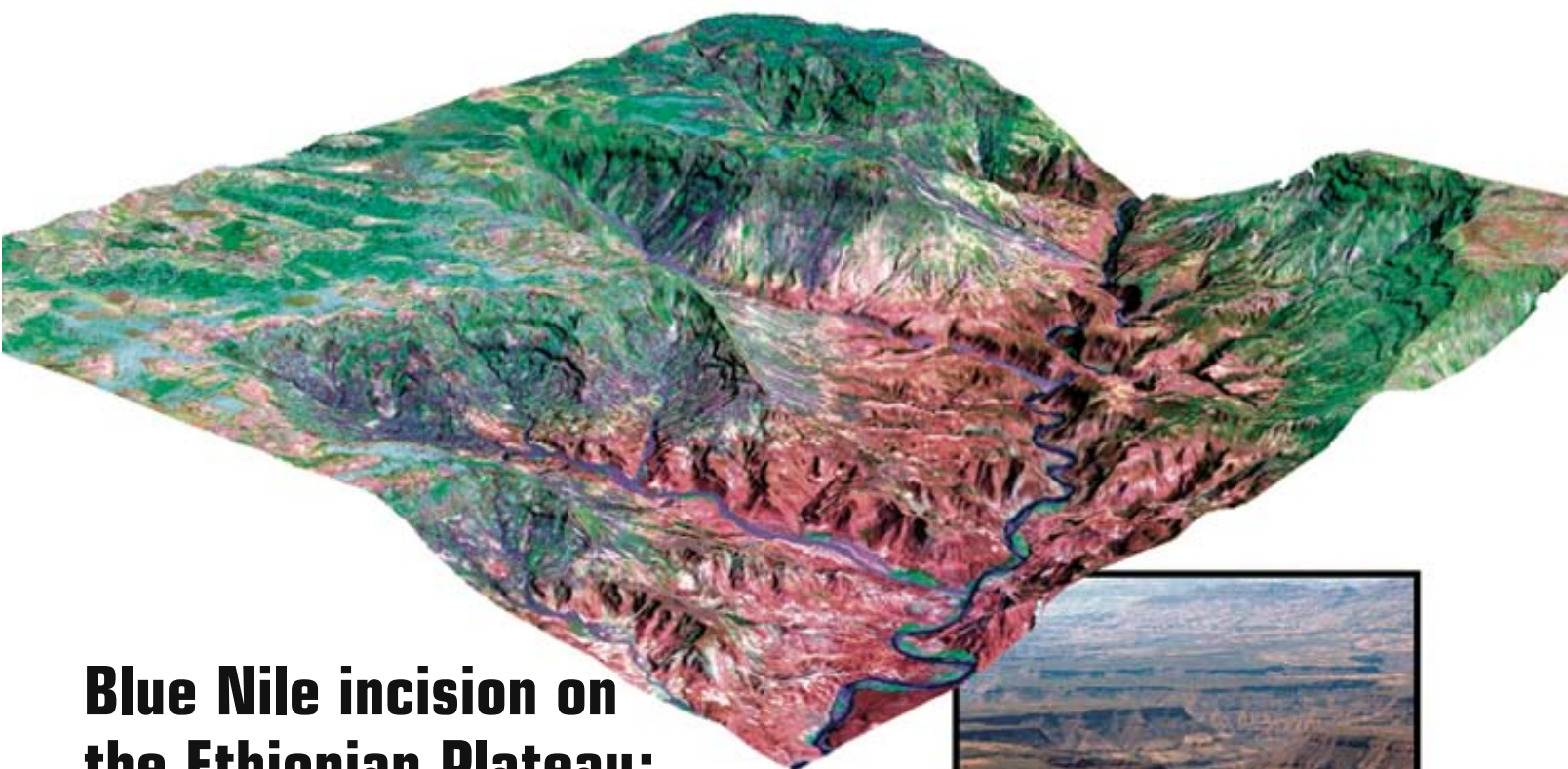


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Blue Nile incision on the Ethiopian Plateau:

Pulsed plateau growth,
Pliocene uplift, and hominin evolution



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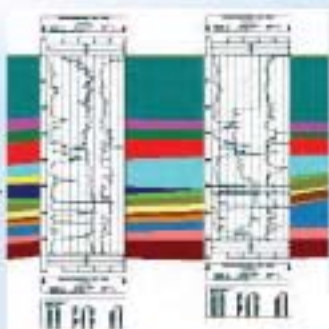
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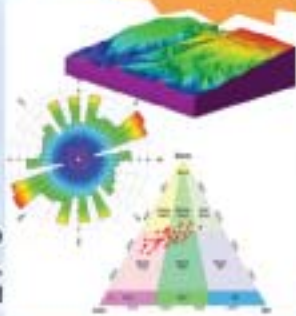
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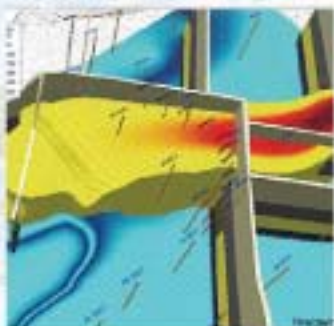


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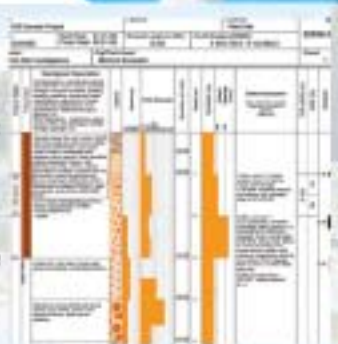


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Cover: Image (~40 × 20 km): 3-D perspective view (vertical exaggeration 5) of part of the Gorge of the Nile on the northwestern Ethiopian Plateau (south of Mount Choke) generated by draping advanced spaceborne thermal emission and reflection radiometer (ASTER) image (7-3-1) over 15-m horizontal resolution ASTER digital elevation model. Trunk river (Blue Nile) is flowing toward the viewer. Photo (~10 × 7 km): Section from the same area, where the Blue Nile deeply dissects Mesozoic sandstones. See "Blue Nile incision on the Ethiopian Plateau: Pulsed plateau growth, Pliocene uplift, and hominin evolution," by Gani et al., p. 4–11.

SCIENCE ARTICLE

4 Blue Nile incision on the Ethiopian Plateau: Pulsed plateau growth, Pliocene uplift, and hominin evolution

Nahid DS Gani, M. Royhan Gani, and Mohamed G. Abdelsalam

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Blue Nile incision on the Ethiopian Plateau: Pulsed plateau growth, Pliocene uplift, and hominin evolution

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ABSTRACT

The 1.6-km-deep Gorge of the Nile, a rival of the Grand Canyon, resulted from the deep incision of the Blue Nile drainage into the uplifted Ethiopian Plateau. Understanding the incision history of the plateau is crucial to unraveling the Cenozoic tectonoclimatic evolution of the region, particularly because the region has long been used as a natural laboratory to understand the geodynamics of continental rifting and the evolution of hominins. We undertake a quantitative geomorphologic approach integrating field, geographic information system (GIS), and digital elevation model (DEM) data to analyze incision (volume, long-term rates, and spatiotemporal variability) and river longitudinal profiles of the Blue Nile drainage. Previously published isotopic ages of the Cenozoic volcanic rocks are used to constrain long-term incision rates through geologic time.

Our data argue that (1) the Blue Nile drainage has removed at least 93,200 km³ of rocks from the northwestern Ethiopian Plateau since ca. 29 Ma (early Oligocene) through a three-phase (ca. 29–10 Ma, ca. 10–6 Ma, and ca. 6 Ma to present) incision, where long-term incision rates increased rapidly and episodically in the late Miocene (ca. 10 Ma and ca. 6 Ma); (2) being out-of-phase with the past climatic events and in-phase with the main volcanic episodes of the region, this episodic increase of incision rate is suggestive of episodic growth of the plateau; (3) of the ~2-km rock uplift of the plateau since ca. 30 Ma, 0.3 km was due to isostatic uplift related to erosional unloading, and the rest was due to other tectonic activities; (4) the extremely rapid long-term incision rate increase, thus a rapid uplift of the plateau, ca. 6 Ma might be related to lithospheric foundering, caused by ponded plume material beneath the Ethiopian Plateau and aided by huge tectonic stresses related to the Messinian salinity crisis of the Mediterranean Sea. These events could have caused the plateau to rise >1 km within a few m.y. in the early Pliocene. This uplift history of the Ethiopian Plateau can shed critical light on the geodynamics of the Afar mantle plume and the evolution of the East African hominins via climate change.

INTRODUCTION

In tectonically active regions, landscape evolution is controlled, mostly in a feedback loop, by tectonics, climate, topography, and surface geomorphic processes. These factors are responsible for shaping the world's most spectacular tec-

tonically active landscapes, including the Himalayas, Rockies, Alps, Pyrenees, Andes, and Southern Alps (New Zealand). The erosional history of the Colorado (e.g., Pederson et al., 2002; McMillan et al., 2006, and references therein) and the Tibetan plateaus (e.g., Clark et al., 2004; Schoenbohm et al., 2004, and references therein), both situated within collisional orogenic belts, are well studied. Conversely, studies of the erosional history of the non-orogenic Ethiopian Plateau are few and preliminary (McDougall et al., 1975; Weissel et al., 1995; Pik et al., 2003). Relative to other elevated regions where direct glacial erosion is pronounced, the Ethiopian Plateau is least affected by Cenozoic global cooling and/or Pleistocene glacial cycles because of its location close to the equator (cf. Molnar and England, 1990). Moreover, because of its non-orogenic setting, tectonic exhumation of the Ethiopian Plateau is insignificant. Therefore, river incision and plateau uplift (tectonic and/or isostatic) have a more direct coupling for the Ethiopian Plateau.

The Blue Nile, a major tributary of the Nile River, extensively dissected the northwestern Ethiopian Plateau (Fig. 1), exposing igneous, metamorphic, and sedimentary rock units ranging in age from Neoproterozoic to Holocene (Figs. 2 and 3). The plateau is also characterized by the deeply incised Gorge of the Nile (Fig. 3; Gani and Abdelsalam, 2006), the deepest and most extensive canyon in the greater Nile drainage basin and a rival of the Grand Canyon of the Colorado Plateau.

In the Late Jurassic, the plateau was below sea level for the last time, as indicated by the deposition of marine Upper Limestone overlain by Cretaceous-age continental-fluvial Upper Sandstone (Gani and Abdelsalam, 2006). Today, the contact between the

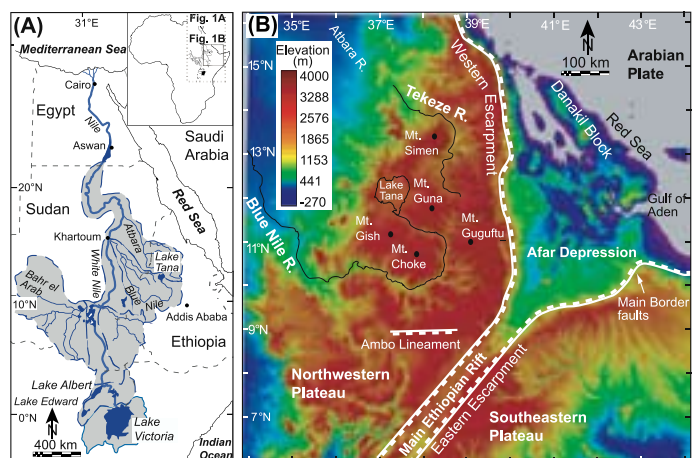


Figure 1. (A) Drainage basin of the Nile, the longest river on Earth, along with its major tributaries, including the Blue Nile. (B) Color-coded hillshade Shuttle Radar Topography Mission digital elevation model of the Ethiopian Plateau. Note locations of the Blue Nile and Tekeze drainage network and major tectonic elements.

Upper Limestone and Upper Sandstone lies at an average elevation of 2.2 km, which is grossly the net rock uplift of the plateau since ca. 150 Ma. However, partitioning of the plateau uplift in geologic time, particularly during the Cenozoic, is poorly understood and debated (Faure, 1973; McDougall et al., 1975; Weissel et al., 1995; Pik et al., 2003; Ayalew and Yamagishi, 2004). Erosional studies of the northwestern Ethiopian Plateau are also in conflict. Based on fractal analysis of drainage network, Weissel et al. (1995) suggested that flexural uplift (i.e., isostatic rebound of the lithosphere due to rifting) of the Western flank of the Main Ethiopian Rift in the late Miocene resulted in the establishment of a new drainage network that controlled the subsequent erosion of the

Ethiopian Plateau. Pik et al. (2003), on the other hand, based mainly on apatite (U-Th)/He thermochronometry, concluded that erosion in the Blue Nile drainage initiated between 29 and 25 Ma and inferred that the present-day elevated and eroded plateau physiography has existed since the late Oligocene. Therefore, further study to constrain the incision of the plateau in time and space is required to better understand the uplift history of the Ethiopian Plateau. This study can also shed critical light on the regional geodynamics as well as paleoclimate and hominin evolution of East Africa, considering that the Afar (Fig. 1) hosts some of the oldest and the most complete fossil remains of hominins, including Lucy and Dikika baby.

Here, we present results of quantitative geomorphologic analysis of the Blue Nile drainage in the northwestern Ethiopian Plateau, integrating field data, geographic information system (GIS), and digital elevation model (DEM) information extracted from a Shuttle Radar Topography Mission (SRTM). The objective is to analyze plateau incision (depth, long-term rates, and spatiotemporal variability) and river longitudinal profiles. The results are discussed in relation to the tectonic and climatic history of the region.

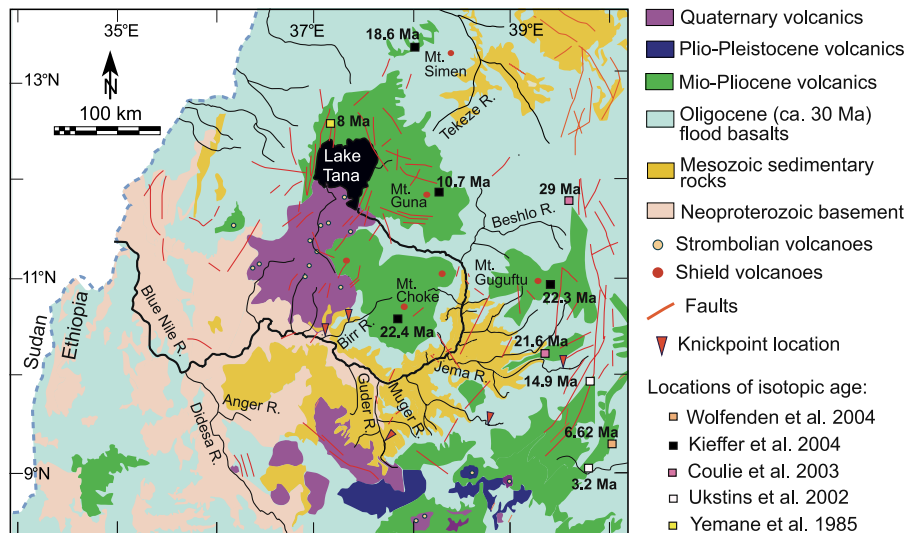


Figure 2. Geologic map of the northwestern Ethiopian Plateau showing main stratigraphic units (modified after Mangesha et al., 1996; Gani and Abdelsalam, 2006). Note locations of isotopic dating of volcanic rocks and major knickpoints in tributary profiles of Figure 6C and GSA Data Repository Figure DR3 (see text footnote 1).

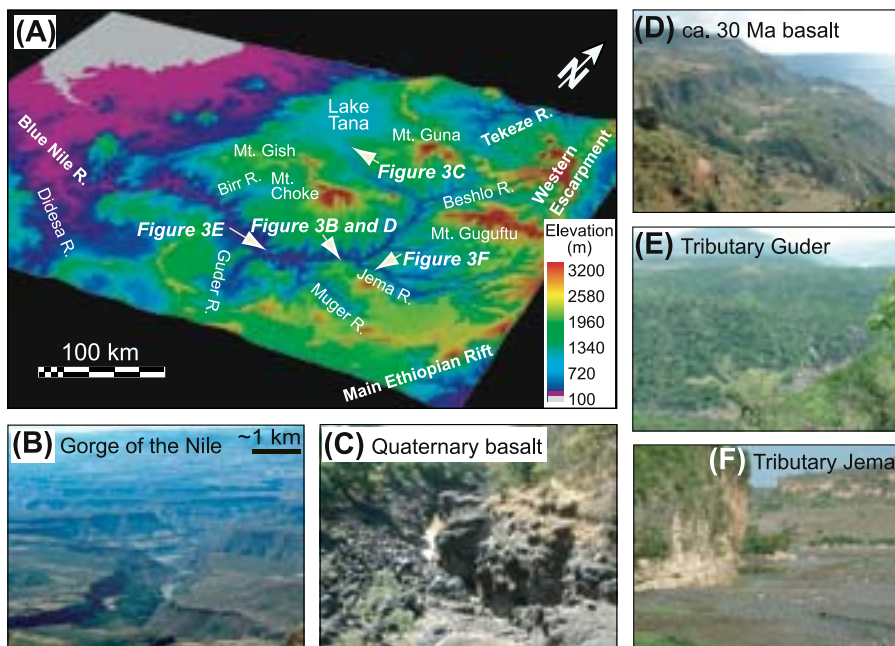


Figure 3. (A) The Blue Nile with major tributaries in three-dimensional perspective generated from a Shuttle Radar Topography Mission digital elevation model. (B) Gorge of the Nile where the Blue Nile deeply dissected the Mesozoic sedimentary rocks. (C) Relatively young incision of the Blue Nile through Quaternary basalts close to its source at Lake Tana. (D) 30 Ma basalts exposed near the confluence of tributary Muger. (E) Neoproterozoic basement rocks exposed at tributary Guder. (F) Late Jurassic Upper Limestone exposed at tributary Jema.

GEOLOGIC SETTING

The northwestern Ethiopian Plateau, with a mean elevation of 2.5 km, is located on the western flank of the tectonically active Main Ethiopian Rift and the Afar Depression (Fig. 1B). The plateau was uplifted due to the combined effects of the rising Afar mantle plume and flank uplift of the Main Ethiopian Rift and the Afar Depression (Collet et al., 1999; Şengör, 2001; Davis and Slack, 2002; Beyene and Abdelsalam, 2005). A tectono-chronostratigraphic calculation led Şengör (2001) to conclude that the ~1000-km-diameter Afar dome began to rise in the middle Eocene, reaching an elevation of ~1 km by the early Oligocene. Extensive basaltic flows (500–2000 m thick) were erupted over a short, 1 m.y., interval ca. 30 Ma ($^{40}\text{Ar}/^{39}\text{Ar}$ age dating and magnetostratigraphy of Hofmann et al., 1997). This eruption, covering an area of >500,000 km², is inferred to mark the appearance of the Afar mantle plume (Mohr and Zanettin, 1988; Hofmann et al., 1997; Kieffer et al., 2004). Plume-related uplift caused deep-seated

faults within the Ethiopian lithosphere, leading to the collapse that formed the Afar Depression ca. 24 Ma (Capaldi et al., 1987; Beyene and Abdelsalam, 2005). This event was followed by shield-volcano–building episodes, which gave rise to the development of Choke and Gugufu volcanoes (Figs. 1B and 3A) in the northwestern Ethiopian Plateau ca. 22 Ma ($^{40}\text{Ar}/^{39}\text{Ar}$ ages of Kieffer et al., 2004).

After the initiation of rifting, the Danakil block (Fig. 1B) started to separate from the Nubian Plate ca. 20 Ma (Manighetti et al., 2001; Beyene and Abdelsalam, 2005). Based on geochronology (Ar/Ar), Wolfenden et al. (2004) suggested that the northern Main Ethiopian Rift, which dissected the Ethiopian Plateau into northwest and southeast sections (Fig. 1B), developed ca. 11 Ma. Meanwhile, the Guna shield volcano (Figs. 1B and 3A) formed at 10.7 Ma (Ar/Ar ages of Kieffer et al., 2004). WoldeGabriel et al. (1990), based on stratigraphic relationships and geochronological (K/Ar) studies, proposed that the western boundary fault of the Main Ethiopian Rift initiated by at least 8.3 Ma. However, in a recent structural, petrological, and geochronological (K/Ar) study, Bonini et al. (2005) concluded that extension forming the Main Ethiopian Rift started between 6 and 5 Ma. Lake Tana appeared ca. 8 Ma, marked by the deposition of lignitiferous sediments (Chorowicz et al., 1998).

METHODS

As demonstrated by Pederson et al. (2002), McMillan (2003), and McMillan et al. (2006), the uplift and incision history of a region can be documented and evaluated through GIS analysis using DEM and stratigraphic markers. We take a similar approach (see the GSA Data Repository¹) using a SRTM-generated DEM with a horizontal resolution of 90 m and vertical accuracy of ± 30 m (Gani and Abdelsalam, 2006). Thirty $1^\circ \times 1^\circ$ DEM tiles covering the Blue Nile and the southern part of the Tekeze drainage in the northwestern Ethiopian Plateau were resampled and mosaiced into a single DEM file (Fig. 4A).

