**

Sponsored by *Central Section, National Association of Geoscience Teachers*. Joseph Hannibal, Cleveland Museum of Natural History, hannibal@cmnh.org.

4. **Fractures in Ohio's Glacial Till.**

Julie Weatherington-Rice, Ohio State University, weatheringtn-rice.1@osu.edu.

5. **Glacial Geology: Sediment, Landforms, and Chronology.**

Timothy Fisher, University of Toledo, timothy.fisher@utoledo.edu; Mandy Munro-Stasiuk, Kent State University, mmunrost@kent.edu.

6. **The World Encompassed: New and Collaborative Research in Cenozoic Processes at Akron and KSU.**

Alison Smith, Kent State University, alisonjs@kent.edu; Lisa Park, University of Akron, lepark@uakron.edu.

THEME SESSIONS

1. **Biophysical Forcing of Water Quality in Large Lakes.**

Joseph Ortiz, Kent State University, jortiz@kent.edu; Donna Witter, Kent State University, dwitter@kent.edu.

2. **Biological Lake Proxies of Paleoenvironmental and Climate Change.**

Jeffrey Snyder, Bowling Green State University, jasnyd@bgnnet.bgsu.edu; Julie Wolin, Cleveland State University, j.wolin@csuohio.edu.

3. **Lakes: A Reflection of Their Watersheds.**

Dana Oleskiewicz, Ohio State University, oleskiewicz.1@osu.edu; Greg Nageotte, Ohio Department of Natural Resources, greg.nageotte@dnr.state.oh.us.

4. **Lakes and Rivers: Environmental Concerns.**

Dina L. Lopez, Ohio University, lopezd@ohio.edu; Elizabeth Gierlowski-Kordesch, Ohio University, gierlows@ohio.edu.

5. **Technology for Water Resource Management.**

Mike Angle, Ohio Department of Natural Resources, mike.angle@dnr.state.oh.us; Wayne Jones, Ohio Department of Natural Resources, wayne.jones@dnr.state.oh.us.

6. **Dam Removals as a Tool for River Restoration.**

James E. Evans, Bowling Green State University, evansje@bgsu.edu.

7. **Fate and Transport of Nitrate in Hydrologic Systems of Agricultural Watersheds.**

Mohammad Iqbal, University of Northern Iowa, m.iqbal@uni.edu; Shafiul Chowdhury, State University of New York–New Paltz, chowdhus@newpaltz.edu.

8. **Karst in Glaciated Regions.**

C. Pius Weibel, Illinois State Geological Survey, weibel@isgs.uiuc.edu; Patrick Mills, U.S. Geological Survey, pcmills@usgs.gov.

9. **Slope Stability Considerations in the Appalachian Region: Investigation, Design, and Remediation.**

Abdul Shakoor, Kent State University, ashakoor@kent.edu; Brian Greene, U.S. Army Corps of Engineers, Pittsburgh District, brian.greene@lrp02.usace.army.mil.

10. **Solid Waste Disposal and Geology.**

Lin Chyi, University of Akron, lchy@uakron.edu.

11. **Multi-Proxy Investigations of Black Shales: What Can They Tell Us?**

Sue Rimmer, University of Kentucky, srimmer@uky.edu; Harry Rowe, University of Kentucky, hrowe@uky.edu.

12. **Geoarchaeology Studies of Mounds and Earthworks in the Ohio Valley.**

David Cremeens, GAI Consultants, Inc., d.cremeens@gaiconsultants.com.

13. **Teaching and Practicing Geophysical Prospecting in Archaeology.**

Timothy Matney, University of Akron, matney@uakron.edu; Mark Schurr, University of Notre Dame, mark.r.schurr.1@nd.edu.

14. **Evaluating Student Learning in Geoscience Courses.**

Sponsored by *Central Section, National Association of Geoscience Teachers*. David Steer, University of Akron, steer@uakron.edu; David McConnell, University of Akron, damm6@uakron.edu.

15. **Issues in Geoscience Education.**

Sponsored by *Central Section, National Association of Geoscience Teachers*. Annabelle Foes, University of Akron, afoos@uakron.edu; Cinzia Cervato, Iowa State University, cinzia@iastate.edu.

16. **Climate Change, Natural Hazards, and the Teaching of Earth System Science.**

Sandra Rutherford, Eastern Michigan University, srutherford@emich.edu.

17. **Undergraduate Research in the Earth and Environmental Sciences.**

Joseph Ortiz, Kent State University, jortiz@kent.edu.

18. **Countering Creationism in the Classroom.**

Sponsored by *Central Section, National Association of Geoscience Teachers*. Patricia Princehouse, Case Western Reserve University, evolution@case.edu.

19. **Recent Advances in Systematics, Evolution, and Paleobiology of Fossil Vertebrates.**

Darin Croft, Case Western Reserve University, dcroft@case.edu; Michael Ryan, Cleveland Museum of Natural History, mryan@cmnh.org.

20. **Fossils of Ohio: A Century after Newberry.**

Lisa Park, University of Akron, lepark@uakron.edu.

21. **Using Biogeochemistry to Solve Paleontological and Geologic Problems.**

David Goodwin, Denison University, goodwind@denison.edu.

22. **Carbon Dioxide Sequestration: From Surface to Subsurface and All Points in between: Terrestrial, Geologic, and Applications.** Ernie R. Slucher, Ohio Geological Survey, ernie.slucher@dnr.state.oh.us.
23. **Undergraduate Research Poster Session.** Sponsored by *Council on Undergraduate Research, Geoscience Division*. Robert D. Shuster, University of Nebraska–Omaha; David J. Matty, Central Michigan University; Karen Fryer, Ohio Wesleyan University.

FIELD TRIPS

For further information regarding these field trips, please contact the field trip leader(s) indicated below, or the field trip chair, Joe Hannibal +1-216-231-4600 ext. 3233, hannibal@cmnh.org. All trips will leave from the University of Akron's Gardner Student Center at 8 a.m. and return to the Student Center at 6 p.m. on the day indicated.

Premeeting

1. **Geologic Setting and Processes along Lake Erie from Fairport Harbor to Sandusky, Ohio.** Two-day trip, Tues.–Wed., 18–19 April. Donald Guy, Ohio Division of Geological Survey, +1-419-626-4296, don.guy@dnr.state.oh.us, and Laura Moore, Oberlin College.
2. **The Geology and Hydrology of Gorge Metro Park, Cuyahoga Falls, Ohio.** One-day trip, Wed., 19 April. Annabelle Foss, University of Akron, +1-330-972-7991, afoos@uakron.edu.
3. **Guide to the Building Stones and Cultural Geology of Akron.** One-day trip, Wed., 19 April. Joe Hannibal, Cleveland Museum of Natural History, +1-216-231-4600 ext. 3233, hannibal@cmnh.org.
4. **Hydrogeologic Setting and Design of a Sanitary Landfill: American Landfill, Stark County, Ohio.** One-day trip, Wed., 19 April. Mohammed Ali, Waste Management, +1-330-575-4329, mali1@wm.com.

Postmeeting

5. **Quaternary Geology of the Interlobate Area between the Cuyahoga and Grand River Lobes, Northeastern Ohio.** One-day trip, Sat., 22 April. John P. Szabo, University of Akron, +1-330-972-8039, jpszabo@uakron.edu.
6. **Surface Water Hydrology of The Wilds, a Reclaimed Surface Mine, Southeastern Ohio.** One-day trip, Sat., 22 April. Stephen Van Horn, Muskingum College, +1-740-826-8306, svanhorn@muskingum.edu.
7. **Classic Cleveland Shale Localities in the Cleveland, Ohio, Area.** One-day trip, Sat., 22 April. Joe Hannibal, Cleveland Museum of Natural History, +1-216-231-4600 ext. 3233, hannibal@cmnh.org; Susan M. Rimmer, University of Kentucky; Robert K. Carr, Ohio University; Philip O. Banks, Case Western Reserve University.

WORKSHOPS AND STUDENT ACTIVITIES

1. **Roy J. Shlemon Mentor Program in Applied Geoscience.** Sponsored by *GSA Foundation*. Thurs.–Fri.,

20–21 April, 11:30 a.m.–1 p.m., Student Union, Room 335. Karlon Blythe, kblythe@geosociety.org. Lunch provided. This interactive and informative program for undergraduate and graduate students, led by professional geoscientists, will cover real life issues including professional opportunities and challenges that await students after graduation. Plan to attend both free luncheons to hear different presenters each day. Students will receive FREE LUNCH tickets in their registration packet to attend both Shlemon Programs, but space is limited: first come, first served.

2. **The John Mann Mentors in Applied Hydrogeology Program.** Sponsored by *GSA Foundation*. Thurs., 20 April, 5–6:30 p.m. Student Union, Room 335. Karlon Blythe, kblythe@geosociety.org. This early evening event presents mentoring opportunities for undergraduate and graduate students and recent graduates with interest in applied hydrogeology or hydrology as a career to interact and network with practicing hydrogeologic professionals. This program is a focused, small-scale event that features Free Pizza for participants. Every student will receive a FREE PIZZA DINNER ticket in his or her registration packet to attend the Mann Program, but space is limited: first come, first served.
3. **Teaching Evolution in the K–12 Classroom.** Sponsored by *Central Section, National Association of Geoscience Teachers*. Saturday, 22 April, 9 a.m.–4 p.m., Pamela Keiper, Cleveland Museum of Natural History, pkeiper@cmnh.org. Classroom techniques for teaching the basic concepts of evolution and the diversity of life throughout the K–12 curriculum.

EXHIBITS

Booth and table space will be available in Ballrooms A & B of the Gardner Student Center adjacent to the poster sessions. Contact John Peck, Department of Earth and Environmental Sciences, University of Akron, +1-330-972-7659, jpeck@akron.edu.

ACCESSIBILITY

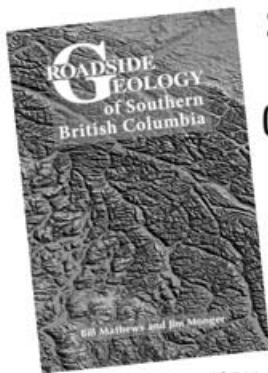
GSA is committed to making its meetings accessible to all people interested in attending. Please indicate special requirements (wheelchair accessibility, etc.) on the registration form. The Gardner Student Center is ADA compliant.

ADDITIONAL INFORMATION

Requests for additional information should be addressed to the general chair, John Szabo, +1-330-972-8039, jpszabo@uakron.edu. Technical program questions should be addressed to Lisa Park, +1-330-972-7633, lepark@uakron.edu, or Ira Sasowsky, +1-330-972-5389, ids@uakron.edu, Department of Earth and Environmental Sciences, University of Akron, Akron, OH 44325-4101, USA.

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Do YOU Know

about the John Mann Mentors in Applied Hydrogeology Programs?

Karlon Blythe, Program Officer

The John Mann Mentor Programs provide a forum for undergraduate and graduate students interested in hydrogeology or hydrology as a career to participate in informal conversation with professionals currently practicing in these fields. These programs, held at GSA Section Meetings, are relaxed, small-scale, focused events. They also include a free meal for all participants.

