

GSA TODAY

The cover image is a composite landscape. At the top, a seagull with white wings and a brown back is in flight over a blue ocean. Below the ocean, a lush green coastal area with a sandy beach and a small stream is visible. In the foreground, there are large, vibrant green fan palm leaves. The background shows a range of blue mountains under a clear sky. At the very bottom, a dense residential town with many houses is visible, suggesting a suburban setting near a natural area.

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Colorado's Front Range:
Salvaging geologic data
in the suburbs
and sharing it with
the citizens**

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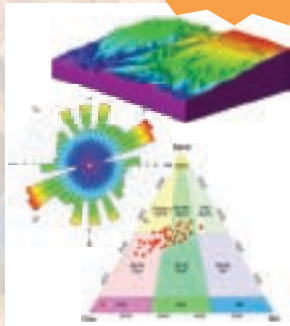
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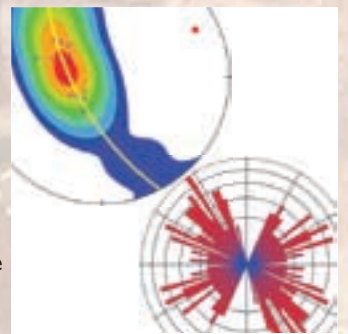


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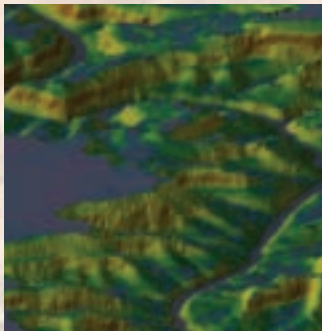
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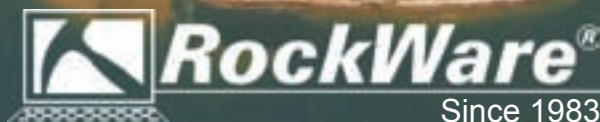
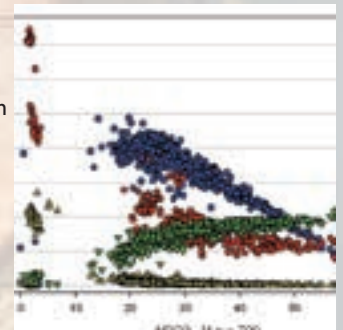


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Cover: Images of the Denver area at different points in geologic time. Top: submarine Colorado, ca. 70 Ma; middle: a few years after the Cretaceous, ca. 65 Ma; bottom: the Front Range today. Paintings by Donna Braginetz; photo by Kirk Johnson. For more images and explanations, go to www.dmsn.org/main/minisites/ancientDenvers/index.html. See "Earth history along Colorado's Front Range: Salvaging geologic data in the suburbs and sharing it with the citizens," by Reynolds et al., p. 4–10.

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Earth history along Colorado's Front Range: Salvaging geologic data in the suburbs and sharing it with the citizens

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ABSTRACT

The Denver Basin preserves >800 m of Laramide synorogenic strata, which record basin accommodation, orogenic topography, and resultant orographic climatic effects. The basin also records the Cretaceous-Tertiary boundary event and the subsequent recovery of terrestrial ecosystems. Outcrops in the basin are modest and commonly consist of temporary construction-related excavations. The Denver Museum of Nature & Science has coordinated a decade-long multidisciplinary program that includes paleontological research, stratigraphic studies, aquifer analyses, and basin evolution studies in this area. As part of this effort, the synorogenic strata were continuously cored in 1999. Unusually diverse floras exhibiting rainforest physiognomy, episodic sedimentation linked to pulsed orogeny, and stratigraphic controls on aquifer distribution and quality have emerged from beneath the urbanizing landscape. Results of this work, summarized in painted reconstructions, have helped Colorado residents and museum visitors gain insight into past climates and settings, and have helped inform decisions regarding the ongoing development of the region.

INTRODUCTION

The enigmatic Laramide Orogeny can be analyzed through evaluation of the sedimentary debris shed from uplifted regions into adjacent basins. While the plate-scale genetic mechanisms responsible for the orogeny remain obscure (English and Johnston, 2004), increased precision in the analysis of synorogenic sediments can reveal patterns and trends that improve our understanding of regional tectonic development (Dickinson et al., 1988). During the Laramide Orogeny, abrupt uplift of the eastern flank of the Rocky Mountain Front Range led to the dispersal of fluvial distributary systems carrying coarse clastic debris into the asymmetrically subsiding Denver Basin (Fig. 1) on the eastern periphery of the Rocky Mountains. As the Front Range mountains rose, >800 m of nonmarine strata accumulated in the basin. These sediments form the bedrock aquifers that are currently mined to supply drinking water to many communities along the Front Range urban corridor. These same rock layers are also extremely fossiliferous: almost any excavation in the rapidly urbanizing Front Range area yields exciting evidence of past flora, fauna, and landscapes. Fresh excavations are commonly only briefly available, so geological and

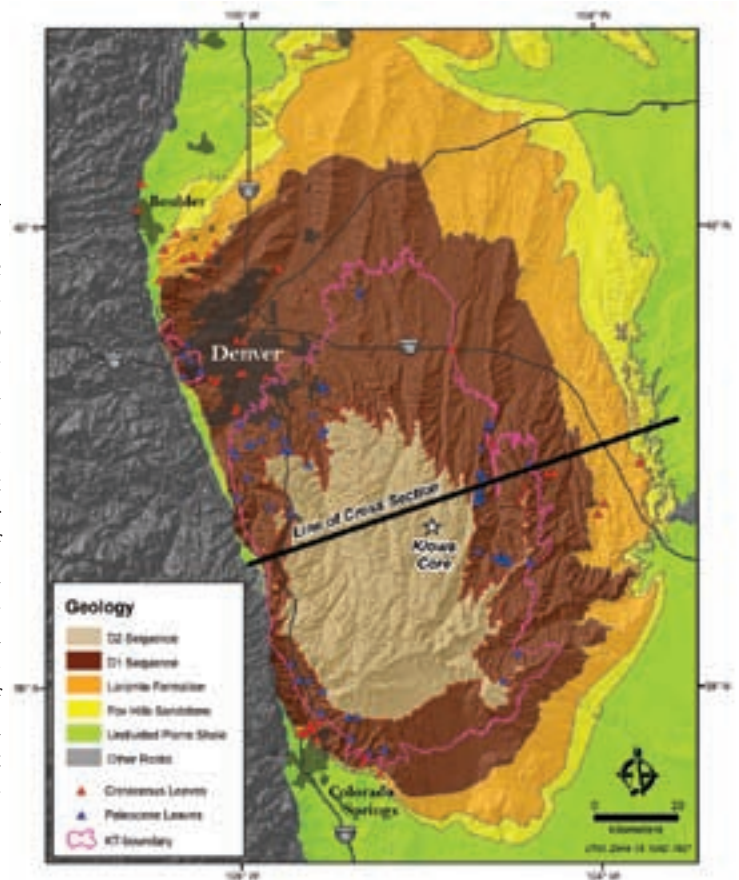


Figure 1. Geologic base map of the synorogenic strata in the Denver Basin showing fossil plant localities and the K-T boundary. This map is a compilation of over 25 geologic maps with additional boundary information obtained by intersecting three-dimensional subsurface models created by using over 1400 oil, gas, and water well electric logs with the digital elevation model. Small outcrops of post-orogenic Castle Rock Rhyolite and Castlewood Conglomerate have been omitted for clarity.

paleontological work needs to be done on an opportunistic and expedient basis. For the past decade, a team of researchers from the Denver Museum of Nature & Science (DMNS), supported by local, state, and National Science Foundation funding, has salvaged newly discovered fossils and worked to assemble the geologic history of the Denver Basin. During the same period, Colorado's population increased by 30%, with 80% of the state's population concentrated in the Front Range urban corridor (Mladinich, 2006).

Dinosaurs are found in people's basement excavations, and leaves from fossilized rainforests litter road cuts along busy freeways. Volcanic ash layers are found in city parks, and strati-

graphic patterns emerge during examination of domestic and municipal water wells. The Denver Basin, while lacking the dramatic outcrops and exposures of neighboring basins, has become one of the best-documented Laramide basins because of synergy between backhoe operators, citizen scientists, and our research team.

The DMNS has catalyzed this effort by coordinating a long-term multidisciplinary research project. The goals of the project are to render accurate views of Denver Basin landscapes through time using high-resolution stratigraphy, geochronology, and paleontology. Because of the important groundwater contained in the studied rocks, we also strive to inform the hydrologic community of the resource implications of our work. With a balanced mission of noteworthy research and reaching out to and inspiring the public, the museum has made a significant effort to promote public awareness of our research results.

THE KIOWA CORE, A 2256-FOOT-LONG KEY TO THE DENVER BASIN

In 1999, we selected a location in the center of the basin near Kiowa, Colorado, and continuously cored a 2256-ft-deep well to calibrate the synorogenic stratigraphy of the basin (Fig. 2). Starting in the sagebrush, we cored down to marine strata, finding fossilized baby ammonites on split core faces in the Pierre Shale deposits of the Cretaceous Interior Seaway. The Kiowa core serves as a key for calibration of geologic studies of the Denver Basin (see the Reference section for 19 articles in *Rocky Mountain Geology*, v. 37 and v. 38), providing a common ground for analysis of sedimentology, palynology, isotope stratigraphy, magnetostratigraphy, petrography, thermochemistry, and sedimentary provenance. The core is archived at the U.S. Geological Survey core repository in Lakewood, Colorado. Palynologic and magnetostratigraphic studies of the core, combined with $^{40}\text{Ar}/^{39}\text{Ar}$ radiometric dating of



Figure 2. Drilling the Kiowa Core. The rig, operated by Layne Western, recovered over 93% of a 2.5 inch diameter core extending 2256 feet into the basin. Drilling occurred in 1999 and took seven weeks. More than 2000 visitors investigated the round-the-clock drilling operation; as the core was described, curious folks looked over our shoulders for evidence of perforated dinosaurs and other treasures.

outcropping volcanic ash layers and the presence of the K-T boundary marker horizon, have allowed us to build a robust age framework for the basin (Fig. 3) (Obadovich, 2002; Nichols, 2003; Raynolds and Johnson, 2003).

We have correlated hundreds of electric logs from oil and gas test wells and water wells to the Kiowa core. This allows us to project the age framework to spotty and widely distributed outcrops at the surface. A new sequence stratigraphic framework divides the synorogenic strata (also known as the Arapahoe Conglomerate and the Denver and Dawson formations) into two unconformity-bounded sequences: D1 and D2 (Raynolds, 2002). This approach uses modern stratigraphic concepts (Miall, 1997) to cut an old Gordian knot of complex and interfingering lithostratigraphic nomenclature tied to facies and lithology (Crifasi, 1990). The D1 Sequence straddles the Cretaceous-Tertiary boundary and is unconformably overlain by the younger D2 Sequence, which was deposited during the latest Paleocene and earliest Eocene. A regional, thick oxisol (Farnham and Kraus, 2002) located near the base of the D2 Sequence may provide a record of the Paleocene-Eocene Thermal Maximum (PETM). This paleosol was recognized early on by the U.S. Geological Survey (Soister and Tschudy, 1978) and is now mapped across the basin. This weathering zone is quarried and has provided source material for the 1,400,000 bricks used in the construction of Denver's Coors Field stadium. Today's baseball fans little realize that they are surrounded by baked clays that may have formed during an earlier episode of global warming.

Our mapping techniques are a hybrid between conventional geologic mapping and three-dimensional (3-D) modeling and geographic information system (GIS)-aided visualization.

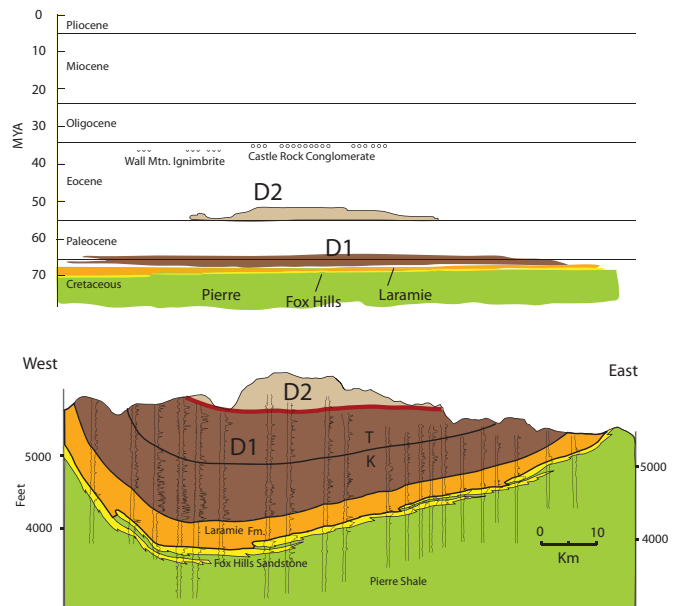


Figure 3. East to west geologic cross section of the Denver Basin with a Wheeler time diagram showing that most of geologic time is not represented by rock in this basin. The sequences of synorogenic sediment accumulated during relatively brief episodes of sedimentation and accommodation.

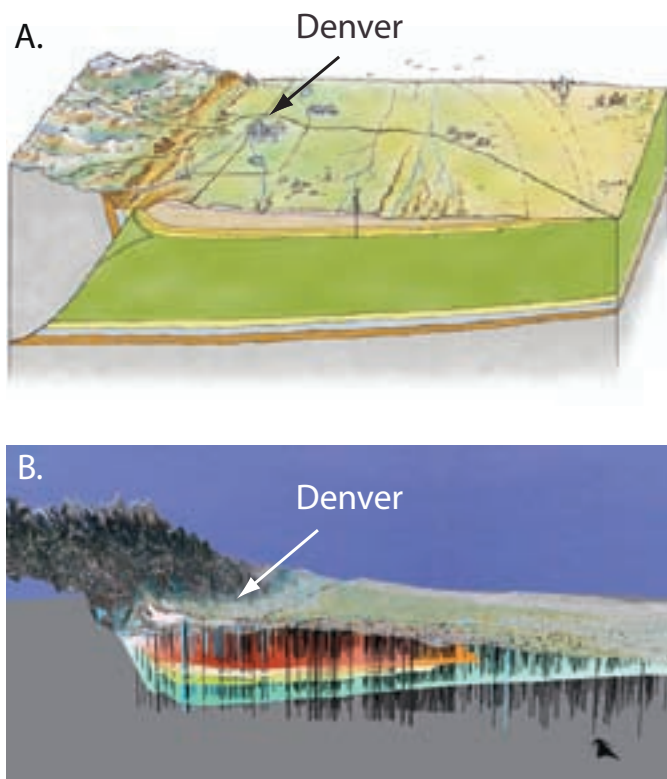


Figure 4. Three-dimensional views of strata in the Denver Basin. (A) Image (drawn by Marjorie Leggitt) is schematic; the thick green unit denotes deposits of the Cretaceous Interior Seaway. The Kiowa well is indicated by the derrick. (B) Diagram depicts a single slice taken from the three-dimensional model of the basin created by using hundreds of well logs. Selected wells are indicated by vertical lines. The orange surface marks the top of the Laramie Formation, and the widespread green surface is a volcanic ash bed near the top of the Pierre Shale.

Using geological data from over 25 published geologic maps and a data set of >1500 wells, detailed digital 3-D models of the subsurface portion of the basin (Fig. 4) have been constructed. These models can be most compellingly viewed interactively as fly-throughs in the museum planetarium (Neafus and Yu, 2007). Three-dimensional visualization has helped us understand the basin geometry and has been a powerful tool for sharing insights with the public and with the local water resource planning community.

Three-dimensional models of subsurface geologic contacts coupled with digital elevation models allow us to create hybrid geologic maps that depict boundaries defined by the intersection of 3-D contacts and the land surface. This in turn allows us to map a predicted outcrop trace in areas of extensive Quaternary and suburban cover and permits precise relative stratigraphic placement and age calibration of fossils collected from isolated outcrops and construction excavations (Fig. 5).

Suburban Dinosaurs and Construction Sites

The Denver Basin strata have been yielding fossils of dinosaurs since the 1870s. The first *Triceratops* ever found came from a gully near the present-day site of INVESCO Field at Mile High in 1887 (Marsh, 1887). Because that specimen was

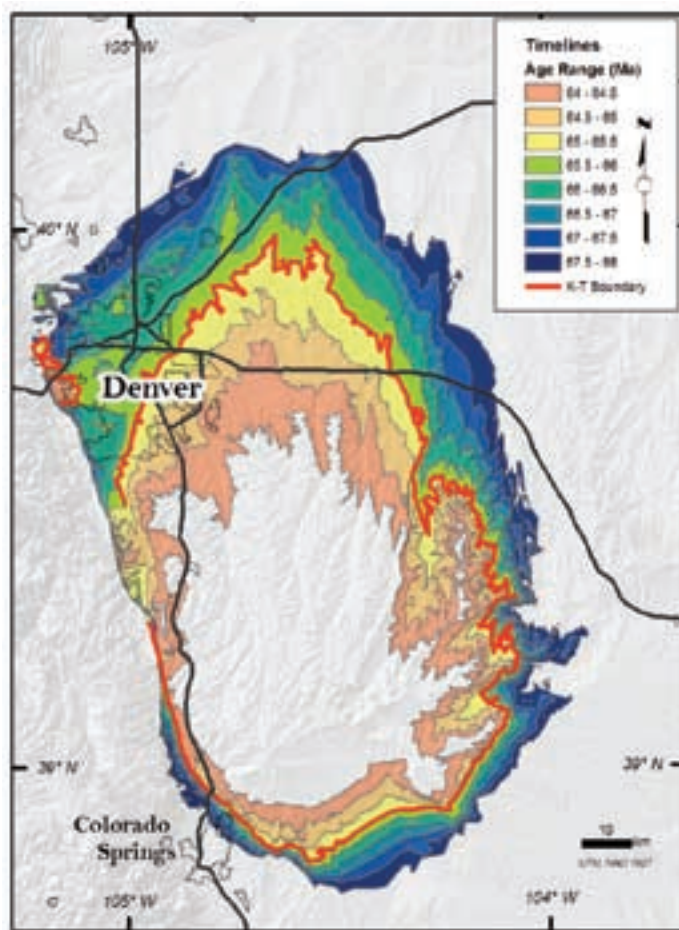


Figure 5. Map of the Denver Basin showing the age of the D1 Sequence rocks, made by assuming linear sediment accumulation rates and taking the three-dimensional rock volume models, assigning ages, and intercepting the model with the topographic surface. Red line—K-T boundary.

housed at the Smithsonian for more than a century, residents of Denver were largely unaware of their dinosaurian heritage.

Economic growth and a burgeoning population in the region led to a building boom in the 1990s. Construction sites routinely uncover dinosaur bones, which are rarely appreciated and are commonly reburied by their excavators. In 1992, a partial *Tyrannosaurus rex* skeleton was discovered in a home construction site in Littleton, a Denver suburb (Carpenter and Young, 2002). Using a grace period allowed by the builder, portions of the skeleton were excavated by museum staff and volunteers. A banana-sized serrated tooth from this site is one of the region's prize fossils. In 1994, an alert workman discovered palm fronds and a dinosaur rib (near home plate) during construction of Coors Field, home of the Colorado Rockies. Dinger, the Rockies' purple *Triceratops* mascot, was born out of the media coverage of that discovery. In 2003, Bruce Young, a DMNS volunteer, discovered a *Triceratops* skull on a freshly bulldozed slope in a housing development in Brighton, north of Denver (Fig. 6). A museum crew excavated the skull in less than 6 hours, and it now forms an iconic display in the Denver Museum's *Prehistoric Journey* exhibit.