In the study area, near-horizontal Mesozoic sedimentary strata are sandwiched between Neoproterozoic basement and volcanic rocks younger than 31 Ma (Gani and Abdelsalam, 2006). Our map of these volcanic rocks (Fig. 2) is based on field observations, the geologic map of Ethiopia (Mangesha et al., 1996), and other published accounts (Hofmann et al., 1997; Ukstins et al., 2002; Coulie et al., 2003; Pik et al., 2003; Kieffer et al., 2004; Wolfenden et al., 2004). Scattered topographic highs, except sharply elevated volcanic peaks, of these volcanic rocks (preserved as erosional remnants; Fig. 4A) were used to construct a diachronous paleodatum surface (Fig. 4B), applying a nearest-neighbor triangulation algorithm (provided in the GSA Data Repository [see footnote 1]). This paleodatum surface is a composite imaginary (as if no incision happened) surface, ranging in age from early Oligocene (ca. 30 Ma) to Quaternary. Regional incision over the northwestern Ethiopian Plateau was mapped by subtracting modern topography from the paleodatum surface (Fig. 4C).

To quantify the long-term incision rates of the Ethiopian Plateau, we exploit the available isotopic ages of the Cenozoic volcanics (Fig. 2; Table DR1, GSA Data Repository [see footnote 1]). Thermochronological studies indicate that the erosion at the Blue Nile and Tekeze drainage initiated ca. 29 Ma (Pik et al., 2003), shortly after the extensive flooding by a thick (average ~ 1 km) basalt ca. 30 Ma. This basalt would have buried preexisting relief of the Ethiopian Plateau and led to fresh regional incision by establishing a new drainage network. Pik et al. (2003) argued, based on thermochronology, ages of volcanic divides, curvature of stratigraphic contacts, and the morphology of the drainage basin, that the present-day overall paths of the Blue Nile and Tekeze rivers were established between 30 and 23 Ma. Therefore, it is assumed that the ages (< 31 Ma) of the erosional remnants (Fig. 4A) give the earliest ages of incision initiations at those locations. We (1) calculate long-term incision rates (dividing the maximum incision depth around a dated remnant by the remnant age, yielding an aver-

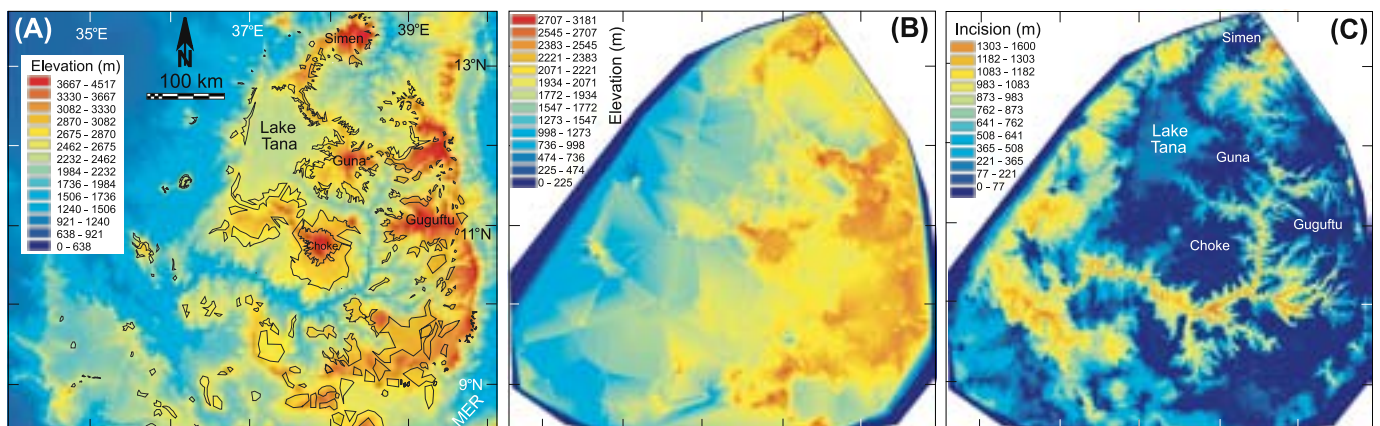


Figure 4. (A) Color-coded map showing present-day elevation of study area. Polygons are drawn around high erosional remnants, excluding volcanic peaks and ridges (see GSA Data Repository [text footnote 1]). (B) Reconstruction of a diachronous paleodatum surface by interpolating erosional remnants. This surface gives a minimum estimate of the elevation of the former zero-incision landscape (relative to modern topography). (C) Color-coded incision map generated by subtracting modern topography (A) from the paleodatum surface (B). The incision pattern broadly follows the present-day Blue Nile and Tekeze drainage network. The deepest incision occurred at the western margin of the plateau where the Blue Nile and Tekeze River leave the plateau.

¹GSA Data Repository Item 2007217, Methods: Stratigraphic-GIS-DEM analysis to quantify incision, Figures DR1–DR3 and Table DR1, is available at www.geosociety.org/pubs/ft2007.htm. You can also obtain a copy by writing to editing@geosociety.org.

age incision rate) at various places on the plateau; (2) plot the long-term incision rates against the ages of the remnants; and (3) draw best-fit lines enveloping the maximum incision rates to demonstrate the variations of long-term incision rates since ca. 29 Ma (Fig. 5). Notably, without proper caution, these types of plots are vulnerable to spurious self-correlation (i.e., auto-correlation between two parameters having a common term; e.g., Kenney, 1982) or to the effect of variable observation spans (e.g., Gardner et al., 1987). Although these issues might be a secondary factor, they do not exert a first-order control in our data analysis (see GSA Data Repository).

RESULTS

Plateau Incision in Time and Space

In the northwestern Ethiopian Plateau, incision varies from 0 to 1.6 km (Fig. 4C). The incision pattern broadly follows the present-day Blue Nile and Tekeze drainage network, where higher magnitude incision characterizes the main course of the Blue Nile. The deepest incision occurred at the western margin of the plateau (Fig. 4C), where the Blue Nile and the Tekeze River leave the plateau (Fig. 1). Both incision and valley width, neither of which are controlled primarily by bedrock lithology or structure (Gani and Abdelsalam, 2006; Gani, 2006), gradually decrease upstream. Incision also decreases upstream from the confluence points of the Blue Nile with its tributaries Guder, Muger, and Jema (Figs. 3A and 4C). These incision patterns are characteristic of headward migration of knick faces, suggesting that Gorge of the Nile excavation was done mostly by headward erosion. The minimum volume of rocks removed as a result of these incisions (and other slope-failure processes) since ca. 29 Ma is calculated (by creating a “Cut/Fill” surface in ArcGIS) to be at least 93,200 km³. These removed rocks were subsequently deposited as sediments in alluvial fans of Sudan and in the Nile Delta and Nile Fan of the Mediterranean (e.g., Garzanti et al., 2006). The northwestern Ethiopian Plateau supplies 96% of the Nile sediment load (Garzanti et al., 2006) through the Blue Nile and Tekeze drainage incision. Therefore, the incision history and eroding rock volume of the Ethiopian Plateau would significantly control the sediment budget and evolution of the Nile Delta and Nile Fan.

The incision history of the northwestern Ethiopian Plateau can be divided into three phases, based on the variation of long-term incision rates (average rates from a particular geologic time to the present) of the drainage basin (Fig. 5). Phase I, ca. 29 to ca. 10 Ma, is characterized by low, long-term incision rates that slowly and steadily rose from 53 to 80 m/m.y. (0.053–0.080 mm/yr). Phase II, ca. 10 Ma to ca. 6 Ma, is an intermediary incision phase during which long-term rates increased from 80 to 120 m/m.y. (0.080–0.12 mm/yr). Phase III, from 6 Ma to the present, is characterized by high, long-term incision rates that increase exponentially from 120 to 320 m/m.y. (0.12–0.32 mm/yr).

River Longitudinal Profiles

Analysis of the shape of a river long-profile is a powerful tool in determining the incision and uplift history of a region (Weissel and Seidl, 1998; Schoenbohm et al., 2004; Clark et al., 2005; Crosby and Whipple, 2006). Change in the base level (e.g., increase in uplift rate, surface rupture on faults, stream capture)

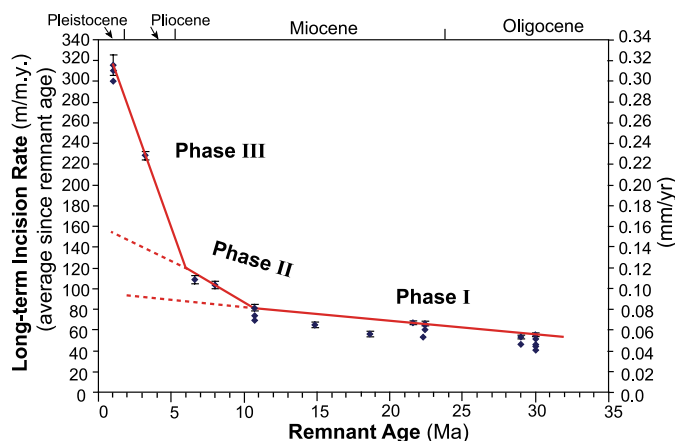


Figure 5. Long-term incision rate versus remnant age, with best-fit lines drawn through maximum rates. To calculate errors in incision rates, vertical accuracy (± 30 m) of the Shuttle Radar Topography Mission digital elevation model is weighted against remnant ages. Graph shows a three-phase incision history for the Ethiopian Plateau, also seen in river long-profiles (Fig. 6). Phase III line is interpolated backward to predict its initiation. Major geologic event chronology to compare incision history: 30 Ma—flood volcanism, Simen volcano; 24 Ma—Afar depression formed; 22 Ma—Choke and Gugufu volcanoes developed; 20 Ma—Danakil Block separated; 10.7–8.4 Ma—second major episode of volcanism, including Guna shield volcano; 10 Ma—Gulf of Aden seafloor spreading; 6–5 Ma—Main Ethiopian Rift initiated; 5.9 Ma—Messinian salinity crisis; 5 Ma—Red Sea seafloor spreading; 4 Ma—third major episode of volcanism; 3 Ma—eastern African climate and vegetation change and hominin evolution.

or incision rate (e.g., due to variable erodibility of bedrock lithology) will result in a new equilibrium slope at a knick-point, which separates the older, upstream, channel profile from the younger, downstream, channel profile. These knick-points migrate headward as upstream-propagating waves of erosion (Weissel and Seidl, 1998; Whipple and Tucker, 1999), and migration is faster in the trunk stream than in the tributaries (Whipple and Tucker, 1999; Crosby and Whipple, 2006). Therefore, tributaries tend to preserve the record of base-level changes as a series of knickpoints still propagating upstream, and the number of subprofiles in a stream should correspond to the number of incision phases of the drainage basin. Because, with time, younger knick faces can overtake and remove older knick faces and selectively erode out older profiles, all incision phases may not be preserved in a stream profile.

Using DEM, longitudinal profiles of the Blue Nile River and seven major tributaries were extracted (Fig. 6). Field investigation and structural mapping of the region (Gani and Abdelsalam, 2006; Gani, 2006) ensure that no major faults cross these streams. Among the seven tributaries, two show one channel profile, four show two subprofiles (Figs. 6C and DR3 [GSA Data Repository; see footnote 1]), and one tributary, Birr, preserves three subprofiles (Fig. 6B), suggesting three phases of incision in the study area. This is consistent with the three incision phases described earlier, based on variations of long-term incision rates (Fig. 5). For the Guder, Muger, and Jema tributaries, each with two subprofiles (Figs. 6C and DR3), the migration of the youngest phase III knick face is interpreted to have eroded out the intermediate phase II subprofile. No major knickpoint was observed in the long-profile of the Blue Nile, which suggests

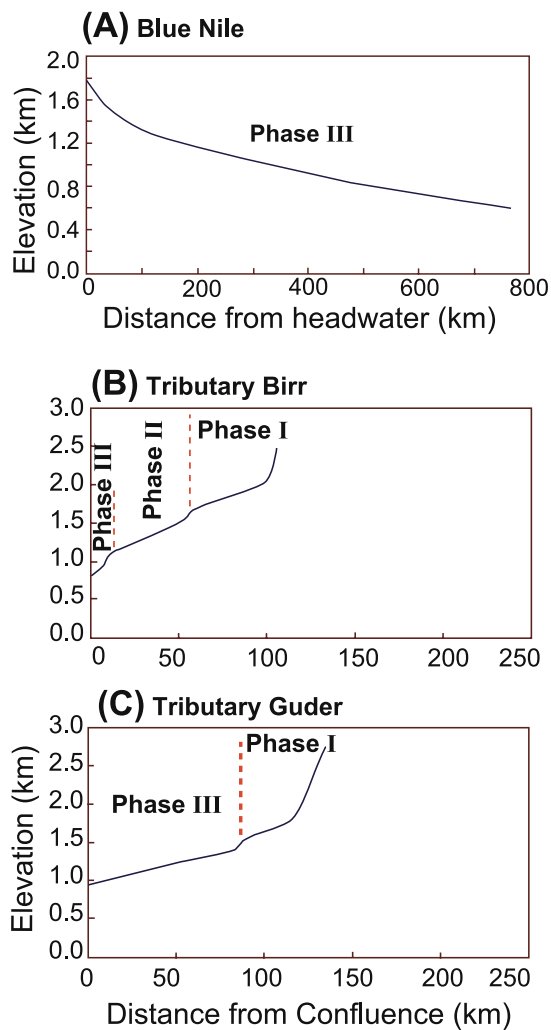


Figure 6. River longitudinal profiles, extracted from a digital elevation model, of the Blue Nile (A) and two representative tributaries (B and C). Phases of incision interpreted from preserved major (relief >200 m) knick faces, which can overtake and remove older knick faces by upstream-migration. Tributary Birr (B) preserves all three phases of incision, consistent with the numbers of incision phases interpreted in Figure 5. See Figures 2 and 3 for tributary and knickpoint locations.

that all knickpoints passed through this trench and that the profile probably represents phase III incision (Fig. 6A).

Knickpoint origins and dynamics are debated (for a discussion, see Crosby and Whipple, 2006), and caution is required when causes of knickpoint formation are interpreted. Our tributary knickpoints (with knick-face relief >200 m) are unassociated with stream capture, faulting, or differential bedrock erosion (GSA Data Repository [footnote 1]). Therefore, we argue that these major knickpoints are likely related to uplift events that affected the plateau.

Rock Uplift of the Ethiopian Plateau

As indicated by the present elevation of the contact between the Jurassic Upper Limestone and Cretaceous Upper Sandstone, the net rock uplift of the Ethiopian Plateau is 2.2 km since ca. 150 Ma. The majority of this uplift occurred during the Cenozoic. The plateau was close to sea level in the middle

Eocene and experienced a domal uplift of ~1 km by the early Oligocene, an uplift attributable to the rise of the Afar mantle plume (Engör, 2001). Hence, the stratigraphic contact (between Jurassic and Cretaceous rocks) was at ~1 km elevation by the early Oligocene. The ~1-km-thick, ca. 30 Ma basalt would have caused subsidence of the plateau, although the abnormal thermal structure below the plateau might have complicated the situation. Using Archimedes' principle, isostatic adjustment (uplift or subsidence) of the crust due to exhumation (\pm) is given as (Isostatic adjustment) = Exhumation \times (Crust density/Mantle density) (Molnar and England, 1990; Molnar, 2003; Pederson et al., 2002). If we use a mantle density of 3300 kg/m³, then a basalt pile with mean thickness of 1 km and density of 2800 kg/m³ results in 0.85 km of plateau subsidence. Ignoring flexural effect, this subsidence would have lowered the stratigraphic contact to an elevation of ~0.15 km (despite the subsidence, the mean surface elevation of the basalt-covered plateau would have been ~1.15 km). Hence, the net rock uplift of the Ethiopian Plateau since ca. 30 Ma has been 2.05 km (2.2 – 0.15 = 2.05 km). Since ca. 29 Ma, 93,200 km³ rocks were removed from the plateau by river incision. As the study area is 250,000 km², the mean thickness of the eroded material is 0.37 km, the removal of which would be expected to result in 0.3 km isostatic uplift of the plateau, assuming a mean density of 2750 kg/m³ for the removed rocks (granite, gneiss, sandstone, limestone, and basalt). Therefore, 1.75 km (2.05 – 0.3 = 1.75 km) of plateau rock uplift since ca. 30 Ma requires further explanation, probably involving the effects of plume-related thermal uplift and flexural rift-flank uplift. However, the length-scale (a few tens of kilometers) of flexural uplift is likely too short to have a major role in uplifting the hundreds of kilometers-wide plateau.

DISCUSSION AND CONCLUSIONS

River Incision and Plateau Growth

Apart from direct base-level fall, two fundamental ways to substantially increase erosion in streams are to increase channel gradient via surface uplift driven by regional tectonics or to increase the ratio of discharge to sediment flux via climate change (cf. Tucker and Slingerland, 1997). In active terrains, the dominance of tectonic versus climate-driven river erosion is debated (Molnar and England, 1990; Whipple et al., 1999; Molnar, 2003), particularly in the light of late Cenozoic global climate change (Molnar and England, 1990; Hay et al., 2002; McMillan et al., 2006). Two of the most recent drastic climate changes in the Cenozoic occurred ca. 15 Ma and ca. 3 Ma (Molnar and England, 1990; Hay et al., 2002). In Eastern Africa, a climate shift toward aridity and the change in vegetation from closed canopy to savannah occurred ca. 3 Ma (deMenocal, 1995; Cane and Molnar, 2001). The long-term incision rate of the Blue Nile increased rapidly ca. 10 Ma and ca. 6 Ma, increases that were out of phase with the climatic events and in phase with the major volcanic episodes of the region. Hence, we argue that such a deep and extensive incision of the Ethiopian Plateau is mostly related to its tectonic uplift history. If correct, then the magnitude and temporal variation of long-term incision rates of the Blue Nile can be used to constrain the plateau uplift.

Our calculated long-term incision rate of 0.053 mm/yr for the Blue Nile drainage since ca. 29 Ma is of the same order as the value of 0.035 mm/yr estimated by Pik et al. (2003). However, our results differ from their prediction that two-thirds of the total incision was achieved within the first 10 m.y. after the initiation and that the present physiography of the elevated plateau existed since the Oligocene, with erosion rate decreasing with time. In fact, identification of major knickpoints in tributary profiles (Fig. 6) suggests that pulses of erosional waves are still propagating in some parts of the drainage basin, indicating a non-equilibrium (i.e., transient) Ethiopian Plateau landscape. The Blue Nile incision history is expressed in the uplift-related knickpoints of stream profiles (Fig. 6) and in the changes of long-term incision rates (Fig. 5). The plateau experienced a slow and steady uplift rate, if any, between ca. 29 and ca. 10 Ma, as indicated by the slow and near-steady incision of phase I. A rapid increase in long-term incision rate ca. 10 Ma (beginning of phase II incision) was probably due to an increase in the uplift rate of the plateau at that time. The dramatic increase in long-term incision rate of the Blue Nile drainage started ca. 6 Ma (Fig. 5; initiation of phase III incision), indicating a dramatic plateau rise.

A close temporal correlation exists between the incision phases of the Blue Nile we interpret and the major volcanic episodes in the region as described by Abebe et al. (2005). After the extensive volcanism of the ca. 30 Ma flood basalt, the region experienced a relatively quiescent phase of volcanism lasting until 10.6 Ma that matches our phase I incision characterized by low and stable long-term incision rates. The next major volcanic episodes occurred between 10.6 and 8.4 Ma and ca. 4 Ma (Abebe et al., 2005), corresponding to our phase II and phase III incisions, respectively. This correlation independently supports our suggestion of a tectonically driven Ethiopian Plateau incision, because thermal heating tends to drive uplift.

Although a mean uplift rate of 0.1 mm/yr since the Eocene has been suggested for the Ethiopian Plateau (Faure, 1973), the temporal distribution of ~2 km rock uplift of the plateau since ca. 30 Ma is poorly constrained. Considering the long-term incision rate (Fig. 5) as a proxy for plateau uplift, our study indicates that the Ethiopian Plateau did not appear to experience a steady growth since ca. 30 Ma. Rather, as reflected in the three-phase incision history of the region, the growth of the plateau was likely episodic in nature, resulting in a pulsed plateau growth similar (in terms of tempo, but not mechanism) to what has been suggested for the Tibetan Plateau (Schoenbohm et al., 2004). Of most importance, we argue that the majority of the ~2-km rock uplift of the Ethiopian Plateau occurred within a few m.y. after ca. 6 Ma. This is in line with the prediction of a rapid uplift of the plateau in the Plio-Pleistocene by Mohr (1967) and Adamson and Williams (1987). A paleo-floral study of a lacustrine deposit located north of Lake Tana (Yemane et al., 1985) also indicates plateau uplift of ~1 km sometime between 8 Ma and the present.