Two pilot sessions for this GSA Mentor Program were run at the 2004 Section Meetings; the program was then tweaked for the sessions held at the 2005 Section Meetings. At roundtables, students and professionals chat about careers in hydrogeology and hydrology, network over free dinners, and leave the events expressing feelings of both personal and professional growth. New friendships are made—and to the students' great good fortune—professional contacts are established for their future.

The growing success of the John Mann Mentors in Applied Hydrogeology Program was evident in the sessions held at the 2005 Section Meetings. Each GSA Section Meeting featured one session of the Mann Mentor Program; all of the programs were well attended, and over all six sessions, 118 students and 32 mentors participated.

Students' comments about the Mann Mentor Programs are thoughtful, reflective, and appreciative:

- "It was great to get a feeling of what industry is doing and what they hope to find in recent graduates or new hires."
- "I appreciate the opportunity to develop new relationships with industry professionals and to improve my networking skills."
- "I wanted to see what the job market is to check that what I'm studying is applied in the real world. I liked that the mentors talked about what they are doing in their everyday jobs."
- "These Mentors were extremely helpful, encouraging, and inspiring. They were clearly still enamored with and excited by their work—that's a good sign."
- "I really liked hearing about how the mentors went about getting to where they are today. I would like to be a mentor someday!"

If you are interested in participating as a mentor at a GSA 2006 Section Meeting, please contact Karlon Blythe, kblythe@geosociety.org.

The John Mann Mentors in Applied Hydrogeology Program gratefully acknowledges these mentors for their individual gifts of time and for sharing their insight with GSA's student members.

CORDILLERAN SECTION

Michael Clark

Kleinfelder, Inc.
San Jose, Calif.

Sue Mattenberger

U.S. Fish and Wildlife
Service
Klamath Falls, Ore.

Keri Murch

Environmental
Resolutions, Inc.
Petaluma, Calif.

Belinda Price

Shaw Environmental &
Infrastructure, Inc.
Knoxville, Tenn.

Scott Warner

Geomatrix
Oakland, Calif.

NORTHEASTERN SECTION

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Benjamin B. Greeley

Pennsylvania Dept. of
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Norristown, Pa.

Scott M. Hulseapple

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Mary Passaretti

Aztech Technologies, Inc.
Saratoga Springs, N.Y.

Stephen J. Rossello

Parsons
Liverpool, N.Y.

Stephen J. Urbanik
New Jersey Dept. of
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Trenton, N.J.

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Minnesota Pollution Control
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Dennis L. Schubbe
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Timothy W. Thurnblad
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Agency
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Ray Wuolo
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Bureau of Land Management
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U.S. Environmental
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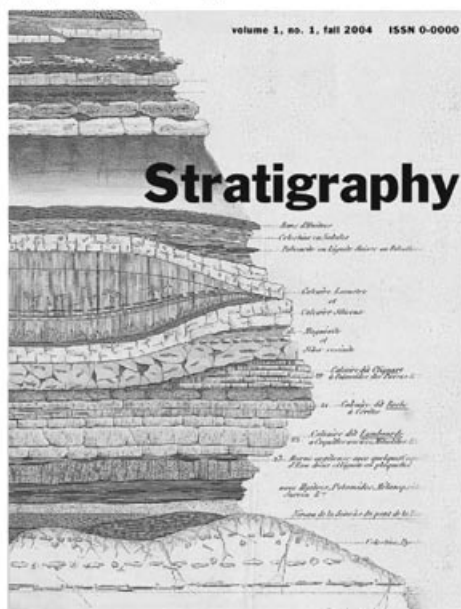
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Backbone of the Americas—Patagonia to Alaska is a GSA specialty meeting co-convened with the Asociación Geológica Argentina. The principal themes are ridge collision, shallow subduction, and plateau uplift along the Americas. Field trips are planned to Patagonia, the Chilean flat-slab, or Central Andean Puna plateau before and after the meeting. Suzanne Kay and Victor Ramos are meeting co-chairs.

Co-convened by:



Asociación Geológica
Argentina



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OF AMERICA

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Early Bird registration through
20 Nov. 2005

BACKBONE OF THE AMERICAS

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

What Happens at the Shlemon Mentor Programs?

P.S.: Students, don't miss an opportunity to attend one!

Karlon Blythe, Outreach Program Officer

If you've attended a GSA Section Meeting within the past six years, you've probably witnessed a growing line of students waiting outside a meeting room marked at lunchtime with a sign that says "Shlemon Mentor Program—FREE Lunch for Students."

Every student registered for GSA Section Meetings gets a free ticket to the Shlemon Mentor Program. The drill is the same at every meeting: When the doors to the meeting room open at 11:30 a.m., the patient students wishing to attend count off so that they can be matched up to the number of free lunches available. In the door they go to pick up their boxed lunches and soft drinks and then take their seats at round, banquet-sized tables where mentors are waiting for them. After announcements and introductions, the one-on-one discussions between students and mentors begin. The room comes alive with the buzz of conversation and laughter. The enthusiastic mentors come prepared for a variety of questions from the students—and they are never disappointed.

During the course of the hour-and-a-half luncheon meeting, the mentors are rotated from table to table so that all the students get to meet all the mentors in attendance. At the end of the event, the students leave the luncheon with a list in hand of mentor contact information, which is provided in case they want to do some personal follow-up with select mentors.

These popular Shlemon Programs, supported by the GSA Foundation through an endowed gift from Roy J. Shlemon, are designed to extend the mentoring reach of individual professionals from applied geology to undergraduates and graduate students attending GSA Section Meetings. Comments on the student evaluation forms clearly demonstrate that this process is working:

- "Interesting to hear from a variety of professionals about what they do now and HOW they got there!! Great insight."
- "I was pleasantly surprised by how informative and personal this program was. I wish we had more time with them."
- "What I took away from the meeting was an understanding of expectations in the field and other requirements. Also, I got an idea of what kind of work they do and it made me think about which route I want to go in geology."

Mentors also had comments:

- "Golly, I wish someone had told me when I was in school the things I can now share with these students."
- "The students' questions were thought-provoking. And, they made me realize what a satisfying job I've got. I'd like to do this again!"

The 2005 season of Roy J. Shlemon Mentor Programs in Applied Geoscience was outstanding. All six GSA Sections participated in the Shlemon Programs, and connections were made that resulted in part-time or full-time positions for half a dozen or more students.

In 2005, program funds provided free box lunches to 305 students and 77 mentors. Three mentors graciously volunteered to participate in more than one session, thus boosting mentor experiences to 80 mentors to 305 students, a commendable 1:4 ratio. These volunteer mentors, from private and public businesses and government agencies, represented a broad range of backgrounds, education, experience, and expertise.

If you are interested in participating as a mentor at a GSA 2006 Section Meeting, please contact Karlon Blythe, kblythe@geosociety.org.

The Roy J. Shlemon Mentor Program in Applied Geoscience gratefully acknowledges the following mentors for their individual gifts of time and for sharing their insight with GSA's student members during the 2005 GSA Section meetings:

CORDILLERAN SECTION

Jacqueline Bott

California Geological Survey
San Francisco, Calif.

John P. Franklin

Geosols, Inc.
San Diego, Calif.

Joseph T. Hannibal

Cleveland Museum of Natural History
Cleveland, Ohio

Jere Jay

INNEX Energy, LLC
Plano, Tex.

Mark J. Johnsson

California Coastal Commission
San Francisco, Calif.

John Karachewski

Weiss Associates at LLNL
Walnut Creek, Calif.

Belinda Price

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Robert Rocky Reifentstahl

Alaska Div. of Geological and Geophysical Surveys
Fairbanks, Alaska

Lew Rosenberg

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Tijeras, N.Mex.

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Marjorie Hollis Gale

Vermont Geological Survey
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Neal C. Grasso

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DiGioia, Gray and
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2006 GSA Awards and Medals

Penrose Medal

The Penrose Medal was established in 1927 by R.A.F. Penrose Jr. to be awarded in recognition of eminent research in pure geology, for outstanding original contributions, or for achievements that mark a major advance in the science of geology. The award is made only at the discretion of the GSA Council; nominees may or may not be members of the Society. Penrose's sole objective in making the gift was to encourage original work in purely scientific geology, which is interpreted as applying to all scientific disciplines represented by the Society. Scientific achievements should be considered rather than contributions in teaching, administration, or service. Mid-career scientists who have already made exceptional contributions should be given full consideration for the award.

Day Medal

The Day Medal was established in 1948 by Arthur L. Day to be awarded annually at the discretion of GSA Council, for outstanding distinction in contributing to geologic knowledge through the application of physics and chemistry to the solution of geologic problems. Day's intent was to recognize outstanding achievement and inspire further effort rather than reward a distinguished career. Scientific achievements should be considered rather than contributions in teaching, administration, or service.

Young Scientist Award (Donath Medal)

The Young Scientist Award was established in 1988 to be awarded to a young scientist (35 or younger during the year in which the award is to be presented) for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences. The award, consisting of a gold medal and a cash prize of \$20,000, was endowed by Dr. and Mrs. Fred A. Donath. *For 2006, only those candidates born on or after 1 January 1971 are eligible for consideration.*

The Penrose, Day, and Donath funds are maintained by GSA Foundation.

Honorary Fellows

The GSA Council established Honorary Fellowship in 1909, and since then, except during a few war years, one or more Honorary Fellows have been elected annually. At present, there are 67 living geologists who have received this honor.

Honorary Fellowship may be bestowed on individuals who have lived and developed their careers outside

of North America and who have made outstanding and internationally recognized contributions to our science, or in rare circumstances, provided notable service to the Society. Under exceptional circumstances, North Americans have been named Honorary Fellows. This amendment to the bylaws was made in 1969 when the Apollo II astronauts who first walked on the Moon were elected.

The GSA Council encourages members to submit names of qualified candidates for this honor. In preparing a nomination, it is imperative that the original research and scientific advances of the candidate be stressed. The nominator should also verify all supporting data, especially degrees received, publications, positions held, etc.

How to Nominate

(Penrose, Day, Donath, and Honorary Fellows)

To ensure thorough consideration by the respective committees, please follow these nomination instructions carefully; additional information supplied will not enhance the nomination. Paper submissions will still be accepted; however, we encourage electronic submission.

For each candidate, please submit the following:

1. **Nomination form**, to be filled out online or on paper. Please go to www.geosociety.org/aboutus/awards/nominations.htm to submit the form online or to download a paper version to be submitted via post.
2. **Supporting documents**, to be submitted by e-mail attachment or via post. Each award requires the submission of supporting documents. For the above four medals and awards, the following are required:
 1. A brief biographical sketch, such as used in *American Men and Women of Science* and *Who's Who in America*.
 2. A **summary** (200 words or less) of the candidate's scientific contributions to geology that qualify the individual for the award.
 3. A **selected** bibliography of no more than 20 titles. For the Donath Medal, only 10 titles are required.
 4. Signed letters from each of five GSA Fellows or Members **in addition** to the person making the nomination.