Figure 6. Top: the construction site northeast of Denver where Bruce Young discovered a *Triceratops* skull in 2003. The specimen is now on permanent display in *Prehistoric Journey* at the Denver Museum of Nature & Science (bottom). Right: artist Ray Troll's whimsical view of the alert backhoe operator (image copyright and courtesy of Ray Troll).

The Cretaceous-Tertiary Boundary and High-Resolution Geochronology

An example of our hybrid mapping technique lies in our mapping of the outcrop pattern of the Cretaceous-Tertiary (K-T) boundary (Fig. 1). The K-T boundary was located in the Kiowa core (Nichols and Fleming, 2002), constrained by palynology, magnetostratigraphy, and the presence of anomalous iridium and shocked minerals. Using the 3-D basin model, we projected the K-T boundary to the surface (Fig. 7), where it was discovered and documented on the West Bijou Creek Escarpment (Barclay et al., 2003).

The West Bijou Creek outcrop section of the K-T boundary is marked by a distinctive 2-cm-thick claystone layer exposed in a 90-cm lignite bed. This section is the most complete terrestrial K-T boundary interval known. It is characterized by a full suite of K-T boundary indicators, including palynological extinction; an iridium anomaly; a shocked quartz anomaly; a fern spore spike; a carbon isotope excursion; reversed polarity (subchron C29r); Late Cretaceous vertebrates (including typical Lancian dinosaurs) and Maastrichtian plant megafossils below the boundary; and early Puercan mammals (Pu1) and basal Paleocene plant megafossils above the boundary. In addition, the 40-m section that contains the K-T boundary contains several distinctive tuff horizons that have yielded $^{40}\text{Ar}/^{39}\text{Ar}$ and U-Pb zircon ages.

Magnetostratigraphy of D1 Sequence strata above the K-T boundary in the Kiowa core records the presence of polarity subchrons C29r, C29n, C28r, and part of C28n (Hicks et al., 2003). The exposures along the escarpment contain more than 80 discrete tuff horizons. A tuff near the top of this section has been dated at 64.13 ± 0.21 Ma using $^{40}\text{Ar}/^{39}\text{Ar}$ techniques (Obradovich, 2002). This series of tuff beds, deposited over a span of 1.5 m.y., offers an unprecedented opportunity to date the four basal subchrons of the Paleocene and thus provides an independent test of the magnetic polarity time scale developed in the marine realm.

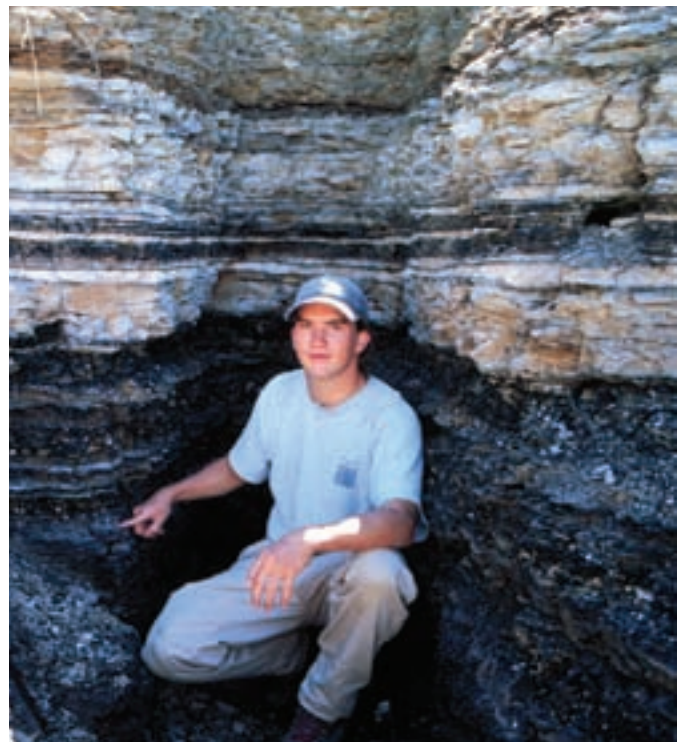


Figure 7. Rich Barclay points to the K-T boundary at a location on the Bijou Creek Escarpment east of Denver. The dark beds are lignite layers and the pale bands are volcanic ash beds suitable for both $^{40}\text{Ar}/^{39}\text{Ar}$ and U-Pb geochronology. The K-T boundary layer is a thin (2 cm) gray band at the tip of Rich's index finger.

Fossil Rainforests and Ancient Orography

Fossil leaves are the most common macroscopic paleontological resource of the Denver Basin (Johnson et al., 2003). The leaves are commonly so well preserved that, when split open, leaf cuticle can be peeled off the rock. Leaf compression fossils can reveal data as detailed as the sixth-order venation patterns, and, in many cases, leaf stomata are preserved and can be studied to determine paleo- CO_2 vapor pressure. The DMNS houses over 50,000 curated fossil leaves, making it one of the largest fossil leaf repositories in the world.

In 1994, Steve Wallace, a Colorado Department of Transportation paleontologist, discovered an extraordinarily diverse early Paleocene (63.8 ± 0.3 Ma) fossil leaf site on the side of Interstate 25 in Castle Rock, Colorado, 40 km south of Denver and 14 km east of the Front Range (Johnson and Ellis, 2002; Ellis et al., 2003). DMNS teams excavated and studied over 10,000 fossil leaf specimens from this site. The Castle Rock floral assemblage is dominated by large, smooth-margined angiosperm leaves, many of which bear drip tips. Today, these types of leaves are common in tropical ever-wet rainforests. To date, the site has yielded more than 100 different species of plants, making it the most diverse Paleocene fossil plant site ever discovered. Diversity, leaf size, and taxonomic affinities of the Castle Rock site suggest that it represents a fossil tropical rainforest.

The diversity of the Castle Rock rainforest is even more remarkable because it grew <2 m.y. after the K-T impact event, an event marked by extinction of ~60% of forest trees in the

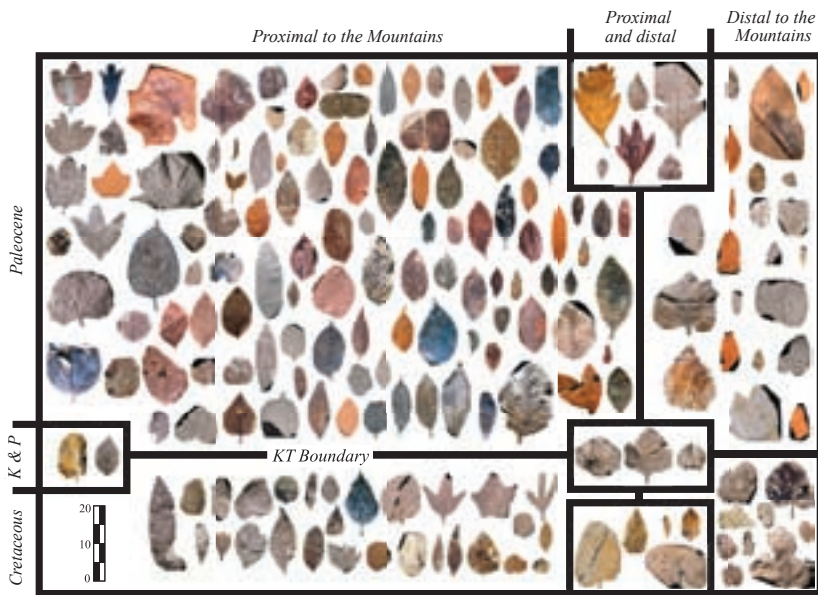


Figure 8. Space-time arrangement of fossil leaves from the Denver Basin. Each photograph depicts a different plant species at the correct relative scale. The left-hand side of the diagram shows leaves found close to the mountain front; the right side illustrates leaves found in the central and eastern portions of the basin. The abundantly populated upper left quadrant reflects the extraordinary diversity of the proximal rainforest watered by orographically controlled precipitation. Leaves in boxes are found in both adjacent areas.

Western Interior. Most Paleocene leaf sites from the Western Interior contain no more than 20 species. Based on the study of nearly 500 Paleocene sites (Brown, 1962; Hickey, 1990; Johnson, 2002; Johnson et al., 2003; Wilf, 2000), it was thought that it took ~10 m.y. for ecosystems to recover from the cataclysmic K-T impact. The Castle Rock flora raises significant questions about K-T boundary recovery and the origin of tropical rainforests in general. Isotopic studies are under way to determine if ancient fractionation patterns in the canopy can be discerned to mimic those seen in modern forests.

To study the changing early Paleocene landscape and to place the Castle Rock rainforest in context, we collected an additional 10,000 fossil leaves from more than 150 Denver Basin fossil plant localities, mapped them in space and time, and tracked the appearance of individual leaf species at each locality. A clear pattern of vegetational zonation relative to the Rocky Mountain front is beginning to emerge (Fig. 8). The Castle Rock rainforest and related sites in Denver and Colorado Springs were close to the base of large alluvial fan complexes that drained the Laramide mountain range. Orographic precipitation related to the Laramide Orogeny may, therefore, be part of the Castle Rock story.

The diversity of Paleocene leaves at Castle Rock and other sites proximal to the mountain range is higher than in Paleocene sites distal to the range. Interestingly, the low-diversity distal Paleocene floras have many species in common with Western Interior Paleocene sites from Saskatchewan to New Mexico, but few species in common with the proximal Paleocene Denver Basin flora (Barclay et al., 2003). This comparison demonstrates that paleovegetation can be mapped across a paleo-altitudinal transect.

Ancient fossil rainforests spark the interest of Colorado residents who today live in an arid land, subject to water shortages, erratic rainfall, and falling aquifer levels.

Groundwater for Expanding Cities from Ancient Alluvial Fans

The poorly consolidated synorogenic sediments that fill the Denver Basin form excellent aquifers. Wells drilled into these rocks have the potential to yield up to 1000 gallons per minute of potable water. Denver's founders were keenly aware that life in the Great American Desert is tied to adequate water supplies. Early efforts secured water rights on a variety of mountain streams, including the headwaters of the Colorado River. Over the years, tunnels, canals, and reservoirs have been constructed to provide Denver, Fort Collins, Colorado Springs,

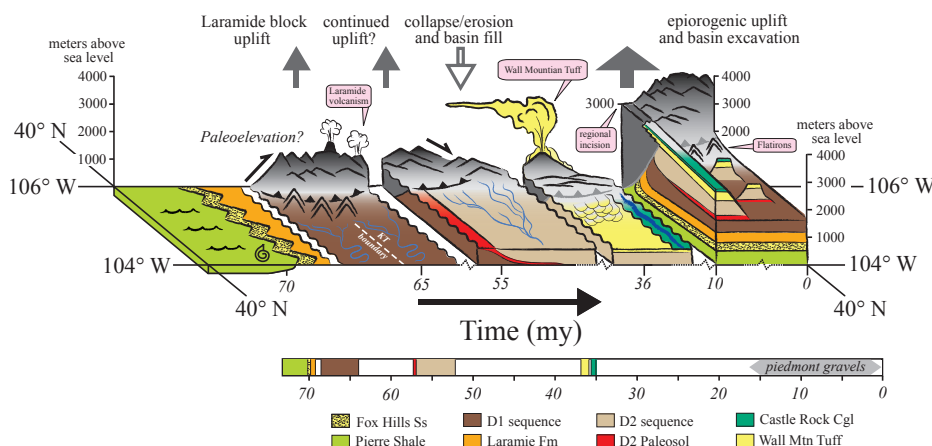


Figure 9. Space-time-elevation diagram showing the evolution of topography in the Colorado Front Range and the Denver Basin. The diagram is fixed in space at latitude 40°N and between longitudes 104°W and 107°W. It scrolls through time from 75 Ma on the left to the present on the right, and Denver moves with time on the x-axis. The diagram shows the Interior Seaway and sea level conditions extending to ca. 68 Ma, followed by abrupt and episodic uplifts to the west. Between ca. 40 and 50 Ma, the area witnessed orogenic collapse and regional beveling. This was followed by late-stage regional uplift and basin exhumation.

and Pueblo, Colorado, with a safe and adequate water supply. The Continental Divide has been tunneled through in 19 spots to divert westbound Colorado River water to these four cities along the Front Range urban corridor.

Those who came west later have had to make due with left-overs. New communities in the areas surrounding Denver and Colorado Springs commonly rely almost entirely on groundwater, because no surface-water rights are available. In fact, much of the surface-water resource is over-appropriated, meaning that in dry years, junior rights holders can be denied water, while those with older (senior) rights continue to use water. This first-come-first-served legal framework is a philosophy that has worked well for many years. Recently, drought and falling groundwater levels have caused municipal water suppliers to strive to better quantify their groundwater resources.

The Denver Basin bedrock aquifers yield Pleistocene water (Novotny and Sanford, 2004). The aquifers recharge at geologic time scales, and current utilization patterns amount to unsustainable mining. Data published annually by the Colorado State Engineer's Office show that the water levels in many municipal wells are falling at 30–50 ft/yr (over an inch per day!) in some of the most heavily used aquifers. In the areas south of Denver, where development continues at a rapid pace and this problem is most evident, plans for alternative water supplies are under discussion, some involving interstate pipelines.

In the area west of Castle Rock and south of Denver, we have mapped a large buried fluvial distributary fan system that forms the bulk of the critical Arapahoe Aquifer (Raynolds, 2004). Analogous to large distributary fans found at the foot of the Bolivian Andes, this fan system becomes sand-poor away from the ancestral source canyon. The lithofacies distribution controls the aquifer quality and volume in the subsurface. Studies of the subsurface fan system, in conjunction with reported water-well information from the State Engineer's Office, form the basis of lifespan and performance projections of this aquifer (Raynolds, 2004). On the west side of the basin, water wells are already suffering reduced pressure heads and lower yields, and this has influenced development planning by local authorities (Douglas County Planning Commission, 2001).

EVOLUTION OF THE FRONT RANGE LANDSCAPE

The Denver Basin strata can be used to deduce changes in regional landscapes and topography (Fig. 9), helping to clarify a piece of the Laramide puzzle. The region formed part of the floor of the Western Interior Seaway for ~30 m.y. in the Late Cretaceous. Marine fossils in the Pierre Shale demonstrate that the region remained below sea level until ca. 69 Ma, the approximate age of the ammonite *Baculites clinolobatus* (Cobban et al., 2006). A series of off-lapping regressive sandstone shingles overlie the Pierre Shale and make up the Fox Hills Sandstone (Fig. 9). The Fox Hills Sandstone is in turn overlain by coastal swamp deposits that comprise the Laramie Formation. The Laramie Formation thickens westward toward the mountain front, suggesting that a gentle sag presaged the Laramide uplift of the Front Range.

An unconformity representing erosion or absence of deposition separates the Laramie Formation from the overlying D1 Sequence. This unconformity is indicated by abrupt facies change: gravels and conglomerates overlie a weakly incised shale-rich Laramie section. The amount of time not represented by rock is

probably <1 m.y. because the extrapolated age of the base of the D1 Sequence—based on assumptions of uniform rates of sediment accumulation—is 68 Ma, only a million years younger than the youngest dated marine faunas in the underlying Pierre Shale. We suggest the basin area was near sea level as these events were taking place, based on the swampy character of the Laramie Formation over large areas, including west of the present Denver Basin, in South Park, Colorado (Washborne, 1910).

The 68 Ma Arapahoe Conglomerate forms the basal unit of the D1 Sequence. It contains clasts of chert, quartzite, and petrified wood derived from Paleozoic and Mesozoic sedimentary sequences together with metamorphic and igneous clasts derived from Precambrian crystalline rocks. This requires that significant topographic relief developed in the source region with incision depths of at least 3 km.

The overlying andesitic facies and numerous volcanic ash horizons provide a record of Laramide volcanism in the Colorado Front Range. The volcanoes have been eroded away; their existence is documented only by volcanoclastic debris in the Denver, South Park, and Middle Park basins (Raynolds, 2003; Izett, 1968). By 64 Ma, rainforests characterized by diverse assemblages of angiosperms with large, smooth-margined leaves dominated the eastern flank of the Front Range, providing a record of early Tertiary orographic precipitation.

An unconformity representing an 8 m.y. depositional hiatus or an episode of erosion separates the top of the D1 Sequence from the overlying arkosic D2 Sequence. The duration of deposition of the D2 Sequence is unknown. Rocks with apatite grains dating in excess of 100 Ma are found in the Front Range (Kelley, 2002), so we know that incision following the Laramide uplift was not sufficient to cut down to rocks heated sufficiently to anneal the fission tracks.

At 36.7 Ma (McIntosh and Chapin, 1994), the Wall Mountain Tuff erupted across the beveled Rocky Mountain Surface (Epis and Chapin, 1975), demonstrating that, by this time, topography had equilibrated between the range and the basin. Following its emplacement, the Wall Mountain Tuff was incised. Paleocanyons cut into this formation are filled and overtopped by the Castle Rock Conglomerate, a rock unit that contains angular rhyolite clasts in excess of a meter in diameter.

Epirogenic uplift of the High Plains together with the Front Range region occurred roughly between 10 Ma and the present, triggering widespread incision (McMillan et al., 2006). Differential uplift between the plains and the range is negligible because the Rocky Mountain Surface, which is preserved in the basin by buttes capped by the Wall Mountain Tuff, lies on the same gentle slope, defining a ramp between the basin and the range (Leonard and Langford, 1994). Miocene and later regional uplift first led to the dispersal of a widespread conglomeratic facies (the Ogallala Group), then to basin exhumation and renewed bedrock incision by the headward erosion of the tributaries to the Mississippi river system. Thus, the present relative relief of the Front Range is a function of differential erosion, not uplift.

SHARING SCIENCE WITH FRONT RANGE CITIZENS

Working with artist Jan Vriesen, and funded by the city of Denver's One Percent for Art Program, we have used paleobotanical and paleogeographic information to reconstitute long-gone vistas as ten *Ancient Colorado* paintings that grace the Colorado

Convention Center. Other paintings by Vriesen, Donna Braginetz, and Gary Staab are on display in the *Ancient Denvers* exhibit at the DMNS (see www.dmns.org/main/minisites/ancientDenvers/index.html), in a popular book of the same title (Johnson and Reynolds, 2002), at the Denver International Airport, and in parks and open space venues throughout the region.

The DMNS plays a key role in public education in the Rocky Mountain region. A particularly critical product of the stratigraphic work has been the evaluation of the regional groundwater potential of the basin-filling sediments. This applied research fulfills a museum goal to emphasize locally derived and relevant information and to make the results of ongoing research available in a variety of formats to both our membership and the community. By involving teams of volunteers in the research, we help bring the excitement of this quest into the everyday lives of lay citizens. We have hosted lecture series and roundtables and sent representatives to speak at state legislative events and city council and regional water forums in order to educate policymakers. Sarah Andrews cast the research into a forensic geology novel in 2005.

The extraordinary diversity of ancient landscapes brought to life through these efforts of data gathering, analysis, and depiction help Denver residents place the present in the context of the past. A population with an appreciation of the ever-changing face of the land will be better positioned to evaluate issues of change that lie ahead.