Pliocene Uplift of the Plateau

Potential causes of large and rapid uplift of the Ethiopian Plateau include delamination or convective removal of lithospheric mantle (e.g., Duggen et al., 2003; Molnar et al., 1993). Broad,

dynamic uplift of the large Afar dome during the Eocene and early Oligocene was probably caused by buoyant pressure from a deep mantle plume (Davis and Slack, 2002) on an intact lithosphere. Preexisting topography (e.g., thinned lithosphere beneath the Mesozoic rifts, which exists within the Ethiopian Plateau; Mege and Korme, 2004; Gani, 2006) at the base of the lithosphere might have caused localized ponding of plume material (Ebinger and Sleep, 1998), which tends to cause thermal erosion of the overriding lithosphere and consequent uplift of the overlying crust (e.g., Johnston and Thorkelson, 2000). Prolonged heating of the ~120-km-thick (cf. Ebinger and Sleep, 1998) lithosphere beneath the Ethiopian Plateau might have weakened it, so that at one stage, likely ca. 6 Ma, part of the lithosphere might have foundered rapidly into the plume, causing a large and rapid uplift of the plateau. A major phase of normal faulting ca. 5.2 Ma that created the Main Ethiopian Rift and a major episode of volcanism in the region ca. 4 Ma (Abebe et al., 2005; Bonini et al., 2005) may also attest to this massive uplift of the Ethiopian Plateau.

There exists an intriguing temporal correlation between the rapid uplift of the Ethiopian Plateau after ca. 6 Ma and the Messinian salinity crisis (MSC) of the Mediterranean between 5.96 and 5.33 Ma (Hsü et al., 1977; Krijgsman et al., 1999). Semi-global reorganization of plates and renewed tectonic activities immediately before and after the MSC have been documented (Adamson and Williams, 1987; Adamson et al., 1992; Krijgsman et al., 1999; Duggen et al., 2003). Unloading and loading of ~2 km of seawater in the Mediterranean along with deposition of a ~1-km-thick halite layer within <0.5 m.y. would have created great mechanical stresses and isostatic adjustments of the lithosphere in and around the region (Norman and Chase, 1986; Adamson et al., 1992). It is possible that these stresses propagated through the lithosphere via stress diffusion and aided in the foundering of already weakened lithosphere beneath the Ethiopian Plateau, causing the plateau to rise >1 km within a few m.y. In fact, substantial uplift of the East African Rift System has been documented between 5 and 2 Ma (see references in Sepulchre et al., 2006; Spiegel et al., 2007). Seafloor spreading in the Red Sea also initiated ca. 5 Ma (Ukstins et al., 2002).

Paleoclimate and Hominin Evolution

A global-scale change from C₃-photosynthesizing (wood-dominated) vegetation to C₄ (grass-dominated) vegetation in the late Miocene (8–6 Ma) has been suggested by stable carbon isotope analysis of fossil tooth enamel (Cerling et al., 1997). Compilation of paleoclimatic data by Cane and Molnar (2001) suggests that this woodland to grassland transition, indicative of increasing aridification, took place ca. 3–4 Ma in East Africa. In the late Pliocene and Pleistocene, several brief (~0.2 m.y.) wet periods were superimposed on this longer-term aridification (lake sediments study of Trauth et al., 2005). These climatic changes have been attributed to decreased sea-surface temperatures related to the onset of Northern Hemisphere glacial cycles (deMenocal, 1995) and/or to the closing of the Indonesian seaway (Cane and Molnar, 2001). However, in explaining East African aridification, Pickford (1990) argued for the late Neogene uplift of the Roof of Africa, the 6000-km-long, north-south-oriented East African Rift System rising to 5.1 km. In an atmospheric and biospheric simulation, Sepulchre et al. (2006)

concluded that the uplift of eastern African topography had a first-order impact on this aridification by inhibiting a zonal circulation of moist air. Asynchronous uplift of the Roof of Africa during the late Neogene and isolated topographic features like volcanoes might have permitted temporally and spatially restricted humid conditions within the overall arid landscape. Hence, the >1 km uplift of the Ethiopian Plateau shortly after ca. 6 Ma likely played a key role in the East African aridification by forming orographic barriers to moist air.

East African aridification caused a gradual replacement of closed forest woodlands by open savanna grasslands. Darwin (1871, as cited *in* Potts, 1998) pioneered the “Savanna Hypothesis” by suggesting, in summary, that human evolution was a consequence of adaptive change on the African savanna. Hence, it is possible that the massive uplift of the Ethiopian Plateau in the Pliocene was critical in the origin, adaptation, and/or demise of East African hominins, particularly forcing an arid-adaptive evolutionary path for *Homo sapiens* (e.g., Reed, 1997; deMenocal, 1995).

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28–31 October 2007
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Denver, Colorado, USA

www.geosociety.org

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For general meeting questions, please contact
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Great things are happening at GSA Headquarters; stop by when you're in town! Photo by Eric Christensen at GSA HQ 14 June 2007.

⇒ Denver 2007 Meeting Highlights ⇐

Don't miss out on these opportunities!

Field Trips

This year's field-trip theme is "The Mysteries in the Rockies." When you come to Denver, you will enter the heart of a vast area of poorly understood geology, notwithstanding the heroic labors of our peers, colleagues, and illustrious predecessors. Come learn with us about the unknown, probe the limits of understanding, and have fun! See the June or August issues of *GSA Today* or go to www.geosociety.org/meetings/2007/fieldTrips.htm for field-trip details.

Subaru Outdoor Life

**Colorado Convention Center
Monday, 29 Oct., 6–7 p.m.**

The Subaru Outdoor Life Keynote: Saluting the outdoor life lived by adventurous geologists.

Public Forum: Forensic Geology

**Rooms 605/607,
Colorado Convention Center
Tuesday, 30 Oct., 7–9 p.m.**

A panel of experts will present the latest forensic geoscience methodologies, case histories, an overview of legal and ethical issues, and more. Learn more at www.geosociety.org/meetings, or see the ad on page 17 of this issue.

Special Session: DEPTHX

Monday, 29 Oct., 4–6 p.m.

The autonomous underwater Deep Phreatic Thermal eXplorer (DEPTHX) is currently engaged in robotic exploration and characterization of Sistema Zacatón, a system of deep, water-filled sinkholes in México (see www.geo.utexas.edu/zacaton/DEPTHX/). This two-hour special session presents results of a NASA-funded DEPTHX project to develop and test such an autonomous robotic underwater vehicle to search for life in the seas of Jupiter's frozen moon, Europa. Seven presentations from project scientists and engineers will cover engineering design, robotic mapping, scientific sensors, hydrogeologic applications, geomicrobial discoveries, future Antarctic exploration, and planetary ties to Europa.

Coffee and Beer in the Poster Hall

Beer will be available during the afternoon poster sessions Monday through Wednesday. Coffee will be served in the poster session area during daily breaks.

↔ Denver 2007 Hot Topics ↔



Colorado Convention Center
28–31 Oct. 2007, 12:15–1:15 p.m.



Join your colleagues at lunchtime for spirited discussion and debate on the following burning issues! Chili and beer will be available for purchase outside the meeting room.

Sunday, 28 October: “Geology, Google Earth–Style!”

The Web revolution has made us hungry to have all of knowledge right at our fingertips. The question is, “How far can this go in the world of geology?” How quickly can geological survey agencies and research centers reformat their information for Web query? Can we assemble consistent information worldwide? Can we “go underground” in a Google Earth–style Web interface? What business models will enable the support of needed Web interfaces? The keys to success will be the understandability, accessibility, and share-ability of geological information; therefore, this Hot Topic session will propose and discuss future scenarios for realizing these three key components. Included in this discussion: Web-based subsurface visualization, needed digital protocols, and worldwide Web accessibility for regional, national, and global geoscience information management and delivery—now called OneGeology—an ambitious plan to ensure that humankind will be properly equipped for good decision making in the fields of research, hazards, energy, minerals, water, and climate change.

Speakers: Harvey Thorleifson, Minnesota Geological Survey—“the vision”; Lee Allison, Arizona Geological Survey—“infrastructure to make it happen”; and Ian Jackson, British Geological Survey—“the OneGeology concept.”

Monday, 29 October: “Importance of Earth Sciences in Decision Making and Infrastructure (Personnel) Problems”

This topic is basic to our discipline and important to its continuance. Major energy and environmental issues and even the future of international relations (e.g., global warming and potential water wars) are better understood via geology. Many societally important decisions rest on geologic information, but the ranks of geoscientists are shrinking due to retirement of the baby-boom generation, the difficulty in finding qualified geologists, and the ability to hold on to them. The panel will discuss the emergence (or possibly re-emergence) of the crucial role that earth sciences play in decision making as well as the challenges to meaningful dialogue between geoscientists and decision makers.

Speakers: Bill Shilts, Illinois State Geological Survey—“recent challenges and staffing issues”; Hal Miller, Subsurface Consultants & Associates—“industry perspective on the shortage of qualified geoscientists”; Rob Young, West Carolina University—“the failure of geology to change coastal management policy in the U.S. using Katrina as an example”; Lucy Jones, U.S. Geological Survey—“disaster scenarios and how successful partnerships have worked.”

Tuesday, 30 October: “Diversity in the Geosciences: Beyond Ethnicity, Gender, and Disability”

There is complex global movement of students to higher education, and as the student population and workforce changes, academic leaders must explore multiple issues in order to be able to manage these global shifts to the benefit of all. The United States remains the predominant destination for foreign students, accounting for 40% of internationally mobile students in 2004. According to a National Science Foundation 2006 report, the number of science, technology, engineering, and mathematics (STEM) graduate students on temporary U.S. visas more than doubled between 1983 and 2003, rising from 19% to 27% of all graduate STEM students over that period. Historically, half or more of students on temporary visas have stayed in the United States immediately after degree conferral, but this percentage has risen in recent years. This Hot Topic discussion will provide data on the trends in numbers and demographics of students in the geosciences and on the pattern of their U.S. activity (how many stay to work here, and if so, where?). Speakers will discuss the development of institutional policies and practices addressing foreign students. In light of anecdotal reports indicating marginalization of some foreign graduate students in STEM, this session will also include discussion about the

quality of academic experience for international graduate students. Finally, the most important question this discussion will address is “What are the implications for the geosciences?”

Speakers: Judith L. Hannah, Colorado State University; Murray Hitzman, Colorado School of Mines; Dallas Rhodes, Georgia Southern University.

Wednesday, 31 October: “What’s All the Flap about Feathered Dinosaurs?”

Perhaps the hottest of the Hot Topics—scientifically it is VERY controversial—revolves around the bird-dinosaur link. This is based on evidence from many “alleged” new “feathered” dinosaurs from China and other bird-like dinosaurs. Recently, a study from some preserved collagen in a *T. rex* leg bone with preserved amino acids/proteins shows similarities to that found in the collagen of chickens. Opponents state that “protofeathers” are the remains of structural fibers that only provide toughness. The fibers show a striking similarity to the structure of dermal collagen, and they dismiss the proposal that these fibers are feather-like.

Speakers: Scott Hartman, Wyoming Dinosaur Center—“pro, feathered dinosaurs”; John Rubin, Oregon State University—“con, feathered dinosaurs.”

Richard Berg, Illinois State Geological Survey
2007 Hot Topics Chair





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2007 GSA Presidential Address & Awards Ceremony

Hyatt Regency Denver at Colorado Convention Center
Cenntenial Ballroom

Saturday, 27 October, 7–9 p.m.

Please join us Saturday evening when GSA President John M. (Jack) Sharp Jr. gives his Presidential Address, "There's Adventure in Geology." Following this address, the citations and responses for the 2007 recipients of the Penrose Medal, the Arthur L. Day Medal, the Young Scientist Award (Donath Medal), the GSA Public Service Award, the GSA Distinguished Service Award, the American Geological Institute (AGI) Medal in Memory of Ian Campbell, and the Subaru Outstanding Woman in Science Award will be presented. The newly elected Honorary Fellows, newly elected GSA Fellows, the GSA Divisions' Awards, and the John C. Frye Environmental Geology awardee will also be announced.

A reception will immediately follow the ceremony.



NOTICE of Council Meetings

Meetings of the GSA Council are open to Fellows, Members, and Associates of the Society, who may attend as observers, except during executive sessions. Only councilors and officers may speak to agenda items, except by invitation of the chair.

The next Council meetings will be held at 1 p.m., Saturday, 27 October, and 8 a.m., Wednesday, 31 October, at the 2007 GSA Annual Meeting in Denver.

⇒ Denver 2007 Exhibitors ⇐

Join a community of over 6,000 geoscientists mingling with exhibitors at the Colorado Convention Center. We have quite a few new exhibitors this year, so stop by to visit, purchase, inquire, sign up, and catch up! Exhibitors are listed by category as registered as of press copy deadline. See up-to-the-minute profiles and listings of exhibitors at www.geosociety.org/meetings/2007/xInfo.htm.

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Government Agencies (Federal, State, Local, International)

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EXHIBITS OPENING & WELCOME RECEPTION
Sun., 28 Oct. 5:30–7:30 p.m.

EXHIBIT HALL HOURS
Mon.–Tues., 29–30 Oct. 9 a.m.–5:30 p.m.
Wed., 31 Oct. 9 a.m.–2 p.m.

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GSA 2007



FORENSIC GEOLOGY

Gets the Dirt on Crime!

A PUBLIC FORUM presented in conjunction with the 2007 GSA Annual Meeting in Denver, CO

Tuesday, 30 October 2007 • 7:00-9:00 P.M.
Colorado Convention Center, Room 605/607

- Free and open to the public!
- Leading panel of experts will give a non-technical presentation on the latest forensic geoscience methodologies, intriguing case histories, and the legal & ethical issues involved.
- Audience Q&A will follow.

See complete program information including speaker bios at www.geosociety.org/meetings/2007/publicforum.htm

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INVITED PAPERS

The Pardee Keynote Symposia are made possible by a grant from the Joseph T. Pardee Memorial Fund.

These Pardee keynote sessions are **special events** of broad interest to the geoscience community. They represent hot issues on the leading edge in a scientific discipline or area of public policy, address broad fundamental issues, and are interdisciplinary. Selection was on a competitive basis. This year's eight Pardee Symposia were reviewed and accepted by the Annual Program Committee, and all speakers were invited.

P1. Creating Citizen Scientists: Needs and Opportunities to Engage Students and the Public in the Process of Science

Mon., 29 Oct., 1:30 p.m.–5:30 p.m.

Cosponsored by *National Association of Geoscience Teachers; U.S. Geological Survey. Geoscience Education; Geoscience Information/Communication.* **Anne E. Egger**, Stanford University; **Robert W. Ridky**, U.S. Geological Survey–Reston.

Imagine a scientifically literate society: a society in which students are engaged in scientific investigations to learn the process of science, a society in which scientists involve students and the public in research instead of just telling them about science, a society in which all citizens can be actively engaged in the scientific process and politicians can include science as a factor in their decisions. Sound utopian? Speakers in this session discuss why we need that society and how we might begin to build it, focusing on the unique role that the earth sciences can play.

P2. Identifying America's Most Vulnerable Oceanfront Communities: A Geological Perspective

Sun., 28 Oct., 1:30 p.m.–5:30 p.m.

Marine/Coastal Science; Public Policy; Geomorphology. **Joseph T. Kelley**, University of Maine–Orono; **Rob Young**, Western Carolina University; **Orrin Pilkey**, Duke University–Durham.

Storms are important natural processes on beaches. Undeveloped beaches not only withstand storm energy but also need storms in order to migrate landward. Many beaches in the United States, however, are completely developed, with buildings that often extend even seaward of the shoreline. Storms destroy the properties on these beaches, but houses are typically rebuilt, and often with public money. Poorly sited engineering structures exacerbate storm damage to buildings, jeopardizing the very existence of beaches. This session provides case histories and puts a geological focus on unsoundly developed beaches that are at perennial risk of destruction.

P3. Middle Eastern Water Resources in Times of Crisis

Tues., 30 Oct., 8 a.m.–noon

Cosponsored by *GSA Hydrogeology Division. Hydrogeology; Public Policy; Geology and Health.* **Avner Vengosh**, Duke University–Durham; **John W. Lane**, U.S. Geological Survey–Storrs Mansfield.

Since early civilization, water resources in the Middle East have been incredibly fragile and contested. The contamination of increasingly scarce groundwater resources presents serious challenges to the people in the region. In many cases, surface and groundwater systems cross political boundaries between hostile neighbors. This session brings together hydrologists and water policy experts to shed light on the fate of Middle Eastern water resources. The session focuses on the interface between hydrological sciences, water management, and political consequences derived from disputes and cooperative efforts in the Middle East.

P4. New Data, Models, and Concepts of the San Andreas Fault System

Tues., 30 Oct., 1:30 p.m.–5:30 p.m.

Cosponsored by *GSA Structural Geology and Tectonics Division. Tectonics; Geophysics/Tectonophysics/Seismology; Structural Geology.* **Basil Tikoff**, University of Wisconsin–Madison; **Mark Zoback**, Stanford University.

This session is dedicated to integrating spatial and temporal variations of deformation observed on the San Andreas fault system in central California and will address new results from SAFOD (San Andreas Fault Observatory at Depth), in addition to other ongoing studies.

P5. New Eyes and Ears on Mars: Recent Advances in Understanding the Red Planet

Mon., 29 Oct., 8 a.m.–noon

Cosponsored by *GSA Planetary Geology Division. Planetary Geology.* **Herbert Frey**, National Aeronautics and Space Administration–Goddard Space Flight Center.

A growing armada of spacecraft has steadily increased our ability to explore Mars in more detailed ways through use of new “eyes” and “ears.” This session highlights recent discoveries using these new sensors. The latest results will be placed in the ongoing context of both continued global mapping and persistent surface exploration.

P6. Oxygen, Evolution, and Extinction

Sun., 28 Oct., 8 a.m.–noon

Cosponsored by *Paleontological Society. Paleontology, Diversity, Extinction, Origination; Paleoclimatology/Paleoceanography; Planetary Geology.* **Peter Ward**, University of Washington; **Robert Berner**, Yale University.

A major discovery of the twenty-first century is that oxygen levels in the past fluctuated more than previously realized, and that major geological and evolutionary events were a consequence. For instance, times of low oxygen can be blamed for at least six major or minor mass extinctions, while times of high oxygen allowed the evolution of giant insects (Carboniferous) and even the conquest of land, which took place in two parts, dictated by oxygen levels. Rates of evolution also appear to be related to oxygen levels, with more “sluggish” evolution during times of high oxygen. Even the major make-up of animal body

plans into the various phyla show that adaptations for respiration were a primary driver of anatomy, while it was an episode of higher oxygen that seems to have stimulated or allowed the first evolution of animals, according to two 2006 studies. Finally, our society must come to grips with episodes of low oxygen and oxygen-free water masses in the oceans and lakes of our planet.

P7. Pulse of the Earth: Geochronology and Paleomagnetism of Large Igneous Provinces—The Key to Reconstructing Precambrian Supercontinents

Sun., 28 Oct., 1:30 p.m.–5:30 p.m.

Cosponsored by *Precambrian [At Large]; IGCP Project 509, Paleoproterozoic Supercontinents and Global Evolution*. Precambrian Geology; Tectonics; Planetary Geology. **David A.D. Evans**, Yale University; **Joseph G. Meert**, University of Florida.

Supercontinents and large igneous provinces (LIPs) relate mantle processes to environmental conditions in deep time. Focused geochronologic and paleomagnetic studies of LIPs can reconstruct pre-Pangean supercontinents and assess relationships with geodynamics, metallogeny, paleoclimate, and life.

P8. The Cause of Global Warming—Are We Facing Global Catastrophe in the Coming Century?

Wed., 31 Oct., 8 a.m.–noon

Cosponsored by *GSA Quaternary Geology and Geomorphology Division*. Environmental Geoscience; Paleoclimatology/Paleoceanography; Quaternary Geology. **Don Easterbrook**, Western Washington University.

Atmospheric CO₂ is at all-time highs, and global temperatures have risen 0.8 °C in the past century. Climate modelers predict temperature increases up to 6 °C by 2100, based on the assumption that atmospheric CO₂ is the cause of global warming, leading to catastrophic changes in food production, drowning of coastal cities, extinction of species, disappearance of arctic ice and alpine glaciers, and others.

This session focuses on physical data related to global climate change. Scientists with expertise in geology, glaciology, climatology, and isotope physics will discuss glacier fluctuations in the past decades to millennia, isotope studies of ice cores, the relationship of climate change to CO₂ and solar variation, and patterns of past climate fluctuations.

→ Denver 2007 Speaker Ready Room ←

The Speaker Ready Room will be open before the meeting to accommodate all speakers submitting their presentation files. All presentations **MUST** be submitted to Conference Exchange (GSA's official audio-visual contractor) either in advance of the meeting via Conference Exchange's Web site (<http://gsa.confex.com/gsa/extra.cgi>) **OR** on-site in the Speaker Ready Room at least half an hour before the start of the session. If you are a Sunday-session speaker and are unable to get to the Speaker Ready Room the day or evening before giving your presentation, please come to the Speaker Ready Room first thing Sunday morning.

Presentations for a specific session will be grouped together and manually uploaded to the meeting computer in the technical session room in which the speakers will be making their presentations. During presentations, each speaker will advance his or her own presentation from the podium.