The names of unsuccessful candidates proposed to the Council by the respective committees will remain for consideration by those committees for three years. For those still under consideration, it is recommended that an updated nomination letter be sent to GSA.

The deadline for receipt of all medal, award, and recognition nominations is 1 February 2006



2006 GSA Awards and Medals

GSA Public Service Award

GSA Council established the GSA Public Service Award in honor of Eugene and Carolyn Shoemaker in 1998 to be awarded for contributions that have materially enhanced the public's understanding of the earth sciences or significantly served decision makers in the application of scientific and technical information in public affairs and public policy related to the earth sciences. This may be accomplished by individual achievement through:

- authorship of education materials of high scientific quality that have enjoyed widespread use and acclaim among educators or the general public;
- acclaimed presentations (books and other publications, mass and electronic media, or public presentations, including lectures) that have expanded public awareness of the earth sciences;
- authorship of technical publications that have significantly advanced scientific concepts or techniques applicable to the resolution of earth-resource or environmental issues of public concern; or,
- other individual accomplishments that have advanced the earth sciences in the public interest.

The award will normally go to a GSA member, with exceptions approved by Council. It may be presented posthumously to a descendant of the awardee.

How to Nominate

Paper submissions will still be accepted; however, we encourage electronic submission.

1. **Nomination form**, to be filled out online or on paper. Please go to www.geosociety.org/aboutus/awards/nominations.htm to submit the form online or to download a paper version to be submitted via post.
2. **Supporting documents**, to be submitted by e-mail attachment or via post.
 1. A letter of nomination (200 words or less).
 2. A brief biographical sketch (clearly demonstrating applicability to the selection criteria listed above).
 3. A selected bibliography of no more than 10 titles.

This award is funded by GSA Foundation.

GSA Distinguished Service Award

GSA Council established the GSA Distinguished Service Award in 1988 to recognize individuals for their exceptional service to the Society. GSA Members, Fellows, Associates, and employees may be nominated for consideration. Any GSA Member or employee may make a nomination for the award. The Executive Committee will select awardees, and the Council must ratify all selections. Awards may be made annually, or less frequently, at the discretion of Council. This award will be presented during the Annual Meeting of the Society.

How to Nominate

Paper submissions will still be accepted; however, we encourage electronic submission.

1. **Nomination form**, to be filled out online or on paper. Please go to www.geosociety.org/aboutus/awards/nominations.htm to submit the form online or to download a paper version to be submitted via post.
2. **Supporting documents**, to be submitted by e-mail attachment or via post.
 1. A letter of nomination summarizing the candidate's contributions to the Society (200 words or less).
 2. A brief biographical sketch (clearly demonstrating applicability to the selection criteria listed above).

All nomination forms and submission instructions are available on the GSA Web site, www.geosociety.org/grants/. A nomination form and instructions may also be obtained from the Program Officer, Grants, Awards, and Recognition, +1-303-357-1028, awards@geosociety.org.

The deadline for receipt of all medal, award, and recognition nominations is 1 February 2006



2006 GSA Awards and Medals

Subaru Outstanding Woman in Science Award

(Sponsored by Subaru of America, Inc.)



The Subaru Outstanding Woman in Science Award was created to recognize a woman who has had a major impact on the field of the geosciences based on her Ph.D. research. The generous support of Subaru of America, Inc., in conjunction with the Doris M. Curtis Fund, makes this award possible. Doris Curtis was GSA's 103rd president. Her popularity was widespread, and she pioneered many new directions for geology, not the least of which was her tenure as GSA president after an unbroken chain of 102 men. Causes dear to her were women, public awareness, minorities, and education.

Women are eligible for the first three years following their degree. The 2006 award will be \$2,500, and it will be presented at the 2006 GSA Annual Meeting.

The award recipient for 2005, Michelle A. Walvoord, will be honored at the President's Student Breakfast at the GSA Annual Meeting in Salt Lake City on Sunday, 16 October, for her thesis work, "A unifying conceptual model to describe water, vapor, and solute transport in deep arid vadose zones."

How to Nominate

Paper submissions will still be accepted; however, we encourage electronic submission.

1. **Nomination form**, to be filled out online or on paper. Please go to www.geosociety.org/aboutus/awards/nominations.htm to submit the form online or to download a paper version to be submitted via post.
2. **Supporting documents**, to be submitted by e-mail attachment or via post.
 1. A letter of nomination that clearly states how the Ph.D. research has impacted the geosciences in a major way (200 words or less).
 2. A brief biographical sketch (clearly demonstrating applicability to the selection criteria listed above).
 3. A selected bibliography of no more than 10 titles.
 4. Dissertation title and abstract.

GSA Fellowship

Fellowship is an honor that is bestowed on the best of our profession once each year at the GSA Spring Council meeting. **If you are a GSA Fellow, please review the following for updated instructions and deadlines:** A GSA Fellow may only support two nominees per election cycle, but only once as the primary nominator. A GSA Member may not be a primary nominator, but may be a secondary nominator for no more than two nominees per election cycle.

How to Nominate

Paper submissions will still be accepted; however, we encourage electronic submission.

1. **Nomination form**, to be filled out online or on paper. Please go to www.geosociety.org/members/fellow.htm#guidelines to submit the form online or to download a paper version to be submitted via post.
2. The following supporting documents will be required from the **primary nominator** (in addition to the online nomination form):
 1. A letter of nomination including a summary of the nominee's significant contributions supporting the selected criteria for election (up to one page).
 2. A curriculum vitae of the nominee.
 3. A paragraph stating the total number of publications and a selected bibliography of the nominee (up to four pages.)
3. The following supporting documents will be required from each of the **secondary nominators**:
 1. One supporting letter of nomination.

Nomination deadline: 1 February 2006.

Errata:

In the July issue of *GSA Today* it was incorrectly noted that **Carol Evenchick**, a newly elected GSA Fellow, was Macdonald Professor of Volcanology at the University of Hawaii. Evenchick is a research scientist at the Geological Survey of Canada. GSA regrets the error.

The deadline for receipt of all medal, award, and recognition nominations is 1 February 2006



John C. Frye Environmental Geology Award

In cooperation with the Association of American State Geologists (AASG), GSA makes an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys. The award is a \$1,000 cash prize from the endowment income of the GSA Foundation's John C. Frye Memorial Fund.

Criteria for Nomination

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

Basis for Selection

Each nominated paper will be judged on its uniqueness or significance as a model of its type of work and report and its overall worthiness for the award. In addition, nominated papers must establish an environmental problem or need,

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

2005 Award Recipients Named

The 2005 award will be presented at the GSA Annual Meeting in Salt Lake City to Carol L. Ruthven, John D. Kiefer, Stephen F. Greb, and William M. Andrews Jr. for *Geologic Maps and Geologic Issues in Kentucky: A Citizen's Guide*, 2003, University of Kentucky Special Publication 3, Kentucky Geological Survey.

Nominations must be sent to Program Officer, Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA. **Deadline: 31 March 2006.**

National Awards for 2008

Nominations for the national awards described below are being solicited for 2008. GSA members are invited to nominate colleagues by sending background information and vitae, specifying the award for which the candidate is being submitted, to Program Officer, Grants, Awards, and Recognition, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, +1-303-357-1028, fax +1-303-357-1070, or e-mail to awards@geosociety.org. **Deadline: 30 April 2006.**

On behalf of its member societies, the American Geological Institute (AGI) coordinates the nomination process. The AGI Member Society Council will finalize a roster of candidates at its spring 2006 meeting for nomination to the respective offices sponsoring the national awards.

The **William T. Pecora Award**, sponsored jointly by the National Aeronautics and Space Administration and the U.S. Department of the Interior, is presented annually in recognition of outstanding contributions of individuals or groups toward the understanding of Earth by means of remote sensing. The award recognizes contributions of those in the scientific and technical community as well as those involved in the practical application of remote sensing. Consideration will be given to sustained or single contributions of major importance to the art or science of understanding Earth through observations made from space.

The president of the United States awards the **National Medal of Science** to individuals "deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, engineering, or social and behavioral sciences." There are now many younger

American scientists and engineers who may be reaching a point at which their contributions are worthy of recognition. The committee is giving increasing attention to these individuals as well as to those outstanding women and minority scientists who deserve recognition.

The **Vannevar Bush Award** is presented from time to time to a person who, through public service activities in science and technology, has made an outstanding contribution toward the welfare of mankind and the nation. The award is given to a senior statesman of science and technology and complements the National Science Foundation's Alan T. Waterman Award, which is given to a promising young scientist. The two awards are designed to encourage individuals to seek the highest levels of achievement in science, engineering, and service to humanity. The nomination should be accompanied by a complete biography and a brief citation summarizing the nominee's scientific or technological contributions to our national welfare in promotion of the progress of science.

The **Alan T. Waterman Award** is presented annually by the National Science Foundation (NSF) and National Science Board to an outstanding young researcher in any field of science or engineering supported by the NSF. Candidates must be U.S. citizens or permanent residents and must be 35 years of age or younger, OR not more than five years beyond receipt of the Ph.D. degree by 31 December of the year in which they are nominated. Candidates should have completed sufficient scientific or engineering research to have demonstrated, through personal accomplishments, outstanding capability, and exceptional promise for significant future achievement.

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Changes to GSA Graduate Student Research Grant Eligibility

GSA's student research grant program works to maintain a high level of support for students and to award grants to nearly 50% of applicants. To sustain and surpass these efforts and to open up funding for new GSA Student Members, we have modified the eligibility for receiving grant funds. Students may now only receive GSA graduate student research grant money *once* at the Master's level and *once* at the Ph.D. level. Grant applicants who do not receive funding are always welcome to reapply.

Please see www.geosociety.org/grants/gradgrants.htm for further details. The 2006 online application system will be available by mid-November 2005 and online applications will be due by Wed., 1 February 2006, at 11:59 p.m. (MST)

Beginning 2006

Call for Applications

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

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

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

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

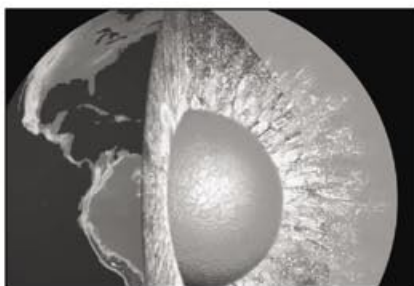
If you possess this professional background, have experience in applying scientific knowledge to societal challenges, and share a passion for helping shape the future of the geoscience profession, GSA invites your application.