ACKNOWLEDGMENTS

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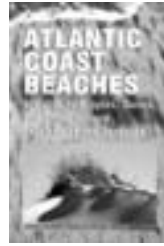
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In cooperation with the Association of American State Geologists, GSA gives an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys. For details, see the October 2007 *GSA Today*, visit www.geosociety.org, or call +1-303-357-1028. Nominations must be sent to Grants, Awards, and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

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Nominations due 30 April 2008

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RESEARCH AWARDS IN GEOMORPHOLOGY AND MICROPALAEONTOLOGY

Application deadline: 1 February 2008

Two of GSA's most prestigious awards supporting research are made possible by the generosity of the late W. Storrs Cole. Qualified GSA Members and Fellows are encouraged to apply. Online application forms are now accepted at www.geosociety.org/grants/postdoc.htm. Supplemental information must be e-mailed to awards@geosociety.org or mailed to Grants, Awards and Recognition, GSA, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301-9140, USA.

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The **Gladys W. Cole Memorial Research Award** provides support for the investigation of the geomorphology of semiarid and arid terrains in the United States and Mexico. GSA Members and Fellows between the ages of 30 and 65 who have published one or more significant papers on geomorphology are eligible for the award. While the funds may not be used for work that is already finished, recipients of previous awards may reapply if they need additional support to complete their work. The 2008 award is US\$9300.

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The **W. Storrs Cole Memorial Research Award** supports research in invertebrate micropaleontology. This award carries a stipend of US\$8200 in 2008 and will go to a GSA Member or Fellow between the ages of 30 and 65 who has published one or more significant papers on micropaleontology.

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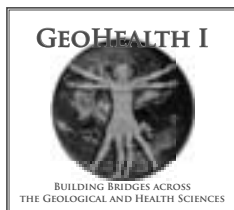
Application deadline: 1 March 2008

The Geological Society of America is accepting applications for the 33rd International Geological Congress (IGC) Travel Grant Program. This program was established as a final act of the organizing committee for the U.S.-hosted 28th IGC held in Washington, D.C., in July 1989. Surplus funds available at the conclusion of the 28th IGC were transferred to the GSA Foundation with the stipulation that income from the fund be used to support the attendance of young geoscientists at future IGC meetings until such time that the United States again hosts an IGC. Travel grants will consist of economy airfare to Norway.

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Applications are on the Web at www.geosociety.org/grants/travel.htm. In addition to the online form and proof of abstract submission, all applicants must provide two letters of reference from current or recent supervisors. All supplemental information must be sent as e-mail attachments directly to awards@geosociety.org. Online applications and supplemental material must be received electronically no later than **1 March 2008**. Applicants will be notified of results no later than June 2008.

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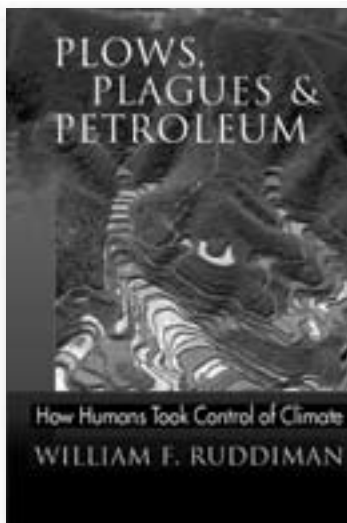
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To access the nomination form and additional information, please go to www.geosociety.org/awards/biggs.htm. All nomination material should be sent to Eric J. Pyle, James Madison University, Dept. of Geology & Environmental Science, MSC 7703, Harrisonburg, VA 22807-0001, USA, pyleej@jmu.edu, by **1 February 2008**.



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GSA Member **Cynthia L. Dinwiddie** with the Geosciences and Engineering Division and Southwest Research Institute has received the 2007 Rossiter W. Raymond Memorial Award from the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) and the Alfred Noble Prize from the American Society of Civil Engineers (ASCE). These awards are in recognition of her paper, “The small-drillhole minipermeameter probe for in-situ permeability measurement” (2005, *SPE Reservoir Evaluation & Engineering*, v. 8, no. 6, p. 491–501).

GSA member **Peter J. McCabe** of Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO) has been named president of the American Geological Institute. McCabe is also the American Association of Petroleum Geologists Distinguished Lecturer for 2007–2008.

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Congratulations to John Townend of Victoria University in Wellington, New Zealand, who is the recipient of an iPod from GSA for his participation in a feasibility study for a potential tectonics and structure journal. Townend was one of about 2000 participants in a survey administered by Glickman Research on behalf of GSA; his name was selected at random.



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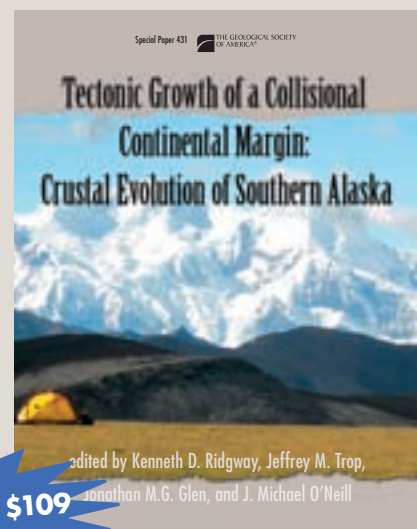
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43rd Annual Meeting
Hyatt Regency Buffalo, Buffalo, New York

27–29 March 2008



Boat tour at Maid of the Mist Falls. Courtesy Buffalo Niagara Convention & Visitors Bureau and Angel Art Ltd.

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Go to www.geosociety.org/sectdiv/northe/08mtg for a complete list of descriptions for symposia and theme sessions. For further information on sessions, contact the session convener(s) or either of the Technical Program co-chairs, Gary Lash, lash@fredonia.edu, or Jason Briner, jbriner@buffalo.edu. Please contact Nancy Wright at GSA, +1-303-357-1061, nwright@geosociety.org, if you have any problems with the electronic abstract submission process.

FIELD TRIPS

Six field trips will be offered in conjunction with this meeting. For full field-trip information go to www.geosociety.org/sectdiv/northe/08mtg/fieldTrips.htm. If you have questions, please contact the field trip leader(s) or the field trip coordinator, Bettina Martinez-Hackert, martinb@buffalostate.edu.

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Roy J. Shlemon Mentor Program in Applied Geoscience. Thurs.–Fri., 27–28 March, 11:30 a.m.–1 p.m. *Free meal included.*

The John Mann Mentors in Applied Hydrogeology Program. Thurs., 27 March, 5–6:30 p.m. *Free meal included.*



Waterfront Buffalo. Courtesy Buffalo Niagara Convention & Visitors Bureau and Angel Art Ltd.

Final Announcement and Call for Papers

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42nd Annual Meeting
Hot Springs, Arkansas, USA

30 March–1 April 2008

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Aerial view of Hot Springs National Park and the surrounding Ouachita Mountains. Photo courtesy Hot Springs Convention & Visitors Bureau.

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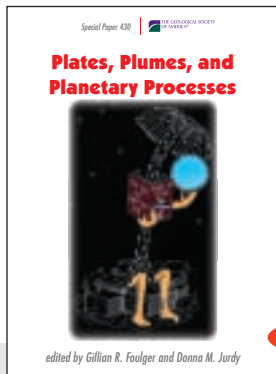
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Roy J. Shlemon Mentor Program in Applied Geoscience. Mon.–Tues., 31 March–1 April, 11:30 a.m.–1 p.m. *Free meal included.*

The John Mann Mentors in Applied Hydrogeology Program. Mon., 31 March, 5–6:30 p.m. *Free meal included.*

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Shlemon Mentor Program Luncheons: Thurs.–Fri.,
20–21 March, 11:30 a.m.–1:00 p.m.

Mann Mentors in Applied Hydrogeology Program:
Thurs., 20 March, 5–6:30 p.m.

NORTHEASTERN

Shlemon Mentor Program Luncheons: Thurs.–Fri.,
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Mann Mentors in Applied Hydrogeology Program:
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Mann Mentors in Applied Hydrogeology Program:
Mon., 31 March, 5–6:30 p.m.

SOUTHEASTERN

Shlemon Mentor Program Luncheons: Thurs.–Fri.,
10–11 April, 11:30 a.m.–1:00 p.m.

Mann Mentors in Applied Hydrogeology Program:
Thurs., 10 April, 5–6:30 p.m.

NORTH-CENTRAL

Shlemon Mentor Program Luncheons: Thurs.–Fri.,
24–25 April, 11:30 a.m.–1:00 p.m.

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JOINT MEETING

19–21 March 2008

University of Nevada–Las Vegas

Information: Rod Metcalf, Univ. of Nevada, Dept. of Geoscience,
Las Vegas, NV 89154-4010, USA, +1-702-895-
4442, rod.metcalf@unlv.edu

NORTHEASTERN

27–29 March 2008

Hyatt Regency Buffalo, New York

Information: Gary Solar, SUNY–College at Buffalo, Dept. of
Earth Sciences & Science Education, 1300
Elmwood Ave., Buffalo, NY 14222-1004, USA,
+1-716-472-7015, solargs@buffalostate.edu

SOUTH-CENTRAL

30 March–1 April 2008

Hot Springs Convention Center, Arkansas

Information: Jeff Connelly, Univ. of Arkansas, Dept. of Earth
Sciences, 2801 S. University Ave., Little Rock, AR
72204-1099, USA, +1-501-569-3543, jbconnelly@
ualr.edu

SOUTHEASTERN

10–11 April 2008

Hilton Charlotte University Place, Charlotte, North Carolina

Information: Andy Bobyarchick, Univ. of North Carolina, Dept. of
Geography & Earth Sciences, 9201 University City
Blvd., Charlotte, NC 28223-0001, USA, +1-704-
545-1337, arbobyar@email.uncc.edu

NORTH-CENTRAL

24–25 April 2008

Casino Aztar, Evansville, Indiana

Information: Paul Doss, Univ. of Southern Indiana, Dept. of
Geology, 8600 University Blvd., Evansville, IN
47712-3534, USA, +1-812-465-7132, pdoss@usi.
edu; John P. Szabo, 64B Crouse Hall, University of
Akron, Akron, OH 44325-4101, USA, +1-330-972-
8039, jpszabo@uakron.edu

FIRE IN THE SOUTHWEST: Integrating Fire into Management of Changing Ecosystems

Tucson, Arizona, USA • 28–31 January 2008



PHOTO: This burn scar near Ringgold, Texas, USA, was captured 8 Jan. 2006 by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on NASA's Terra satellite and was enhanced for visibility with sensor observation of near- and shortwave infrared energy and visible light. Ground is tan and brown; vegetation is red. Image created by Jesse Allen, National Aeronautics and Space Administration (NASA) Earth Observatory (http://visibleearth.nasa.gov/view_rec.php?id=20426).

This timely forum for scientific information exchange on the ecology and management of fire-adapted and -affected ecosystems in the southwestern United States under changing climate conditions is being organized by a dozen partners, including GSA. Burned Area Emergency Response (BAER) sessions and a field trip will examine the effectiveness of post-fire emergency stabilization and rehabilitation treatments, including geologic factors. For details and to register at member rates, go to www.humboldt.edu/swfire/. Questions may be directed to Deborah Nelson at dnelson@geosociety.org.



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FIELD FORUM REPORT

Assessing the State of Our Knowledge of Continental Arc Volcanism: The Tatará–San Pedro Complex, 36°S, Andean Southern Volcanic Zone

Talca and Tatará–San Pedro, Chile • 4–12 February 2007

Conveners:

Claude Jaupart, *Institut de Physique du Globe de Paris, 4, Place Jussieu, 75252 Paris Cedex 05, France*

Tom Sisson, *U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025-3561, USA*

Jon Blundy, *Department of Earth Sciences, University of Bristol, Wills Memorial Building, Bristol BS8 1RK, UK*

Richard Arculus, *Research School of Earth Sciences, Australian National University, Canberra ACT 0200, Australia*

INTRODUCTION

The Tatará–San Pedro Volcanic Complex, Chile, is a well-exposed continental arc volcanic center ranging from basalt to rhyolite in composition. Its exposure, compositional diversity, moderate accessibility, and setting within the geochemically and tectonically segmented Andean Arc have prompted numerous detailed studies of its geologic history and magma genesis. Consequently, it is among the best-studied continental arc volcanic centers in the world. Forty international participants from diverse scientific backgrounds gathered for this Field Forum to discuss the processes involved in the construction of such volcanoes and the origins of their magmas. The forum opened in the Talca municipal library with two days of presentations by invited speakers that provided a general background to the complex and fostered vigorous debate. Field work commenced with two days of helicopter-supported visits to all stratigraphic components of the complex, followed by two days on foot from a spectacularly beautiful lakeside camp on the complex's west flank, where stratigraphic and petrologic relationships were examined and discussed in depth. A hike to the trailhead was followed by a concluding day in Talca during which key issues were discussed by separate working groups and then in plenary session.

FIELD OBSERVATIONS

The Tatará–San Pedro Field Forum identified four linked behavioral characteristics of long-lived (ca. 1 Ma) volcanic systems. First: The complex grew as a series of temporally distinct eruptive phases whose products overlap widely in location, composition, and appearance. Detailed mapping, sampling, and accurate and precise eruption-age measurements are essential for unraveling the volcanic history and specific petrogenetic events; broad-scale reconnaissance sampling of complex volcanoes almost certainly leads to highly misleading conclusions. Second is the scarcity of near-primary (i.e., high-Mg) magmas, despite an abundance of olivine-rich rocks, which are mostly the result of magma contamination. The third characteristic is the role of paleotopography and climate in controlling the eruptive distribution and subsequent preservation of the volcanic products. Most

of the Tatará–San Pedro Complex formed during the Pleistocene, and it is unclear how much material has been removed by glacial ice, river incision, and/or sector collapse. Fourth: Local basement tectonics influenced the distribution of volcanism. Incision is sufficient around the complex to expose grabens, dike systems, and hydrothermally altered areas that mark the former locations of Pleistocene volcanoes removed by erosion. Participants discussed at length the specific and general implications of the large data set for major and trace elements, as well as mineral compositions and assemblages of Tatará–San Pedro Complex lavas. Compositions range from basalt to high-silica rhyolite, encompassing most of the range and types present in the Andean Southern Volcanic Zone, within which near-primary magmas are absent. Magmatic diversity at the complex shows that local investigations and interpretations of regional along-arc compositional trends are highly complementary; for example, isotopic, trace element, and major element indices are to varying degrees systematically variable between 33°S and 41°S, and these variations are in part related to segmentation of the arc.

KEY ISSUES

A Complete Data Set

Many important issues are difficult to address without comprehensively documenting the volcano in question, and the basic requirement for this task is information on the compositions, ages, and distributions of preserved eruptive products.

Episodicity

Eruptions are by nature transient events, and volcanic activity exhibits different types of episodic behavior. Some results at the Tatará–San Pedro Volcanic Complex are consistent with a link between eruptive periods and crustal unloading during deglaciation, but the strength of this inference was debated vigorously. A few forum participants questioned whether the number and precision of radiometric age measurements and the extent of outcrop preservation are adequate to draw this conclusion. There was much additional discussion of spatial episodicity, such that magmas are channeled into discrete eruptive centers. Estimates of a volcano's chemical budget would be improved if the dimensions of the system's deep "capture zone" could be determined, for example, by geophysical techniques.

Liquid Lines of Descent

Participants expressed concerns about whether pristine parental compositions, unperturbed by open-system inputs, can be identified and how the characterization of extraneous crystals (xenocrysts and antecrysts) can contribute to an understanding of such processes. Conversely, determining liquidus phase relations on rocks with crystals of uncertain parentage is an exercise of dubious value. The recognition that many volcanic rocks are mixtures of melts and entrained crystals has considerable impli-

cations for the ways in which we use experiments to constrain phase relations and liquid lines of descent.

THE WAY FORWARD

Forum participants identified the following areas of future study: (1) architecture of a volcanic system, (2) the mantle signal, (3) episodic behavior, (4) phase equilibria and volatiles, and (5) natural hazards.

Recommendations

Physics of Magmatic Processes

Discussions on almost every topic during the Field Forum focused at one stage or another on an examination of the physical processes responsible for what is observed. Many participants felt that inadequate progress has been achieved in the quantification of the physics of volcanological and petrological processes and that more effort is required. Over 25 years have passed since the publication of the pioneering textbook *The Physics of Magmatic Processes* (Hargrave, 1980, Princeton University Press); a fresh examination of the problems addressed in that book is overdue. Several examples arose during the forum: (1) assimilation and mixing are ubiquitous subvolcanic processes that may occur at various locations in the magmatic plumbing system and over a range of time scales; (2) configurations of volcanic plumbing systems remain elusive—greater effort is needed in quantitative modeling to constrain the conditions under which these systems develop; (3) chemical and petrological studies of volcanic products eventually lead to mass balance estimates for the magmatic-volcanic system, although this is not usually attempted on a trans-crustal scale; and (4) the lateral extent of the system at depth: An eruptive center captures magmas coming from a wider area, and this affects a comparison between the results of the petrological-chemical mass balance and the local crustal structure; however, very little is known about the physical extraction of melts.

The Ideal Volcano

Forum participants discussed the attributes of an ideal volcanic system that might serve as a case study for the comprehensive understanding of volcano behavior and hazards for human populations and cities. It was agreed that an ideal volcano should be active so that eruptive regimes are known or reconstructable from recent and well-preserved deposits, and because active centers produce a wealth of seismic, geothermal, volcanic gas, geodetic, and other monitoring signals that help to characterize the system. An obvious goal is to obtain a precise and complete history of eruptive and chemical evolution. Tephra layers are a high-fidelity record of eruptive activity, but they are fragile and erode rapidly.

A long-lived lake, bay, or submarine area in the immediate vicinity would offer the opportunity to sample complete stratigraphic sequences at high temporal resolution. Exposures of deep sections, from sector collapse events for example, would allow access to parts of the volcano's roots. Other desirable features: peripheral cinder cones, xenolith-bearing lavas, high isotopic contrast with the crust in order to facilitate geochemical interpretations, and frequent eruptions to allow for U-Th disequilibrium studies. In addition, the volcanic system must be large, the surrounding topography subdued to facilitate geophysical surveys, and the tectonic setting well known. Another class of attributes deals with practical issues, such as logistical and political accessibility.

Interdisciplinary Workshop

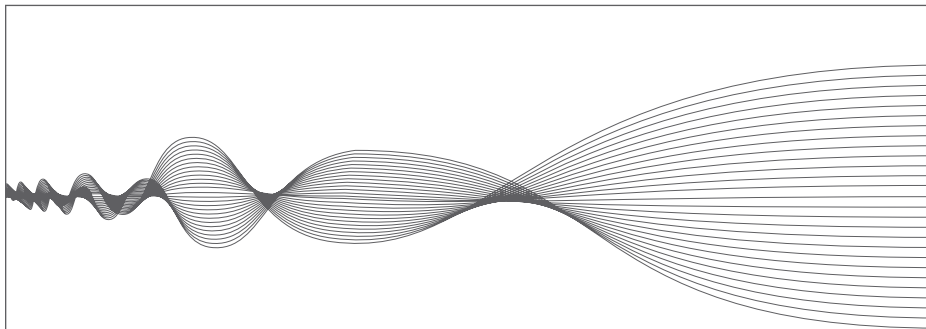
Forum participants endorsed the general need for geophysical studies to determine the locations, sizes, and shapes of intrusive portions of active arc magmatic systems, as well as the distributions of melts and crystals. Participants also stressed the community's need for integrated geological, geophysical, and petrological studies of dormant volcanic systems to complement results obtained from studying active eruptions. An interdisciplinary workshop with members of the geophysical community was proposed to explore joint studies of an active arc volcanic center with the aim of developing better quantitative images and models of the integrated magmatic system. Such study would ultimately enhance the ability of geoscientists to correctly interpret monitored signals and so better anticipate and mitigate volcanic hazards.