Speakers may submit presentation files in PowerPoint (.ppt or .pps), Microsoft Word (.doc), or portable document format (.pdf) format. Please note that **the GSA-supplied computer does not run Microsoft Vista**. All presentations created using PowerPoint 2007 should be saved as a PowerPoint 2003 file or as a .pdf file and should be tested on a Windows XP machine prior to the meeting. Please bring your presentation on one of the following media: USB hard drive (Pocket Drive, iPod); USB flash drive; 3.5" diskette; CD-ROM, CD-R, or DVD. *Note:* If your graphics or video clips are not embedded in your presentation, please be sure that you bring them as well.

Mac-Produced Presentations

If your presentation was created on a Macintosh and converted to run on a PC, please test it before you come to the meeting. Make sure that the hyperlinks still function, and avoid using a rewritable CD (CD-RW), as we've encountered compatibility problems with them. If your presentation was produced on a Macintosh and includes embedded video, your video will most likely NOT play automatically on the PC platform. You will need to either convert your .mov files to .avi format or create a link in your slide show to an external .mov file. If you choose the latter, your animation will play in a separate QuickTime window, outside of your PowerPoint presentation. We strongly recommend that you test your Mac-produced presentation on a Windows-based system before arriving at the meeting.

Colorado Convention Center Room 304

Hours of Operation

Fri., 26 Oct., 3–6 p.m.

Sat., 27 Oct., 7 a.m.–8 p.m.

Sun.–Tues., 28–30 Oct., 6:30 a.m.–6 p.m.

Wed., 31 Oct., 6:30 a.m.–2:30 p.m.

To submit your presentation prior to the meeting, please upload to the Conference Exchange Web site:

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DENVER 2007
2007 EARTH SCIENCES FOR SOCIETY
Beginning of the International Year of Planet Earth
237 Technical Sessions

All sessions will be held at the Colorado Convention Center.

 Check www.geosociety.org/meetings/2007/ for updates, details, and the abstracts database.

GSA 2007

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
SUNDAY, 28 OCTOBER 2007			
1	8 a.m.	Geochemistry	503
2	8 a.m.	Hydrogeology	704/706
3	8 a.m.	Mineralogy/Crystallography; Petrology; Volcanology I	709/711
4	8 a.m.	Paleontology I: Morphology, Evolution, and Environment	507
5	8 a.m.	P6. Oxygen, Evolution, and Extinction (<i>Paleontological Society</i>)	605/607
6	8 a.m.	T1. Denver Then and Now: From Paleontology to Public Policy on the Front Range Urban Corridor (<i>Paleontological Society; Denver Museum of Nature & Science; GSA Geology and Society Division</i>)	506
7	8 a.m.	T2. Sourcing Techniques in Archaeology (<i>GSA Archaeological Geology Division</i>)	504
8	8 a.m.	T7. The Environmental Geology and Geochemistry of Mineral Deposits: Best Practices for Effective Prediction, Mitigation, Closure, and Remediation I (<i>Society of Economic Geologists</i>)	505
9	8 a.m.	T17. Management and Restoration of Fluvial Systems with Broad Historical Changes and Human Impacts I (<i>GSA Quaternary Geology and Geomorphology Division; GSA Geology and Society Division</i>)	407
10	8 a.m.	T26. Field-Based Quantitative Studies of Chemical and Physical Weathering (<i>GSA Quaternary Geology and Geomorphology Division</i>)	404
11	8 a.m.	T38. Springs and Spring Deposits (<i>GSA Hydrogeology Division; GSA Sedimentary Geology Division; GSA Geobiology and Geomicrobiology Division</i>)	708/710/712
12	8 a.m.	T39. Hydrogeology of Mountainous Terrains (<i>GSA Hydrogeology Division</i>)	705/707
13	8 a.m.	T49. Groundwater Mining and Population Growth (<i>GSA Geology and Society Division</i>)	702
14	8 a.m.	T76. Three-Dimensional Geological Mapping for Engineering and Environmental Geology Applications I (<i>GSA Engineering Geology Division; Association of Environmental & Engineering Geologists [AEG]; GSA Geology and Society Division</i>)	502
15	8 a.m.	T85. Combining Geophysics and Geology to Solve Geoscience Problems I (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division; GSA Geology and Society Division</i>)	703
16	8 a.m.	T90. Geology of the Northern Plains of Mars: New Tectonic, Petrologic, and Geomorphic Perspectives (<i>GSA Planetary Geology Division</i>)	405
17	8 a.m.	T108. Reservoirs to Ruptures: Multidisciplinary Approaches to Studying Fault Rock Distribution and Evolution in the Seismogenic Crust (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	403
18	8 a.m.	T113. Regional Tectonics of Basement-Cored Foreland Shortening: Integrating Geological and Geophysical Insights from Laramide and Analogous Orogens (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	401/402


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Technical Program

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
19	8 a.m.	T124. Medical Geology (<i>GSA Geology and Society Division</i>)	501
20	8 a.m.	T129. Teaching Climate Change and Energy Issues in the Classroom: An Imperative for Educated Citizens and Geoscientists I (<i>National Association of Geoscience Teachers; GSA Geology and Society Division; GSA Geology and Health Division; GSA Geoscience Education Division</i>)	601
21	8 a.m.	T145. Challenges in Geoscience Publishing: The Use of Nomenclature (<i>Association of Earth Science Editors</i>)	603
22	8 a.m.	Environmental Geoscience; Geology and Health; Public Policy I: Environmental Health, Natural Hazard Assessment, and Environmental Remediation and Water Management (Posters)	Exhibit Hall E/F
23	8 a.m.	Geoinformatics (Posters)	Exhibit Hall E/F
24	8 a.m.	Geomicrobiology (Posters)	Exhibit Hall E/F
25	8 a.m.	Marine/Coastal Science (Posters)	Exhibit Hall E/F
26	8 a.m.	Paleontology (Posters) I: Faunas, Forms, and Phylogenies	Exhibit Hall E/F
27	8 a.m.	Quaternary Geology and Geomorphology (Posters)	Exhibit Hall E/F
28	8 a.m.	T54. Late Paleozoic Glacial-interglacial Climate Changes: Analogs for Present and Future Climate Changes (Posters) (<i>GSA Sedimentary Geology Division</i>)	Exhibit Hall E/F
29	3:30 p.m.	Geoscience Education I	601
30	1:30 p.m.	Paleontology II. Taphonomy and Paleocology	506
31	1:30 p.m.	Paleontology III. Geographic Diversity Patterns	507
32	1:30 p.m.	Structural Geology	404
33	1:30 p.m.	P2. Identifying America's Most Vulnerable Oceanfront Communities: A Geological Perspective	708/710/712
34	1:30 p.m.	P7. Pulse of the Earth: Geochronology and Paleomagnetism of Large Igneous Provinces—The Key to Reconstructing Precambrian Supercontinents (<i>Precambrian [At Large]; IGCP Project 509, Paleoproterozoic Supercontinents and Global Evolution</i>)	605/607
35	1:30 p.m.	T3. Alluvial Cycles, Climate, and Human Prehistory (<i>GSA Archaeological Geology Division; GSA Quaternary Geology and Geomorphology Division</i>)	504
36	1:30 p.m.	T7. The Environmental Geology and Geochemistry of Mineral Deposits: Best Practices for Effective Prediction, Mitigation, Closure, and Remediation II (<i>Society of Economic Geologists</i>)	505
37	1:30 p.m.	T13. Sources, Transport, Fate, and Toxicology of Trace Elements in the Environment I (<i>International Association for GeoChemistry</i>)	503
38	1:30 p.m.	T17. Management and Restoration of Fluvial Systems with Broad Historical Changes and Human Impacts II (<i>GSA Quaternary Geology and Geomorphology Division; GSA Geology and Society Division</i>)	407
39	1:30 p.m.	T21. Episodic Landscape Change (<i>GSA Quaternary Geology and Geomorphology Division</i>)	406
40	1:30 p.m.	T27. Inverse Methods in Practice: Perspectives and Future Directions (<i>GSA Hydrogeology Division</i>)	705/707
41	1:30 p.m.	T31. Innovations and New Technologies for Measuring and Characterizing Groundwater–Surface Water Interaction (<i>GSA Hydrogeology Division</i>)	704/706
42	1:30 p.m.	T33. Innovative Uses of Environmental Isotopes in Hydrology (<i>GSA Hydrogeology Division</i>)	709/711
43	1:30 p.m.	T60. Esker Systems: Processes, Deposits, and Models for Aquifer Development (<i>GSA Quaternary Geology and Geomorphology Division; GSA Sedimentary Geology Division</i>)	603
44	1:30 p.m.	T76. Three-Dimensional Geological Mapping for Engineering and Environmental Geology Applications II (<i>GSA Engineering Geology Division; Association of Environmental & Engineering Geologists [AEG]; GSA Geology and Society Division</i>)	502
45	1:30 p.m.	T85. Combining Geophysics and Geology to Solve Geoscience Problems II (<i>GSA Geophysics Division; GSA Structure and Tectonics Division; GSA Geology and Society Division</i>)	703
46	1:30 p.m.	T95. Techniques for Studying the Development of Fields of Small Basaltic Vents on Earth and Mars (<i>GSA Planetary Geology Division</i>)	405
47	1:30 p.m.	T102. The Solar Stew: The Search for Ingredients of Life and Biomarkers in Our Solar System: Past or Present (<i>GSA Geobiology and Geomicrobiology Division; GSA Planetary Geology Division; Paleontological Society</i>)	501
48	1:30 p.m.	T110. Combining Kinematics and Mechanics in Understanding Deformation Processes (<i>GSA Structural Geology and Tectonics Division</i>)	403
49	1:30 p.m.	T114. Mantle Dynamics and Crust-Mantle Interactions in Collisional Orogens (<i>GSA International Division; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; MARGINS Initiative</i>)	401/402

Technical Program

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
50	1:30 p.m.	T129. Teaching Climate Change and Energy Issues in the Classroom: An Imperative for Educated Citizens and Geoscientists II (<i>National Association of Geoscience Teachers; GSA Geology and Society Division; GSA Geology and Health Division; GSA Geoscience Education Division</i>)	601
51	1:30 p.m.	T148. The Science of Groundwater Recharge, Coal Mine Hydrology/Geochemistry, Stream Restoration and its Application to the Public Good: In Honor of Mary W. Stoertz (<i>GSA Hydrogeology Division</i>)	702
52	1:30 p.m.	Engineering Geology (Posters)	Exhibit Hall E/F
53	1:30 p.m.	Geomorphology (Posters)	Exhibit Hall E/F
54	1:30 p.m.	Sediments, Carbonates (Posters)	Exhibit Hall E/F
55	1:30 p.m.	Stratigraphy (Posters)	Exhibit Hall E/F
56	1:30 p.m.	T119. The Impact of Geoinformatics on Geoscience Research and Education (Posters) (<i>GSA Geoinformatics Division; GSA Geoscience Education Division</i>)	Exhibit Hall E/F
57	6:00 p.m.	T75. Tsunamis: Monitoring, Notification, Geology, Modeling, Education and Outreach; The State of the Art (Posters) (<i>GSA Geophysics Division; GSA Geology and Society Division</i>)	Exhibit Hall E/F
58	6:00 p.m.	T146. Geologic Mapping: Innovations and Interoperability (Posters) (<i>GSA Engineering Geology Division; GSA Geology and Society Division; GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division; Association of American State Geologists</i>)	Exhibit Hall E/F


MONDAY, 29 OCTOBER 2007

59	8 a.m.	Paleontology IV. Paleocology and Preservation	507
60	8 a.m.	P5. New Eyes and Ears on Mars: Recent Advances in Understanding the Red Planet (<i>GSA Planetary Geology Division</i>)	605/607
61	8 a.m.	T4. From Geoarchaeology and Paleoanthropology to Sedimentary Geology and Geochemistry I: A Memorial to Richard L. Hay (<i>GSA Archaeological Geology Division; GSA Limnogeology Division; GSA Sedimentary Geology Division; Mineralogical Society of America</i>)	401/402
62	8 a.m.	T5. Materials Flow in Coal Utilization (<i>GSA Coal Geology Division; GSA Geology and Society Division</i>)	502
63	8 a.m.	T13. Sources, Transport, Fate, and Toxicology of Trace Elements in the Environment II (<i>International Association for GeoChemistry</i>)	503
64	8 a.m.	T18. Hydrogeomorphic Responses of Convulsive Events (<i>GSA Quaternary Geology and Geomorphology Division; GSA Engineering Geology Division; GSA Sedimentary Geology Division</i>)	405
65	8 a.m.	T19. Geomorphology and Ecology: Interactions and Feedbacks (<i>GSA Quaternary Geology and Geomorphology Division</i>)	406
66	8 a.m.	T25. Deformation and the Landscape: Quantitative Approaches to Tectonic Geomorphology I	407
67	8 a.m.	T34. Regional Groundwater Flow I: In Honor of Jozsef Toth (<i>GSA Hydrogeology Division; National Ground Water Association</i>)	704/706
68	8 a.m.	T50. Hydrogeology in the Desert: A Tribute to Ronit Nativ and Mahdi Hantush (<i>GSA Hydrogeology Division</i>)	708/710/712
69	8 a.m.	T51. The Spatial and Temporal Variability of Groundwater Recharge (<i>GSA Hydrogeology Division</i>)	705/707
70	8 a.m.	T53. Evidence for Paleoenvironmental Change during the Paleogene from the Interior Basins of Western North America (<i>Paleontological Society</i>)	501
71	8 a.m.	T55. Landscape Evolution and Land Use Practices in Western Colorado (<i>Colorado Geological Survey; Mesa State College</i>)	505
72	8 a.m.	T70. Au-Ag-Te-Se Deposits and Other Precious Metal Deposits (<i>Society of Economic Geologists; International Geological Correlations Program [IGCP486]</i>)	504
73	8 a.m.	T77. Forensic and Engineering Geology Case Studies: A Tribute to James E. Slosson (<i>GSA Engineering Geology Division; GSA Geology and Society Division</i>)	404
74	8 a.m.	T82. The Structure, Composition and Evolution of the Lithosphere of Western North America I (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	703
75	8 a.m.	T87. A Retrospective and Prospective Look at Mineralogy, Petrology, and Geochemistry I: A Session in Honor of Gordon E. Brown Jr. (<i>Mineralogical Society of America; Geochemical Society</i>)	709/711
76	8 a.m.	T97. Trace Fossils, Mass Extinctions, and Event Boundaries: Endobenthic and Fossorial Responses to Terrestrial and Extraterrestrial Perturbations (<i>Paleontological Society; GSA Geobiology and Geomicrobiology Division; GSA Sedimentary Geology Division; Society for Sedimentary Geology [SEPM]</i>)	506

Technical Program

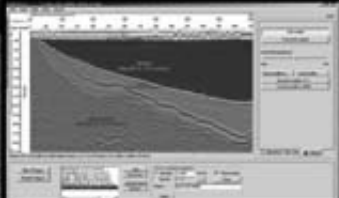
NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
77	8 a.m.	T115. The Blue Mountains Region of Oregon, Idaho, and Washington: Recent Advances in the Mesozoic and Cenozoic History of an Enigmatic Accretionary Province I (<i>GSA Sedimentary Geology Division; GSA Structural Geology and Tectonics Division</i>)	403
78	8 a.m.	T123. Geoscience Data for Geoinformatics (<i>GSA Geoinformatics Division</i>)	702
79	8 a.m.	T128. Charting the Future of Geological and Environmental Science Undergraduate Programs (<i>GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	601
80	8 a.m.	T144. GeoScience Information: Making the Earth Sciences Accessible for Everyone (<i>Geoscience Information Society</i>)	603
81	8 a.m.	Environmental Geoscience; Geology and Health; Public Policy II: Environmental Geology for Public Use and Biogeochemistry (Posters)	Exhibit Hall E/F
82	8 a.m.	Precambrian Geology (Posters)	Exhibit Hall E/F
83	8 a.m.	Structural Geology and Tectonics (Posters)	Exhibit Hall E/F
84	8 a.m.	T9. Identifying America's Most Vulnerable Oceanfront Communities: A Geological Perspective (Posters) (<i>GSA Geology and Society Division</i>)	Exhibit Hall E/F
85	8 a.m.	T17. Management and Restoration of Fluvial Systems with Broad Historical Changes and Human Impacts (Posters) (<i>GSA Quaternary Geology and Geomorphology Division; GSA Geology and Society Division</i>)	Exhibit Hall E/F
86	8 a.m.	T103. Pulse of the Earth: Geochronology and Paleomagnetism of Large Igneous Provinces, the Key to Reconstructing Precambrian Supercontinents (Posters) (<i>Precambrian [At Large]; IGCP Project 509, Paleoproterozoic Supercontinents and Global Evolution</i>)	Exhibit Hall E/F
87	8 a.m.	T135. Early Undergraduate Research Experiences (Posters) (<i>GSA Geoscience Education Division; Council on Undergraduate Research; National Association of Geoscience Teachers</i>)	Exhibit Hall E/F
88	1:30 p.m.	Geomorphology	404
89	1:30 p.m.	Geoscience Education II	603
90	1:30 p.m.	P1. Creating Citizen Scientists: Needs and Opportunities to Engage Students and the Public in the Process of Science (<i>National Association of Geoscience Teachers; U.S. Geological Survey</i>)	605/607

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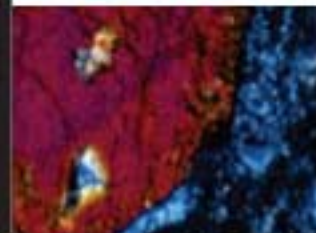
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Technical Program

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
91	1:30 p.m.	T6. Microbial Origin of Hydrocarbon Gases in Coal Beds and Sedimentary Basins (<i>GSA Coal Geology Division</i>)	502
92	1:30 p.m.	T14. Innovative Approaches to Uranium Mining and Groundwater Restoration (<i>GSA Hydrogeology Division; GSA Geology and Society Division</i>)	503
93	1:30 p.m.	T22. Evidence of Climatic and Tectonic Change Recorded in Alluvial Fans (<i>GSA Quaternary Geology and Geomorphology Division</i>)	406
94	1:30 p.m.	T25. Deformation and the Landscape: Quantitative Approaches to Tectonic Geomorphology II	407
95	1:30 p.m.	T30. Ecohydrology of Riparian Zones (<i>GSA Hydrogeology Division</i>)	708/710/712
96	1:30 p.m.	T34. Regional Groundwater Flow II: In Honor of Jozsef Toth (<i>GSA Hydrogeology Division; National Ground Water Association</i>)	704/706
97	1:30 p.m.	T42. Remote Sensing and Geophysical Approaches for Regional Aquifer Characterization and Monitoring (<i>GSA Hydrogeology Division</i>)	705/707
98	1:30 p.m.	T58. Long Records of Paleoclimate in the Southern Deserts of North America (<i>GSA Quaternary Geology and Geomorphology Division; GSA Limnogeology Division</i>)	505
99	1:30 p.m.	T62. Teaching Sedimentary Geology in the Twenty-First Century (<i>GSA Sedimentary Geology Division; National Association of Geoscience Teachers; GSA Geoscience Education Division</i>)	506
100	1:30 p.m.	T65. Metallogeny and Isotope Geochemistry—New Approaches, New Perceptions, New Paradigms (<i>Society of Economic Geologists</i>)	504
101	1:30 p.m.	T82. The Structure, Composition and Evolution of the Lithosphere of Western North America II (<i>GSA Geophysics Division; GSA Structural Geology and Tectonics Division</i>)	703
102	1:30 p.m.	T87. A Retrospective and Prospective Look at Mineralogy, Petrology, and Geochemistry II: A Session in Honor of Gordon E. Brown Jr. (<i>Mineralogical Society of America; Geochemical Society</i>)	709/711
103	1:30 p.m.	T91. Wet Mars: Understanding The Red Planet's Aqueous History through Terrestrial Fieldwork (<i>GSA Planetary Geology Division</i>)	405
104	1:30 p.m.	T103. Pulse of the Earth: Geochronology and Paleomagnetism of Large Igneous Provinces, the Key to Reconstructing Precambrian Supercontinents (<i>Precambrian [At Large]; IGCP Project 509, Paleoproterozoic Supercontinents and Global Evolution</i>)	601
105	1:30 p.m.	T107. Recognition and Implications of Coseismic Fault-Zone Structures I (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	507
106	1:30 p.m.	T115. The Blue Mountains Region of Oregon, Idaho, and Washington: Recent Advances in the Mesozoic and Cenozoic History of an Enigmatic Accretionary Province II (<i>GSA Sedimentary Geology Division; GSA Structural Geology and Tectonics Division</i>)	403
107	1:30 p.m.	T117. The Track of the Yellowstone Hot Spot I: What Do Neotectonics, Climate Indicators, Volcanism, and Petrogenesis Reveal about Subsurface Processes? (<i>U.S. Geological Survey</i>)	401/402
108	1:30 p.m.	T120. Geological and Geophysical Data Preservation Best Practices (<i>U.S. Geological Survey; Association of American State Geologists; GSA Geoinformatics Division; GSA Geology and Society Division; Paleontological Society</i>)	702
109	1:30 p.m.	T127. Positive and Beneficial Aspects of Earth Sciences in Public Health (<i>GSA Geology and Health Division; GSA Geology and Society Division</i>)	501
110	1:30 p.m.	Coal Geology (Posters)	Exhibit Hall E/F
111	1:30 p.m.	Paleoclimatology/Paleoceanography (Posters)	Exhibit Hall E/F
112	1:30 p.m.	T53. Evidence for Paleoenvironmental Change during the Paleogene from the Interior Basins of Western North America (Posters) (<i>Paleontological Society</i>)	Exhibit Hall E/F
113	1:30 p.m.	T55. Landscape Evolution and Land Use Practices in Western Colorado (Posters) (<i>Colorado Geological Survey; Mesa State College</i>)	Exhibit Hall E/F
114	1:30 p.m.	T59. Explorations in Sedimentary Geology: Student Research (Posters) (<i>GSA Sedimentary Geology Division</i>)	Exhibit Hall E/F
115	1:30 p.m.	T104. Impact Craters and Events: From the Field to the Laboratory (Posters) (<i>GSA Planetary Geology Division; GSA Sedimentary Geology Division</i>)	Exhibit Hall E/F
116	1:30 p.m.	T105. The Chesapeake Bay Impact Structure: Results from the 2005–2006 ICDP-USGS Deep Drilling Project (Posters) (<i>GSA Planetary Geology Division; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; GSA Sedimentary Geology Division; GSA Hydrogeology Division; International Continental Scientific Drilling Program [ICDP]</i>)	Exhibit Hall E/F
117	1:30 p.m.	T118. Sigma Gamma Epsilon Undergraduate Research (Posters) (<i>Sigma Gamma Epsilon</i>)	Exhibit Hall E/F
118	1:30 p.m.	T137. Involvement in Geological Research: Close Collaboration among the Faculty and Undergraduate and K–12 Students (Posters) (<i>GSA Geoscience Education Division</i>)	Exhibit Hall E/F