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

Deadline to apply: 1 February 2006

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

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PENROSE CONFERENCE REPORT

Kinematics and Geodynamics of Intraplate Dextral Shear in Eastern California and Western Nevada

21–26 April 2005

Mammoth Mountain Inn, Mammoth Lakes, California

Conveners:

Jeffrey Lee, Department of Geological Sciences, Central Washington University, Ellensburg, Washington, USA

Daniel Stockli, Geology Department, University of Kansas, Lawrence, Kansas, USA

Christopher Henry, Nevada Bureau of Mines and Geology, University of Nevada, Reno, Nevada, USA

Timothy Dixon, Marine Geology & Geophysics Division, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida, USA

This conference provided a forum to discuss the range of geological and geophysical datasets from the eastern California shear zone (ECSZ) and Walker Lane belt (WLB) that bear on how intraplate deformation is accommodated and how to integrate the data into a comprehensive, spatially and kinematically coherent view of intraplate deformation through time. The session goals were to discuss what we know about deformation in this region at a range of spatial and temporal scales, how to integrate the longer temporal view provided by geologic data with the instantaneous present-day view provided by geodetic and geophysical data, what geomorphic tools can be used to link geodetic and geologic fault slip rate data, whether magmatism and faulting are linked, the geodynamic hypotheses proposed for the evolution of the region, and the uncertainties associated with interpretations. The conference brought together 68 researchers, including 17 graduate students and four international participants, from academia, the U.S. Geological Survey, industry, and the U.S. Nuclear Regulatory Commission.

The conference opened with evening overviews on the plate tectonic setting of western North America by Tanya Atwater and the geologic setting of the United States Cordillera by Brian Wernicke. Atwater summarized how plate motions are determined via rigid plate circuit recon-

structions and noted that these reconstructions show a change in Pacific–North America relative plate motion ca. 8 Ma. She illustrated these global plate motions, as well as Pacific–North America plate motions, via a series of computer animations. The Pacific–North America plate motion animations highlighted the kinematically coordinated links among plate motions and continental tectonics. Wernicke's presentation summarized a new tectonic reconstruction for southwestern North America that shows that the Sierra Nevada–Great Valley block has moved ~235 km N78°W with respect to the Colorado Plateau since ca. 16 Ma. He also highlighted transient deformation recorded in geodetic data collected across the Basin and Range and suggested that a “megadetachment” at the base of the crust is one possible explanation for these transient deformations.

The first full day of the conference was a field trip to view evidence for active dextral, normal, and sinistral fault slip, as well as contraction and the kinematics of fault slip transfer in the ECSZ/WLB. The field trip, led by Jeff Lee and Danny Stockli, visited sites along the White Mountains fault zone, Queen Valley fault system, and the Coaldale fault. The evening was dedicated to posters on the geology of the eastern California shear zone. Poster topics ranged from the transition from extension to transtension in Panamint Valley by Joe Andrew to testing geodesy from fault slip rates in the Mojave Desert by Mike Oskin.

Sessions during the second full day of the conference concentrated on the geology and geodesy of the ECSZ and WLB. Rick Bennett discussed geodetic deformation rates across the ECSZ. Doug Walker focused on the mismatch between geologically determined rates for individual faults versus geodetic rates and orientation, style, and geometry of deformation in close proximity of the Garlock fault. John Oldow combined data from the GPS velocity field, seismicity, and tectonic boundaries to argue for contractional strain during transtension to produce displacement partitioning in the southern WLB. Jim Faulds discussed the kinematics of active faulting in the northern WLB and proposed that the WLB was propagating northward as part of the development of an incipient transform plate boundary. The evening was dedicated to posters on regional and Walker Lane belt geology. Poster topics ranged from Basin and Range normal faulting in southeastern Oregon by Kaleb Scarberry to comparing the evolution of the ECSZ/WLB to the proto-gulf of California by Paul Umhoefer.

The third day of sessions focused on two topics: a morning session on the links among climate, tectonics, and geomorphology and an afternoon session on the interplay between magmatism and tectonics. Kelin Whipple and Eric Kirby emphasized that tectonic geomorphology provides information on intermediate time scale rates and thereby the link between geodetic and geologic rates, noting that tectonic processes can be inferred from topographic observations. Whipple and Kirby discussed the use of drainage knickpoints and channel gradients to elucidate relative rates of rock uplift histories. Each provided an example of the use of this geomorphic tool from a different tectonic setting—the San Gabriel Mountains and the eastern side of the Inyo Mountains. Subsequent discussion focused on



these topics and geochronologic techniques applicable to Quaternary time scales. Allen Glazner began the afternoon session with the interplay between magmatism and tectonics by showing an animation of the spatial and temporal distribution of magmatism in the western United States using ~26,000 data points in the NAVDAT (navdat.geongrid.org) data set. Obvious magmatic patterns included a Pliocene mafic magmatic event in the Sierra Nevada and eastern California; the southward dying-out of silicic volcanism in Nevada; 12–0 Ma westward migration of magmatism from western Nevada, through Death Valley to Owens Valley; and magmatism circumnavigating the southern edge of the Colorado Plateau. Chris Henry and his colleagues argued that complex interactions between basement structures, including Mesozoic faults and batholiths and the Cenozoic caldera belt, and magmatic heating by the ancestral Cascade arc focused dextral shear in the western Great Basin. For example, the southwestern limit of a NW-striking, 100- to 200-km-wide caldera belt through central Nevada parallels the northeastern edge of the WLB, including the right step at the Mina deflection. This simple observation led to much discussion about its tectonic significance. That evening, we reconvened for a poster session on geodynamics, geophysics, reconstructions, and volcanism. Topics ranged from an animation showing a strain-compatible kinematic model of deformation in the western Cordillera during the past 36 m.y. by Nadine McQuarrie to mass flux in the continental crust by Dennis Harry to the geodynamic driving forces for the uplift of the Sierra Nevada by Craig Jones.

The last morning session of the conference centered on the geodynamic evolution of the ECSZ/WLB. Kevin Furlong discussed the relationship between geological and geophysical observations. In particular, he raised some important questions, including can geology/geodesy discrepancies provide us with important physical information on the crust and lithosphere?—what role does rheology play in localization of strain?—are elastic layer over viscoelastic halfspace models an appropriate model for ECSZ? Subsequent discussions centered on whether the upper crust is dragging the mantle or visa versa, and what is the best approach to use geologic and geophysical observations to produce a physically comprehensive model of driving forces. Gene Humphreys followed with a geodynamic talk that encompassed nearly the entire western United States and discussed the relative roles of grav-

itational potential energy, boundary forces, and basal forces to localization and development of deformation. In the afternoon, participants rode the gondola to the top of Mammoth Mountain where Wes Hildreth provided an impromptu geologic tour of the greater Mammoth Mountain, Long Valley caldera, and Inyo Craters region. The conference ended with a discussion, lead by Tim Dixon, on the topic “Where do we go from here?” Unresolved issues, many remaining from the framework questions proffered by the conveners, include discrepancies between geologic and geodetic rates, the timing of initiation and character of intraplate deformation, the influence of magmatism on tectonics, and whether the ECSZ/WLB will evolve to become the sole boundary between the Pacific and North American plates.

Registration and logistics at the conference venue went very smoothly. Thanks to the Geological Society of America’s Penrose Fund and the National Science Foundation for partially supporting the conference. The conference was a great success because keynote speakers provided stimulating presentations, moderators and recorders admirably kept the discussions going smoothly, and the attendees willingly shared their research and interpretations and contributed thought-provoking questions, comments, and discussions.

Participants

Ernie Anderson
Thomas Anderson
Joseph Andrew
Tanya Atwater
Steve Bacon
Rick Bennett
Byron Berger
Ross Black
John Casteel
Darrel Cowan
Nancye Dawers
Craig DePolo
John Demboski
Tim Dixon
James Dolan
Peter Drakos
Andreas Eckert
James Faulds
Luigi Ferranti
David Ferrill
Robert Finkel
David Fountain

Kurt Frankel
Anke Friedrich
Kevin Furlong
John Geissman
Allen Glazner
Evan Goldstein
Bill Hammond
Dennis Harry
Chris Henry
Wes Hildreth
Dave Hill
Gwyneth Hughes
Gene Humphreys
Angela Jayko
Craig Jones
Philip Justus
Eric Kirby
Corne Kreemer
Peter LaFemina
Kimberly Le
Richard Lease
Jeff Lee
Rocco Malservisi

Nadine McQuarrie
Christopher Menges
Tye Numelin
John Oldow
Michael Oskin
Lewis Owen
Michael Petronis
Silvio Pezzopane
Marith Reheis
Phillip Resor
Kaleb Scarberry
Jeffrey Schroeder
Timothy Sheehan
John Stamatakos
Daniel Stockli
Daniel Sturmer
Tatia Taylor
Christopher Tincher
Paul Umhoefer
Doug Walker
Brian Wernicke
Kelin Whipple
Caroline Whitehill



Planned Giving: The Common Thread among Four Major GSA Donors

Robert L. Fuchs

What do R.A.F. Penrose Jr., Larry Sloss, John F. Mann Jr., and Joseph T. Pardee have in common? As geologists, their entire lives were spent in the study of Earth. Certainly all were well-known GSA Members whose collective lives spanned nearly a century and a half. But most important to GSA's well-being over the years, these individuals were selfless philanthropists and each utilized a form of **planned giving** to leave a legacy for the benefit of geology.

A definition is in order at the outset. **Planned giving** is making a charitable gift of any amount for any purpose, whether deferred or given currently, wherein the assistance of an estate professional (e.g., lawyer, accountant, financial planner, and possibly also a representative of the receiving charity) is necessary to complete the activity. Planned gifts are funded with property, personal or real. Property is anything an individual owns that he or she has the power to keep, sell, or give.

How did each of these four noted geologists use planned giving to achieve his particular philanthropic goals?

Although he died in 1931, R.A.F. Penrose Jr. has made and continues to make an indelible impression on geology. A wealthy bachelor from a prominent northeastern family, Penrose left \$3.9 million to GSA. In comparison to the menu of legal and structural options available to planned givers today, the Penrose gift was pure simplicity—a few sentences in his will established an unrestricted bequest that today is the core of GSA's endowed assets and financial strength.

Penrose Fund income now impacts practically every facet of GSA operations. The interest from the Penrose Fund goes into the GSA unrestricted funds and for fiscal year 2006 will be used for the strategic budget (membership, Section Meeting support, and publications).

During the later years of his career, Larry Sloss created a deferred planned gift by giving the Foundation appreciated shares in a mutual fund. The Foundation sold the shares and invested the proceeds of \$50,000 in the Pooled Income Fund, a fund run by the Foundation that provided Sloss with quarterly income until his death in 1996. His equity interest in the fund, which had grown to over \$99,000 due to subsequent gifts, was then separated and added to the assets of the Foundation and has supported the research grants program.

John F. Mann Jr., a noted California hydrogeologist, made another type of deferred planned gift to the Foundation in December 1994. He set up a charitable remainder trust, valued then at \$1.247 million, from which he received income until his death in 1998. His wife, Carol, now is the income beneficiary, and the principal of the trust will pass to the Foundation upon her death. The Manns made additional major gifts and pledges in support of hydrogeology and environmental programs via the John F. Mann Fund, but the remainder trust remains at the core of their philanthropy to GSA.