ACKNOWLEDGMENTS

We thank GSA for sponsoring the Field Forum. Cosponsoring institutions: the U.S. National Science Foundation, Immanuel Friedländer Foundation (ETH, Switzerland), SERNAGEOMIN (Chile), and the Swiss National Science Foundation. Mike Dungan instigated this forum, but he could not have managed without essential contributions from co-organizers Daniel Sellés, Carolina Rodríguez, Rebecca Lange, Ren Thompson, Fidel Costa, José Antonio Naranjo, and John Pallister. The execution of this logistically complex meeting was impeccable, the weather superb, the *esprit congénial*, and the scientific discussions outstanding. A measure of the effort involved is a lavishly and comprehensively illustrated 112-page Tatará-San Pedro Complex Field Forum Guidebook, which has established a daunting benchmark for future meetings of this type. Mike Dungan was also prominent in the organization of the fourth International Association of Volcanology and Chemistry of the Earth's Interior State of the Arc (IAVCEI SOTA) meeting held in southern Chile just prior to the Field Forum; all participants applaud Mike's dedication to our scientific endeavors through his efforts to bring the IAVCEI SOTA meeting and GSA Field Forum to successful conclusions.



Field Forum participants at Volcán San Pedro. **Back rows, standing, left to right:** José Antonio Naranjo (helicopter pilot), Ren Thompson, Daniel Sellés, John Pallister, Patricia Sruoga, Dennis Geist, Tom Sisson, Gerhard Wörner, William Leeman, Fidel Costa, Silvano Sinigoi, Joe Dufek, Andy Calvert, James Quick, Philipp Ruprecht, Paul Wallace, Claude Jaupart, Charlie Bacon. **Front rows, sitting, left to right:** Daniel Basualto, Wendy Bohrsen, Carolina Rodríguez, Emily Johnson, Merry Yue Cai, Holli Frey, Olivier Bachmann, Mark Reagan, Maureen Feineman, Saskia Erdmann, Madeleine Humphreys, Caroline Bouvet de Maisonneuve, Peter Lipman, Jason Dungan (videographer), Katie Kelley, Jon Blundy, Rachel Teasdale, Steve Ownby, Tim Grove, Mike Dungan, Anita Grunder. Photo by Richard Arculus (not shown).



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Call for Papers:



GROUNDWORK FURTHERING THE INFLUENCE OF EARTH SCIENCE

GSA Today seeks articles that lay the groundwork for furthering the influence of earth science on education, policy, planning, and funding. Articles can include in-depth geoscience commentary, short observations and analyses of hot topics, and discussion of policy news and issues.

CHARACTERISTICS OF A “GROUNDWORK” ARTICLE:

- 1 The printed article should be a **complete, stand-alone article**. (Ongoing or serial commentary or meetings summaries are not appropriate for this series.)
- 2 Supplemental information may be included as a **GSA Data Repository item**.
- 3 **Length:** No longer than 1400 words with two small figures or 1600 words with one figure. The philosophy behind this is twofold: (1) keeping an article short can increase the clarity and quality of the writing; and (2) a short article encourages readers to engage and seek more information.
- 4 **Color figures** may be included at no cost to authors.
- 5 *GSA Today* science editors will be responsible for **review and acceptance** of the articles.
- 6 **Frequency:** Accepted articles will be published on a space-available basis.

To submit a “Groundwork” article, send your manuscript and figures via e-mail to *GSA Today* Science Editors Stephen Johnston, stj@uvic.ca, and David Fastovsky, dfastov@uri.edu.

GSA Committees: Progress through Service

The GSA Committee on Minorities and Women in the Geosciences

The mission of the Committee on Minorities and Women in the Geosciences (MWC) is to stimulate recruitment and promote positive career development for ethnic minorities, women, and persons with disabilities in the geoscience professions. The committee focuses on correcting the apparent lack of involvement and participation of these groups in the geosciences. This is an important undertaking, given the growing need for geoscience personnel in academia, government, and industry, particularly in environmental fields.

SUPPORT FOR STUDENTS

The MWC is currently working toward providing sponsorship for activities in support of geoscience education for minorities, women, and persons with disabilities. In order to reach out to these segments of our society, the committee engages in a variety of approaches, such as

- providing travel support for students to present their research at the GSA Annual Meeting;
- offering free GSA membership;
- promoting research interest via the GSA Foundation Minority Fund; and
- hosting field trips for grade 7–12 students.

Traditionally, geology or earth science–related subjects have not been taught in most minority-focused institutions, and most students in grades 7–12 do not consider geology as a college-level career discipline. The MWC is working in close collaboration with colleges and universities through GSA campus representatives in order to create awareness and draw attention among the undecided majors. Complimentary subscriptions to GSA online journals are available to minority institutions and historically black colleges and universities.

The MWC feels very strongly about reaching out to grade 7–12 students and stressing the importance of geoscience as a major in college. The theme for the “Geoscience Days” conducted in conjunction with the 2007 GSA Annual Meeting in Denver was “LEADING STUDENTS TO SCIENCE”. Field trips offered grade 7–12 students from the Denver area an opportunity to appreciate the local geology and learn about geologic hazards.

RECOGNITION OF PROFESSIONALS

The MWC encourages visibility for ethnic minorities, women, and persons with disabilities so that they may serve as role models in the geosciences. Such visibility can be achieved through GSA publications, including *GSA Today* and *GSA Con-*

nection. The MWC also stresses the importance of recognizing women chairs, deans, and other academic leaders in the geosciences. The

committee hosted more than two dozen distinguished women academicians and administrators at the 2006 GSA Annual Meeting in Philadelphia.

The MWC also works closely with other professional societies (e.g., American Geophysical Union, Association for Women Geoscientists, National Association of Black Geologists and Geophysicists), government agencies, and private organizations to find ways to increase the representation and visibility of ethnic minorities, women, and persons with disabilities in the geosciences.

HOW THE COMMITTEE WORKS

The make-up of the MWC is unique and involves participants from academia, consulting, administration, and others from the private sector. The committee routinely meets via teleconference several times a year as well as during the GSA Annual Meeting. Topics discussed are related to recruitment, retention, and career development of ethnic minorities, women, and persons with disabilities in the geoscience professions.

Funding for the MWC comes from the generous support of the GSA Foundation. In addition, McGraw-Hill Higher Education provided financial support for the successful Geoscience Days held in Philadelphia (2006), organized by Marilyn Suiter.

Nazrul I. Khandaker, York College–City University of New York, kdaker@york.cuny.edu
Chair, Committee on Minorities and Women in the Geosciences



SCIENCE ■ STEWARDSHIP ■ SERVICE

Note: For more information on GSA committees, go to www.geosociety.org/aboutus/committees/.

2006–2007 Congressional Science Fellow Final Report



Craig Cooper, 2006–2007 GSA–U.S. Geological Survey
Congressional Science Fellow

My Congressional Science Fellowship ended over a month ago, and I'm still not quite sure what to make of it. It was undoubtedly the most enriching professional experience of my life, and I am deeply grateful to the U.S. Geological Survey and the Members of GSA for making this possible. I am also grateful to the Idaho National Laboratory for supporting me as an employee during my one-year tenure in Washington D.C., and to my family for their support during a year that was, at times, as challenging as it was rewarding.

The greatest highlight of my year was the experience of working with Senator Dianne Feinstein and her staff, learning what public service truly means, and devoting myself to that cause. One such cause was improving automobile fuel economy; I contributed meaningfully to the legislative team that passed improved fuel economy standards through the Senate this year—raising requirements for the first time in over 30 years. Another cause was developing legislation to reduce greenhouse gas emissions, which was a major part of my work. I contributed significantly to the development of legislation to implement a cap-and-trade system for both the electric utility sector and the economy-at-large. Such legislation would impact many facets of American life, create new costs for business, and create a new type of wealth—potentially worth tens of billions of dollars. A cap-and-trade system is a tricky proposition, and doing it wrong could create more problems than it solves.

In addition to these contributions, I have found great value in the lessons I learned about policy, leadership, service, and how the political process works. I observed first-hand how a leader in the Senate develops and manages an impressive staff, cuts through the chaff to get to the essence of an issue, and builds coalitions to achieve difficult policy goals. These lessons on how to be an effective leader are extremely valuable, perhaps even more valuable than my new understanding of how the political process works.

My challenge now is to apply these lessons to the next stage of my career, working with the technical and business leadership at the Idaho National Laboratory to help build a research and development program in “carbon management.” I believe this challenge is well-suited to the capabilities I've developed over the past year. The first step is to determine what exactly “carbon management” means and whether there are research opportunities beyond the development of new technologies and supporting science for carbon capture and sequestration (CCS). I believe that, while there is much work to do on CCS, there are many opportunities to optimize carbon transfers between diverse energy systems. Hence, carbon management also involves the development of a broad range of technologies and supporting science to reduce, recycle, and reuse waste CO₂ in order to generate more energy with less net carbon emissions to the atmosphere. In addition to CCS, this may include (i) improving our ability to utilize CO₂ for enhanced oil recovery, (ii) building on the work of Donald Brown and Karsten Pruess to develop technologies to use CO₂ as a heat transfer fluid for deep geothermal energy, (iii) developing technologies to cost-effectively generate H₂ from water and recombine it with waste CO₂ to create synthetic fuels, and/or (iv) finding new ways to cultivate and utilize biomass. Such opportunities have been somewhat limited in the past because there were few costs to emitting CO₂ to the atmosphere, but the development of regulatory systems that require the private sector to include the cost(s) of managing waste carbon into the price of a

product changes this situation and creates new needs for science and technology development.

Improving our capabilities in carbon management requires investment in science, technology, and policy. Science and technology cannot solve these problems on their own. Policy must set a reasonable rate for reducing greenhouse gas emissions and prioritize public investments to help CO₂ evolve from an unmanageable waste stream to a valuable commodity. This, in turn, requires improved knowledge of our technological capabilities, knowledge that is itself dependent on policy decisions. For example, the accepted sequestration capacity of a reservoir is somewhat dependent on the method(s) used to quantify and manage it, and those need to be codified in policy. Progress in one is dependent upon progress in the other; that is, improving our ability to manage waste carbon requires advances in both science and policy. The Congressional Science Fellowship experience has helped to prepare me for this challenge and continues to help the geosciences provide service to society. Thank you for this opportunity to learn and to serve.

This manuscript is submitted for publication by Craig Cooper, 2006–2007 GSA–U.S. Geological Survey Congressional Science Fellow, with the understanding that the U.S. government is authorized to reproduce and distribute reprints for governmental use. The one-year fellowship is supported by GSA and by the U.S. Geological Survey, Department of the Interior, under Assistance Award No. 06HQGR0169. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government. Cooper can be reached at Craig.Cooper@inl.gov.





A Successful Denver Meeting

The 2007 GSA Annual Meeting in Denver was very rewarding for the Foundation. A record number of items were successfully auctioned off during our 8th Silent Auction. The Senior Fellows Reception hosted over 280 attendees, and a good time was had by all. The Board of Trustees adopted a five-year plan that will eventually be tied to the Society's Strategic Plan. Also passed by the Board was an *Adopt a Leader Program*, whereby each Trustee is to be paired with a GSA Councilor or officer for the balance of FY08 (to 30 June 2008) for the purpose of enhancing communication between the two organizations. Another major addition was the creation of a new Standing Committee on Donors Intent, with the purpose of monitoring whether donor wishes are successfully followed.

A most important activity in Denver was welcoming seven new Trustees and acknowledging the dedicated service of four Trustees who retired from the board. Those leaving are Robert D. Hatcher, Jr., who had been serving as board chair; Thomas D. Fouch; H. Catherine W. Skinner; and Lee J. Suttner. Our new Trustees are Charles B. Andrews, president of S.S. Papadopoulos & Associates Inc.; Bruce R. Clark of the Leighton Group Inc.; Margaret R. Eggers of Eggers Environmental Inc.; George O. Linkletter, principal of ENVIRON International Inc.; Michael Thonis, managing director of the Charles Bank of Boston; L. Harvey Thorleifson, Minnesota State Geologist; and John C. Wise, retired director of the Environmental Protection Agency's Region IX. We welcome these individuals to our board! The GSA Foundation now has 18 members of the Board of Trustees, with a balance of representatives from academia, industry, and agencies.

December 31st is the Deadline for 2007 Gifts

If you are planning to make a donation to the GSA Foundation this year, your gift must be postmarked by 31 December 2007 in order to count towards your charitable donations for 2007. Your donation may be structured as a pledge over two to three years if a one-time contribution is not convenient, and it may include gifts other than cash. You can even donate using your credit card by visiting the GSA Foundation Web site at www.gsafweb.org. Online gifts processed by 31 December are tax-deductible for 2007. You may also send a check to the Foundation in support of the program of your choice or for the Greatest Needs Fund (see the coupon below). If you need assistance, please call the Foundation office at +1-303-357-1054 or e-mail drussell@geosociety.org.

We thank you so much for your continued support of GSA and the GSA Foundation.



Most memorable early geologic experience:

Going on class field trips with Dr. John M. Dennison, UNC Chapel Hill, and always taking a flashlight with me; John always had so much to show his students, he would run out of daylight before he would run out of field trip stops.

—Katharine L. Avary



3300 Penrose Place, P.O. Box 9140
Boulder, CO 80301-9140
+1-303-357-1054
drussell@geosociety.org
www.gsafweb.org

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- Free Charitable IRA Brochure Jackson Fund for Student Travel

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UCLA GEOSCIENCES INITIATIVE

FACULTY POSITIONS IN ATMOSPHERIC, OCEANIC, EARTH,
PLANETARY, AND SPACE SCIENCES

UCLA is launching an initiative to grow the Geosciences under the theme Surface Envelopes of Earth and Planets: Processes and Interactions. This initiative represents significant new resources to promote interdisciplinary research on the dynamic processes affecting interactions of air, ice, clouds, water, rock and living systems, informed by studies of other planets and the Sun. Appointees will complement UCLA's current expertise and span disciplinary boundaries to better understand Earth's future in the context of changing global climate and diminished natural resources.

In the coming year, appointments will be made in the Department of Atmospheric and Oceanic Sciences (AOS), the Department of Earth and Space Sciences (ESS), and the Institute of Geophysics and Planetary Physics (IGPP). Joint appointments will be made as appropriate. Appointments not filled this year may be filled later. In subsequent years we plan new rounds of appointments spanning a wider range of physical, biological and social sciences and engineering.

Faculty positions are sought in the following areas, with multiple and/or senior appointments possible in certain areas. Applicants may be considered in multiple areas with a single application. **Please submit only one application and designate in priority order, by the categories below, the areas under which you prefer your application to be considered.**

- A1. Atmospheric Chemistry and Aerosols.
- E1. Planetary Science
- E2. Biogeoscience
- E3. Land Surface Processes
- G1. Planetary Atmospheres
- G2. Environment, Energy and Society
- G3. Surface Processes and Climate
- G4. Solar variability

A1. Atmospheric Chemistry and Aerosols. A broad Earth-system view of atmospheric chemistry, composition, and aerosols in the context of global and regional climate changes: Relevant methodologies include model formulation, data assimilation, and interpretation of observations.

E1. Planetary Science. Successful candidates may take theoretical, observational, or preferably both approaches to explore the formation, evolution, and present state of planets, satellites, and small bodies. All the objects in the solar system and extra-solar planets are of interest as are their interiors, surfaces, atmospheres and near-space environments.

E2. Biogeoscience. Field and/or laboratory investigations of major questions such as: What conditions must be met for life to initiate, and how have primitive organisms evolved into complex ones? How have the biosphere and the rest of earth co-evolved? How does the biosphere respond to human influences?

E3. Land Surface Processes. Theoretical and/or observational studies of landscape evolution; comparative planetary-surface studies; Quaternary geochronology; low-temperature thermochronology; remote sensing; geohazards; experimental geomorphology.

G1. Planetary Atmospheres. Observations, theory, and modeling of the physical and chemical processes responsible for the structure and circulation of extra-terrestrial planetary and satellite atmospheres, from the thermosphere to the solid surface or into the deep interior of the gas planets, and in relation to Earth's past, present, and future climate.

G2. Environment, Energy and Society. Water, soil, and energy resources; impacts of environmental change on health and population; assessment of environmental mitigation and remediation strategies (e.g., clean, efficient technology; pollutant sequestration and recycling; planetary geo-engineering); global economic risk modeling.

G3. Surface Processes and Climate. Modeling and observational studies of interactions and feedbacks between climate, erosion and deposition, soil, water, ice, ecosystems, and geodynamics. Includes paleoclimate, marine chemistry, hydrology, and glaciology. Compare with E3. Applicants who list G3 and E3 as first and second priorities will be considered in both.

G4. Solar variability. Causes of solar variability and its consequences for Earth and the rest of the heliosphere: Of interest are the regular 22 year magnetic cycle, longer-period fluctuations, and the sudden, episodic eruption of flares from the surface for the Sun as our nearest star and as a paradigm for stellar variability elsewhere.

Most appointments are targeted at the Assistant Professor level but applications from senior candidates are welcomed. Candidates must hold a Ph.D. and postdoctoral experience will be an advantage. Information about the Departments and the Institute, including the breadth and depth of their faculty and research enterprises may be found at www.atmos.ucla.edu, www.ess.ucla.edu and www.igpp.ucla.edu.

Your single application should include a curriculum vitae, publication list, short statement of teaching and research interests, names of four or more individuals familiar with the applicant's work who could be contacted for letters of reference, and three publications. Consideration of applications will begin **December 17, 2007**, but later applications may be considered. Applications and inquiries should be directed to: Faculty_Positions@igpp.ucla.edu or Faculty Positions, Institute of Geophysics and Space Physics, UCLA, Los Angeles, CA 90095-1567. Women and minority applicants are encouraged to apply. UCLA is an equal opportunity/Affirmative Action employer.

Classified Rates—2007

Ads (or cancellations) must reach the GSA Advertising office no later than the first of the month, one month prior to issue. Contact Advertising Department: advertising@geosociety.org; +1.800.472.1988 x1053; +1.303.357.1053. Complete contact information, including mailing and email address, must be included with all correspondence.

Classification	Per Line for 1st month	Per line each add'l month (same ad)
Positions Open	\$7.75	\$7.50
Opportunities for Students		
First 25 lines	\$0.00	\$4.00
additional lines	\$4.00	\$4.00
Situations Wanted	\$3.50	\$3.25

To estimate cost, count 54 characters per line, including all punctuation and blank spaces. Actual cost may differ if you use capitals, centered copy, or special characters.

Positions Open

KANSAS GEOLOGICAL SURVEY UNIVERSITY OF KANSAS, LAWRENCE

SECTION CHIEF—Energy Research Section: Research Associate to academic rank of Senior Scientist, depending on qualifications. Full-time position to lead section, conduct research and disseminate information about Kansas energy. Requires advanced geoscience degree; experience in management, developing/implementing a research program, addressing technical challenges related to energy industry; and record of high-quality written and oral presentations, including peer-reviewed publications. Prefer terminal degree in the geosciences and background in petroleum.

PETROLEUM GEOSCIENTIST or PETROLEUM ENGINEER—Energy Research Section: Research Assistant to academic rank of Senior Scientist, depending on qualifications. Full-time position to conduct research and disseminate information about Kansas energy. Requires advanced degree in the geosciences or petroleum engineering, demonstrated ability or potential to develop/implement a research program and address technical challenges related to the energy industry, and record of, or potential for, high-quality written and oral presentations, including peer-reviewed publications. Prefer terminal degree in the geosciences or petroleum engineering and background in petroleum.