Technical Program

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
119	1:30 p.m.	T148. The Science of Groundwater Recharge, Coal Mine Hydrology and Geochemistry, Stream Restoration, and its Application to the Public Good (Posters): In Honor of Mary W. Stoertz (<i>GSA Hydrogeology Division</i>)	Exhibit Hall E/F

TUESDAY, 30 OCTOBER 2007

120	8 a.m.	Paleontology V: Early Life	507
121	8 a.m.	Precambrian Geology	601
122	8 a.m.	Stratigraphy	407
123	8 a.m.	Tectonics; Neotectonics/Paleoseismology I	403
124	8 a.m.	P3. Middle Eastern Water Resources in Times of Crisis (<i>GSA Hydrogeology Division</i>)	605/607
125	8 a.m.	T4. From Geoarchaeology and Paleoanthropology to Sedimentary Geology and Geochemistry II: A Memorial to Richard L. Hay (<i>GSA Archaeological Geology Division; GSA Limnogeology Division; GSA Sedimentary Geology Division; Mineralogical Society of America</i>)	401/402
126	8 a.m.	T15. Perspectives in Redox Geochemistry and Microbial Processes	503
127	8 a.m.	T32. Numerical Modeling of Hydrothermal Fluids (<i>GSA Hydrogeology Division</i>)	704/706
128	8 a.m.	T35. Solute Plume Conceptual Models: Processes, Predictions, and Paradigms (<i>GSA Hydrogeology Division</i>)	705/707
129	8 a.m.	T45. Advances in Understanding and Detection of Groundwater–Stream Water Interactions across Temporal and Spatial Scales	708/710/712
130	8 a.m.	T54. Late Paleozoic Glacial-Interglacial Climate Changes: Analogs for Present and Future Climate Changes (<i>GSA Sedimentary Geology Division</i>)	709/711
131	8 a.m.	T63. Gas Shales of North America (<i>GSA Sedimentary Geology Division; GSA Structural Geology and Tectonics Division</i>)	505
132	8 a.m.	T68. Magmatic Nickel Sulfide Deposits: Geology, Geochemistry, and Genesis (<i>Society of Economic Geologists</i>)	504
133	8 a.m.	T79. Landslide Processes, Case Studies, and Issues: A Tribute to James E. Slosson (<i>GSA Engineering Geology Division; GSA Geology and Society Division</i>)	502
134	8 a.m.	T86. New Perspectives on the Rio Grande Rift: From Tectonics to Groundwater (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division; GSA Hydrogeology Division</i>)	703
135	8 a.m.	T92. Up-Close and Personal: Geology on Mars and Earth at the Handlens Scale (<i>GSA Planetary Geology Division; GSA Sedimentary Geology Division</i>)	405
136	8 a.m.	T98. Selectivity of Ancient and Modern Extinctions: Bridging the Gap between Neontological Prediction and Paleontological Observation (<i>Paleontological Society</i>)	506
137	8 a.m.	T104. Impact Craters and Events: From the Field to the Laboratory (<i>GSA Planetary Geology Division; GSA Sedimentary Geology Division</i>)	406
138	8 a.m.	T107. Recognition and Implications of Coseismic Fault-Zone Structures II (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	404
139	8 a.m.	T141. Geology in the National Parks: Research, Mapping, and Resource Management (<i>GSA Geology and Society Division</i>)	501
140	8 a.m.	T143. Geoscience and the Community: An Exploration of Ways to Become Involved (<i>GSA Geology and Society Division; American Geological Institute; GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	603
141	8 a.m.	T147. Exemplars and Exceptions: Using Individual and Group Biography to Understand Critical Issues in the History of Geology (<i>GSA History of Geology Division; GSA Geology and Society Division; History of Earth Sciences Society</i>)	702
142	8 a.m.	Limnogeology (Posters)	Exhibit Hall E/F
143	8 a.m.	Mineralogy/Crystallography; Petrology; Volcanology (Posters)	Exhibit Hall E/F
144	8 a.m.	Paleontology II: Environments, Ecosystems, and Interactions (Posters)	Exhibit Hall E/F
145	8 a.m.	T7. The Environmental Geology and Geochemistry of Mineral Deposits: Best Practices for Effective Prediction, Mitigation, Closure, and Remediation (Posters) (<i>Society of Economic Geologists</i>)	Exhibit Hall E/F
146	8 a.m.	T88. Geochemistry of Magmatic and Metamorphic Processes: In Honor of the Contributions of Joseph L. Wooden (Posters)	Exhibit Hall E/F

Technical Program

NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
147	8 a.m.	T101. Emerging New Methods in Early Earth Studies: Unraveling the Co-Evolution of Earth and Life (Posters) (<i>GSA Geobiology and Geomicrobiology Division; Paleontological Society</i>)	Exhibit Hall E/F
148	8 a.m.	T134. Professional Development for the Professional Developers: Aspects of Effective Teacher Professional Development Programs in the Earth Sciences (Posters) (<i>GSA Geoscience Education Division; GSA Geology and Society Division</i>)	Exhibit Hall E/F
149	1:30 p.m.	Economic Geology	404
150	1:30 p.m.	Halbouty Distinguished Lecture	704/706
151	1:30 p.m.	History of Geology	702
152	3 p.m.	MSA Awards Lectures, Presidential Address, and Annual Business Meeting	704/706
153	1:30 p.m.	Paleontology VI: Stratigraphic and Systematic Paleontology	507
154	1:30 p.m.	Sediments, Carbonates	501
155	1:30 p.m.	P4. New Data, Models, and Concepts of the San Andreas Fault System (<i>GSA Structural Geology and Tectonics Division</i>)	605/607
156	1:30 p.m.	T10. Afghanistan Reconstruction—USGS Activities in Afghanistan (<i>GSA International Division</i>)	705/707
157	1:30 p.m.	T11. Combined Ecological and Geologic Perspectives in Modern Terrestrial Ecosystems (<i>GSA Geobiology and Geomicrobiology Division; Paleontological Society</i>)	407
158	1:30 p.m.	T12. The Black Sea—Mediterranean Corridor: Paleoenvironmental and Geoarchaeological Context for the Past 30 k.y. (<i>GSA Archaeological Geology Division; GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division; GSA International Division; Avalon Institute of Applied Science</i>)	504
159	1:30 p.m.	T46. Climate Change Hydrology (<i>GSA Hydrogeology Division; GSA Limnogeology Division</i>)	708/710/712
160	1:30 p.m.	T52. Inland Waters, Playas, and Saline Lakes: More than Mini-Oceans (<i>GSA Limnogeology Division</i>)	703
161	1:30 p.m.	T64. The Sedimentary Tape Recorder: Characterizing and Quantifying the Dynamics of Geomorphic-Sedimentologic Coupled Systems	709/711
162	1:30 p.m.	T72. Debris Flow, Landslide, and Rockfall: Initiation, Prediction, and Warning (<i>GSA Engineering Geology Division</i>)	503

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NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
163	1:30 p.m.	T80. Active Faulting and Government Response to Geohazards: A Tribute to James E. Slosson (<i>GSA Engineering Geology Division; GSA Structural Geology and Tectonics Division</i>)	502
164	1:30 p.m.	T89. Geophysics of the Terrestrial Planets: The G.K. Gilbert Award Session (<i>GSA Planetary Geology Division</i>)	406
165	1:30 p.m.	T99. Environmental Change and Evolution: Micropaleontological Case Studies (<i>Cushman Foundation for Foraminiferal Research</i>)	506
166	1:30 p.m.	T101. Emerging New Methods in Early Earth Studies: Unraveling the Co-Evolution of Earth and Life (<i>GSA Geobiology and Geomicrobiology Division; Paleontological Society</i>)	601
167	1:30 p.m.	T105. The Chesapeake Bay Impact Structure: Results from the 2005–2006 ICDP-USGS Deep Drilling Project I (<i>GSA Planetary Geology Division; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; GSA Sedimentary Geology Division; GSA Hydrogeology Division; International Continental Scientific Drilling Program [ICDP]</i>)	405
168	1:30 p.m.	T109. Mélanges: Processes of Formation and Societal Significance (<i>GSA International Division; GSA Structural Geology and Tectonics Division; GSA Engineering Geology Division; GSA Sedimentary Geology Division</i>)	403
169	1:30 p.m.	T117. The Track of the Yellowstone Hot Spot II: What Do Neotectonics, Climate Indicators, Volcanism, and Petrogenesis Reveal about Subsurface Processes? (<i>U.S. Geological Survey</i>)	401/402
170	1:30 p.m.	T130. Forensic Geoscience: Research and Case Studies (<i>GSA Geology and Society Division; American Society of Forensic Geologists; GSA Geology and Health Division</i>)	505
171	1:30 p.m.	T142. Geology of Parks and Public Lands: Effective and Innovative Informal Earth Science Education for the Masses (<i>National Park Service; Bureau of Land Management; Association of Earth Science Editors</i>)	603
172	1:30 p.m.	Geochemistry (Posters)	Exhibit Hall E/F
173	1:30 p.m.	Geophysics/Tectonophysics/Seismology (Posters)	Exhibit Hall E/F
174	1:30 p.m.	Hydrogeology (Posters)	Exhibit Hall E/F
175	1:30 p.m.	T28. Geologic Controls on Chemical Migration in Fractured and Carbonate Aquifers (Posters)	Exhibit Hall E/F

Reviews in Engineering Geology XVII

Understanding and Responding to Hazardous Substances at Mine Sites in the Western United States

edited by Jerome V. DeGraff

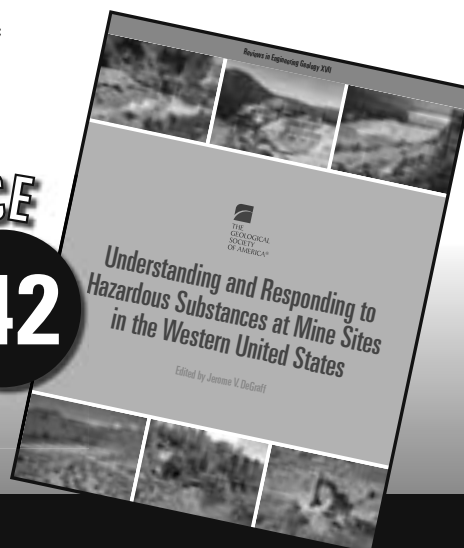
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NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
176	1:30 p.m.	T31. Innovations and Advances for Measuring and Characterizing Groundwater–Surface Water Interaction (Posters) (<i>GSA Hydrogeology Division</i>)	Exhibit Hall E/F
177	1:30 p.m.	T33. Innovative Uses of Environmental Isotopes in Hydrology (Posters) (<i>GSA Hydrogeology Division</i>)	Exhibit Hall E/F
178	1:30 p.m.	T35. Solute Plume Conceptual Models: Processes, Prediction, and Paradigms (Posters) (<i>GSA Hydrogeology Division</i>)	Exhibit Hall E/F
179	1:30 p.m.	T38. Springs and Spring Deposits (Posters) (<i>GSA Hydrogeology Division; GSA Sedimentary Geology Division; GSA Geobiology and Geomicrobiology Division</i>)	Exhibit Hall E/F
180	1:30 p.m.	T40. The Role of Sediments in Hydrology and Hydrogeology: Streams, Springs, Karst Systems, and Hyporheic Zones (Posters) (<i>GSA Hydrogeology Division; GSA Quaternary Geology and Geomorphology Division</i>)	Exhibit Hall E/F
181	1:30 p.m.	T84. Active and Ancient Tectonics along the Northern Cordillera Margin—Magmatism, Deformation, Metamorphism, and Basin Development (Posters) (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics; GSA Sedimentary Geology Division</i>)	Exhibit Hall E/F
182	1:30 p.m.	T86. New Perspectives on the Rio Grande Rift: From Tectonics to Groundwater (Posters) (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division; GSA Hydrogeology Division</i>)	Exhibit Hall E/F


WEDNESDAY, 31 OCTOBER 2007

183	8 a.m.	Paleoclimatology/Paleoceanography I	501
184	8 a.m.	Paleontology VII: Phylogeny and Morphology	507
185	8 a.m.	Quaternary Geology and Geomorphology	502
186	8 a.m.	Sediments, Clastic	403
187	8 a.m.	P8. The Cause of Global Warming—Are We Facing Global Catastrophe in the Coming Century? (<i>GSA Quaternary Geology and Geomorphology Division</i>)	605/607
188	8 a.m.	T8. Role of Geology in Planning and Mitigation of Natural Hazards (<i>GSA Engineering Geology Division; Association of Environmental & Engineering Geologists [AEG]; GSA Geology and Health Division; GSA Geology and Society Division</i>)	505

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Susan Hough – *Richter's Scale*

Kirk Johnson – *Cruisin' the Fossil Freeway*

David Montgomery – *Dirt: The Erosion of Civilizations*

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Peter Ward – *Out of Thin Air* and *Under a Green Sky*

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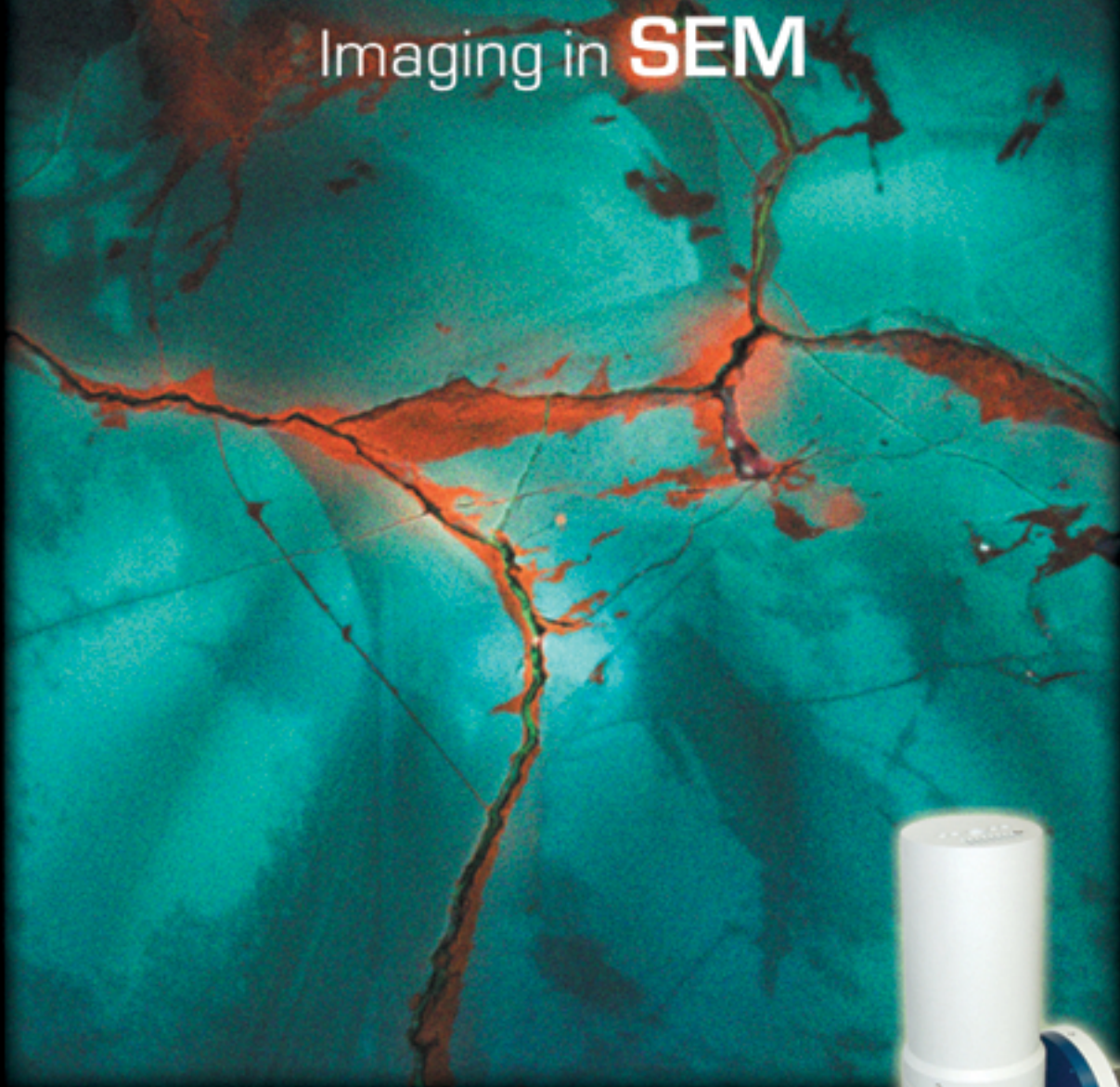
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NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
189	8 a.m.	T16. Geological, Geophysical, Geochemical, and Environmental Studies in Big Bend National Park and the Trans-Pecos Region, Texas (<i>GSA Geophysics Division; International Association of GeoChemistry; National Park Service</i>)	503
190	8 a.m.	T23. Using Geochronology to Build Better Records and Solve Geomorphic and Paleoclimate Questions—Recent Advances and Findings (<i>GSA Quaternary Geology and Geomorphology Division</i>)	407
191	8 a.m.	T28. Geologic Controls on Chemical Migration in Fractured and Carbonate Aquifers I	705/707
192	8 a.m.	T29. Arsenic: From Nature to Human I (<i>GSA Geology and Society Division; Geochemical Society; International Society of Groundwater for Sustainable Development</i>)	704/706
193	8 a.m.	T41. High-Resolution Geophysical Methods for Hydrogeologic Site Characterization (<i>GSA Geophysics Division; National Ground Water Association</i>)	702
194	8 a.m.	T43. Hydrogeological Research, Capacity Building, and Teaching in the Developing World I	703
195	8 a.m.	T47. Models and Other Tools for Managing Surface and Groundwater Resources and Informing Policy Makers I (<i>GSA Hydrogeology Division; National Ground Water Association; GSA Geology and Society Division</i>)	708/710/712
196	8 a.m.	T88. Geochemistry of Magmatic and Metamorphic Processes I: In Honor of the Contributions of Joseph L. Wooden	709/711
197	8 a.m.	T94. Advanced Remote Sensing of the Earth, Moon, and Mars: Mars Reconnaissance Orbiter and Other Platforms (<i>GSA Planetary Geology Division</i>)	406
198	8 a.m.	T100. Whole-Organism Paleoecology and the Relationship of Form, Function, and Ecological Interactions I: In Memory of Richard Alexander (<i>Paleontological Society</i>)	506
199	8 a.m.	T105. The Chesapeake Bay Impact Structure: Results from the 2005–2006 ICDP-USGS Deep Drilling Project II (<i>GSA Planetary Geology Division; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; GSA Sedimentary Geology Division; GSA Hydrogeology Division; International Continental Scientific Drilling Program [ICDP]</i>)	405
200	8 a.m.	T106. Geologic Structures, Fluid Flow, and Ore Deposits (<i>GSA Hydrogeology Division; GSA Structural Geology and Tectonics Division; GSA Geophysics Division; Society of Economic Geologists; U.S. Geological Survey; GSA Geology and Society Division</i>)	504
201	8 a.m.	T116. Evolution of Appalachian–Ouachita Salients and Recesses from Reentrants [Embayments] and Promontories in the Continental Margin I: Thirtieth Anniversary Celebration of Advances Derived from Bill Thomas' 1977 <i>American Journal of Science</i> Paper (<i>GSA Structural Geology and Tectonics Division</i>)	401/402
202	8 a.m.	T134. Professional Development for the Professional Developers: Aspects of Effective Teacher Professional Development Programs in the Earth Sciences (<i>GSA Geoscience Education Division; GSA Geology and Society Division</i>)	601
203	8 a.m.	T138. Learning in the Field: Effective Strategies for Teaching Undergraduate Geology Outside the Classroom (<i>GSA Geoscience Education Division; National Association of Geoscience Teachers</i>)	603
204	8 a.m.	T139. The Future of Geoscience Field Courses I (<i>GSA Structural Geology and Tectonics Division; GSA Geoscience Education Division; National Association of Geoscience Teachers; GSA Geophysics Division; GSA Quaternary Geology and Geomorphology Division</i>)	404
205	8 a.m.	Archaeological Geology (Posters)	Exhibit Hall E/F
206	8 a.m.	Geoscience Education (Posters)	Exhibit Hall E/F
207	8 a.m.	Geoscience Information and Communication: Park Your Public Lands by the Library (Posters)	Exhibit Hall E/F
208	8 a.m.	Paleontology (Posters) III: Diversity, Evolution, and Turnover	Exhibit Hall E/F
209	8 a.m.	Planetary Geology: Potpourri (Posters)	Exhibit Hall E/F
210	8 a.m.	T12. The Black Sea–Mediterranean Corridor: Paleoenvironmental and Geoarchaeological Context for the Past 30 k.y. (Posters) (<i>GSA Archaeological Geology Division; GSA Sedimentary Geology Division; GSA Quaternary Geology and Geomorphology Division; GSA International Division; Avalon Institute of Applied Science</i>)	Exhibit Hall E/F
211	1:30 p.m.	Archaeological Geology	504
212	1:30 p.m.	Environmental Geoscience; Geology and Health; Public Policy	505
213	1:30 p.m.	Geoscience Education III	601
214	3:30 p.m.	Mineralogy/Crystallography; Petrology; Volcanology II	709/711
215	1:30 p.m.	Paleoclimatology/Paleoceanography II	501
216	1:30 p.m.	Paleontology IX. Paleoclimate and Paleoenvironmental Change	405
217	1:30 p.m.	Paleontology VIII. Diversity and Extinction	507