Joseph T. Pardee might be considered GSA's planned giving renaissance man, for his gifts took a variety of forms: an estate bequest, an irrevocable trust, and two charitable remainder unitrusts. Pardee's will passed his estate to wife, Ruby, in 1960 in the form of an irrevocable trust, and thereafter to daughter Mary Kelly after Ruby's death in 1976. Mary and Ralph Kelly each set up charitable remainder unitrusts of which GSA was the principal remainder beneficiary. When Mary died in 1994, GSA and the Foundation



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received an endowment totaling \$2.7 million. Pardee Fund income supports a number of GSA activities, such as the Pardee Keynote Symposia at annual meetings and a significant portion of the GSA research grants program each year.

Four major donors of planned gifts to GSA—each gift different in form and tailored to the needs of the donor and the donor's family. The Foundation has received other planned gifts, and there are more in the planning process that will mature in the future. All planned givers are members of the Pardee Coterie, which meets for breakfast with a speaker at each annual meeting.

If you have the charitable intent to make a gift provision in your estate plans to support the work of GSA, by all means consider a bequest, the Pooled Income Fund, an irrevocable trust, a remainder trust, or even a relatively simple gift form currently in vogue among many donors and charities, the charitable gift annuity. Let your wishes be known to your estate professional, or call the Foundation office to discuss the giving opportunities available to you.

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

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Brian
Denver, Colorado



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Positions Open

UNIVERSITY OF WYOMING: GEOHYDROLOGIST
The Department of Geology and Geophysics at the University of Wyoming invites applications for a tenure-track position in geohydrology at the assistant professor level. Higher rank (associate professor) is possible for individuals with an established research program and demonstrated ability to secure external funding. Ph.D. is required at time of appointment, August 2006. We seek an individual who shows the potential to develop an internationally recognized, externally funded research program and who will be involved in the undergraduate and graduate teaching mission of the department. We welcome applicants with any specialization within the general field of geohydrology, including those who will build on departmental strengths in sedimentation, energy research, seismology, tectonics and structural geology. Additional information on the Department can be obtained on our web page (<http://home.gg.uwyo.edu/>).

Applications should include a statement of research and teaching interests and accomplishments, curriculum vitae, graduate transcripts, and the names and contact information of three references. Review of completed applications will begin January 3, 2006. Send an electronic copy of your application to: Ms. Carol Pribyl at cpribyl@uwyo.edu; if you have additional application materials to send, please direct them to the Geohydrology Search Committee, Prof. Carol Frost, Chair, Department of Geology and Geophysics, University of Wyoming, 1000 E. University Ave., Dept. 3006, Laramie, WY 82071.

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FLUVIAL GEOMORPHOLOGIST

Field Geology Services in Farmington, Maine, is seeking a full-time fluvial geomorphologist to assist with geomorphic assessments of watersheds throughout northern New England. Field Geology Services is a small private consulting firm that assists clients with understanding and managing erosion, flooding, and habitat enhancement issues. Candidates for the position should hold an M.S. in geology or a bachelor's degree in a closely allied field with at least 3 years experience/equivalent training in geomorphic assessments or stream restoration. Expertise with GIS and other computer software is a plus. Relocation to Maine and frequent travel throughout New England during the field season will be required. If interested, please send a letter of interest, resume, and contact information for 3 references to Dr. John Field at jfield@field-geology.com. Position will be filled no later than October 31, 2005.

FELLOWSHIPS

RADCLIFFE INSTITUTE FOR ADVANCED STUDY HARVARD UNIVERSITY

The Radcliffe Institute for Advanced Study at Harvard University awards fully funded fellowships each year. Radcliffe Institute fellowships are designed to support scientists of exceptional promise and demonstrated accomplishment. Scientists, in any field, with a doctorate in the area of the proposed project by December 2004 are eligible to apply. Only scientists who have at least one published article or monograph are eligible to apply.

The stipend amount of \$55,000 is meant to complement sabbatical leave salaries of faculty members.

Fellows receive office space, computers and high speed links, and access to libraries and other resources of Harvard University during the fellowship year, which extends from early September 2006 through June 30, 2007. Residence in the Boston area is required as is participation in the Institute community. Fellows are expected to present their work-in-progress and to attend other fellows' events.

For more information, including lists of present and past fellows, visit our Web site at www.radcliffe.edu. Apply online or write, call, or e-mail for an application: Radcliffe Application Office, 34 Concord Avenue, Cambridge, MA 02138, 617-496-3048, science@radcliffe.edu, www.radcliffe.edu.

THE UNIVERSITY OF TEXAS AT AUSTIN DEPARTMENT OF GEOLOGICAL SCIENCES JACKSON SCHOOL OF GEOSCIENCES FACULTY POSITION

WATER SCIENCES AND HYDROGEOLOGY

The Department of Geological Sciences, Jackson School of Geosciences, at The University of Texas at Austin seeks to fill a faculty position in water sciences and hydrogeology. The specific area of research is open, and might include studies in one or more of the following areas: modeling of flow, contaminant transport, and reactions on a variety of scales; groundwater/surface water interactions; theory and applications of geophysical and remote sensing methods; analysis of water resources and related policy; land-atmosphere interactions; and hydrologic impacts of climate variability and climate change. The rank is open, and candidates at all levels, including Chair level, will be considered. The successful candidate will join the Jackson School of Geosciences, which includes the Department of Geological Sciences, the Bureau of Economic Geology, and the Institute for Geophysics. The School has a large and diverse community of geoscientists, with excellent research facilities and support. Through other campus departments in science and engineering and research units, such as the Environmental Science Institute, Center for Space Research, Institute for Computational Engineering and Sciences, and Center for Research in Water Resources, there are opportunities to interact with faculty and scientists from many disciplines. The selected candidate will have demonstrated strong potential for conducting a vigorous externally funded research program, should be an enthusiastic teacher at the undergraduate and graduate levels, and well qualified to direct the research of M.S. and Ph.D. students. A Ph.D. in an Earth science or related discipline is required at the time of appointment. Please refer to <http://www.geo.utexas.edu> for additional information. To apply: please send a curriculum vitae, statement of research and teaching interests, and names and contact information for four references to: Hydrogeology Search, Department of Geological Sciences, The University of Texas at Austin, Austin, Texas 78712-1101. Review of applications began March 1, 2005, and will continue until the position is filled. The University of Texas is an Equal Opportunity/Affirmative Action employer.

O.K. EARL AND TEXACO POSTDOCTORAL FELLOWSHIPS

The California Institute of Technology announces two one-year fellowships in Geological and Planetary Sciences beginning with the 2006-07 fall term. The O.K. Earl and Texaco Postdoctoral Fellowships are awards funded by endowments from Orrin K. Earl, Jr., and the Texaco Philanthropic Foundation. Each fellowship carries an annual stipend of \$46,000 plus a research expense fund of \$2,000 per year and one-way travel costs to Pasadena. Fellows are eligible to participate in Caltech's health and dental program. For fellowship details, please visit www.gps.caltech.edu.

Materials in support of an application should include a curriculum vitae, list of publications, and a one-page statement of research interests. These should be sent in word or .pdf format to: chairman@gps.caltech.edu. The candidate should also request that three letters of reference be sent to the same email address. **All applications and references are due by Friday, December 16, 2005.**

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POSTDOCTORAL POSITION SURFACE PROCESSES/SEDIMENTARY GEOLOGY TULANE UNIVERSITY

Applicants are invited to a postdoctoral research associate position, in the first instance for two years and with an option for an additional year. Starting date is negotiable. The premier topic of research concerns (but is not necessarily limited to) the evolution of the lower Mississippi River during the past glacial-interglacial

cycle, based on borehole data and optical dating. One possible ingredient of this project consists of experimental stratigraphic work in collaboration with the St. Anthony Falls Laboratory at the University of Minnesota. A Ph.D. in the geosciences is required, preferably with one or more relevant specialties (e.g., sedimentology, stratigraphy, geomorphology, Quaternary science) and demonstrable peer-reviewed publication experience. The Department of Earth and Environmental Sciences at Tulane is a growing, dynamic unit, and its strong focus on river-ocean studies has recently been designated one of four university-wide strategic program areas.

Send an application letter with a research statement and career goals, along with a curriculum vitae and the names and addresses of three references by October 20, 2005, to Dr. Torbjörn E. Törnqvist, Department of Earth and Environmental Sciences, Tulane University, 6823 St. Charles Avenue, New Orleans, LA 70118-5698, USA. More information can be obtained via our website (<http://www.tulane.edu/~eens/>) or directly by e-mail (tor@tulane.edu). Since communication may be problematic due to hurricane Katrina, applications can be sent directly by e-mail to tor@uic.edu; phone contact is possible at +1-773-988-8820. Tulane University is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

VOLCANOLOGY/MAGMATIC PROCESSES EARTH AND SPACE SCIENCES THE UNIVERSITY OF WASHINGTON

The Dept. of Earth and Space Sciences at the University of Washington invites applications for a tenure-track Assistant Professor position in volcanology/magmatic processes, to begin September 2006. In exceptional circumstances, appointment as Associate Professor or Professor may be considered for candidates who have demonstrated a commitment to mentoring underrepresented students in the sciences. Applicants must have a Ph.D. by the date of appointment.

Duties will include engaging in undergraduate and graduate teaching, field work, independent research, and service. Preferred research areas include, but are not limited to, mineral chemistry and thermodynamics of minerals, experimental or theoretical modeling of the formation and stability of mantle and crustal materials, isotope geochemistry, and the role of volatiles in magmatic processes. We are especially interested in an individual who complements current departmental programs in surface processes, crust and mantle geochemistry, or solid-earth geophysics.

Applications must include a curriculum vitae and list of publications, a statement of research and teaching experience and interests, and three letters of reference (sent directly to the search committee by the referees). Send applications and reference letters to: VMP Search Committee, Dept. of Earth and Space Sciences, University of Washington, Box 351310, Seattle, WA 98195-1310. Electronic applications will be accepted at vmp-search@ess.washington.edu, with subject line "VMP-Application, (your name)."

Priority will be given to applications, including recommendations, received by November 11, 2005.

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GEOBIOLOGY EARTH AND SPACE SCIENCES THE UNIVERSITY OF WASHINGTON

The Dept. of Earth and Space Sciences at the University of Washington invites applications for a tenure-track Assistant Professor position in geobiology, to begin September 2006. In exceptional circumstances, appointment as Associate Professor or Professor may be considered for candidates who have demonstrated a commitment to mentoring underrepresented students in the sciences. Applicants must have a Ph.D. by the start of appointment.

Duties will include engaging in undergraduate and graduate teaching, independent research, and service. Preferred research areas include, but are not limited to, geomicrobiology and biogeochemistry, emphasizing the reciprocal interactions between the Earth, life and environments through time. We are particularly interested in individuals who use new genetic, microbiological, geochemical and/or computing techniques in their research and who can incorporate these into their teaching. Opportunities for collaboration exist with the Burke Museum, Program on Climate Change, Marine Geology & Geophysics, Atmospheric Sciences, Astrobiology Program, and departmental research groups in isotopic geochemistry, sedimentology/stratigraphy, Quaternary studies and geomorphology, among others.