Possible academic appointment in appropriate department at the Univ. of Kansas for either position. Women and minority candidates are especially encouraged to apply. Full announcement and application instructions are at www.kgs.ku.edu/General/jobs.html. Review begins Jan. 15, 2008. Annette Delaney, HR, hr@kgs.ku.edu or +1-785-864-2152. Technical questions: Rex Buchanan, rex@kgs.ku.edu, +1-785-864-2106. EO/AA employer.

SEM LAB MANAGER UNIVERSITY OF MINNESOTA—DULUTH

In early 2008, the Geological Sciences program at UMD (www.d.umn.edu/geology) will acquire a new variable-pressure scanning electron microscope (SEM) equipped with low-vacuum secondary detector, high-resolution BSE, EDS, EBSD, and CL systems. This SEM will be part of a growing materials characterization and analysis facility shared by the Geological Sciences and other science and engineering programs at UMD. In support of the new lab, we seek a full-time, permanent Laboratory Manager. The successful candidate will have a degree in geological sciences or a related field in materials science, and demonstrated knowledge of instrumental geochemistry, mineral chemistry and/or crystallography. A background of graduate-level (M.S. or higher) research experience in mineralogy and/or hard-rock petrology is preferred. Additional experience with materials analysis, electronics, PC computer networks, Web design and/or database management is desirable. We seek an enterprising person with sound knowledge of electron-beam or X-ray analysis, good communication skills, and a desire and ability to work with a diverse range of laboratory users, including faculty researchers, students and lab visitors.

Principal duties of this position will be manager and technologist for the SEM lab, and provide support for related departmental equipment (X-ray diffractometer, X-ray fluorescence spectrometer, and polarizing optical microscopes). As SEM Lab Manager, chief respon-

sibilities include day-to-day operation, user training and assistance, instrument scheduling, routine instrument operation and regular maintenance, budgets and accounts, contract analyses, development of outside user community, and development of new methods.

Applications will be submitted electronically through the University of Minnesota online employment system (<https://employment.umn.edu/>). The job posting may be found in reference to Requisition Number 151427. Applicants must submit a cover letter, curriculum vitae, a statement of relevant prior laboratory experience, and the names of three references. We will begin reviewing applications on December 1 and continue until the position is filled.

The University of Minnesota is an equal opportunity educator and employer.

GEOLOGY INSTRUCTOR, PALEONTOLOGY MISSOURI STATE UNIVERSITY

The Department of Geography, Geology and Planning anticipates an opening for a 9-month, non-tenure-track **Instructor in Geology with a specialty in Paleontology** to begin in August 2008. M.S. in Geology or closely related field required; Ph.D. (or ABD) preferred. Expertise in the area of invertebrate paleontology and evidence of teaching effectiveness required; commitment to and ongoing involvement in paleontological research preferred. Teaching responsibilities will include our upper-division undergraduate course in Invertebrate Paleontology plus some subset of the following: sophomore/junior-level Historical Geology, junior-level Directed Geology Field Trip, General Education Principles of Geology, General Education Environmental Geology, and freshman-level Life of the Past.

Applicants should submit a letter of interest and current CV and arrange for three reference letters and copies of all academic transcripts to be submitted to Chair, Geology Search Committee, Department of Geography, Geology and Planning, Missouri State University, 901 South National, Springfield, MO 65897. The evaluation of applications will begin January 21 and will continue until a successful candidate is found. Further information can be obtained at +1-417-836-5800 or fax to +1-417-836-6006, or visit our Web site at geosciences.missouristate.edu. **Employment will require a criminal background check at university expense.** Women and minority candidates are encouraged to apply. EO/AA employer. E-mail: Geology@missouristate.edu

EARTH AND SPACE SYSTEMS BUFFALO STATE COLLEGE

The Department of Earth Sciences and Science Education at Buffalo State College (SUNY) seeks to fill a tenure-track position in Earth and Space Systems beginning September, 2008. The area of specialty in this field is open, but we seek a qualified Geologist/Earth Systems Scientist with expertise to complement and strengthen our current programs in Geology, Earth Sciences, and Earth Science Education. The successful candidate will be a scientist who is qualified to teach Introductory Astronomy each semester as well as other Earth and Space Systems courses on a rotating schedule, such as Introductory Geology and upper-division astronomy courses. The successful candidate will also develop upper-division courses that reflect the successful candidate's specialty area for majors within our department and graduate courses for secondary Earth Science teachers. A Ph.D. in geosciences at the time of appointment is required, as is a demonstrated commitment to undergraduate education, including providing field and research experiences for students in the area of Earth and Space Systems. The successful candidate will be expected to develop a research program that involves mentoring undergraduate students conducting their own research and must be committed to working with pre- and in-service Earth Science teachers. Preferred qualifications include prior undergraduate-level teaching experience.

Further information about our programs, faculty, and this position can be found at www.buffalostate.edu/earthsciences. Qualified applicants should send their curriculum vitae, statement of teaching philosophy and teaching interests, statement of research interests, examples of potential undergraduate research projects, and copies of transcripts. They should also arrange to have three letters of reference sent directly to the search committee. All materials should be sent to Chair of Earth and Space Systems Search Committee, Department of Earth Sciences and Science Education, Buffalo State College, 1300 Elmwood Avenue, Buffalo, NY 14222. Review of applicants will begin January 11, 2008, and will continue until the position is filled. Buffalo State College is an equal-opportunity/affirmative action employer and committed to respect for diversity and individual differences.

Assistant Professor of Marine Science (Coastal Marine Geoscientists)



Coastal Carolina University invites applications for two Tenure-Track Faculty positions in the Department of Marine Science beginning Fall 2008. The University seeks a highly motivated individual with a commitment to undergraduate and graduate education and an established record of research accomplishments. Candidates will be expected to have a coastal marine geoscience focus. Applied hydrogeology is preferred for one of the positions while other areas of preference are coastal Quaternary studies, coastal sedimentary environments or processes, or estuarine/nearshore dynamics.

The Department of Marine Science is committed to a collaborative, interdisciplinary philosophy of education and research. The successful candidate will be expected to teach introductory and upper division courses in the undergraduate Marine Science program, as well as graduate courses in the Coastal Marine and Wetlands Studies program. The candidate will be expected to develop a successful externally-funded research program involving both undergraduate and graduate students. Applicants must have a Ph.D. in Marine Science or a related field.

Coastal Carolina University is a public mid-sized, comprehensive liberal arts-oriented institution. Coastal Carolina University is located in Conway, South Carolina, just nine miles from the Atlantic coastal resort Myrtle Beach, one of the fastest-growing metropolitan areas in the nation. It has an enrollment of 8,400 students and is expected to have continued growth for the next several years. Coastal Carolina University is a part of the South Carolina system of public education and has close ties with its founders, the Horry County Higher Education Commission.

Interested candidates should submit a letter of application, curriculum vitae, statement of teaching and research interest and the contact information for at least three professional references, electronically at <http://jobs.coastal.edu>. Review of applications will begin immediately and continue until the position is filled.

For further information about CCU and Marine Science visit:
<http://kingfish.coastal.edu/marine>.

Coastal Carolina University is an EO/AA employer.

**Chair, Geography and Geology****EASTERN KENTUCKY UNIVERSITY**

The Department of Geography and Geology at Eastern Kentucky University, invites applications for Department Chair, a 12 month position at the rank of Associate or Full Professor, to begin July 1, 2008. We seek an individual who possesses excellent administrative capabilities. Moreover, as a newly-merged department, the successful candidate will lead us in building a strong department with integrated programs at both the undergraduate (Bachelor's programs in both Geography and Geology) and Master's (Geoscience) level. The applicant must also possess a terminal degree in either discipline (specialty open) from a regionally (SACS, North Central, etc.) accredited or internationally recognized institution with a record of exemplary teaching and scholarship and an interest in civic engagement and regional stewardship. See our website at www.geoscience.eku.edu To apply, visit <http://jobs.eku.edu> and search requisition **0601912** (sorry, no paper copies accepted). Materials required include a letter of application, curriculum vita, names and full contact information for 5 references, and a one-page, double-spaced statement of career progress and goals. Review of applications will begin December 1, 2007 and will continue until the position is filled.

Offers of employment are contingent upon satisfactory background check and educational credential verification. Eastern Kentucky University is an EEO/AA institution that values diversity in its faculty, staff, and student body. In keeping with this commitment, the University welcomes applications from diverse candidates and candidates who support diversity.

**COLORADO SCHOOL OF MINES, DEPT. OF GEOLOGY & GEOLOGICAL ENGINEERING ASSISTANT PROFESSOR STRATIGRAPHY/SEDIMENTOLOGY**

Colorado School of Mines Department of Geology & Geological Engineering invites applications for an anticipated tenure-track Assistant Professor. The successful candidate will be expected to teach stratigraphy and sedimentology at the undergraduate and graduate levels, direct graduate research, and develop a strong, externally funded interdisciplinary research program, which preferably includes gas hydrates research.

Applicants must have a Ph.D. in a science or engineering field. Preference will be given to applicants with specialties in stratigraphy and sedimentology especially in ancient and/or modern continental-margin systems at a variety of scales and scopes. The successful candidate must demonstrate strong interpersonal and communications abilities, as well as providing a record of successful collaborative research/teaching experiences.

For a complete job announcement, more information about the position and the university, and instructions on how to apply, please visit our Web site at www.is.mines.edu/hr/Faculty_Jobs.shtm.

CSM is an EEO/AA employer and is committed to enhancing the diversity of its campus community. Employment with CSM is contingent upon the satisfactory completion of a background investigation.

TENURE TRACK FACULTY POSITION ENVIRONMENTAL SCIENCES**UNIVERSITY OF ILLINOIS AT SPRINGFIELD**

Environmental Sciences: Interdisciplinary Environmental Studies Department in the College of Public Affairs and Administration seeks a tenure track **ASSISTANT PROFESSOR**, beginning August 15, 2008. Candidates must have a Ph.D. in an appropriate field—environmental science, geology, earth science, or a related discipline, evidence of research potential and the ability to teach undergraduate and graduate courses in the environmental sciences. Teaching expectations include introduction to environmental science, environmental geology, climate change, and a broad-based, integrated natural science course that brings together the natural and environmental sciences.

Send a letter of application, statement of teaching philosophy and research interest, vita, unofficial undergraduate and graduate transcripts, and the names and contact information of at least three references to: **Search Committee, Department of Environmental Studies, University of Illinois at Springfield, One University Plaza, Springfield, Illinois 62703.**

Review of applications will begin January 7, 2008, and continue until the position is filled.

The University of Illinois at Springfield is an Affirmative Action/Equal Employment Opportunity Employer. Persons with disabilities, women, minorities, and veterans are encouraged to apply.

PROJECT- AND SENIOR-SCIENTIST EARTH KNOWLEDGE, INC.

Over the last 5 years, Earth Knowledge has been developing innovative and practical earth and environmental science programs for businesses and communities. Earth Knowledge's principals have spent their careers developing very successful collaborative teams dedicated to integrity and respect.

Earth Knowledge has been experiencing significant growth as a result of its successful interdisciplinary, multi-stakeholder projects and is currently seeking to expand its core team of experienced scientists and engineers who will help guide the firm's growth and expansion.

Earth Knowledge is seeking project- and senior-level scientists to assist in addressing ongoing and developing projects in the domain of water resources sustainability in the Great Basin (Utah, Nevada, and California), Mojave Desert (Nevada and California), Colorado Plateau (Utah and Arizona) and Sonoran Desert (Arizona and California). The projects require very specialized and pragmatic skills associated with hydrogeologic characterization, ground-water modeling, surface-water and ground-water interactions, geospatial analysis, and Web-based knowledge management applications.

Job Responsibilities: (1) Evaluate and interpret geologic and hydrologic data and information; (2) Synthesize geologic, hydrologic, and other environmental science information for use in ground-water flow models; (3) Design, construct, calibrate and evaluate ground-water flow models; (4) Prepare/review technical reports and data for submittal to clients; (5) Conduct other project related operational and administrative activities including, but not limited to, monitoring and reporting on monthly project progress and overseeing the work of project personnel; (6) Communicate with (integrate information from) multiple scientists and stakeholders; (7) Assist in the development of technical/non-technical presentations and reports.

Requirements: (1) Degree in geology, hydrogeology, or hydrology required, MS or Ph.D. preferred; (2) Considerable knowledge of hydrological and geological sciences (including climatology, ecology, and soils), physics, mathematics, and computer science required; (3) Experience with ground-water modeling (MODFLOW 2000, MODFLOW 2005, UCODE), computer data analysis applications, parameter estimation, sensitivity and uncertainty analysis, required; (4) Experience with Geographic Information System (ArcGIS or related ESRI products) and other computer software needed to construct ground-water models required; (5) Excellent organizational and time-management skills required; (6) Ability to write and review both technical and non-technical reports for publication required; (7) Ability to communicate on a professional level the results of technical investigations orally to both technical and non-technical audiences required; (8) Experience with Google Maps, Google Earth, and/or other Web based GIS mapping desired; (9) Experience with Web 2.0 technologies including news aggregation (via RSS and geoRSS), social networking, and/or content management systems desired.

Job Location: Tucson, Arizona.

Salary Range: Appropriate to qualifications and experience.

Contact Information: Julia Armstrong D'Agness, CEO, Earth Knowledge, Inc., 500 N. Tucson Blvd., Ste. 150, Tucson, Arizona 85716, julia@earthknowledge.net, +1-520-829-7127.

MIAMI UNIVERSITY (HAMILTON CAMPUS) GEOSCIENCE

The Department of Geology at Miami University invites applications for a tenure-track faculty position at the Assistant Professor level on our regional campus in Hamilton, Ohio. This appointment will establish a permanent geoscience presence on the regional campus and will provide new opportunities for educational and community outreach. Applicants must have a Ph.D. degree at the time of appointment. The successful candidate will be expected to teach and advise effectively at the undergraduate level, engage in outreach and other

service to the university and the surrounding community, and develop and continue a record of research and published scholarship. We encourage applications from geoscientists with interests in contributing to graduate education, supervision of undergraduate and graduate student research, and educating students of earth and environmental sciences in the field. The successful candidate's teaching and research agenda should complement existing department and regional campus strengths and ideally will benefit from the regional geologic setting, interdisciplinary interactions with department and campus colleagues, and existing research facilities. You are invited to visit the following Websites for information on the department (www.muohio.edu/geology), the Hamilton regional campus (www.ham.muohio.edu), and the university (www.muohio.edu).

Miami University—Hamilton, with 3500 students, is a commuter campus located in an urban setting close to both Cincinnati and Dayton. The campus has a strong connection to the main campus in Oxford, 16 miles away, as well as to the communities it serves. Interested candidates should submit a packet containing a letter of application, curriculum vitae, statement of teaching philosophy, and service and research objectives and accomplishments, transcripts; and arrange three letters of reference to be sent to: Geoscience Search Committee, Miami University Hamilton, 1601 University Blvd., Hamilton, OH 45011; fax +1-513-785-3050. Review of applications will begin on January 14, 2008, and will continue until the position is filled. The appointment will be effective August 18, 2008.

Miami University is an affirmative action/equal opportunity employer. Women and minorities are encouraged to apply. For information regarding campus crime and safety, visit www.muohio.edu/righttoknow.

ASSISTANT PROFESSOR DEPARTMENT OF GEOLOGICAL SCIENCES FLORIDA STATE UNIVERSITY

The Department of Geological Sciences, Florida State University, invites applications for two tenure track position to be filled at the rank of Assistant Professor beginning in August, 2008. We seek candidates who are committed to excellence in teaching at both the graduate and undergraduate level and to the goal of becoming a major contributor to their science by advancing knowledge and understanding in one of the two broad and general areas: (1) igneous/metamorphic materials, terranes, and processes; and (2) sedimentary systems, processes, materials.

We will consider applicants whose research is laboratory, field, or computation based. The successful candidate will be expected to participate in teaching at both the graduate and undergraduate level, establish and sustain an externally funded research program, and provide service to the university, profession, and public.

The Department of Geological Sciences embraces a vision to educate scientists for the 21st century multidisciplinary workplace, maintaining strong programs in traditional geological disciplines as well as environmentally related fields. Faculty and students are housed in the recently renovated Carraway Building, and at the National High Magnetic Field Laboratory, where the department maintains a state-of-the-art isotope geochemistry facility. Department members enjoy affiliations with the Geophysical Fluid Dynamics Institute, the School of Computational Science, the Antarctic Marine Geology Research Facility, and the Center for Materials Research and Technology.

Applications should include a vita, a statement of research and teaching interests, and names of at least three references, including e-mail addresses and telephone numbers. Applications sent electronically (PDF format) to search_committee@gly.fsu.edu are highly preferred, but may be sent via normal mail to Search Committee, Department of Geological Sciences, Florida State University, Tallahassee, Florida 32306-4100. Copies of no more than two representative papers may be sent with applications.

In addition, Florida State University will also hire six new faculty over the next three years with focus on exploration and characterization of marine extreme environments. Announcement of this initiative can be found at <http://pathways.fsu.edu/faculty/geeo/>.

Information on applying for the GEO faculty positions can be found at www.gly.fsu.edu/Cluster_faculty_ad.htm.

Florida State University is an Equal Opportunity/Affirmative Action employer, committed to diversity in hiring, and a Public Records Agency.

LOW TEMPERATURE GEOCHEMISTRY FACULTY POSITION, UNIVERSITY OF AKRON

The University of Akron Department of Geology and Environmental Science invites applications for a tenure-track Assistant Professor position in the broadly defined

fields of environmental geochemistry or biogeochemistry. The University of Akron is a growing metropolitan university with more than 24,000 students. The ideal candidate should complement existing departmental strengths in paleoclimatology, paleolimnology, environmental geology and/or karst hydrology, and have the potential to collaborate with faculty from the Integrative Bioscience program. Applicants should have a Ph.D. in the Geosciences or related field at the time of appointment. The successful candidate should provide evidence that they have the potential to develop and maintain an active externally-funded research program involving both undergraduate and graduate students. Teaching responsibilities will include undergraduate and graduate classes, as well as introductory geochemistry, and courses in the candidate's area of specialization. Applications must include curriculum vitae, statements of research and teaching philosophy and contact information for at least three references. The position remains open until filled with review of applications beginning January 15, 2008. Send application materials to Dr. David McConnell, Chair of Search Committee, Department of Geology and Environmental Science, University of Akron, Akron, Ohio 44325-4101, USA. Further information about the department can be found at www.uakron.edu/colleges/artsci/depts/geology/. The University of Akron is an Equal Opportunity Employer.

**TENURE-TRACK FACULTY POSITION
EARTH SCIENCE EDUCATION
UNIVERSITY OF WISCONSIN-EAU CLAIRE**

Earth science education position available August 18, 2008. A completed doctorate in geology or a closely related discipline is required at the time of appointment. Essential qualifications include demonstrated ability or potential to teach a laboratory and field-intensive introductory earth science course for education majors and related courses, to work with the K-12 education community, and to establish a strong program of scholarship in geology or science pedagogy (area of specialization is open but should complement existing strengths within the college).

Applications include a letter describing interest and qualifications for the position along with a curriculum vitae and unofficial copies of university transcripts. Send applications electronically (PDF files or MS-Word attachments strongly preferred) to GeologyHire@uwec.edu. Arrangements should be made to have three letters of recommendation sent either electronically (PDF files of MS-Word) or by mail directly from your references. Review of completed applications will commence January 15, 2008, and continue until the position is filled.

For a complete position description, call +1-715-836-3732 or visit www.UWEC.edu/Geology. UW-Eau Claire is an AA/EEO employer and encourages applications from women and minorities.