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NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
218	1:30 p.m.	Planetary Geology: Potpourri	605/607
219	1:30 p.m.	Tectonics; Neotectonics/Paleoseismology II	502
220	1:30 p.m.	T24. New Developments in Glaciation (<i>GSA Quaternary Geology and Geomorphology Division</i>)	407
221	1:30 p.m.	T28. Geologic Controls on Chemical Migration in Fractured and Carbonate Aquifers II	705/707
222	1:30 p.m.	T29. Arsenic: From Nature to Human II (<i>GSA Geology and Society Division; Geochemical Society; International Society of Groundwater for Sustainable Development</i>)	704/706
223	1:30 p.m.	T43. Hydrogeological Research, Capacity Building, and Teaching in the Developing World II	703
224	1:30 p.m.	T47. Models and Other Tools for Managing Surface and Groundwater Resources and Informing Policy Makers II (<i>GSA Hydrogeology Division; National Ground Water Association; GSA Geology and Society Division</i>)	708/710/712
225	1:30 p.m.	T57. Quaternary Deposits in Arid Lands: Rates and Processes (<i>GSA Archaeological Geology Division</i>)	406

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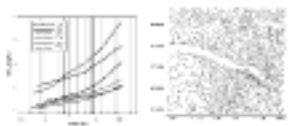
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NO.	TIME	DESCRIPTION (SPONSORS)	LOCATION
226	1:30 p.m.	T81. Diversity in Crustal Fluid Compositions: Geological Origins and Consequences (<i>Society of Economic Geologists; U.S. Geological Survey</i>)	503
227	1:30 p.m.	T88. Geochemistry of Magmatic and Metamorphic Processes II: In Honor of the Contributions of Joseph L. Wooden	709/711
228	1:30 p.m.	T100. Whole-Organism Paleocology and the Relationship of Form, Function, and Ecological Interactions II: In Memory of Richard Alexander (<i>Paleontological Society</i>)	506
229	1:30 p.m.	T112. A Synoptic Crustal Section from the Cascadia Margin to the Southern Appalachians: Focusing EarthScope Research on Crustal Domains, their Boundaries, and Fundamental Processes of the U.S. Continent (<i>GSA Structural Geology and Tectonics Division; GSA Geophysics Division</i>)	403
230	1:30 p.m.	T116. Evolution of Appalachian-Ouachita Salients and Recesses from Reentrants [Embayments] and Promontories in the Continental Margin II: Thirtieth Anniversary Celebration of Advances Derived from Bill Thomas' 1977 <i>American Journal of Science</i> Paper (<i>GSA Structural Geology and Tectonics Division</i>)	401/402
231	1:30 p.m.	T122. Growing the Cyberinfrastructure for the Geosciences: New Tools, New Research, New Partnerships (<i>GSA Geoinformatics Division</i>)	702
232	1:30 p.m.	T132. Innovative, Inquiry-Based Approaches that Bring the Field into the Classroom: Moving from Virtual Tour to Virtual Fieldwork (<i>GSA Geoscience Education Division</i>)	603
233	1:30 p.m.	T139. The Future of Geoscience Field Courses II (<i>GSA Structural Geology and Tectonics Division; GSA Geoscience Education Division; National Association of Geoscience Teachers; GSA Geophysics Division; GSA Quaternary Geology and Geomorphology Division</i>)	404
234	1:30 p.m.	Economic Geology (Posters)	Exhibit Hall E/F
235	1:30 p.m.	Sediments, Clastic (Posters)	Exhibit Hall E/F
236	1:30 p.m.	T16. Geological, Geophysical, Geochemical, and Environmental Studies in Big Bend National Park and the Trans-Pecos Region, Texas (Posters) (<i>GSA Geophysics Division; International Association of GeoChemistry; National Park Service</i>)	Exhibit Hall E/F
237	1:30 p.m.	T23. Using Geochronology to Build Better Records and Solve Geomorphic and Paleoclimate Questions—Recent Advances and Findings (Posters) (<i>GSA Quaternary Geology and Geomorphology Division</i>)	Exhibit Hall E/F

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	TIME	COST
SUNDAY, 28 OCT.		
101. Denver City Swing	9 a.m.–noon	US\$37
102. Cherry Creek Art Walk	1–4 p.m.	US\$39
103. Dinosaurs Rock!	1–4 p.m.	US\$53
MONDAY, 29 OCT.		
104. Discover Colorado Springs	9 a.m.–5 p.m.	US\$63
105. Foothills Fandango	12:30–5:30 p.m.	US\$39
TUESDAY, 30 OCT.		
106. Denver Museum of Nature & Science and Titanic: The Artifact Exhibition	9 a.m.–1 p.m.	US\$53
107. Back to the Future	1:30–5:30 p.m.	US\$59
WEDNESDAY, 31 OCT.		
108. Behind the Velvet Curtain	10 a.m.–noon	US\$23

Booth 1038

The Paleontological Institute

The University of Kansas
 Editorial Office of *Treatise on Invertebrate Paleontology*,
University of Kansas Paleontological Contributions, and PALAIOS

- * The final volume of the *Treatise* brachiopod series is now available at the GSA Bookstore!
- * For sale at the booth:
 Color two-sided brachiopod poster
 CD of movie of living brachiopods
- * *Treatise* authors! Come by to meet our new director, Paul Seiden, and hear news about our plans for the digital *Treatise*.
- * PALAIOS authors! Come by to meet Steve Hasiotis and Edie Taylor, coeditors of PALAIOS.
- * Author Dan Merriam will be signing copies of his biography about the legendary RC Moore!

GUEST SEMINARS

Payment of the guest registration fee entitles you to also attend the following seminars, offered at no additional charge.

Welcome to Denver
Hyatt Regency Denver
Sun., 28 Oct., 10–11 a.m.

Denver is a vibrant city with 300 days of sunshine, year-round adventure, and the breathtaking Rocky Mountains nearby. From a thriving arts and culture scene, world-class attractions, and endless shopping possibilities to nationally recognized chefs, exciting nightlife, and abundant outdoor recreation, Denver welcomes you to experience, explore, and discover how the Mile High City will awaken your senses like nowhere else. Our Denver insider will tell you everything you need to know to get the most out of your visit—the hottest new restaurants, exciting cultural attractions, and little-known gems that are not to be missed!

Chocolate Every Day
Hyatt Regency Denver
Mon., 29 Oct., 10–11 a.m.

Author and international speaker Julie Pech (“the chocolate therapist”) has a “tough” job: teaching people about the health benefits of chocolate and how to eat the right chocolate for health. Julie’s presentation on the benefits of chocolate will be a balance between education and entertainment and will teach you things about chocolate you’ve never known! Guests will have the opportunity to implement Julie’s teachings with handmade truffles from local confectioner Stephany’s Chocolates.

Denver’s Past
Hyatt Regency Denver
Tues., 30 Oct., 10–11 a.m.

A representative of the Colorado Historical Society will introduce you to Denver’s unique western heritage. Go back in time and relive Denver’s glory days as mining camp, frontier crossroads, supply center, and Wall Street of the West. Prepare to be regaled by stories of boomtown conditions, Indian wars, lawlessness, and frontier justice.



Registered guests are invited to



BREAKFAST with GSA’s President and Executive Director

Grand Hyatt Guest Hospitality Suite
Mon., 29 Oct., 8–8:30 a.m.

Come meet GSA President Jack Sharp and GSA Executive Director Jack Hess and enjoy a complimentary breakfast, provided especially for those registered as guests for the meeting.

SHORT COURSES

GSA ASSOCIATED AND ALLIED SOCIETIES

Pond Scum to Carbon Sink: Geological and Environmental Applications of the Diatoms

Sponsored by the *Paleontological Society*. Sat., 27 Oct. Preregistration not required. For information, contact Scott W. Starratt, ssarratt@usgs.gov.

Paleoaltimetry: Geochemical and Thermodynamic Approaches

Cosponsored by the *Mineralogical Society of America* and the *Geochemical Society*. Fri.–Sat., 26–27 Oct. For information and registration, contact the MSA business office, 3635 Concorde Pkwy, Suite 500, Chantilly VA 20151-1125, USA, +1-703-652-9950, fax: +1-703-652-9951, business@minsocam.org; www.minsocam.org.

SEG Nickel Course: Nickel Sulfide Deposits Association with Komatiite and Komatiitic Basalt Magmas

Sponsored by the *Society of Economic Geologists* (SEG). Sat., 27 Oct. For information and registration, contact SEG, +1-720-981-7204, fax: +1-720-981-7874, seg@segweb.org; www.segweb.org.

Geoscience Librarianship 101

Sponsored by the *Geoscience Information Society*. Sat., 27 Oct. For information and registration, contact Shaun Hardy, GSIS Publicity Officer, Carnegie Institution of Washington, 5241 Broad Branch Rd. N.W., Washington, D.C. 20015, USA, +1-202-478-7960, hardy@dtm.ciw.edu.



Annual GeoScience Educators' Social Reception

Saturday, 27
Oct., 5–7 p.m.

*Appetizers and
cash bar provided.*

All educators are invited to this relaxing forum for socializing, sharing ideas, and meeting other geoscience community members interested in education. Come get to know the GSA Education and Outreach staff as well!

Thanks to our reception cosponsors: GSA Education Committee, the National Association of Geoscience Teachers (NAGT), the GSA Geoscience Education Division, Cutting Edge, the Digital Library for Earth System Education (DLESE), the Incorporated Research Institutions for Seismology (IRIS) Consortium, the American Geological Institute (AGI), EarthScope, the National Earth Science Teachers Association (NESTA), and UNAVCO. The reception location will be announced in a future issue of *GSA Today*.



→ Denver 2007 K–12 Education Events ←



Civic Park and downtown Denver. Photo courtesy Denver Metro Convention & Visitors Bureau, www.denver.org/PhotoLib.aspx.

K–12 Building Stones of Denver EarthCache Tour

Sun., 28 Oct., 9 a.m.–TBD

K–12 teachers, spouses, and guests are invited to explore the canyons of downtown Denver in search of fossils, rocks, and lesson ideas to enhance their classes. Bring your GPS unit along to help locate the EarthCaches. The trip will be followed by lunch, with opportunities for sharing ideas with colleagues and professional geologists, freebies, and a pass to the GSA Exhibit Hall. We will meet outside Union Station at 9 a.m. on Sunday. For more information, contact educator@geosociety.org.

GSA Education Share-a-Thon

Share in the success of others!

Sun., 28 Oct., 5:30–7:30 p.m.

Mon.–Tues., 29–30 Oct., 9 a.m.–5:30 p.m.

Wed., 31 Oct., 9 a.m.–2 p.m.

Join us at the Education and Outreach booth in the Exhibit Hall to meet other educators and learn about their activities. At the same time, pick up FREE education materials, and share your favorites!

RECOMMENDED SHORT COURSES FOR K–12 EDUCATORS

See www.geosociety.org/meetings/2007/cw.htm for complete descriptions and instructor information. After 24 Sept., registration is an additional US\$30.

505. Introduction to the “Learning with Data Workshop”

Sun., 28 Oct., 8 a.m.–noon. CEU: 0.4. Fee: US\$30; includes course materials and refreshments. Limit: 25.

511. Education Research: An In-Depth Look at Qualitative Methods

Sat., 27 Oct., 1–5 p.m. CEU: 0.4. Fee: US\$100; includes course materials. Limit: 55.

513. Teaching College-Level Earth Science to High-School Students

Sat., 27 Oct., 8 a.m.–noon. CEU: 0.4. Fee: US\$5; includes course materials and refreshments. Limit: 25.

514. Using GPS Data to Learn about Tectonic Plate Movement, Earthquakes, Volcanoes, and other Applications: A Workshop for Educators in Secondary Education

Sun., 28 Oct., 1–5 p.m. CEU: 0.4. Fee: US\$41; includes course materials and refreshments. Limit: 20.

↔ Denver 2007 Mentor Program ↔

NEW!

WOMEN IN GEOLOGY



Sun., 28 Oct., noon–1:30 p.m.

This new mentoring program, sponsored by Subaru, will address the issues faced by women in geology. The event will begin with addresses from several key speakers, followed by a relaxing forum for socializing, sharing ideas, and meeting other women in geology. *Appetizers provided.* **Registration not required.**

Speakers include Robbie Gries, GSA Treasurer; **Mary Lou Zoback**, recipient of the 2007 Arthur L. Day Medal and the GSA Public Service Award; and **Tanja Boask**, the 2007 Subaru Outstanding Woman in Science Award recipient. The master of ceremonies for this event is **Jean Bahr**, chair of the Outstanding Woman in Science Award Committee.

GEOLOGY IN GOVERNMENT

Free lunch for undergraduate and graduate students

Mon., 29 Oct., 11:30 a.m.–1:30 p.m.

This popular annual event features a select panel of mentors representing various government agencies who will invite questions from the students, offer advice about preparing for a career, and comment on the prospects for current and future job opportunities within their agencies. **Registration not required.**

JOHN MANN MENTORS IN APPLIED HYDROGEOLOGY PROGRAM

Distinguished Hydrogeology Division Luncheon and Awards Presentation

Tues., 30 Oct., noon–3 p.m.

This program underwrites the cost for up to 25 students to attend the Distinguished Hydrogeology Division Luncheon and Awards Presentation. **Eligible students are those who have: (1) checked the box on their membership application indicating their professional interest in hydrology and/or hydrogeology, AND (2) registered for the GSA Annual Meeting by 24 September 2007.** The lucky recipients of these tickets will have the chance to meet with some of the nation's most distinguished hydrogeologists. Tickets will be awarded to the first 25 students who *respond* to an **e-mail invitation**, based on the eligibility criteria above (registration required).

NEW!

GEOLOGY IN INDUSTRY



Free lunch for undergraduate and graduate students

Tues., 30 Oct., 11:30 a.m.–1:30 p.m.

This new mentoring program, cosponsored by ExxonMobil, Foundation Coal Company, and Chevron, brings together a select panel of mentors representing various industries. These mentors will invite questions from students, offer advice about preparing for a career in industry, and comment on the prospects for current and future job opportunities within their agencies. **Registration not required.**

Companies represented include Chevron, ExxonMobil, Foundation Coal, Gold Fields Exploration, Marston & Marston, Merendon Mining, Newmont Mining, Orica USA, and Pincock, Allen and Holt.

Read full program descriptions at www.geosociety.org/science/.

For additional information

contact Jennifer Nocerino, jnocerino@geosociety.org.



GSA 2007

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President's Student Breakfast Reception

Sunday, 28 Oct., 7–8:30 a.m.

Colorado Convention Center, Four Seasons Ballroom 2/3

Sponsored by

ExxonMobil

Hosted by GSA

GSA President John M. (Jack) Sharp Jr. invites all students registered for the meeting to attend a free breakfast buffet sponsored by ExxonMobil Corporation. Jack Sharp and members of GSA leadership, along with ExxonMobil staff members, will be on hand to answer questions and address student issues. This will also be a time to recognize the top-ranked graduate student research grant recipients, as well as to acknowledge other student research grant awardees.

Each student registered for the meeting will receive a ticket for the complimentary breakfast buffet. This is one of the most popular events at the meeting for students—with good reason! Make the most of this opportunity to network with fellow students, meet the officers of GSA, recognize fellow student award recipients, and learn about GSA GeoCorps.



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Student Travel Fund

GSA is pleased to offer assistance to undergraduate and graduate student Members to cover some of the cost associated with attending the GSA Annual Meeting. A fund has been set up within the GSA Foundation for meeting attendee contributions, and GSA and the Foundation will each contribute US\$1,000 for the 2007 Denver Annual Meeting. The number and amount of awards will be based solely on contributions received, including those from your fellow GSA Members, and 100% of those contributions will go to the student travel fund. For more information on this fund or to apply for assistance, go to www.geosociety.org/meetings/2007.



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FREE Research Proposal Writing Workshop

Graduate Students: Are you interested in improving your chances of receiving a GSA student research grant or looking for tips to improve your proposal writing for future funding? Then GSA's free proposal-writing workshop is for you!

Led by a member of the GSA Research Grant Committee, this workshop will be based on recent GSA graduate research grant proposals. The workshop will put several examples into hypothesis-driven studies to illustrate the dos and don'ts of the proposal-writing process. The review process of the GSA Research Grant Committee will also be outlined.

Check www.geosociety.org/grants in September for updates on the date, time, and location for this annual workshop.



GSA Student Members who are registered for the meeting may apply online for these grants. **Deadline:** 17 September 2007.



Student Travel Grants from GSA Sections

The GSA Foundation has made US\$4,500 in grants available to each of the six GSA sections. The money, when combined with equal funds from the sections, is used to help GSA undergraduate and graduate Student Members travel to GSA meetings. For information and deadlines, please visit your section Web site or contact your section secretary directly (see www.geosociety.org/sectdiv/).

➤ Graduate School Information Forum ◀

Colorado Convention Center, Exhibit Hall

Sun., 28 Oct., 8 a.m.–7:30 p.m.; Mon.–Wed., 29–31 Oct., 8 a.m.–5:30 p.m.

Searching for the right graduate school? Meet with university representatives from across the nation at GSA's Graduate School Information Forum. The participating schools (as of press time) are listed below. To check if a school has a booth in the Exhibit Hall, go to <http://rock.geosociety.org/gsif/>, or contact William Cox, +1-303-357-1013, wcox@geosociety.org. See p. 17 for a list of universities and schools in the Exhibit Hall.

INSTITUTION	SUN.	MON.	TUES.	WED.	INSTITUTION	SUN.	MON.	TUES.	WED.
Ball State University		x			University of Colorado–Boulder		x		
Central Washington University	x	x			University of Delaware	x			
Colorado School of Mines	x	x			University of Idaho	x	x		
Dartmouth College	x	x	x		University of Illinois–Urbana		x		
Duke University	x	x	x		University of Iowa		x		
East Carolina University	x	x			University of Kansas	x	x		
Indiana University	x	x			University of Massachusetts		x		
Iowa State University	x				University of Michigan	x	x	x	
Miami University–Ohio	x	x			University of Missouri–Columbia	x	x	x	x
Missouri State University		x			University of Missouri–Rolla	x	x		
Montana State University		x	x		University of Montana	x			
Ohio State University	x	x	x		University of Nebraska	x			
Oklahoma State University	x	x			University of Nevada–Reno		x	x	
Oregon State University	x	x			University of North Carolina– Charlotte	x	x		
Pennsylvania State University	x	x			University of Oklahoma	x	x	x	
Purdue University	x	x			University of Texas–El Paso	x	x	x	
Rice University	x	x	x		University of Utah		x		
South Dakota School of Mines and Technology	x	x	x		University of Vermont		x		
SUNY Binghamton		x			University of Wisconsin–Madison	x	x	x	
Texas A&M University	x	x			Utah State University	x	x	x	x
Texas Tech University	x	x			Virginia Tech	x			
Tulane University	x	x			Wright State University	x	x		
University of Arkansas	x	x	x						

GSA 2007

GSA TRIVIA NIGHT



Registration not required.