Applications must include a curriculum vitae and list of publications, a statement of research and teaching experience and interests, and three letters of reference

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P. Hearn, Jr., T. Hare, P. Schruben,
D. Sherrill, C. LaMar, P. Tsushima

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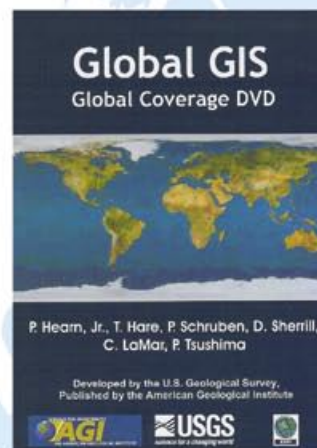
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EARTH SYSTEMS SCIENTISTS
BOSTON COLLEGE**

The Department of Geology and Geophysics at Boston College anticipates hiring two faculty in the broad area of Earth Systems Science over the next two years, with one position beginning Fall 2006. Areas of expertise might include but are not limited to environmental geochemistry, stable isotope geochemistry, biogeochemistry, and sedimentary processes. The successful candidate will be expected to develop an externally funded research program integrated with excellence in teaching within the geology/geophysics/environmental geoscience curriculum at both the undergraduate and graduate levels. The appointment is expected to be made at the Assistant Professor level, but outstanding individuals qualified for appointment at a higher rank will be considered. Information on the Department, its faculty and research strengths can be viewed on the Department's web page at www.bc.edu/geosciences. Applicants should send a curriculum vita, a statement of teaching and research interests and the names and contact information of at least three references to: Faculty Search Committee, Department of Geology and Geophysics, Devlin Hall 213, Boston College, Chestnut Hill, MA 02467-3809. Electronic applications will be accepted, but only as a single PDF-file e-mail attachment sent to geo_position@bc.edu. Review of applications will begin on November 15, 2005. Department faculty will be available at the GSA and AGU fall meetings to interview applicants. Boston College is an academic community whose doors are open to all students and employees without regard to race, religion, age, sex, marital or parental status, national origin, veteran status, or handicap.

**RANDOLPH-MACON WOMAN'S COLLEGE
ASSISTANT PROFESSOR
ENVIRONMENTAL STUDIES AND PHYSICS**

Tenure-track position jointly in the Environmental Studies and the Physics departments, beginning July 1, 2006. A Ph.D. in a relevant discipline (such as Earth or Environmental Science, Geology, Geophysics, or Physics) or interdisciplinary graduate program is required. Geology experience and GIS proficiency are highly desirable. We seek a natural scientist whose first priority is high-quality teaching in a competitive liberal arts college for women. The successful candidate will demonstrate ability and interest in interdisciplinary teaching and scholarship, enthusiasm for community involvement, and will strengthen the interaction between environmental studies and the physical sciences at R-MWC. Responsibilities include teaching introductory and upper-level physics, geology, and environmental science courses, developing and modernizing laboratories at all levels, and scholarship that encourages undergraduate research. Modest start-up funds are available, and pursuit of external funding for research is encouraged. Review of applications will begin December 1, 2005 and continue until the position is filled. Women and minorities are encouraged to apply. Send curriculum vitae, cover letter, transcripts, statement of teaching philosophy, and three letters of recommendation (including at least two addressing teaching ability) to Dr. Peter Sheldon, Physics Dept., Randolph-Macon Woman's College, 2500 Rivermont Avenue, Lynchburg, VA, 24503. EOE/M/F/V/D.

**COASTAL GEOLOGY, GEORGIA
SOUTHERN UNIVERSITY**

The Department of Geology and Geography invites applications for a tenure-track Assistant Professor in coastal geology. A Ph.D. in geology or a closely related field must be completed by the position starting date of August 1, 2006. Preference will be given to candidates who have active research projects on the Atlantic Coast of the United States, who apply GIS to their research, and who have prior undergraduate teaching experience. Full text of the advertisement, including information about the department, faculty, and the complete position announcement with all qualifications and application instructions, is available at <http://cost.georgiasouthern.edu/geo/>.

Screening of applications begins December 1, 2005,

and will continue until the position is filled. Applications and nominations should be sent to: Dr. Charles H. Trupe, Department of Geology and Geography, Georgia Southern University, P.O. Box 8149, Statesboro, GA 30460. E-mail: CHTrupe@GeorgiaSouthern.edu.

Georgia is an open records state. Georgia Southern University is an AA/EO institution. Individuals who need reasonable accommodations under the ADA in order to participate in the search process should contact the search chair.

**FACULTY POSITION IN GEOPHYSICS
UNIVERSITY OF WISCONSIN-MADISON**

The Department of Geology and Geophysics invites applications for a position as tenure-track assistant professor or associate professor of geophysics, beginning August 2006. The evaluation of candidates will focus primarily on their potential for innovative scientific research and teaching. We invite applications from outstanding candidates across the spectrum of geophysical research, and particularly encourage candidates who would interact with our existing programs in geodynamics, seismology, structural geology, and tectonophysics. Teaching responsibilities are at both the graduate and undergraduate level. Ph.D. required by start of appointment. Candidates for a tenured appointment must have demonstrated excellence in research, teaching, and service. Applicants should submit a resume, statement of research and teaching interests, and names of three or more references to: Geophysics Search Committee Chair, Department of Geology and Geophysics, University of Wisconsin-Madison, 1215 W. Dayton St., Madison, WI 53706.

To ensure full consideration, applications must be received by October 15, 2005.

The University of Wisconsin-Madison is an equal-opportunity/affirmative action employer and encourages applications from women and minorities.

**POST-DOCTORAL RESEARCH ASSOCIATE
DESERT RESEARCH INSTITUTE (DRI)**

The Division of Hydrologic Sciences (DHS) at the Desert Research Institute (DRI) is seeking a post-doctoral research Aqueous Geochemist to participate in analysis of regional hydrogeologic systems with complex groundwater flow and geochemistry, reactive transport of mine wastes, and subsurface transport of radionuclides. Opportunities exist for the candidate to develop their own research ideas and to pursue additional external funding to investigate these ideas in addition to contributing to existing projects.

Applicants are expected to possess appropriate professional experience including a Ph.D. in hydrology, geochemistry, or a relevant discipline. Review of applications will begin immediately and continue until the position is filled. More specific requirements and application instructions are available at www.dri.edu.

DRI is an AA/EO employer.

**SAN DIEGO STATE UNIVERSITY
STRATIGRAPHY/SEDIMENTOLOGY AND
LOW-TEMPERATURE GEOCHEMISTRY**

The Department of Geological Sciences at San Diego State University invites applications for two tenure-track Assistant Professor positions, one in **stratigraphy/sedimentology** and one in **low temperature geochemistry**, beginning Fall 2006. A Ph.D. is required at time of appointment and post-doctoral experience is preferred. We seek motivated teacher-scholars who will establish vigorous, externally funded and nationally recognized research programs involving both graduate and undergraduate students. Research specialty within the two positions is open but will preferably complement and build on existing strengths in the department, which has extensive analytical and computational facilities. See <http://www.geology.sdsu.edu/>. The successful candidates will have teaching responsibility at both the undergraduate and graduate level. Applicants should submit a cover letter, statement of research and teaching interests, curriculum vitae, and names and contact information of three references to: Faculty Search Committee, Department of Geological Sciences, San Diego State University, San Diego CA 92182-1020. Deadline Nov. 1, 2005. SDSU is a Title IX, equal opportunity employer and does not discriminate against individuals on the basis of race, religion, national origin, sexual orientation, gender, marital status, age, disability or veteran status, including veterans of the Vietnam era.

**ILLINOIS STATE GEOLOGICAL SURVEY
HEAD OF QUATERNARY GEOLOGY SECTION**

Provide scientific leadership in Quaternary geology. Direct, coordinate, develop and participate in mapping, research and service programs of the Section. Conduct original research and provide Quaternary expertise. Master's degree in Quaternary Geology with 12 years experience or Ph.D. with 8 years experience in field

mapping Quaternary deposits including subsurface mapping at 1:24,000-scale, and preparation of technical publications, reports and maps; and computer applications related to geologic mapping such as 3D geologic modeling and spatial analysis. Prefer experience with geologic mapping applications such as GIS, relational database management and/or contouring software. Starting salary: \$60,000 to \$75,000. Closing date: 11/15/05. For required application form and more information contact walston@igs.uiuc.edu or visit www.igs.uiuc.edu. EEO/ADA employer.

**HYDROGEOLOGY TENURE-TRACK POSITION
UNIVERSITY OF PITTSBURGH**

The Department of Geology and Planetary Science at the University of Pittsburgh invites applications for a tenure-track position in hydrogeology at the Assistant Professor level, pending budgetary approval. The position will begin in the Fall Term 2006. We seek an outstanding individual who will combine field- and laboratory-based studies with hydrologic modeling to build an interdisciplinary research program focused on hydrologic systems and water resources. Preference will be given to candidates whose expertise will strengthen existing research groups in the department. Possible areas of emphasis could include (but are not limited to) (1) watershed-scale studies of organic and chemical compound transport, (2) biochemical processes in groundwater and surface waters, (3) geothermal fluid processes and geophysical fluid modeling, and (4) hydrologic and paleohydrologic studies of lake and river systems.

Qualifications include a Ph.D. at the time of appointment, as well as demonstrated excellence in teaching, research, and intellectual leadership. The successful candidate will be expected to develop a vigorous, externally funded research program, including supervision of M.S. and Ph.D. students and undergraduate research projects. Strong teaching and communication skills are essential for this position, and the candidate will have the opportunity to teach both undergraduate and graduate courses in her/his areas of expertise. Experience in industry and in numerical modeling of groundwater flow would provide an added benefit to our students.

The Department of Geology and Planetary Science is equipped with state-of-the-art analytical facilities, including stable and radiogenic isotope labs, ICP-AES instrumentation, a sediment core lab and carbon analyzer, an infrared spectroscopy laboratory, GIS and remote sensing computer laboratories with a multi-terabyte server, a paleomagnetic laboratory, and geophysical survey instruments including reflection seismic system and frequency and time domain electromagnetic systems. Additional information can be found on our Web site: <http://www.geology.pitt.edu/>.

Review of applications will begin on December 15, 2005. Qualified applicants should submit a curriculum vitae that includes a statement of research and teaching interests, current and past grant support, copies of relevant publications, and the names and contact information of at least four references. Send all information to Hydrogeology Search Committee, Department of Geology and Planetary Science, 200 SRCC, University of Pittsburgh, Pittsburgh, PA 15260, USA.

The University of Pittsburgh is an Affirmative Action, Equal Opportunity Employer. Women and members of minority groups under-represented in academia are especially encouraged to apply.

**SEDIMENTARY GEOLOGY AND
STRUCTURAL GEOLOGY/IGNEOUS &
METAMORPHIC**

**PETROLOGY/MINERALOGY
THE UNIVERSITY OF TENNESSEE AT MARTIN**

The Department of Geology, Geography, and Physics invites applications for two tenure-track positions at the assistant professor level starting August 1, 2006.