**ENDOWED CHAIR POSITION
EXPLORATION GEOPHYSICS
BOONE PICKENS SCHOOL OF GEOLOGY
OKLAHOMA STATE UNIVERSITY**

The Boone Pickens School of Geology at Oklahoma State University (OSU) invites applications and nominations for a distinguished geophysicist with demonstrable international reputation and strong research background to fill The Boone Pickens Chair in Exploration Geophysics position at the full professor level. Applicants are required to have a Ph.D. degree in geophysics or related field.

The applicants should have a broad background in the geophysical sciences especially in seismic reflection techniques applied to oil exploration. The School also will consider applicants with an expertise in crustal scale reflection seismology. Specific research areas may include, but are not restricted to, seismic data processing and quantitative seismic analysis, seismic attribute analysis based on rock physics, or processing and inversion for 4-D applications. Applicants must have a strong research and publication record, a demonstrated ability to attract external funding, and be tenurable at the time of appointment. Salary and benefits will be competitive and commensurate with experience and future potential.

The successful candidate will be expected to pursue a vigorous research program, as well as a strong record of publication and funding. The candidate will supervise M.S. graduate students and develop courses in his or her specialty and participate in the development of an anticipated Ph.D. program in the School of Geology. In addition, they will participate in teaching introductory geology courses.

The successful candidate will join a faculty of eleven geoscientists, including two other geophysicists, and will be part of a strong petroleum geology and tecton-

ics research group that includes six other faculty and has close ties to the petroleum industry. The School of Geology has a well equipped geophysical laboratory with a Geometrics 48 channel seismograph, an Iris Syscalpro 10 channel resistivity system, an AGI Supersting resistivity system, a Scintrex C-G5 gravimeter, a Geometrics control source audio magnetelluric system (Stratagem), a Pulse Ekko GPR system, a Geonics EM-34 system, a Geometrics 858 Cs vapor magnetometer, and state-of-the-art software for processing both potential field and seismic data. In addition the School has recently constructed the Devon Teaching and Research Laboratory, which contains state-of-the-art 3-D image processing facilities.

Applicants should submit a complete vita/resume, statement of research and teaching interests, and a list of five persons who could provide references, including names, phone numbers, e-mail addresses, and complete mailing addresses. Applications should be sent to: Geophysics Search, Boone Pickens School of Geology, 105 Noble Research Center, Oklahoma State University, Stillwater, Oklahoma 74078-3031. Phone: +1-405-744-6358; fax: +1-405-744-7841. Screening of candidates will begin in January 21, 2008, and will continue until the position is filled.

Inquires about this position may be directed to Dr. Estella Atekwana, Chair of the search committee (estella.atekwana@okstate.edu) or Dr. Jay Gregg, Head of the School of Geology (jay.gregg@okstate.edu), both at the above address. More information on OSU and the Boone Pickens School of Geology can be found on the Web www.pio.okstate.edu and www.okstate.edu/geology, respectively.

Oklahoma State University is an Affirmative Action/Equal Opportunity Employer. People from underrepresented groups are strongly encouraged to apply for this position.

**SOLID EARTH GEOPHYSICIST
UNIVERSITY OF NEW HAMPSHIRE**

The Department of Earth Sciences at the University of New Hampshire invites applications for a tenure-track position in solid earth geophysics at the assistant professor level starting August 2008 or thereafter. The Department of Earth Sciences (www.unh.edu/esci) conducts research in geology, oceanography, atmospheric sciences, and hydrology, and offers Bachelors, Masters, and Ph.D.'s in the earth sciences. The successful candidate will be expected to teach geophysics, an introductory earth sciences course as part of the core curriculum in geology, and graduate course(s) in his/her specialty, and to develop a strong externally funded research program involving graduate and undergraduate students. Research specialization is open, but applicants with interests in tectonics that complement current departmental efforts are particularly encouraged to apply. The Department has strong ties to the Institute for the Study of Earth, Oceans, and Space (www.eos.sr.unh.edu/) and the Center for Coastal and Ocean Mapping (www.ccom-jhc.unh.edu/). Starting salary will be commensurate with experience and qualifications. A Ph.D. at the time of appointment is expected.

Review of applications began October 22, 2007, and will continue until the position is filled. Please send complete CV, statement of research and teaching interests, and names and addresses of three references to Geophysics Search Committee, Department of Earth Sciences, University of New Hampshire, 56 College Road, Durham, NH 03824. UNH is committed to excellence through diversity among its faculty and strongly encourages women and minorities to apply.

**PALEOCLIMATE/CLIMATE DYNAMICS
FACULTY POSITION, DEPT. OF EARTH SCIENCES
UNIVERSITY OF SOUTHERN CALIFORNIA**

The Department of Earth Sciences at the University of Southern California seeks to appoint an assistant professor in paleoclimatology/climate dynamics whose research focuses on modeling/dynamics of global climate/environmental changes on a variety of time scales. This person would join an active group of existing faculty with interests in climate/environment variability, which extend from the Archean to the present day.

Review of applications will begin in January 2008 and continue until the position is filled. The appointment could begin as early as August 16, 2008. Applications should include a curriculum vitae, statement of research interests, statement of teaching experience and interests, and the names, addresses, and e-mail addresses of at least three referees. Electronic applications are encouraged. USC values diversity and is committed to equal opportunity in employment. Women and men, and members of all racial and ethnic groups are encouraged to apply. All applicants should have their Ph.D. degrees completed before the review process begins.

GRADUATE OPPORTUNITIES IN GEOSCIENCES

THE DEPARTMENT OF GEOSCIENCES AT STONY BROOK UNIVERSITY has Ph.D. Research Assistantships for graduate students interested in carrying out research projects in fields that include crystallography, experimental petrology, geodynamics, glacial geology, global geophysics and seismology, isotope geochemistry, low-temperature geochemistry (ground water, water-rock interaction), mineral physics, molecular environmental geochemistry, planetary geology, rock mechanics, and sedimentary geochemistry.

Students with backgrounds in chemistry, geochemistry, geology, geophysics, mathematics, and physics are encouraged to apply. The Department maintains active collaborations with the Mineral Physics Institute, the Consortium for Materials Properties Research in Earth Science, and the School of Marine and Atmospheric Sciences (all on the Stony Brook campus), as well as Brookhaven National Laboratory on Long Island.

Stony Brook University, located on Long Island's north shore, just 60 miles from New York City, is ranked in the top 2 percent of all universities worldwide by the 2006 *London Times Higher Education Supplement*. *U.S. News & World Report* ranks Stony Brook among the top 100 best national universities and among the 50 best public universities. A member of the elite Association of American Universities, Stony Brook is among the 62 best research institutions in North America.

Interested applicants should apply by January 15, 2008.

See our Web site at www.geosciences.stonybrook.edu for online application and information.



Stony Brook University/SUNY is an affirmative action, equal opportunity educator and employer.

Applications should be submitted to Steve P. Lund (slund@usc.edu), Chair, Climate Search Committee, Department of Earth Sciences, University of Southern California, Los Angeles, CA, 90089-0740.

**MICHAEL L. JOHNSON ENDOWED CHAIR
IN GEOLOGICAL SCIENCES
NEW MEXICO STATE UNIVERSITY**

The Department of Geological Sciences at NMSU invites applicants for a tenure-track faculty position at a rank commensurate with experience and demonstrated research accomplishments in the field of isotope geochemistry other than U-Pb and Ar geochronology. A Ph.D. is required at time of appointment. NMSU has a firm commitment to excellence in both teaching and research (www.nmsu.edu/~geology). We seek applicants who will teach undergraduate courses in physical geology, geochemistry, and isotope geochemistry; develop graduate courses in the applicant's specialty; maintain a strong, externally funded research program; sustain a record of peer-reviewed publication; and advise MS thesis projects. The Johnson Endowed Chair includes an annual research stipend of \$20,000.

For more details, see http://hr.nmsu.edu/jobs/posting_2007011274. Applicants should submit a curriculum vita, statement of research and teaching interests, and a list of three references including names, phone numbers, e-mail addresses, and complete mailing addresses to Dr. Jeff Amato, Chair of the Search Committee, Department of Geological Sciences-MS 3AB, P.O. Box 30001, New Mexico State University, Las Cruces, NM 88003, or amato@nmsu.edu. Review of applications will begin 3 December 2007 and continue until the position is filled; the position is anticipated to start in August 2008. NMSU is an EEO/AA employer. Offer of employment is contingent upon verification of individual's eligibility for employment in the United States.

GLACIOLOGY, UNIVERSITY OF KANSAS

The Department of Geology and the Center for Remote Sensing of Ice Sheets (CRISIS) at the University of Kansas seek applications for an academic year, tenure-track faculty position in the field of glaciology. We seek an outstanding colleague whose research addresses fundamental problems related to glaciology and the

UNIVERSITY OF WYOMING

ENERGY-RELATED GEOPHYSICS - OPEN RANK

The Department of Geology and Geophysics at the University of Wyoming invites applications for a faculty position in the Department and in the newly created School of Energy Resources (SER) at the University of Wyoming, an institute dedicated to energy-related teaching and research in support of State, national, and international energy-related activities. This appointment may be made at any rank. The position can begin as soon as January 1, 2008.

We seek an individual who will establish a well-recognized, externally funded research program in geophysics, with a preference toward reflection seismology, petrophysics, or potential fields as applied to energy-related research. Applicants should complement and/or expand on departmental strengths in geophysics, structure geology and tectonics, sedimentology, and/or crustal studies. We seek a person with the ability to cooperate productively with other SER faculty in geology and geophysics, mathematics, chemical and petroleum engineering, economics, and other energy-related fields. The successful candidate will be involved in the undergraduate and graduate teaching mission of the Department of Geology and Geophysics. The SER is an ambitious, state-funded institute that seeks innovative researchers working on new approaches at the forefront of the expanding fields in energy research. Information about the School of Energy Resources is available at uwyo.edu/SER. Additional information on the Department of Geology and Geophysics can be obtained at <http://home.gg.uwyo.edu/>.

Applications should include a statement of research and teaching interests and accomplishments, curriculum vitae, and the names and contact information for three individuals who can provide letters of evaluation. Review of completed applications will begin October 1, 2007; however, applications will be accepted until the position is filled. 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 Geophysics Search Committee, Department of Geology and Geophysics, University of Wyoming, 1000 East University Avenue, Dept. 3006, Laramie, WY 82071-2000.

The University of Wyoming is an equal opportunity/affirmative action employer.

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motion of glacial ice, who will participate in the CRISIS research mission, and who will complement existing programs in behavior of ice sheets, rates of geological processes, and climate change. Individuals with expertise in numerical modeling of ice sheets, remote sensing of ice sheets, landscape evolution, cosmogenic nuclide dating, and ocean-ice-atmosphere modeling are particularly encouraged to apply. The successful candidate will be expected to establish an externally funded research program, direct graduate students, and participate in teaching graduate and undergraduate students, including courses in glaciology. Refer to www.geo.ku.edu and links for additional information about the department and the University of Kansas. This faculty position will directly support the mission of CRISIS—to understand and predict the role of polar ice sheets in sea-level change. CRISIS is an NSF-funded Science and Technology Center established in 2005—see www.crisis.ku.edu for additional description of that effort. The academic affiliation is expected to be with the Department of Geology, but appointment in a different academic department would be possible. Appointment is expected to begin August 18, 2008.

Applicants are expected to have a Ph.D. or terminal degree in geology or a related field by the start date of the appointment. For full position announcement, see: www2.ku.edu/~clas/employment/ or www.geo.ku.edu. A letter of application outlining research and teaching interests, a complete curriculum vitae, and names and contact information of at least three persons, who can be contacted for letters of reference, should be sent to Doug Walker, Department of Geology, 1475 Jayhawk Blvd., Rm. 120, Lindley Hall, University of Kansas, Lawrence, KS 66045-2124 (tel. +1-785-864-2735, fax +1-785-864-5276, e-mail: jdwalker@ku.edu). Initial review of completed applications will begin on January 15, 2008, and will continue until the position has been filled. EO/AA employer. The University is committed to increasing the ethnic and gender diversity of its faculty, and we strongly encourage women and minority candidates to apply.

GLACIAL/QUATERNARY GEOLOGIST UNIVERSITY OF WISCONSIN-MILWAUKEE

The Department of Geosciences at the University of Wisconsin-Milwaukee invites applicants for a tenure track position in glacial/Quaternary geology at the rank of Assistant or Associate Professor with a start date of August 2008. Applicants must hold a Ph.D. in geology or related field at the time of appointment, and have demonstrated research experience in glacial/Quaternary geology. Post-doctoral experience is desirable. The successful candidate is expected to conduct an active, internationally recognized, externally funded research program. The successful candidate will teach an undergraduate/graduate course in glacial/Quaternary geology (processes, deposits, and landforms), introductory and upper level undergraduate and graduate level courses in his or her field of expertise, and advise graduate student thesis projects. A normal teaching load is 3 courses per academic year. Information is available on-line regarding the Department of Geosciences at www.uwm.edu/Dept/Geosciences/ and the College of Letters and Sciences at www.uwm.edu/letsai/jobs/index.html.

Applications should be postmarked by January 18, 2008. Candidates must mail a curriculum vitae, a statement of teaching and research interests/philosophy, examples of published work, and names and contact information of at least three current references to Dr. John L. Isbell, Search Committee Chair, Department of Geosciences, University of Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, WI 53201 (fax: +1-414-229-5452; e-mail: jisbell@uwm.edu). The University of Wisconsin-Milwaukee is an Equal Opportunity/Affirmative Action Employer.

The University of Wisconsin-Milwaukee is a large research-oriented institution located on the north side of Milwaukee. The Department of Geosciences offers B.S./B.A., M.S., and Ph.D. degree programs and is staffed by 12 full-time faculty. Southeastern Wisconsin has easy access to many classic Quaternary glacial sites.

THE UNIVERSITY OF TEXAS AT DALLAS HEAD, DEPARTMENT OF GEOSCIENCES

The University of Texas at Dallas seeks a distinguished scientist to head its Department of Geosciences and enhance its national and international stature. A Ph.D. in Geoscience, Geology, Geochemistry, Geophysics, or a related field is required together with a proven record of scholarly research and teaching commensurate with tenure at the full professor level. A candidate with a multidisciplinary research emphasis excited by the opportunity to integrate with and influence the growth of UTD programs in Geospatial Sciences, Computational Sciences, Math and Science Education, Nanotechnology, Materials Science, Planetary Sciences, or Molecular Biology would be particularly welcome. The

successful candidate will present a vision for the future of the department and clear evidence of leadership potential. The position represents an unusual opportunity to shape a geosciences department for the future in an expanding, research-oriented university with a strong science, engineering and computational emphasis.

The department maintains strong BS, MS and Ph.D. degrees in Geoscience. In addition, MS and Ph.D. degrees in Geospatial Information Sciences are offered in conjunction with the School of Economic, Political and Policy Sciences and the Eric Jonsson School of Engineering and Computer Science. The university is located in the rapidly growing and increasingly cosmopolitan suburbs of north Dallas amid one of the largest and most vibrant concentrations of high technology multi-national corporations in the nation, including a substantial energy sector. For more information, visit www.utdallas.edu/geosciences/.

Discreet telephone inquiries may be made to any of the Search Committee members: Ron Briggs, Tom Brikowski, George McMechan, Bob Rutford, or Bob Stern. Applications should be sent to Academic Search #20090, The University of Texas at Dallas, 800 W. Campbell Road, Mail Station AD 42, Richardson, TX 75080-3021, and should include a complete resume, statement of research interests and visions, and the names, addresses and telephone numbers of five references. Indication of sex and ethnicity for affirmative action statistical purposes is requested as part of the application but not required. Applications will be accepted until the position is filled. The University of Texas is an Equal Opportunity, Affirmative Action employer and applications from minority and female candidates are especially welcome.

DEAN, MURRAY STATE UNIVERSITY, COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY

Murray State University seeks nominations and applications for Dean of the College of Science, Engineering and Technology. The successful candidate must have an earned doctorate related to one or more of the departments in the college: biological sciences, chemistry, geosciences, industrial and engineering technology, mathematics and statistics, and engineering and physics.

The position will be available July 1, 2008. Application deadline is January 4, 2008. Women and minorities are encouraged to apply. Please see our full posting at www.murraystate.edu/provost for complete list of required qualifications, position responsibilities, and a description of how to apply.

Murray State University is an equal education and employment opportunity, M/F/D, AA employer.

GEOLOGY/STRUCTURAL GEOLOGY/TECTONICS THE COLLEGE OF WOOSTER

The College of Wooster invites applications for a one-year, visiting position at the assistant professor level in the Department of Geology beginning in August 2008. The successful candidate will teach courses that include Structural Geology, Processes and Concepts in Geology and introductory courses that may include Oceanography, Geology of Natural Hazards or Environmental Geology. Wooster has a strong program in undergraduate research in which the successful candidate will supervise student research. Applicants should have a Ph.D. or be ABD.

Interested persons should send a letter of application, curriculum vitae, graduate transcripts, and three letters of reference by 15 January 2008 to Dr. Mark Wilson, Department of Geology, The College of Wooster, 1189 Beall Avenue, Wooster, OH 44691.

The College of Wooster is a highly selective liberal arts institution with an enrollment of approximately 1750 men and women. The Department of Geology comprises four faculty members and averages 25-40 undergraduate majors annually. Major research facilities within the department include the Tree Ring, Sediment Core Analysis, Paleomagnetism, Paleontology, Sample Preparation, Petrology/Fluid Inclusion, and Mineral Separation Laboratories.

The Department of Geology is a member of the OhioSeis seismic network and the Keck Geology Consortium.

The College of Wooster is an independent college of the liberal arts and sciences with a Wooster seeks to ensure diversity by its policy of employing persons without regard to age, sex, color, race, creed, religion, national origin, disability, veteran status, sexual orientation, or political affiliation. The College of Wooster is an Equal Opportunity/Affirmative Action Employer.

EAST TENNESSEE STATE UNIVERSITY COLLEGE OF ARTS AND SCIENCES DEPARTMENT OF GEOSCIENCES, CHAIR

The ETSU College of Arts and Sciences is planning to merge existing programs in Geography and Geology

to create a new Department of Geosciences. The proposed Department of Geosciences will consist of thirteen faculty drawn from the existing programs. It will offer undergraduate majors in Geology and Geography, and plans to offer a multi-tracked Masters degree in Geosciences. Current research interests of the faculty include paleontology (linked to the Center of Excellence in Paleontology and the nearby Natural History Museum and Gray Fossil Site), environmental geology, natural hazards and risk, GIS and remote sensing. We are seeking a dynamic leader to chair the new department, providing leadership and direction. Visit our Web sites at www.etsu.edu/physics/geology/ and www.etsu.edu/cbat/efus/geography.jsp.

ETSU serves some 13,000 students and offers nearly 200 programs of study in ten colleges and schools. It is one of six public universities governed by the Tennessee Board of Regents system. The Department of Geosciences will be one of 17 departments within the College of Arts and Sciences, which also houses three Centers of Excellence.

Applicants should be qualified to hold a tenured appointment at ETSU, and have demonstrated leadership skills. Research area is open, but preference will be given to applicants whose interests complement those of the current faculty. Review of applications will begin on January 3, 2008. The position will remain open until filled and is contingent upon state funding. Submit a letter of application, statement of teaching and leadership philosophy, curriculum vitae, transcripts, and three letters of recommendation to Geosciences Chair Search Committee, College of Arts and Sciences, East Tennessee State University, Box 70307, Johnson City, TN 37614. ETSU is an equal opportunity employer.