Tues., 30 Oct., 7–9 p.m.

Come test your knowledge of geoscience trivia at this evening of fun. Over 100 questions have been prepared to rack your brain and test your skills! Come as a team or join a mixed team, meet new people, share your knowledge, and have a great evening in Denver! Winning teams will be awarded fabulous prizes and the prestige of being GSA Trivia Night winners!

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For more information about course implementation visit us at Booth #627 at the GSA Annual Meeting or on the Web:

www.ametsoc.org/weatherstudies
www.ametsoc.org/oceanstudies
 or contact Elizabeth Mills/Donna Strahan: 800-824-0405

Employers: Looking for QUALIFIED CANDIDATES in the geosciences?



The **GSA Employment Service Center** offers a database of candidates seeking positions in more than 30 geoscience specialties.

- ▶ Search online by specialty, experience, location, and more.
- ▶ Post your open position(s).
- ▶ Only US\$300 through 30 April 2008.

Live interview service at GSA's 2007 Annual Meeting in Denver, 28–31 Oct. 2007.

- ▶ Includes interview booth, appointment scheduling, posting of your open position(s), access to the applicant database, message service, and more!
- ▶ 385 interviews were conducted with over 145 applicants at last year's annual meeting.

Job Seekers: Looking for EMPLOYMENT in the geosciences?

Post your online profile and résumé now.
 This is a FREE service to all GSA Members.

Information: GSA's Employment Service Center, www.geosociety.org/employment_service, 1-800-472-1988, ext. 1036.

ANNOUNCING FOR **JANUARY 2008**

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→ Denver 2007 Travel & Transportation ←

AIR TRAVEL TO DENVER

Denver International Airport (DIA) is located 24 miles northeast of downtown Denver and houses easily accessible buses, shuttles, taxis, and car rental companies. **Get up-to-the-minute airport information at +1-303-DIA-TIPS ext. 8477 or www.flydenver.com.**

Frontier Airlines
www.frontierairlines.com

Receive a 10% discount on all roundtrip tickets purchased for the GSA Annual Meeting by using the meeting code **95LMUW**. The discount is applicable for travel from 24 Oct. 2007 through 3 Nov. 2007 only and is *valid only for reservations made online*. At www.frontierairlines.com, click on "More Search Options" and enter the meeting code in the "Meeting ID" box.

United Airlines
+1-800-521-4041

Receive up to a 15% discount on domestic and international roundtrip flights for the GSA Annual Meeting by using the meeting code **577IA** when you call +1-800-521-4041. Discounts are applicable for travel from 22 Oct. 2007 through 3 Nov. 2007 only, and *reservations must be made by phone*.

TRANSPORTATION OPTIONS TO & FROM DENVER INTERNATIONAL AIRPORT

TAXIS

Taxis are available both outside the east terminal, exit door 507, or the west terminal, exit door 510. Yellow Cab (+1-303-777-7777) and Metro Taxi (+1-303-336-9127) have wheelchair-accessible vehicles and can provide assistance for limited numbers with prior notice and reservation.

SHUTTLE SERVICE

SuperShuttle, +1-303-370-1300, +1-800-258-3826,
+1-800-525-3177, www.supershuttle.com

Shuttles run to and from DIA each day from 4:30 a.m. until midnight and serve all downtown hotels. The cost is US\$19 each way or US\$30 roundtrip (for a special roundtrip rate for the GSA Meeting, please bring the coupon that will be printed in the October *GSA Today*, or print it out from the GSA Meeting Web Site). The SuperShuttle counter is on level 5 in the main terminal. SuperShuttle uses wheelchair-accessible vehicles. Discount code: **YS5CJ**.

PUBLIC BUS SERVICE

RTD, +1-800-366-7433, +1-303-299-6000,
www.rtd-denver.com/skyRide/

Route AF: Regional Transportation District (RTD) wheelchair-accessible buses provide service from DIA to downtown Denver at 50 minutes past the hour from 6:50 a.m. to 12:50 a.m. Buses depart DIA from level 5, island 5, on the east side of the main terminal, outside door 511. RTD also has an information booth on level 5 in the main terminal. Route AF takes about 50 minutes and is US\$8 each way.

CAR RENTAL

Enterprise Rent-a-Car, +1-800-593-0505,
www.enterprise.com

Book your car online and enter the group code **1299A11** in the optional account box. On the next screen, enter the first three letters of the event name, "GEO," and press enter. You may also book over the phone by calling +1-800-593-0505.

Visit www.geosociety.org/meetings/2007/ for detailed information on transportation to and around Denver.

CHILDCARE at the GSA Annual Meeting & Exposition

Sat.–Wed., 27–31 October
Colorado Convention Center



Bring the Kids!

KiddieCorp offers professional childcare services for children ages 6 months to 12 years. Children will enjoy games, story time, arts and crafts, and other fun-filled activities for each age group. Fees are US\$6 per hour, per child, with a 2-hour minimum.

Register at www.kiddiecorp.com/gsakids.htm by 1 October 2007 to secure your child's spot!

What parents are saying:

*"Thank you so much!
The folks at KiddieCorp were wonderful."*

*"Gave me peace of mind to have quality
child care at work!"*

For more information, contact the Meetings Department at meetings@geosociety.org. *Childcare services are a contractual agreement between each individual and the childcare company. GSA assumes no responsibility for the services rendered.*

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↔ Denver 2007 Registration ↔

Geological Society of America

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Early registration deadline: 24 September.

Deadline for standard registration by mail or fax: 22 October (see the June *GSA Today* for prices and a registration form.) Registrations will not be accepted via mail, fax, or phone after 22 October. Please register at the Colorado Convention Center, Lobby F, starting Saturday, 27 October, at 7 a.m.

Online registration will be open throughout the meeting.

BADGES

Did you register before 1 October?

If you are located within the United States, your confirmation and badge will be mailed to you about two weeks before the meeting. **IMPORTANT: Remember to bring your badge and registration confirmation with you to the meeting.** Badge holders and programs will be available at the Colorado Convention Center, Lobby F, beginning Saturday, 27 October, at 7 a.m. For your convenience, a pick-up desk with badge holders and programs will also be provided at the Hyatt Regency Denver.

Did you register after 1 October, or are you located outside of the United States?

Please pick up your badge, badge holder, and program on-site at the GSA registration desk located in Lobby F of the Colorado Convention Center beginning Saturday, 27 October, at 7 a.m.

ACCESSIBILITY FOR REGISTRANTS WITH SPECIAL NEEDS

GSA is committed to making the annual meeting accessible to all people interested in attending. If you need auxiliary aids or service because of a disability, check the appropriate box on the registration form. If you have suggestions or need further information, contact William Cox, wcox@geosociety.org, +1-303-357-1013. Please let us know your needs by 18 September 2007.

There's still time to sign up for a field trip or two!

Choose from 16 premeeting trips, 4 trips during the meeting, or 11 trips after the meeting, each ranging from one to four days. See photos and descriptions at www.geosociety.org/meetings/2007/fieldtrips.htm.



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Vail Valley, Colorado. Photo by Vince Matthews.

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FUTURE GSA ANNUAL MEETINGS

- 2008* Houston, Texas (5–9 October)
- 2009 Portland, Oregon (18–21 October)
- 2010 Denver, Colorado (31 Oct.–3 Nov.)
- 2011 Minneapolis, Minnesota (9–12 October)

***Joint Meeting** with the American Society of Agronomy–Crop Science Society of America–Soil Science Society of America and the Gulf Coast Association of Geological Societies with the Gulf Coast Section of the Society for Sedimentary Geology (SEPM); *hosted by* the Houston Geological Society

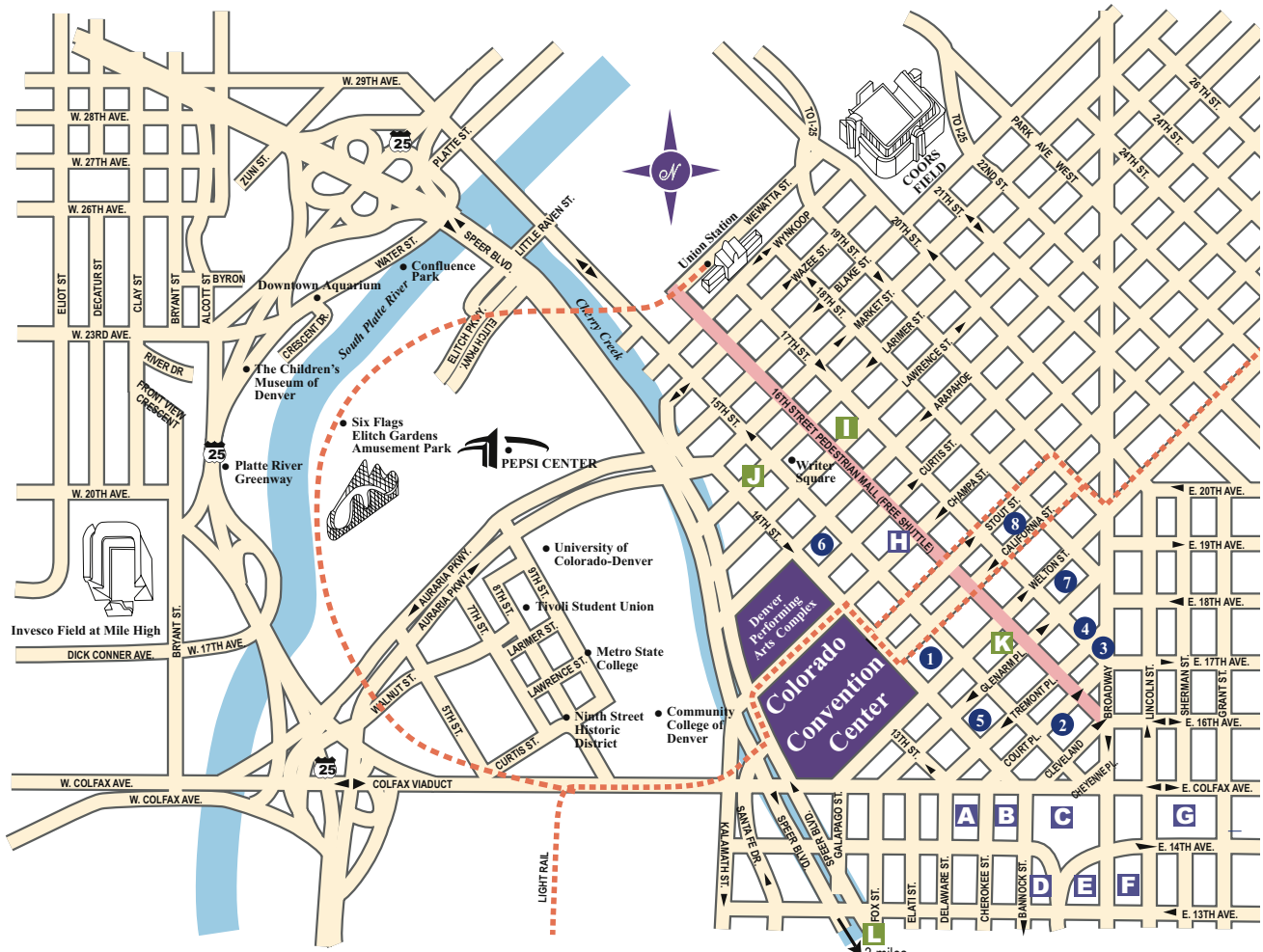
GSA Foundation's 8th Annual SILENT AUCTION Colorado Convention Center Exhibit Hall 28–31 October 2007

Browse amongst the fossils, mineral specimens, jewelry, rare geologic books and maps, wine, field supplies, antiques, artwork, and even dinners and timeshares at our booth in the GSA Headquarters area, and then place your bid! Proceeds will go to the Foundation's "Greatest Needs" fund.

Questions? Please call +1-303-357-1054 or e-mail drussell@geosociety.org.

➔ Denver 2007 Hotel and Street Map ◀

- ① Hyatt Regency (Headquarters Hotel), 650 15th Street, Denver, CO 80202: US\$175
- ② Adam's Mark, 1550 Court Place, Denver, CO 80202: US\$139
- ③ Brown Palace, 321 17th Street, Denver, CO 80202: US\$174
- ④ Comfort Inn, 401 17th Street, Denver, CO 80202: US\$119/\$129
- ⑤ Crowne Plaza (formerly Holiday Inn), 1450 Glenarm Place, Denver, CO 80202: US\$129
- ⑥ Curtis, 1405 Curtis Street, Denver, CO 80202: US\$124
- ⑦ Grand Hyatt, 1750 Welton Street, Denver, CO 80202: US\$165
- ⑧ Marriott City Center, 1701 California Street, Denver, CO 80202: US\$169



- | | | | |
|--|--|---|---|
| <ul style="list-style-type: none"> A U.S. Mint B Denver City & County Building C Civic Center Park | <ul style="list-style-type: none"> D Denver Art Museum E Denver Public Library F Colorado History Museum | <ul style="list-style-type: none"> G Colorado State Capitol Building H DMCVB Visitor Information Center | <ul style="list-style-type: none"> I Tabor Center Shopping J Larimer Square Shopping K Pavilions Shopping L Cherry Creek Shopping |
|--|--|---|---|

Call for Field Trip Proposals

Do you have an idea for an interesting and educational field trip beginning or ending near Houston? GSA encourages you to submit your field trip proposals online at <http://gsa.confex.com/gsa/2008am/fieldtrip.htm>. Trips can be anywhere from half a day to three days long. Questions? Please contact Eric Nocerino, +1-303-357-1060, enocernio@geosociety.org.

Field trip proposal deadline:
4 December 2007.

Call for Short Course Proposals

YOU too can run a GSA short course! Share your unique knowledge and experience with peers, students, or earth science teachers in our dynamic annual meeting setting. Learn how to submit your short course proposal at www.geosociety.org/meetings/2008/scProposals/. Questions? Contact Jennifer Nocerino, +1-303-357-1036, jnocerino@geosociety.org.

Short course proposal deadline:
4 December 2007.



Big Bend National Park. Photo courtesy of the National Park Service.

Celebrating the International Year of Planet Earth

5–9 October 2008 Houston, Texas, USA



The 2008 Joint Meeting of

The Geological Society of America

Soil Science Society of America
American Society of Agronomy
Crop Science Society of America

Gulf Coast Association of Geological Societies
with the Gulf Coast Section of the
Society for Sedimentary Geology (SEPM)

Hosted by the Houston Geological Society.

2008 GSA ANNUAL MEETING & EXPOSITION

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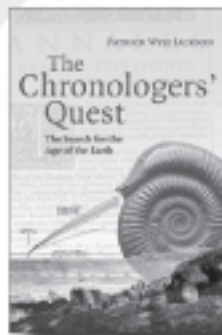
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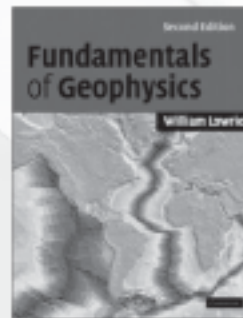
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JOINT MEETING

104th Annual Meeting, Cordilleran Section, GSA
60th Annual Meeting, Rocky Mountain Section, GSA
Las Vegas, Nevada, USA

19–21 March 2008



Valley of Fire State Park near Las Vegas, Nevada, USA. Photo courtesy Las Vegas News Bureau, <http://www.lvcva.com/press/media-resources/veg-as-images.jsp>.

SETTING

While Las Vegas has a worldwide reputation as a glittering tourist town, it is also a geologic paradise. Located within the Basin and Range province adjacent to the Colorado Plateau, Las Vegas offers many field trip opportunities, including trips in the eastern Mojave Desert, the northwest Colorado Plateau, and the Northern Colorado River Extensional Corridor. The accessible geology includes Proterozoic basement complexes, Paleozoic marine strata, Mesozoic continental strata, Miocene-Pliocene volcanic-plutonic complexes and syn-extensional sedimentary basins, Quaternary volcanic fields, tilted crustal sections, and structures recording Mesozoic and Cenozoic tectonism.

CALL FOR PAPERS

Abstract Deadline: 11 December 2007

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Contact Nancy Carlson, +1-303-357-1061, ncarlson@geosociety.org, if you have any problems with the electronic submission of abstracts.

REGISTRATION

Early Registration Deadline: 18 February 2008

Cancellation Deadline: 25 February 2008

Online registration will begin in early November 2007 at www.geosociety.org/meetings, with a discount offered for early registration. Additional information and registration fees will be posted on the Web and published in the November *GSA Today*. If you have questions or special requirements, please contact the general meeting co-chairs: Rod Metcalf, +1-702-895-4442, rod.metcalf@unlv.edu, and Larry Middleton, +1-928-523-2429, larry.middleton@nau.edu.

TECHNICAL PROGRAM

Technical program chair: Terry Spell, terry.spell@unlv.edu.

Symposia

1. Basin & Range Seismic Hazards Summit III.

Wanda J. Taylor, University of Nevada–Las Vegas, wanda.taylor@unlv.edu; Craig dePolo; Jim Werle; Catherine Snelson, New Mexico Tech, snelson@ees.nmt.edu; Barbara Luke, University of Nevada–Las Vegas, barbara.luke@unlv.edu.

2. The Klamath Mountains Province—500 Million Years of Crustal Accretion and Exhumation.

Cal Barnes, Texas Tech University, cal.barnes@ttu.edu; Aaron Yoshinobu, Texas Tech University, aaron.yoshinobu@ttu.edu; Rod Metcalf, University of Nevada–Las Vegas, rod.metcalf@unlv.edu; Art Snoke, University of Wyoming, snoke@uwyo.edu.

3. Mafic-Silicic Magmatism: Crystallization Histories, Magma Interactions, and Eruption Mechanisms.

Terry Spell, University of Nevada–Las Vegas, terry.spell@unlv.edu; Eugene Smith, University of Nevada–Las Vegas, gene.smith@unlv.edu.

4. Geomorphic Responses to Holocene Climate Change in the Western USA.

Grant Meyer, University of New Mexico, gmeyer@unm.edu; Les McFadden, University of New Mexico, lmcfadnm@unm.edu.

Theme Sessions

1. Driving Mechanisms and Structural Styles of Synconvergent Extension.

John P. Platt, University of California, john.platt@usc.edu; Michael L. Wells, University of Nevada–Las Vegas, michael.wells@unlv.edu; Thomas D. Hoisch, Northern Arizona University, thomas.hoisch@nau.edu.

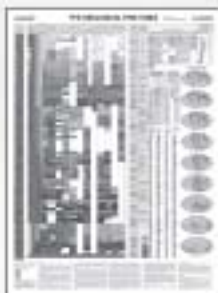
2. Causes and Consequences of Laramide Tectonics in the Forearc, Arc, and Backarc of the Southwestern United States.

Michael L. Wells, University of Nevada–Las Vegas, michael.wells@unlv.edu; Carl E. Jacobson, Iowa State University, cejac@iastate.edu; Andrew P. Barth, Indiana University–Purdue University, ibsz100@iupui.edu.

Continued on p. 50

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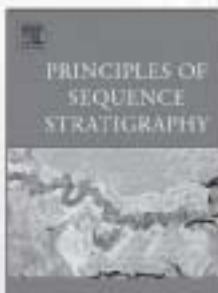
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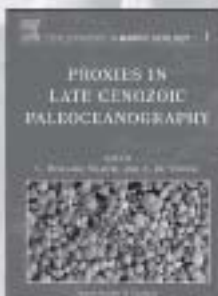
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Joint Meeting continued from p. 49

3. **Pennsylvanian to Early Triassic Deformation and Sedimentation in the Western United States.** Pat Cashman, University of Nevada–Reno, pcashman@mines.unr.edu; James Trexler, University of Nevada–Reno, jtrexler@mines.unr.edu; Wanda J. Taylor, University of Nevada–Las Vegas, wanda.taylor@unlv.edu.
4. **Paleozoic Environmental and Climate Changes: Evidence from the Great Basin and Beyond.** Gan-jing Jiang, University of Nevada–Las Vegas, jiangg@unlv.nevada.edu.
5. **Rancholabrean Paleocology of Western North America.** Steve Rowland, University of Nevada–Las Vegas, steve.rowland@unlv.edu; Aubrey Shirk, University of Nevada–Las Vegas; Josh Bonde, University of Nevada–Las Vegas.
6. **Mineralization in the Western United States.** Adam Simon, University of Nevada–Las Vegas, adam.simon@unlv.edu.
7. **Geology in the K–12 Curriculum (Posters).** Steve Rowland, University of Nevada–Las Vegas, steve.rowland@unlv.edu; Kim Johnson, University of Nevada–Las Vegas, kimberly.johnson@ccmail.nevada.edu.
8. **Importance of Outdoor Education to Earth Sciences.** Peg Rees, peg.rees@unlv.edu.