Sedimentary Geology—Candidate must have the ability to teach undergraduate Sedimentology and Stratigraphy. Ability to teach Geology is beneficial.

Structural Geology/Igneous & Metamorphic Petrology/Mineralogy—Candidate must have the ability to teach undergraduate Structural Geology, Igneous/Metamorphic Petrology, and Mineralogy.

Candidates for both positions will be expected to teach introductory level Geology courses, advanced undergraduate courses depending upon their field of specialty, develop a research program involving undergraduates, and participate in K-16 Geoscience education outreach. UTM is a regional university with an enrollment over 6100. The department offers a B.S. degree in Geoscience with concentrations in Geology, Geography, and Travel and Tourism and a minor in Physics.

Candidate must have a Ph.D. in Geology; however, candidates with coursework completed toward their doctorate and significant progress in their dissertation may also be considered.

Review of applicants will begin December 5, 2005, and continue until the position is filled. Send letter of application, resume, transcripts, statements of teaching and research philosophy, and three letters of recommendation to: Chair Geology Search, Department of Geology, Geography, and Physics, 215 Johnson EPS Building, University of Tennessee at Martin, Martin, Tennessee 38238. UT Martin is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA employer. The University seeks to diversify its work force. Therefore, all qualified applicants, regardless of race, color, national origin, religion, gender, age, disability or Vietnam veteran status, are strongly encouraged to apply.

DICKINSON COLLEGE ASSISTANT PROFESSOR

The Dickinson College Geology Department invites applications for two one year positions at the Assistant Professor level to begin Fall 2006. We envision one to be in the general area of "hard rock" geology and the other "soft rock" geology. The successful candidates will be committed to teaching excellence in the liberal arts tradition and will be field-oriented with broad interests in geosciences beyond their specialty. Demonstrated success in student-faculty undergraduate research is highly desirable. Teaching responsibilities include a topical introductory course each semester and an upper level required course or elective. Completion or near completion of the Ph.D. is required. Applications, including a cover letter describing research interests, a teaching statement, curriculum-vitae, and addresses for three referees, should be sent to Dr. Marcus Key, Department of Geology, Dickinson College, P.O. Box 1773, Carlisle, PA 17013-2896. Review of applications will begin on 23 January 2006. Preliminary interviews will be conducted through the employment services at the fall GSA and AGU meetings.

Our curriculum emphasizes project-based learning with a strong field component centered in the folded Appalachians, Blue Ridge, and Mesozoic lowlands of Pennsylvania. The department has excellent analytical (AAS, SEM-EDS, XRD, XRF, TOC, digital 3-component seismometer, a 5-well well field for hydrogeologic investigations) and computing facilities including a GIS lab. More information can be found on the college and department web pages at <http://www.dickinson.edu/departments/geol>. Dickinson College is a highly selective private liberal arts college in south-central Pennsylvania within easy drive of the New York-Washington, DC, metro corridor. Dickinson College is an equal opportunity/affirmative action employer and strongly encourages minorities and women to apply.

COASTAL SEDIMENTOLOGY BROOKLYN COLLEGE

The Department of Geology seeks to fill a new tenure track position in Coastal Sedimentology. The successful candidate will be expected to expand upon initiatives to integrate GIS into the curriculum, and teach courses related to sedimentology, oceanography, and GIS. The successful candidate will also be expected to maintain an active research program (a portion of which should focus upon aspects of the New York City region), contribute to collaborative research within the department, college, and the CUNY Earth and Environmental Sciences doctoral program, and supervise student research.

The successful candidate must have a Ph.D. Experience with ArcGIS is essential. The candidate should be able to demonstrate teaching and research ability in the areas listed. Teaching experience, professional recognition in his/her field, a balance of field and laboratory experience, and a history of collaborative research would enhance an application.

Salary is competitive and commensurate with qualifications and experience. Send curriculum vitae, three letters of recommendation, and writing sample or research plan to: Michael Hewitt, Assistant Vice President for Human Resource Services, Brooklyn College, 2900 Bedford Avenue, Brooklyn, NY 11210-2889. Review of applications will begin on November 1 and continue until position is filled.

SURFACE HYDROLOGY MONTCLAIR STATE UNIVERSITY

The Department of Earth and Environmental Studies at Montclair State University invites applications for a full-time, tenure-track faculty position in surface hydrology, with an emphasis on water resource management. This appointment will be at the assistant rank starting September 1, 2006. Expertise in hydrodynamics, hydroclimatology, or water quality issues, and research and teaching capability in applied GISciences would be highly desirable. A Ph.D. is required at the time of appointment. Additional information about the position and the department is available at <http://www.csam.montclair.edu/earth/eesweb>. Applicants should send

cover letter, CV, three letters of recommendation, and a statement of professional goals, research interests, and teaching philosophy to: Dr. Duke Ophori (ophorid@mail.montclair.edu), Hydrology Search Committee Chair, Dept. of Earth & Environmental Studies, Montclair State University, Montclair, NJ 07043. Review of applications will begin immediately. Montclair State University is an Equal Opportunity/Affirmative Action Employer. Qualified women, minorities, and individuals with disabilities are encouraged to apply.

THREE FACULTY POSITIONS DEPARTMENT OF GEOLOGY UNIVERSITY AT BUFFALO, SUNY

The Department of Geology at the University at Buffalo is building on sustained growth in research productivity and teaching in its core areas of environmental geology, volcanology, and integrated tectonics and stratigraphy. We invite applications for three tenure-track faculty positions:

1. Nanogeochemistry, Biogeochemistry, or Geomicrobiology (Rank: Assistant Professor). We seek a scientist who studies aqueous/microbial/rock interactions at the nano-scale and who will integrate with our existing strength in hydrogeology. Research topics might include identification, characterization, and study of the reactivity of nanoparticles or nanostructures in the environment, or examining the interactions and biogeochemical processes associated with microbes and minerals. Researchers interested in applying nano-scale geochemistry to environmental problems are particularly encouraged to apply. Search Committee Chair: Dr. Richelle Allen-King. Application target date: Oct. 15, 2005.

2. Remote Sensing (Rank: Assistant or Associate Professor). We seek a broadly trained geoscientist who employs an array of airborne and space-based remote sensing tools to address geological questions that complement and integrate with one or more of our existing research strengths. Areas of particular interest include geohazard evaluation, assessment of water or petroleum resources, and climate change. Search Committee Chair: Dr. Marcus Bursik. Application target date: Nov. 1, 2005.

3. Hydrogeophysics or Environmental Geophysics (Rank: Assistant Professor). We seek a scientist with demonstrated ability to apply geophysical techniques to the shallow subsurface and who will integrate with our existing strength in hydrogeology. Researchers with expertise in GPR, ER, or seismic, and an interest in extracting geologic and hydrologic data from complex datasets for the purpose of characterizing or remediating contaminated geologic systems are of particular interest.

Search Committee Chair Dr. Richelle Allen-King. Application target date: Nov. 15, 2005.

We expect faculty to develop and maintain innovative, extramurally funded research groups. Successful applicants for these positions must have a Ph.D. degree at the time of appointment and a demonstrated potential to publish or otherwise disseminate results of research and a commitment to effective teaching. Teaching duties will involve undergraduate and graduate level courses in the candidates' specialties. More information about our department can be found at: <http://www.geology.buffalo.edu>. The University at Buffalo is an Equal Opportunity Employer/Recruiter. We committed to the importance of a diverse faculty. Women and minorities are particularly encouraged to apply.

Send applications to Robyn Wagner by email to rtwagner@buffalo.edu or post to Department of Geology, 876 Natural Sciences Complex, University at Buffalo, Buffalo, NY 14260.

Applications should state clearly the position applied to and include (1) a curriculum vitae, including published research and grant support, (2) a statement of research goals, (3) a statement of teaching experience and interests, (4) selected reprints, and (5) the names and contact information of at least three references. Applications should be complete by the target dates given above, when we will begin our review of candidates, which will continue until the positions are filled.

FACULTY POSITION AT BRYN MAWR COLLEGE PETROLOGY/MINERALOGY

Bryn Mawr College seeks to fill a full-time, tenure-track position at either the beginning Assistant Professor or Associate Professor level in petrology/mineralogy. The applicant should be able to contribute substantially to igneous and/or metamorphic petrology plus one or more of the following: geochemistry, geodynamics, environmental geology, earth system science, remote sensing or geoarchaeology. This individual will direct undergraduate research projects and conduct an active research program. In the case of mid-career applicants, we are seeking an individual who could contribute to leadership of the Department. Demonstrated teaching ability and a Ph.D. at the time of appointment are required. Applicants should submit a CV, description of research

interests, a list of possible courses that could be offered, and three references to: Geology Search, Department of Geology, Bryn Mawr College, 101 N. Merion Ave., Bryn Mawr, PA 19010 (e-mail contact: koconnel@brynmawr.edu). Members of the Department will be available for preliminary interviews at the Geological Society of America meetings in October, and formal review of applications will begin in December 2005. Details about the Department are available at <http://www.brynmawr.edu/geology/>.

Located in suburban Philadelphia, Bryn Mawr College is a highly selective liberal arts college for women, who share an intense intellectual commitment, a self-directed and purposeful vision of their lives, and a desire to make meaningful contributions to the world. Bryn Mawr comprises an undergraduate college with 1,200 undergraduate students, as well as coeducational graduate schools in some humanities, sciences, and social work. The College supports faculty excellence in both teaching and research. Bryn Mawr College is an equal-opportunity, affirmative action employer. Minority candidates and women are especially encouraged to apply.

WELLESLEY COLLEGE ASSISTANT PROFESSOR GEOSCIENCES/SURFACE PROCESSES

The Department of Geosciences at Wellesley College invites applications for a tenure-track faculty position at the rank of first-level assistant professor beginning September 2006. We seek an exceptional scientist who can integrate classroom, field and laboratory approaches to teaching undergraduates in a liberal arts environment. This individual will have broad expertise in surface processes and be expected to develop courses at all levels of our curriculum, particularly including sedimentation and earth history. The ideal candidate will also be active in research that can include students in the department. Completion of the Ph.D. is required, and previous post-doctoral and/or teaching experience would be beneficial.

Applicants should send their curriculum vitae, a statement of teaching and research interests, and the names and contact information (including email address) of three referees to Dr. Margaret D. Thompson, Chair, Department of Geosciences, Wellesley College, 106 Central Street, Wellesley, MA 02481-8203. Applications will be accepted until October 15, 2005.

Wellesley College is an Affirmative Action/Equal Opportunity educational institution and employer. The College is committed to increasing the diversity of the college community and the curriculum. Candidates who believe they can contribute to that goal are encouraged to apply.

U.S. GEOLOGICAL SURVEY MENDENHALL POSTDOCTORAL RESEARCH FELLOWSHIP PROGRAM

The U.S. Geological Survey (USGS) invites applications for the Mendenhall Postdoctoral Research Fellowship Program for fiscal year 2007. The Mendenhall Program provides opportunities to conduct research in association with selected members of the USGS professional staff. Through this Program the USGS will acquire current expertise in science to assist in implementation of the science strategy of its programs. Fiscal year 2007 begins in October 2006.