GLOBAL CLIMATE CHANGE/MARINE PALEOCLIMATE UNIVERSITY OF CALIFORNIA AT SANTA BARBARA

The Department of Earth Science invites applications for a tenure-track position at the assistant professor level in global climate change with a marine paleoclimate emphasis, available July 1, 2008. We are seeking applicants with broad geoscience backgrounds and primary research interests centered on the application of marine paleoclimate records to the study of global climate change. Applicants must be well versed in the interdisciplinary elements of modern climate science and be able to conduct cutting-edge research in conjunction with UCSB colleagues in marine science, earth science, geography, and environmental science and management who are working in the broad area of global change. The successful applicant will be expected to build a strong research program and participate in the Interdepartmental Marine Science Graduate Program at UCSB. The successful applicant will also fulfill graduate and undergraduate teaching needs in paleoclimatology, paleoceanography, marine geology, oceanography and/or other areas of the candidate's specialization. A Ph. D. is required at the time of appointment. This is one of two new faculty positions in global climate change at UCSB; the other position, in climate science, is in the Department of Geography. Submit applications as PDFs including cover letter, complete CV, statement of research and teaching interests, and names of three references before January 15, 2008, to paleoclimate-search@geol.ucsb.edu. Inquiries about the position should be directed to David W. Lea, Search Committee Chair, at lea@geol.ucsb.edu.

UCSB is an Equal Opportunity/Affirmative Action employer. The department is especially interested in candidates who can contribute to the diversity and excellence of the academic community through research, teaching, and service.

PLANETARY SCIENCE FACULTY POSITION THE UNIVERSITY OF TENNESSEE-KNOXVILLE

The Department of Earth and Planetary Sciences (<http://Web.eps.utk.edu>) invites applications for a tenure track faculty position in planetary science, with a specialty in the study of surface processes. This position is at the Assistant Professor level and begins August, 2008. Successful candidate must have a Ph.D. in planetary science, geology, or a related field at the time of appointment. Preference will be given to candidates with a demonstrated record of high quality research in applying quantitative geomorphic approaches to the study of planetary surfaces, including terrestrial analogs. It is also desirable that applicants complement existing departmental research strengths. The successful candidate will be expected to develop a strong, externally funded research program and participate in graduate and undergraduate teaching. Salary will be competitive. UT-Knoxville is the flagship campus of The University of Tennessee system, which co-manages nearby Oak Ridge National Laboratory. Applicants are encouraged to e-mail a PDF-format file including a résumé, a letter describing

research and teaching interests, and a list with names and contact information for three references to Dr. Jeffrey Moersch, Faculty Search Committee Chair, at jmoersch@utk.edu. Alternatively, applications may be mailed to: Dr. Jeffrey Moersch, Faculty Search Committee Chair, Department of Earth and Planetary Sciences, University of Tennessee, 1412 Circle Drive, Knoxville, Tennessee 37996-1410. Review of applications will begin January 2, 2008, and will continue until the position is filled. The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services. All qualified applicants will receive equal consideration for employment without regard to race, color, national origin, religion, sex, pregnancy, marital status, sexual orientation, age, physical or mental disability, or covered veteran status.

PROCESS CARBONATE SEDIMENTOLOGY UNIVERSITY OF KANSAS

The Department of Geology at the University of Kansas seeks applications for an academic year, tenure-track faculty position in the field of process carbonate sedimentology. We seek an outstanding colleague who studies carbonate depositional processes in marine environments to better understand environmental change. We welcome candidates who combine traditional field and laboratory approaches and those that integrate quantitative or modern analytical techniques to the study of carbonate systems. Candidates whose research is applicable to carbon cycling and energy resources are particularly encouraged to apply. The successful candidate will be expected to establish an externally funded research program, direct graduate students, and participate in teaching graduate and undergraduate students. Refer to www.geo.ku.edu and links for additional information about the department and the University of Kansas. The successful candidate for the position should be eligible to work in the U.S. prior to the start date of the position. Appointment is expected to begin August 18, 2008.

Applicants are expected to have a Ph.D. or terminal degree in geology or a related field by the start date of the appointment. For full position announcement, see: www2.ku.edu/~clas/employment/. Applicants should send a statement of research interests, statement of teaching interests, a complete Curriculum Vitae and arrange for at least three letters of recommendation to be sent directly to Luis A. González, Department of Geology, 1475 Jayhawk Blvd., 120 Lindley Hall, University of Kansas, Lawrence, KS 66045-7613 (tel. +1-785-864-3977, fax +1-785-864-5276, e-mail: lgonzlez@ku.edu). Initial review of completed applications will begin January 9, 2008, and will continue until the position is filled. The University is committed to increasing the ethnic and gender diversity of its faculty, and we strongly encourage women and minority candidates to apply.

ASSISTANT PROFESSOR STRUCTURAL GEOLOGY/CONTINENTAL TECTONICS DEPARTMENT OF GEOLOGY UNIVERSITY OF CALIFORNIA AT DAVIS

We seek a creative, field-based geoscientist whose research quantitatively addresses continental deformation and its relationship to crustal rheology and/or surface processes within the evolution of orogenic systems. Areas of interests include, but are not limited to, the use of the geologic record to quantify the rheological evolution of continental crust, crust-mantle coupling, mass redistribution, the development of landforms related to deformation, and the fundamental structural architecture of mountain belts.

This tenure-track appointment will begin July 1, 2008, at the Assistant Professor level. The successful candidate is expected to develop a dynamic, externally funded research program, effectively mentor and teach at both undergraduate and graduate levels, and engage in professional service. For more information about the UC-Davis Department of Geology, see www.geology.ucdavis.edu.

A Ph.D. or equivalent degree in geological sciences is required at the time of appointment. To ensure full consideration, applications should be received by December 21, 2007. Applicants should submit a PDF file containing a letter of application, curriculum vitae, a statement of research/teaching interests, and contact information (including e-mail) for at least three references to tectonics-search@geology.ucdavis.edu.

UC-Davis is an affirmative action/equal employment opportunity employer and is dedicated to recruiting a diverse faculty community. We welcome all qualified applicants to apply, including women, minorities, individuals with disabilities and veterans.

UNIVERSITY OF WEST FLORIDA ASSISTANT PROFESSOR, GEOLOGY

The Department of Environmental Studies, University of West Florida, invites applications for one tenure-track assistant professor position beginning August 2008, pending budgetary approval.

Position. Geology, specialization open. Areas of expertise should complement departmental strengths. Application of geomorphology or geology to environmental issues is strongly preferred. Ability to utilize and teach GIS or quantitative methods is desirable, as is interest in community outreach.

Applicants are expected to develop an active research program and should be committed to peer-reviewed publication. Applicants must have an appreciation for undergraduate education. A Ph.D. in Geology or related discipline is required at the time of appointment. Salary is commensurate with qualifications and experience.

The Department of Environmental Studies offers a Bachelor of Science degree, and a Certificate in Geographic Information Science. Over 100 majors specialize in tracks in natural science, environmental policy, and geography. A master's program started in Fall 2004 has over 20 active graduate students. The department maintains the university-wide GeoData Center, which has extensive GIS capabilities. Personnel include 7 full-time faculty, several adjunct faculty, and a GIS Coordinator. For more information on the department see <http://uwf.edu/environmental/>.

Applicants should apply online at <https://jobs.uwf.edu> and be prepared to attach a statement of research and teaching interests and experience, a curriculum vitae, and transcripts to the online application. This position requires a criminal background screening. Three letters of reference, and/or inquiries, should be sent directly to Search Committee Chair Dr. Johan Liebens, Department of Environmental Studies, University of West Florida, 11000 University Parkway, Pensacola, FL 32514 (phone: +1-850-474-2065, fax: +1-850-857-6036, or e-mail liebens@uwf.edu).

Review of applications will begin December 14, 2007 and will continue until the position is filled.

The University of West Florida is an Equal Opportunity/Access/Affirmative Action Employer. Minorities and women are encouraged to apply.

OPEN RANK POSITION IN COAL GEOLOGY SOUTHERN ILLINOIS UNIVERSITY-CARBONDALE

The Department of Geology at Southern Illinois University Carbondale invites applications for a tenure-track position in coal geology, starting Aug. 16, 2008. Research emphasis may include paleobotany, coal petrology, coal basin analysis, coal bed methane and carbon sequestration, or other coal-related fields. Rank is open and will depend on the experience of the successful candidate. Requirements: Ph.D. in Geology or closely related field or show that they will complete all degree requirements by the time of appointment. Assistant Professor rank: Post-doctoral experience is preferred. The applicant should demonstrate the existence of, or potential for developing, an internationally recognized externally funded research program; Assoc. Prof.: an established record of teaching and of peer-reviewed publications and significant grant activity commensurate with tenure; Full Prof.: exceptional candidates with an international reputation and a long standing record of peer reviewed publication and substantial current grant activity and an established record of teaching. Please visit our Web sites www.siu.edu/~affect and www.science.siu.edu/geology/coalposition.html for more information. Review of applications will begin February 15, 2008, and continue until the position is filled. Applicants should submit curriculum vitae, a statement of teaching and research interests, and the names and addresses of at least three references to: Dr. Ken Anderson, Search Committee Chair, Department of Geology, Mail Code 4324, Southern Illinois University Carbondale, 1259 Lincoln Drive, Carbondale, IL 62901. Fax: +1-618-453-7393; e-mail: kanderson@geo.siu.edu. SIUC is an affirmative action/equal opportunity employer that strives to enhance its ability to develop a diverse faculty and staff and to increase its potential to serve a diverse student population. All applications are welcomed and encouraged and will receive consideration.

UNIVERSITY OF KENTUCKY, GEOPHYSICS

The Department of Earth and Environmental Sciences at the University of Kentucky invites applications for a tenure-track faculty position in Geophysics, beginning August 15, 2008. We are seeking candidates who use field and/or computational modeling approaches to interdisciplinary research in crustal-scale and/or hazard-evaluation geophysics, complementary to our existing programs in near-surface geophysics, engineering

seismology, global to local-scale potential-fields geophysics, planetary geophysics, hydrogeology, tectonics, and energy resources. The applicant should demonstrate the ability to develop externally funded research, as well as challenging coursework at the introductory undergraduate and graduate levels. A broad range of opportunities also exists for cooperation with other departments and agencies on campus (e.g., UK's Kentucky Geological Survey, Department of Civil Engineering, Kentucky Transportation Center, Water Resources Research Institute, Center for Applied Energy Research, and the Tracy Farmer Center for the Environment). Learn more about the Department's faculty and degree programs, as well as the university's location, profile, and aspirations by visiting our Web site.

Interested applicants should submit their curriculum vitae, a brief statement of research and teaching interests, copies of relevant research publications, and at least three letters of recommendation to: Dr. Edward W. Woolery, Search Committee Chair, Department of Earth and Environmental Sciences, 101 Slone Research Building University of Kentucky, Lexington, KY 40506-0053, or e-mail woolery@uky.edu

The committee will begin to review the applications on October 15, 2007. The University of Kentucky is an Affirmative Action employer, and applications from minority and female applicants are particularly encouraged.

NORTH DAKOTA STATE UNIVERSITY

The Department of Geosciences at North Dakota State University invites applications for a tenure-track appointment to begin August, 2008. We seek a colleague with research expertise in Quaternary sedimentology, Quaternary geology, and/or surface process geology to expand and complement our existing strengths in Quaternary geology.

Research at NDSU is considered a vital component of both undergraduate and graduate education. The successful candidate will contribute to this research-teaching effort by developing a vigorous, externally funded, research program, and by supervising students in an Environmental Sciences graduate program. Applicants must possess strong English oral and written communication skills, and will demonstrate the qualifi-

cations and/or adaptability to teach courses in sedimentology-stratigraphy, structural geology, and introductory geology. A Ph.D. is required at the time of appointment, and postdoctoral experience is preferred. Applicants should submit a CV, a description of research goals, a statement of teaching interests/ qualifications, academic transcripts, and the names and addresses of three referees to: Dr. Kenneth Lepper, Search Committee Chair, Department of Geosciences, NDSU, Fargo, ND, 58105-5517. Screening will begin December 10, 2007. North Dakota State University is an affirmative action/equal opportunity employer. Members of groups underrepresented in STEM are encouraged to apply. For further information on the department and its faculty, visit www.ndsu.edu/geosci/.

TENURE-TRACK PALEOCLIMATOLOGIST DEPARTMENT OF GEOLOGY BAYLOR UNIVERSITY

The Department of Geology at Baylor University invites applications for a tenure-track open-rank (Assistant to full Professor) faculty position in the general area of paleoclimatology, beginning August 2008. A Ph.D. in earth sciences, or in a related field, is required at the time of appointment. The Department currently consists of 13 geoscientists (please see the Department Web site at www.baylor.edu/Geology/ for further information).

Research: The Geology Department seeks an individual with a strong research agenda that includes field and laboratory studies of terrestrial climate records archived within fluvial (river and floodplain), eolian (loess and sand dune), lacustrine (lake), and coastal systems. The individual must be able to communicate and collaborate with a subset of five Geology faculty members that are currently engaged in studies in the general area of paleoclimatology, and to carry out a vigorous research program that involves both undergraduate and graduate students. Possible areas of specialization to be considered are those identified in the major strategic proposal for enhancement of the Terrestrial Paleoclimatology Research Program at Baylor University including **paleobotany, palynology, paleomagnetism, and organic geochemistry. We currently project a total of three new faculty hires in these areas, staged over five**

years. Research space for terrestrial paleoclimatology is available in the three-year-old, 500,000 ft² "state-of-the-art" Baylor Sciences Building, and startup funds associated with this position are highly competitive.

Teaching: The Department seeks an individual with a strong commitment to excellence in teaching, and who can contribute significantly to both the undergraduate B.S. Geology and B.A. earth science programs by teaching a freshman course, an undergraduate core or elective course, as well as contribute to the graduate programs in Geology by teaching graduate courses in his/her areas of specialization.

Application Process: Send letter of application, including statement of teaching and research interests, curriculum vitae, copies of transcripts, and the names and contact information for three references to: Dr. Zhaodong (Jordan) Feng, Search Committee Chair, Department of Geology, Baylor University, One Bear Place #97354, Waco, TX 76798-7354 (Tel: +1-254-710-2361; e-mail: Zhaodong_Feng@baylor.edu). The review of applications will begin December 1, 2007 and will be accepted until the position is filled. To ensure full consideration, application must be completed by January 1, 2008. Baylor is a Baptist university affiliated with the Baptist General Convention of Texas. As an Affirmative Action/Equal Opportunity employer, Baylor encourages minorities, women, veterans and persons with disabilities to apply.

HYDROGEOLOGIST EARTH & ENVIRONMENTAL SCIENCES CALIFORNIA STATE UNIVERSITY-EAST BAY

The Department of Earth & Environmental Sciences at California State University-East Bay invites applications for an assistant professor tenure-track position in Environmental Hydrogeology to begin in Fall of 2008. Responsibilities include teaching undergraduate and graduate courses in the applicant's areas of expertise in the Geology and Environmental Science programs and other courses. Applicants should have a Ph.D., outstanding teaching skills, and a commitment to pursue an active research program involving undergraduate and graduate students. For additional information, visit our department's Web site at www.sci.csueastbay.edu.

UNIVERSITY OF WYOMING

Aqueous and Environmental Geochemistry

The Department of Geology and Geophysics at the University of Wyoming invites applications for a tenure-track Assistant Professor position in the broadly defined area of aqueous and environmental geochemistry beginning in August 2008.

We are interested in promising scientists in fields of research including, but not restricted to, aqueous and environmental geochemistry, mineral-fluid interface geochemistry, microbiological geochemistry, reactive and contaminant transport, watershed chemistry and weathering, and ground-water geochemistry. The successful candidate will be involved in the undergraduate and graduate teaching mission of the Department of Geology and Geophysics, and will be expected to develop an active externally funded research program that complements and expands upon departmental strengths.

The Department of Geology and Geophysics has well-equipped and staffed laboratories for SEM, XRD, EPMA, TIMS for radiogenic isotopes, and a full range of aqueous geochemical analyses from automated titrations to ICP-MS. Several user facilities on campus afford easy access to a wide variety of analytical techniques, from stable isotope analysis to PCR. The Department of Geology and Geophysics is working closely with the newly created School of Energy Resources (SER), an institute dedicated to energy-related teaching and research in support of state, national, and international energy-related activities (including carbon sequestration, environmental impact, and renewable energy resources). The Helga Otto Haub School of Environment and Natural Resources and William D. Ruckelshaus Institute also offer venues for integrating research across disciplinary boundaries. Additional information on the Department Geology and Geophysics can be obtained at <http://home.gg.uwyo.edu/>. Information about the School of Energy Resources is available at <http://uwacadweb.uwyo.edu/SER/> and the Haub School and Ruckelshaus Institute at <http://www.uwyo.edu/ENR/enschool.asp>.

Applications should include a statement of research and teaching interests and accomplishments, curriculum vitae, and the names and contact information for three individuals who can provide letters of evaluation. Review of completed applications will begin November 1, 2007; however, applications will be accepted until January 31, 2008. 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 Geochemistry Search Committee, Department of Geology and Geophysics, University of Wyoming, 1000 East University Avenue, Dept. 3006, Laramie, WY 82071-2000.

The University of Wyoming is an equal opportunity/affirmative action employer.

edu/earth. Review of applications will begin December 17, 2007. Please submit a letter of application; a complete and current vita; graduate transcripts; copies of major publications; and three letters of recommendation to Dr. Jeffery Seitz, 08-09 EES-ENV/HYDROGEOLOG-TT, Department of Earth & Environmental Sciences, California State University, East Bay, 25800 Carlos Bee Blvd., Hayward, CA 94542-3088. CSUEB is an Equal Opportunity Employer.

Opportunities for Students

NASA Planetary Biology Internship Program. The NASA Planetary Biology Internship Program (PBI) provides opportunities to explore scientific questions of global scale about planet Earth. For eight weeks graduate students are granted a one-time opportunity to travel outside their home institutions to participate in research related to NASA's planetary biology objectives. Interns have participated in a wide variety of planetary biological studies including metal precipitating bacteria; microbial ecology of extreme environments; morphological, biochemical, and isotopic analyses of stromatolites and microbial mats; and molecular evolution.

Students should obtain an application brochure by contacting the PBI Administrator, Michael Dolan, Department of Geosciences, University of Massachusetts, Amherst, MA 01003. Telephone: +1-413-545-3223; fax: +1-413-545-1200; e-mail, pbi@geo.umass.edu; Web page, www.mbl.edu/education/courses/other_programs/pbi.html.

Application packages must be received at the MBL Admissions Office by March 3, 2008. Students are admitted without regard to race, age, sex, national origin, or physical handicap.

Graduate Assistantship Opportunities. Atmospheric Sciences, University of Nevada-Reno & Desert Research Institute. Graduate assistantships are currently available for all M.S. and Ph.D. students in atmospheric sciences at the University of Nevada, Reno (UNR) (www.unr.edu) and the Desert Research Institute (DRI) (www.dri.edu). Research opportunities include: atmospheric dynamics, modeling, and forecasting; atmospheric chemistry, aerosol physics, and air quality; climatology and climate change; atmospheric measurements and instrument development; and renewable energy.

These opportunities are available through more than 150 DRI research faculty members who manage approximately \$35 million per year of basic and applied environmental research in locations throughout Nevada, the U.S., and world. Both the UNR and DRI campuses are within an hour's drive of Lake Tahoe, many of the West's finest ski resorts, and extensive mountain recreation activities.

Information about the UNR-DRI graduate program can be found at www.dri.edu/Education/GradPrograms. The on-line student application is at www.unr.edu/grad/prospective/apply.asp. Please contact Prof. Darko Koracin at +1-775-674-7091, e-mail: Darko.Koracin@dri.edu, for additional information.