Opportunities for research are available in a wide range of topics. The postdoctoral fellowships are 2-year appointments. The closing date for applications is December 1, 2005. Appointments will start October 2006 or later, depending on availability of funds. A description of the program, research opportunities, and the application process are available at <http://geology.usgs.gov/postdoc>. The U.S. Geological Survey is an equal opportunity employer.

SEDIMENTOLOGIST, LAFAYETTE COLLEGE

Tenure-track Assistant Professor beginning Fall 2006. We seek a geologist with primary training and research interests in Sedimentology with secondary interests in fields such as Paleoenvironments, Paleontology, Paleobotany, or Geochemistry. Ph.D. required, evidence of high-quality teaching and research preferred.

Individual must have a strong interest in teaching undergraduates and establishing and maintaining an active research program involving undergraduates. Teaching responsibilities include courses in sedimentology, historical geology, and participation in the core curriculum (First-Year Seminar or Values and Science/Technology). Applicants should describe additional courses they may wish to teach.

Lafayette College is a private undergraduate liberal arts college with an engineering division and 2,200 students.

Send CV, separate statements of teaching and research interests, graduate and undergraduate transcripts, and three reference letters to Dru Germanoski,

Head, Dept. of Geology and Environmental Geosciences, Lafayette College, Easton, PA 18042-1768. We will interview at the Geological Society of America meeting in Salt Lake City; however, applications will be accepted through Jan. 15, 2006, or until position is filled. EEO/women and minorities encouraged to apply.

ACTIVE TECTONICS/ENGINEERING GEOLOGY CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

The Department of Geological Sciences invites applications for a tenure-track faculty appointment at the assistant professor level. Requirements are a Ph.D., an established record of published research in the area of active tectonics and/or engineering geology, a demonstrated record of teaching ability, and strong field skills. Preference will be given to applicants with experience in obtaining research funding, and who have research interests that complement and enhance existing departmental strengths. Teaching assignments will include undergraduate courses in geologic field mapping, a senior and/or graduate course in the hire's specialty, and, on a rotational basis, physical science for prospective K-5 teachers or appropriate general-education courses.

To apply send as e-mail attachments a *curriculum vitae*, statements of teaching and research interests, and names and addresses of at least three referees to j.d.yule@csun.edu. Include "Active Tectonics/Engineering Geo Application" in the subject line. Ancillary materials, such as copies of recent publications, may be mailed to: Dr. Doug Yule, Department of Geological Sciences, California State University, 18111 Nordhoff Street, Northridge, CA 91330-8266. Review of applications will begin December 1, 2005, and continue until the position is filled.

For additional information see www.csun.edu/geology. The University is an EO/AA educator and employer. Candidates will be expected to provide effective instruction to students of diverse backgrounds in a multicultural setting. Position is subject to final approval of budget.

Opportunities For Students

Earth Sciences Graduate Fellowship. The New Mexico Bureau of Geology and Mineral Resources, a division of New Mexico Tech, is soliciting candidates for the Kottlowski/Bureau Fellowship. The fellowship, for an incoming Ph.D. candidate in the Department of Earth and Environmental Science, offers a 12-month, \$22,000 stipend plus full coverage of tuition. The fellowship is renewable for up to three years. Additional funding is available to cover some laboratory and field expenses.

All Ph.D. applicants to the Department will be considered for the fellowship. The successful candidate may have interests in any earth or environmental science specialty, but will be expected to do a project within the state or of particular interest to the state, under the direction of advisors from both the Bureau and the Department. Application deadline is 1 February 2006. Applicants will automatically be considered for other support within the Department.

New Mexico Tech is a highly rated science and engineering university with more than 60 earth science faculty shared between the academic division and the Bureau. More complete descriptions of the fellowship, of New Mexico Tech, and of the Bureau are available at <http://www.nmt.edu/> and <http://geoinfo.nmt.edu/>.

Ph.D. Opportunity in Sea-Level Research—Tulane University. The project "Middle to Late Holocene Sea-Level Change and Coastal Evolution, Northern Gulf of Mexico Coast," recently recommended for NSF funding, provides support for a Ph.D. candidate. Preferred starting date is January 2006. The study is field-based and aims at obtaining high-resolution sea-level data from different sections of the Gulf Coast, and to assess Holocene sea-level history in the context of global climate change, crustal movements, coastal hazard, and coastal wetland dynamics. An M.S. or equivalent degree in the geosciences is required, preferably with one or more relevant specialties (e.g., Quaternary science, sed-

imentology, micropaleontology). The project includes specialized training in microfossil analysis during a one-month visit to the University of Plymouth, UK. The Department of Earth and Environmental Sciences at Tulane is a growing, dynamic unit, and its strong focus on river-ocean studies has recently been designated one of four university-wide strategic program areas.

Send an application letter outlining research interests and career goals, along with a curriculum vitae, transcripts (copies are acceptable), and the names and addresses of three references by October 20, 2005, to Dr Torbjörn E. Törnqvist, Department of Earth and Environmental Sciences, Tulane University, 6823 St. Charles Avenue, New Orleans, LA 70118-5698, USA. More information can be obtained via our Web site (<http://www.tulane.edu/~eens/>) or directly by e-mail (tor@tulane.edu). Since communication may be problematic due to hurricane Katrina, applications can be sent directly by e-mail to tor@uic.edu; phone contact is possible at +1-773-988-8820. Tulane University is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

The Department of Geology at Kansas State University is seeking qualified applicants for its M.Sc. program. Located in the Flint Hills of Kansas, our department offers a wide-array of state-of-the art computing, geophysical and microscopy equipment either in-house or through cross-campus collaborations. Areas of disciplinary strength include petroleum geology, geophysics/tectonics, geoscience education, geochemistry, and sedimentology/paleobiology. Recent students have completed field research in New Zealand, Colorado, Brazil, and the Aleutians. Assistantships are available beginning January 2006. For more information, please see <http://www.k-state.edu/geology/>, or contact the Geology Graduate Program Coordinator, Dr. Matthew Totten (mtotten@ksu.edu). Kansas State University is an equal opportunity/affirmative action employer.



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- Finally: the point of Rhodinia
- Waltzing in xenotime
- Milankovich precession causes Lofelite succession
- Le Tour de Mars

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- Trail of sand found offshore California
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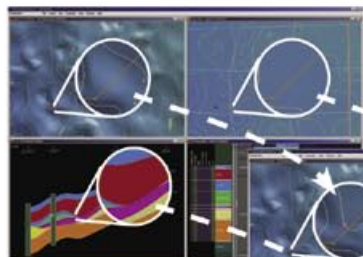
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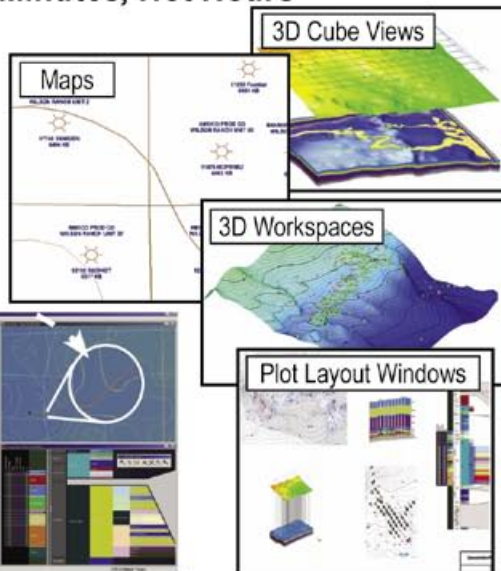
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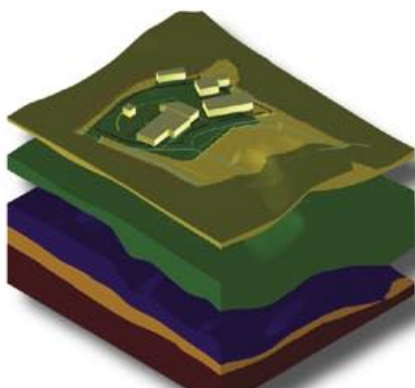
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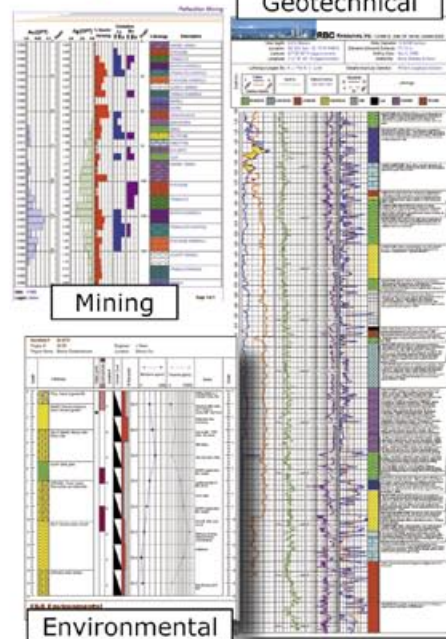
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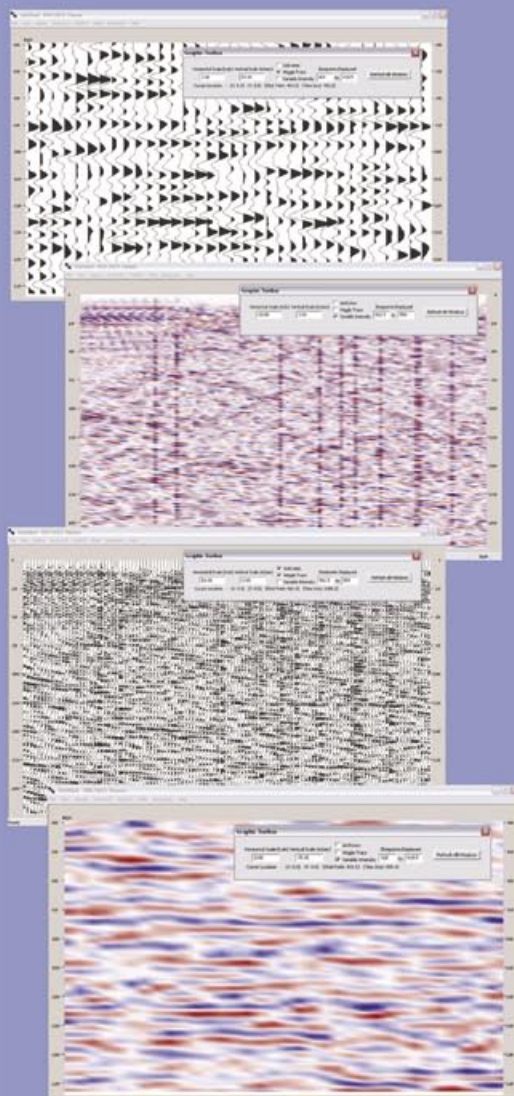
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