GTA Positions Available. The Department of Earth and Planetary Sciences at the University of Tennessee-Knoxville has 5 Graduate Teaching Assistantships available starting in January 2008. These positions carry a competitive stipend and a tuition waiver. Candidates should have an undergraduate degree in Geology, a good command of the English language, and must be eligible to enroll as either a M.Sc. or Ph.D. student in our Graduate School. Students with records of academic excellence in related disciplines such as Geography and Soil Science will also be considered. Possible areas of study include hydrogeology, geochemistry, near surface geophysics, planetary geology, stratigraphy/sedimentology, or tectonics. Please visit our Website (<http://Web.eps.utk.edu>) for information on faculty research interests and how to apply.

Interdisciplinary Hydrologic Science Opportunities at New Mexico Tech. New Mexico Tech offers Ph.D. and M.S. Research Assistantships to graduate students interested in topics in hydrologic science ranging from subsurface processes to the atmospheric boundary layer. The interdisciplinary Hydrology Program is one of the largest and strongest in the United States. Seven full-time faculty and ten adjunct faculty in hydrology allow us to offer more than 20 different courses in hydrologic science and conduct research across a broad range of cutting edge topics. Our interdisciplinary curriculum has been revised to provide students with training in the multiple scientific techniques necessary

to resolve societally relevant hydrological problems. Recent research efforts are focused on understanding the impacts of vegetation, climate and human-induced changes on water supply and water quality. Students with strong scientific or engineering backgrounds are encouraged to apply. For more information contact: Dr. Fred Phillips. Additional information and application forms can be found at www.ees.nmt.edu/Hydro/.

Petroleum Geosystems Masters Degree Initiative at Penn State. The Petroleum GeoSystems Initiative is searching for masters candidates to begin in fall 2008. The Initiative, Co-Directed by Professors Rudy Slingerland and Turgay Ertekin, is an interdisciplinary Master's Degree educational model that links the Department of Energy and Mineral Engineering (Petroleum and Natural Gas Engineering Program), the Department of Geosciences, and corporate partners. MS students are sponsored by industry, formed into research teams focused on applied industry problems, and have the opportunity to intern with industry.

A team of students, including petroleum engineers, geologists, and geophysicists, embarks on a collaborative graduate research experience. The team takes common, cross-training, and disciplinary depth courses and shares office and lab space. The foundation of each team's research is the analysis of an oil- and gas-producing field based on real-world data provided by industry.

To date, three teams of students have successfully received Masters degrees, and the fourth team has almost completed their degrees. We are now accepting applications. For further information, contact Petroleum GeoSystems Office: 508 Deike Building, University Park, PA 16802; +1-814-863-7072, geosystem@geosc.psu.edu, <http://hydro.geosc.psu.edu/Geosystems/geosystems.html>.

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

Applications for graduate study at Case are accepted on a rolling basis, though students requesting financial assistance in Fall 2008 are encouraged to apply by February 1, 2008.

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

New Mexico Highlands University, Graduate Assistantship. Graduate assistantships are available for students wishing to pursue an MS in Geology beginning Fall 2008 term. The NMHU Environmental Geology Program offers a field-intensive curriculum emphasizing earth materials, mineral-rock-water interactions, environmental geophysics, and natural geologic hazard assessment. Program strengths are in mineralogy, petrology, geochemistry, rock-paleomagnetism, structural geology, volcanology, and collaborative endeavors with the Forestry Program and the new Forest and Watershed Restoration Institute. Nestled in the foothills of the Sangre de Cristo Mountains, Highland's campus has been cited as one of New Mexico's best-kept secrets. A low student:faculty ratio, state-of-the-art laboratory facilities, and committed faculty provide students with a superior learning experience. The graduate assistantship includes a stipend of \$10,100 and tuition waiver per academic year. Application review begins 01/15/08. For more information, contact Dr. Michael Petronis, Department of Natural Sciences, New Mexico Highlands University, Box 9000, Las Vegas, New Mexico 87701, mspetro@nmhu.edu. For disabled access or services call +1-505-454-3513 or TDD# +1-505-454-3003. EOE.

Graduate Student Opportunities, Ohio University. The Department of Geological Sciences at Ohio University is seeking qualified students for its graduate program. Positions are available beginning April or September 2008. The department offers a competitive program leading to an MS degree in Geological Sciences with areas of emphasis including hydrogeology, geochemistry, geomorphology, paleontology, stratigraphy/sedimentology, planetary geology, geophysics, and tectonics. Prospective students are encouraged to contact faculty directly to discuss potential research

topics. Qualified students are eligible to receive teaching assistantships that carry a tuition waiver and a stipend of \$12,150/year. For program and application information, visit the department Web site at www.ohiou.edu/geology/ or contact the graduate chair, Greg Springer (springeg@ohio.edu), for additional information.

Jonathan O. Davis Scholarship, Division of Earth and Ecosystem Sciences, Desert Research Institute. The family and friends of Jonathan O. Davis, a prominent U.S. geologist and geochronologist and a DRI faculty member, have established an endowment that provides a yearly national Jonathan O. Davis Scholarship, as well as a stipend for a University of Nevada-Reno student.

Jonathan was killed tragically in an automobile accident in December 1990. It is the wish of his family and friends to support graduate students working on the Quaternary geology of the Great Basin, research close to Jonathan's heart. The national scholarship is \$4,000 and the University of Nevada, Reno stipend is \$1,500.

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

Applications should include: (1) A cover letter explaining how the individual qualifies for the award. Please include your social security number and state whether you are applying for the national scholarship or for the UNR stipend; (2) A current resumé or vitae; (3) A two-page, single spaced description of the thesis/dissertation research, which also clearly documents the geological orientation and research significance. Figures, tables, and references do not count against the two-page limit; (4) A short statement on how funding would be used; (5) A letter of recommendation from the thesis/dissertation supervisor, which emphasizes the student's ability and potential as a Quaternary scientist.

Applications must be post-marked by February 2, 2008. Proposal reviews will not be returned to applicants. Applications should be addressed to: Executive Director, Division of Earth and Ecosystem Sciences, Desert Research Institute, 2215 Raggio Parkway, Reno, NV 89512.

If you have further questions regarding the awards or the application process, please contact Barbara Jackson at +1-775-673-7454 or bj@dri.edu.

Fellowship Opportunities

INTERDEPARTMENTAL POSTDOCTORAL FELLOWSHIP, GEOSCIENCES, YALE UNIVERSITY

The Department of Geology and Geophysics at Yale University (www.geology.yale.edu) seeks applicants for a postdoctoral fellowship in research that links geosciences (studies of the solid earth, oceans, atmosphere, climate, and the evolution of life) with other sciences, including, for example, astronomy and astrophysics; environmental studies; physics; chemistry; biology; engineering; anthropology; medical science and public health; economics and political science.

This Postdoctoral Associate position is awarded for two years, contingent on satisfactory progress, and provides a stipend (\$48,000/yr) and base research funds (\$5,000/yr), plus health care benefits and expenses for relocation.

The Interdepartmental Postdoctoral Fellowship will have at least two faculty collaborators: the primary sponsor will be from Geology and Geophysics, while others are from one or more other Yale departments. Interested candidates should first contact a faculty member in Geology and Geophysics to define a research theme and to identify other appropriate faculty collaborators.

Applicants should submit a curriculum vita, a list of publications, an interdisciplinary research proposal (2-3 pages, in which the Yale collaborators are identified), and a brief letter of endorsement from each of the Yale faculty collaborators. Applicants should also arrange for three reference letters to be sent directly to the Department. The deadline for receipt of all application materials is January 2, 2008, and decisions will be announced by February 29, 2008. Successful candidates are expected to begin their program at Yale between July 1 and December 31, 2008.

Alberta Geological Survey

www.ags.gov.ab.ca

Earth System Science Career Opportunities

The province of Alberta, with its strong, vibrant economy and beautiful natural environment, is one of the greatest places to work, live, raise a family and enjoy life. Alberta's capital city, Edmonton, is recognized throughout North America as a centre of research and a leader in children's education and post-secondary training.

The Alberta Geological Survey (AGS), located in Edmonton, provides geoscience information and expertise to government, industry and the public to support exploration, development and conservation of Alberta's energy and mineral resources.

Within the AGS Earth Systems Program, we are studying the natural circulation of heat, water, petroleum and dissolved elements in the Alberta Sedimentary Basin to better understand the long-term potential of deep geological formations as sources of water for industry, aquifer storage and retrieval, geothermal energy, and long-term, safe sequestration of CO₂ and other industrial wastes.

With the intent to create a multidisciplinary team, we are looking for motivated individuals with Masters and/or Ph.D degrees for the following positions.

Basin/Petroleum Hydrogeologist

Geochemist

Hydrostratigrapher

Hydrogeochemist

At AGS, you will have the opportunity to work in a stimulating environment on challenging projects in the energy and minerals sectors, work with advanced technology and stay current in your field while making significant contributions to your community of practice.

Come and enjoy the Alberta Advantage!

For full job descriptions, qualifications and application details, please visit www.ags.gov.ab.ca/employment.html.

To learn more about Alberta and Edmonton, please visit www.gov.ab.ca/home and www.movetoedmonton.com/, respectively.

The career you want!



View classified and GeoMart ads online at www.geosociety.org/advertising.htm

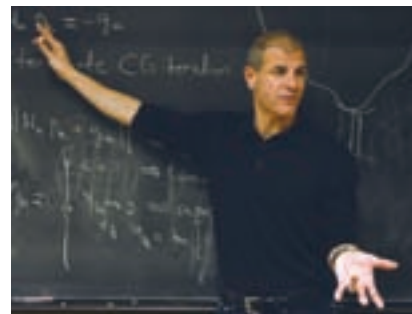
Application materials and reference letters should be sent by email (interdepartmental.fellowship@geology.yale.edu) or by post: Interdepartmental Postdoctoral Fellowship, Yale University, Department of Geology and Geophysics, PO Box 208109, New Haven, CT 06520-8109. Yale University is an equal opportunity/affirmative action employer; applications from women and minority scientists are strongly encouraged.

**BATEMAN POSTDOCTORAL FELLOWSHIPS
GEOSCIENCES, YALE UNIVERSITY**

The Department of Geology and Geophysics at Yale University (www.geology.yale.edu) announces an annual competition for one or more Bateman Postdoctoral Fellowships. We welcome applicants with research interests across the full range of disciplines within the earth sciences, including studies of the solid earth, oceans, atmosphere, climate dynamics, geochemistry, paleoclimatology, and the evolution of life. Each of these Postdoctoral Associate positions is awarded for two years, providing a stipend (\$48,000/yr) and base

research funds (\$5,000/yr), plus health care benefits and expenses for relocation. Applicants should contact a sponsor in the Department to identify potential research projects, and then submit a short (2–3 pages) statement of research interests and proposed research, a curriculum vita, and list of publications. Applicants should also arrange for three reference letters to be sent directly to the Department. The deadline for receipt of all application materials is January 2, 2008, and decisions will be announced by February 29, 2008. Successful candidates are expected to begin their program at Yale between July 1 and December 31, 2008.

Application materials and reference letters should be sent by email (bateman.fellowship@geology.yale.edu) or by post: Bateman Postdoctoral Fellowship, Yale University, Department of Geology and Geophysics, PO Box 208109, New Haven, CT 06520-8109. Yale University is an equal opportunity/affirmative action employer; applications from women and minority scientists are strongly encouraged.



**NEW HIRES IN
GEOSCIENCE EDUCATION**

The Jackson School of Geosciences seeks individuals attracted to the challenge of geoscience education at the university level. As leaders in geoscience pedagogy, candidates should excel as teachers and developers of courses set in field, laboratory, and lecture environments. The new hires may also contribute to the Jackson School's commitment to educate the wider community of the public and K-12 pre-college students.

We encourage applications from those with proven records of teaching and related experience at the college level. Candidates are expected to hold a PhD degree in the geosciences or a closely related field. Additional credentials may include experience in securing external funding, and a record of publications related to geoscience education. Opportunities exist for appointments as Lecturer, Senior Lecturer, Adjunct Faculty, or tenure-track Faculty, depending upon credentials and interests. Appointments will be primarily within the Department of Geological Sciences, but may include affiliations with the Jackson School's main research units, the Bureau of Economic Geology or the Institute for Geophysics. The schedule of appointment is negotiable.

Send inquiries and applications (cover letter, CV, publications) to: Office of the Chairman / Department of Geological Sciences / Jackson School of Geosciences, The University of Texas at Austin / 1 University Station C1100 / Austin, TX 78712-0254 or jobs@jsg.utexas.edu.

For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

THE UNIVERSITY OF TEXAS AT AUSTIN IS AN AFFIRMATIVE ACTION / EQUAL OPPORTUNITY EMPLOYER

THE UNIVERSITY OF TEXAS AT AUSTIN
JACKSON
SCHOOL OF GEOSCIENCES

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- The Franciscan exposed in Mount Diablo
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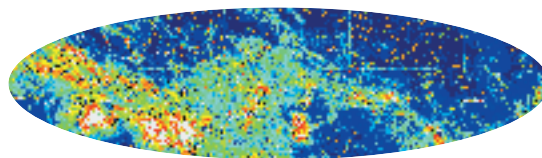
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MULTIPLE HIRES IN CLIMATE SYSTEMS SCIENCE

The Jackson School is building a premier education and research program in Climate System Science. We seek scientists at the forefront of their disciplines attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We seek the expertise required to address fundamental questions associated with a changing Earth system, including:

- What processes control the rates of change and variability of the climate system, including the atmosphere, ocean, cryosphere, land surface, and biosphere?
- Can we improve our ability to anticipate these changes and determine the potential impacts on society?

Over the next three years, we will hire six or more faculty and scientists who complement our growing strengths. We will hire individuals who will enable us to build a comprehensive climate program and who will make fundamental advances in our understanding of the climate system. These areas include, but are not limited to:

- Improved modeling of the Earth system, specifically including ice sheets, the global carbon cycle, and interaction between the components of the Earth system.
- Enhanced observation of the Earth system, including remote sensing of Earth-surface processes and components.
- Greater capability to utilize geologic archives to understand climate change, including paleoclimatology, paleoceanography, and paleobiology.
- Improved ability to link climate and hydrology, particularly at the basin-to-continent scale.
- Increased strengths in atmospheric dynamics and physical oceanography.
- Increased ability to understand variability and quantify uncertainties, including statistical climatology.
- Greater capability to address societal impacts and vulnerability, including adaptation and mitigation.

We encourage applications from innovative scientists in other areas that are related to climate system science.



MULTIPLE HIRES IN ENERGY—SCIENCE, ENVIRONMENT, AND POLICY RESEARCH

The Jackson School is building a premier education and research program in Energy—Science, Environment and Policy Research. We seek scientists at the forefront of their disciplines attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We seek to address compelling questions within the broad theme of determining how we can create an energy future that is sustainable and environmentally and economically robust. These questions include, but are not limited to:

- How can we integrate classically separated disciplines (geomechanics, geochemistry, tectonics, stratigraphy, petrophysics, geophysical imaging, regional/basin scale studies) to advance interrelationships at the forefront of energy and environmental science?
- How do fluid-rock interactions and the interplay between mechanical and chemical processes influence fluid flow and storage in the subsurface?
- How can we improve identification and recovery of energy resources by comprehensive integration of information at all scales, integrated numerical modeling, and innovative automated and continuous monitoring?
- Can we solve the compelling environmental issues associated with the extraction and use of fossil fuel energy sources, including water and land use, and carbon sequestration?
- Can we develop energy policies founded on solid scientific and engineering information and innovative approaches that will simultaneously promote environmental stewardship and energy security?

Over the next three years we will hire six or more faculty and scientists who complement our existing strengths. We are interested in a wide variety of research areas ranging from rock/fluid systems, subsurface sensing, tectono-stratigraphy, carbon management, energy economics and policy, basin-scale analysis and modeling, and resource and reserve geoinformatics. We also encourage applications from innovative scientists in other areas related to energy—science, environment and policy.

Opportunities exist at any level, can include cluster hires, and can be within or in combination with any Jackson School Unit—the Department of Geological Sciences, the Bureau of Economic Geology, or the Institute for Geophysics. The schedule of appointment is also negotiable. For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

Ph.D. is minimum requirement for application. Send inquiries and applications (cover letter, CV, list of publications, list of references, statements of teaching and/or research interests) to: Randal Okumura, Office of the Dean / Jackson School of Geosciences, The University of Texas at Austin / PO Box B, University Station / Austin, TX 78713 or jobs@jsg.utexas.edu.

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MULTIPLE HIRES IN CRUST, MANTLE, AND CORE DYNAMICS

The Jackson School is building a premier education and research program in Crust, Mantle, and Core Dynamics. We seek scientists at the forefront of their disciplines attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We particularly seek individuals eager to address the questions encompassing the broad theme of determining how the core, mantle, crust, and surface interact to shape the physical, chemical, and biological evolution of the Earth across a wide range of spatial and temporal scales. These questions include, but are not limited to:

- What controls the style, vigor and time dependence of mantle and core convection?
- How are chemical and physical processes acting in the Earth's interior manifested at the surface and how do surface processes affect Earth's interior?
- What controlling influence do fluids have on geological processes in the Earth's crust and mantle?
- How can knowledge of active tectonic processes and present-day plate motions be utilized to better decipher Earth's history?

Over the next three years, we will hire six or more faculty and scientists who complement our existing strengths. We are interested in a wide variety of research areas ranging from geodynamics, seismology, mineral physics, GPS/remote sensing of active and surface deformation, fluid dynamics, geochronology, geochemistry, rock physics, and computational geosciences focusing on modeling and simulation. We also encourage innovative scientists in other areas related to crust/mantle/core dynamics to apply. Successful applicants will join a strong and diverse group of 125 Ph.D. faculty and scientists, with the facilities and partnerships that will help ensure their success.



MULTIPLE HIRES IN EARTH SURFACE AND HYDROLOGIC PROCESSES

The Jackson School is building a premier education and research program in Earth Surface and Hydrologic Processes. We seek outstanding scientists at the forefront of their disciplines who are attracted to challenging areas of scholarship that require collaboration across disciplines and programs. We seek to address compelling questions in surface and hydrologic processes within the broad theme of determining how surface and hydrologic processes are influenced by their dynamic setting at the interface of the lithosphere, atmosphere, hydrosphere, and biosphere. These questions include:

- How do climate, ice sheets, and tectonics interact to define the distribution and character of sea level change?
- How do coastal zone geology, biology, biogeochemistry, and hydrology respond to surficial processes, particularly to sea level change?
- What are the impacts of climate variability/change and land use change on water, nutrient, and sediment cycles?
- What is the integrated result of the interplay between tectonic deformation, climate change, and biota on the Earth's surface and on the supply, distribution, and storage of sediments?
- What are the physical, chemical, ecological processes and social forces that will determine the sustainability of our water resources?

Over the next three years, we will hire six or more faculty and scientists who complement our existing strengths. We are interested in a range of research areas from quantitative geomorphology to hydrologic-biologic interactions to societal impacts and resource sustainability, and capabilities ranging from modeling landscape dynamics to remote sensing, shallow environmental geophysics, aerogeophysics, and monitoring groundwater and coastal systems. We also encourage innovative scientists in other areas related to surface and hydrologic processes to apply.

Opportunities exist at any level, can include cluster hires, and can be within or in combination with any Jackson School Unit—the Department of Geological Sciences, the Bureau of Economic Geology, or the Institute for Geophysics. The schedule of appointment is also negotiable.

For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

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