FIELD TRIPS

The details, schedule, and roster of field trips are still being finalized. Please see the GSA Web site for the current field trip roster and updates. Field trip committee co-chairs: Eugene Smith, gene.smith@unlv.edu, and Ernie Duebendorfer, ernied@nau.edu.

Up-to-date information and details about field trips, workshops, student opportunities, the guest program, symposia, and theme sessions for this meeting are listed at www.geosociety.org/meetings.



Riverboat on Lake Mead. The lake is only 25 miles (40 km) from Las Vegas at its closest point and has more than 550 miles (880 km) of shoreline. Photo: Las Vegas News Bureau, www.lvcva.com/press/media-resources/vegas-images.jsp.



Charitable Giving

Time is running out for you to take advantage of the Pension Protection Act of 2006!

This act offers a chance for tax-free charitable giving to those 70 and a half years of age or older who wish to make donations of potentially taxable IRA fund withdrawals directly to qualified charities. GSA Foundation is one such charity, and your donation under this act would be deducted from income that would otherwise be subject to tax under federal law.

To qualify under the Pension Protection Act, charitable gifts must be made from a traditional IRA. Check with your financial advisor to determine if you are able to transfer funds from another account, such as a 401k, to your IRA and then make a charitable rollover gift.

- Total rollover gifts cannot exceed \$100,000 per taxpayer per year.
- Rollover gifts are not tax deductible (but are not included as taxable income, either).
- Gifts must be made directly to the GSA Foundation; i.e., not to a donor-advised fund or private foundation.

To receive a free booklet about charitable IRAs, please contact the Foundation office, +1-303-357-1054, drussell@geosociety.org, or check the IRA box on the coupon below.

The Pension Protection Act expires on 31 December 2007.

Silent Auction

GSA Annual Meeting in Denver, 28–31 October 2007

Come to the GSA Foundation booth in the Headquarter Services Area at the Colorado Convention Center to participate in our eighth annual silent auction. Browse among dozens of exciting items and then take a moment to place your bid. All proceeds from the auction will go into our "Greatest Needs" fund, which supports research grants, student travel grants,


mentor programs, international travel, Field Forums, and other Education and Outreach Programs.

Want to Donate to the Foundation's Silent Auction?

You can donate fossils, mineral specimens, jewelry, rare geologic books or maps, wine, field supplies, antiques, artwork, and even dinners and timeshares. Last year, bidders enthusiastically pursued timeshares from a variety of places around the country.

Donations are tax deductible based upon the retail value of the donated item. Your name will be listed as the donor on the auction item displayed in the Foundation booth.

You may mail or ship donations directly to the attention of Donna Russell at the GSA Foundation, P.O. Box 9140, Boulder, CO 80301, USA. If you don't have an item, we'd be happy to accept a cash donation. For further information, please call +1-303-357-1054 or e-mail drussell@geosociety.org.



Most memorable early geologic experience:

On a cold, rainy spring day, dressed in foul weather gear while reconnoitering the geology of Anacapa Island (off L.A.) from a dory, we capsized.

—George H. Keller



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NORTHEASTERN

43rd Annual Meeting
Northeastern Section, GSA
Hyatt Regency Buffalo, Buffalo, New York

27–29 March 2008



This National Aeronautics and Space Administration Ikonos image, acquired 2 August 2004, pictures the Niagara River, which connects Lake Erie to Lake Ontario, and Niagara Falls. Niagara Falls consists of three main falls: Canadian-Horseshoe Falls, American Falls, and Bridal Veil Falls. Every second, more than two million liters of water plummet over the half-circle of the Canadian-Horseshoe portion of the Niagara Falls; the force of the pounding water eats away at the rock behind the falls, pushing them back as much as 2 m per year. Buffalo, New York, USA, is located about 12 miles downstream, at the confluence of Lake Erie and the Buffalo and Niagara Rivers. Source: http://visibleearth.nasa.gov/view_rec.php?id=17118.

Up-to-date information and details about field trips, workshops, student opportunities, the guest program, symposia, and theme sessions for this meeting are listed at www.geosociety.org/meetings.

CALL FOR PAPERS

Abstract Deadline: 18 December 2007

Submit abstracts online: www.geosociety.org/meetings

Abstract submission fee: US\$10

Deadline for technical session proposals:

26 September 2007.

If you would like to propose a symposium or theme session, please contact one of the technical program co-chairs, Gary Lash, lash@fredonia.edu, and Jason Briner, jbriner@buffalostate.edu, or the local committee general chair, Gary Solar, +1-716-878-6731, solargs@buffalostate.edu.

Contact Nancy Carlson, +1-303-357-1061, ncarlson@geosociety.org, if you have any problems with the electronic submission of abstracts.

REGISTRATION

Early Registration Deadline: 25 February 2008

Cancellation Deadline: 3 March 2008

Online registration begins in December 2007. If you have questions or special requirements, please do not hesitate to contact one of the committee chairs.

ACCOMMODATIONS

Hotel Registration Deadline: 25 February 2008

A block of rooms has been reserved at the Hyatt Regency Buffalo, Two Fountain Plaza, Buffalo, NY 14202, USA, at US\$119 + tax per night for up to four occupants. For reservations, please call the Buffalo Hyatt Regency reservation line, +1-800-233-1234, and request a reservation under "NE GSA 2008." Reservations can also be made via the Hyatt Web link, www.buffalo.hyatt.com.

FIELD TRIPS

If you would like to propose a field trip, contact field trip chair Bettina Martinez-Hackert, martinb@buffalostate.edu. For a list of field trips already scheduled, check www.geosociety.org/meetings.

OPPORTUNITIES FOR STUDENTS

Mentoring: Learn more about the Roy J. Shlemon Mentor Program in Applied Geoscience and the John Mann Mentors in Applied Hydrogeology Program at www.geosociety.org/students.htm or contact Jennifer Nocerino, jnocerino@geosociety.org.

Travel Grants: You must register for the meeting *before* the travel grant application deadline of **28 January 2008**, and apply online using the travel grant application form at www.geosociety.org/grants/negrant.htm. Contact NE GSA Secretary-Treasurer, Stephen Pollock, pollock@usm.maine.edu, if you have questions.

Volunteering: Receive free meeting registration in return for ~6 hours of volunteer work. Contact student volunteer coordinator Kevin Williams, williakk@buffalostate.edu, for more information. **Deadline to volunteer: 25 February 2008.**

SOUTH-CENTRAL

42nd Annual Meeting
South-Central Section, GSA
Hot Springs, Arkansas, USA

30 March–1 April 2008

Hot water and steam cascade, Hot Springs National Park. Photo courtesy Hot Springs Convention & Visitors Bureau, http://www.hotsprings.org/media_room/photo-gallery.



SETTING

Hot Springs, Arkansas (pop. 38,000), is located in the core of the Ouachita Mountains, 49 miles southwest of Little Rock. Hot Springs National Park surrounds the north end of the city and is the oldest park in the National Park System, dating back to 1832, when Congress established the first federally protected area in the nation's history. Hot Springs Reservation—renamed Hot Springs National Park in 1921—was created to protect the 47 naturally flowing thermal (147 °F) springs on the southwestern slope of Hot Springs Mountain.

Hot Springs is surrounded by spectacular and diverse geology. Geologic and hydrologic features of interest include the thermal springs, a well-exposed Ordovician through Mississippian sedimentary sequence of chert, shale, sandstone, and novaculite, recent damage from landslides and flash floods, quartz crystal mines, barite and vanadium mines, the Magnet Cove alkalic intrusive complex, and diamond-bearing lamproite near Murfreesboro.

CALL FOR PAPERS

Abstract Deadline: 15 January 2008

Submit abstracts online: www.geosociety.org/meetings/

Abstract submission fee: US\$10

Contact Nancy Carlson, +1-303-357-1061, ncarlson@geosociety.org, if you have any problems with the electronic submission of abstracts.

REGISTRATION

Early Registration Deadline: 25 February 2008

Cancellation Deadline: 3 March 2008

Online registration begins December 2007. For further information, or if you have special requirements, please contact one of the local committee chairs: Jeff Connelly, +1-501-569-3543, jbconnelly@ualr.edu, or Scott Ausbrooks, +1-501-683-0119, Scott.Ausbrooks@arkansas.gov. Guest program committee chair: Angela Chandler, angela.chandler@arkansas.gov.

ACCOMMODATIONS

Hotel Registration Deadline: 28 February 2008

A block of rooms has been reserved at The Austin Hotel (305 Malvern Avenue, Hot Springs, AR 71901, USA; www.theaustinhotel.com) at US\$75 + tax per night for one to two occupants and US\$85 + tax for three or four occupants. For reservations, please call The Austin Hotel, +1-877-623-6697, and request a reservation under "2008 GSA South-Central Section Meeting."

TECHNICAL SESSIONS

Deadline for new session proposals: 15 September 2007

To propose additional symposia or theme sessions, please contact the technical program chair, Beth McMillan, +1-501-569-3024, memcmillan@ualr.edu.

Symposium

1. Marine Vertebrate Faunas of the Gulf Coastal Plain.

Gary L. Stringer, University of Louisiana at Monroe, stringer@ulm.edu.

Theme Sessions

1. Alkali Magmatism and Associated Minerals and Rocks.

Volker Gobel, Stephen F. Austin State University, vgobel@sfasu.edu; Don R. Owens, University of Arkansas at Little Rock, drowens@ualr.edu.

2. Hydrogeology of Thermal Springs.

John V. Brahana, University of Arkansas, brahana@uark.edu.

3. Geologic Hazards of the South-Central United States.

Wm. J. Sims, University of Arkansas at Little Rock, wjsims@ualr.edu; Kenneth V. Luza, Oklahoma Geological Survey, kluza@ou.edu.

4. Unconventional Gas Resources in the South-Central United States: Geological, Geochemical, and Environmental Aspects.

Bill Prior, Arkansas Geological Survey, bill.prior@arkansas.gov.

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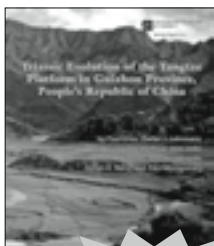
5. **Undergraduate Research (Posters).** *Cosponsored by Council on Undergraduate Research, Geosciences Division.* Diane Smith, Trinity University, dsmith@trinity.edu.
6. **Geologic Mapping in the South-Central United States (Posters).** Angela Chandler, Arkansas Geological Survey, angela.chandler@arkansas.gov.
7. **Groundwater Resources of the Mississippi Embayment.** John B. Czarnecki, U.S. Geological Survey, jczarnec@usgs.gov.
8. **New Directions in Karst Science.** John V. Brahana, University of Arkansas, brahana@uark.edu.
9. **Stratigraphy and Structure of the Ouachita-Marathon Orogenic Belt.** Roger Slatt, University of Oklahoma, rslatt@ou.edu; Jeffrey Connelly, University of Arkansas at Little Rock, jbconnelly@ualr.edu.
10. **Technology in Teaching Earth Science K–20.** Keith R. Harris, University of Arkansas at Little Rock, krharris@ualr.edu; Wendi J.W. Williams, w3science@williams.arcoxml.com.
11. **Students Exploring Geosciences through Science Fairs: Show Us Your Work! (Posters).** Keith R. Harris, University of Arkansas at Little Rock, krharris@ualr.edu; Wendi J.W. Williams, w3science@williams.arcoxml.com.

FIELD TRIPS

Deadline for new field trip proposals: 15 September 2007
Please contact field trip chair, Doug Hanson, doug.hanson@arkansas.gov, if you would like to propose a field trip. Field trips currently set for the meeting are listed online.

Up-to-date information and details about field trips, workshops, student opportunities, the guest program, symposia, and theme sessions for this meeting are listed at www.geosociety.org/meetings.

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4442, rod.metcalf@unlv.edu

Call for Papers Announcement: p. 49

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

Call for Papers Announcement: p. 52

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

Call for Papers Announcement: p. 53

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

Call for Papers Announcement: October 2007 *GSA Today*

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.

Call for Papers Announcement: October 2007 *GSA Today*



PENROSE CONFERENCE REPORT

Unlocking 3-D earth systems—
Harnessing new digital technologies to
revolutionize multiscale geologic models

Durham University, Durham, UK

17–21 September 2006

Conveners:

Ken McCaffrey, *Reactivation Research Group, Department of Earth Sciences, University of Durham, South Road, Durham DH1 3LE, UK, k.j.w.mccaffrey@durham.ac.uk*

Jonathan Imber, *Reactivation Research Group, Department of Earth Sciences, University of Durham, South Road, Durham DH1 3LE, UK, jonathan.imber@durham.ac.uk*

Nicolas Holliman, *e-Science Research Institute, University of Durham, South Road, Durham DH1 3LE, UK, n.s.holliman@durham.ac.uk*

Bob Holdsworth, *Reactivation Research Group, Department of Earth Sciences, University of Durham, South Road, Durham DH1 3LE, UK, r.e.holdsworth@durham.ac.uk*

John Howell, *Centre for Integrated Petroleum Technology, University of Bergen, Allegaten 41, Bergen N-5007, Norway, john.howell@geo.uib.no*

Tim Wawrzyniec, *LiDAR Laboratory, Department of Earth and Planetary Sciences, Northrop Hall, University of New Mexico, Albuquerque, NM 87131-0000, USA, tfw@unm.edu*

MEETING OVERVIEW

Earth systems are inherently four-dimensional and multiscale, requiring a geospatial approach to capture and model natural architectures. In September 2006, 50 participants from North America, Europe, and Australia, including 16 students, met at Durham University to discuss how new digital data capture and 3-D visualization technologies can improve our understanding of the uncertainty and geometric-spatial scaling in multiscale geologic models.

The conference began with a field trip to assess how to digitally capture, visualize, and analyze geological outcrops (in this case, the 90 Fathom fault, Cullercoats). Four groups addressed issues related to the conference themes, including scaling and dimensionality of geological structures, quantifying uncertainty in geological models, and capturing geological complexity. Over the following four days of talks and “e-posters,” partici-

pants discussed the application of digital technologies and stereo visualization to better understand outcrop- to plate-scale processes and for quantifying uncertainty in multiscale models. Participants were encouraged to show “live” datasets using immersive 3-D visualization and to use plasma screens in the poster sessions. Each day ended with a plenary discussion, and the conference closed with a two-hour panel-led wrap-up.

High precision spatial data are now routinely acquired using laser scanning, photogrammetry, and/or GPS-GIS to create digital geospatial databases (“*n*-dimensional maps”) that contain much more information—and associated metadata—than traditional paper maps. Covisualization of multiple attributes can be used to integrate different types of data across all scales. Such models permit spatial analysis and the use of geostatistics and thus go beyond just “pretty pictures.” Virtual reality environments have the additional advantage of enhancing interaction both with the data *and* among users. Digital technologies also enable simple validation exercises during data acquisition (e.g., section balancing while mapping), increasing confidence in the final interpretation. In addition, careful use of digital technologies can provide improved understanding of the fourth (time) dimension to reconstruct the growth of geological architectures.

Geospatial models provide a platform to define and manage the different types and magnitudes of uncertainty inherent in geoscience datasets. Uncertainty can be represented at each locality in the database as a compound function of spatial precision, measurement error, and geological interpretation. Interpretation is subjective and will depend on an individual’s experience, age, bias, etc. Research shows that interpreters are more likely to arrive at the correct geological interpretation if they consider the geological processes rather than simply “drawing lines.” Thus, the user’s prior expert knowledge is a key component in any digital workflow.

An underlying benefit of geospatial data is that 3-D models can fundamentally improve how we communicate our science to industrial and academic users, students, and schools; hence, these models have great potential for raising the earth-science profile within the wider community. End-users can interrogate digital datasets, which in turn gives them the ability to conduct their own scientific inquiries. These models are a great way to train high school teachers to teach fundamental scientific techniques, including data analysis and hypothesis testing. At the undergraduate level, digital mapping combined with 3-D visualizations in the field allow students to check correlations and hypotheses “on the fly,” creating new opportunities for advanced fieldwork techniques.

MEETING CONCLUSION

Participants came to broad agreement on the need for the digital geology group to become a more visible, coherent community, with the aim of facilitating the paradigm shift that appears to be changing the way geoscientists collect and analyze data. Specifically, there should be greater sharing of best-practice workflows, raw data, and open source software. A volume of papers presented at the meeting is forthcoming, as is a Web site. It was agreed that a ground-based LiDAR

Continued on p. 56

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Penrose Report continued from p. 55

archive should be established, with a view to obtaining long-term funding (cf. airborne LiDAR archive). Many participants felt that uncertainty was the next “big issue” to tackle using digital technology, while others pointed out that we need a list of “digital success stories,” both in terms of academic scientific achievement and commercial benefits. These issues will be developed in a series of follow-up workshops and symposia.

Participants: Carlos Aiken, Mohammed Alfarhan, Frank Arnott, Jerry Bellian, Richard Blewett, Nicky Boak, Clare Bond, Simon Buckley, Christian Carlsson, Christopher Crosby, Mauro De Donatis, Wetherbee Dorshow, Amy Ellwein, Havard Enge, Luigi Ferranti, Kurt Frankel, Klaus Gessner, Alan Gibbs, Dave Healy, Ronan Hennessy, Paul Henson, Bob Holdsworth, Nicolas Holliman, Andrew Hughs, David Hunt, Jonathan Imber, Richard Jones, Donald Keefer, Tobias Kurz, Zbigniew Malolepsy, Ken McCaffrey, Erik Monsen, Robert Moroz, Ian Mynatt, Mariana Olariu, John Oldow, Douglas Paton, Geoffrey Phelps, Jamie Pringle, Steven Smith, Barbara Souter, Ken Thomson, John Thurmond, Mark Tomasso, Dean Tuck, Erik Venteris, Doug Walker, Cameron Walsh, Tim Wawrzyniec, Ruth Wightman.



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Field Forum Report

Marine impact craters on Earth: Field investigation of the Wetumpka impact structure, a well-preserved marine impact crater, and the K-T boundary in the Alabama Gulf Coastal Plain

8–11 March 2007

Wetumpka, Alabama, USA

Forum Conveners and Field-Trip Leaders

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Jens Ormö, *Centro de Astrobiología, Instituto Nacional de Técnica Aeroespacial, Ctra de Torrejón a Ajalvir, km 4, Torrejón de Ardoz, 28850 Madrid, Spain*

Field-Trip Co-Leaders

Lucille W. Petruny, *Astra-Terra Research, Auburn, Alabama 36831-3323, USA*

Thornton L. Neathery, *Neathery and Associates, 1212-H Veterans' Parkway, Tuscaloosa, Alabama 35404, USA*

Student Assistants

Ashley Taylor Gilomen, Jennifer Glidewell, Germari de Villiers, Reuben C. Johnson, *Auburn University, Auburn, Alabama 36849, USA*

This field forum, focused on the topic of marine impacts by cosmic objects, was held at Wetumpka, Alabama, USA, on 8–11 March 2007. The field forum objectives were to examine the well-exposed, 7-km-diameter, marine-target impact structure at Wetumpka and to examine distal ejecta from the marine-target Chicxulub impact structure in México (i.e., the Cretaceous-Tertiary [K-T] boundary¹), which is exposed in western Alabama. The field forum accomplished these objectives, as recounted in this report.

In addition to the two conveners, the field forum was attended by 37 participants, two field-trip co-leaders, and four student assistants. To make it easy for international participants to attend the field forum, it was scheduled in the days immediately preceding the annual Lunar and Planetary Science Conference in Houston, Texas.

Day 1, 8 March: Volunteered and invited posters were presented and participants enjoyed an evening meal at the civic center after two brief lectures by the conveners.

Field day, 9 March: A brief oral presentation giving a geologic overview of the Wetumpka impact structure was given at breakfast in order to introduce the participants

to the localities to be visited during the day as well as the issues and open questions to be discussed. The field day included eight stops within the Wetumpka impact structure. The stops began with an overview stop on the crystalline rim to view breccia dikes. Subsequent stops included a road cut through the western crystalline rim, a sedimentary slump deposit of mega-blocks inside the rim, an exposure of impactite slurry sands including mega-blocks, the center of the structure to see resurge deposits of polymict proximal ejecta, core samples (plus lunch and poster viewing), an example of deformation in the extra-structure disturbed terrain, and a final stop to see weathering and truncation in the crystalline rim. A brief poster presentation was made by the conveners at each stop to introduce the participants to the outcrop and to the special issues to be discussed. At selected stops on the outcrop, invited posters on related topics were also presented (including Jared Morrow, San Diego State University). Posters and discussions continued prior to dinner that evening, which ended with a gala dinner at the Wetumpka Civic Center arranged by the Wetumpka Impact Crater Commission, the City of Wetumpka, the Elmore County Commission, and some



10 March 2007: Participants and leaders of the Wetumpka Field Forum gathered for a group photograph at the K-T boundary in western Alabama.

¹We use Cretaceous-Tertiary (K-T) here, but readers should be aware that the new IUGS-ICS terminology is Cretaceous-Paleogene (see www.stratigraphy.org).

local businesses. At this dinner, proclamations from the city, county, and the Alabama governor's office were presented. The governor's proclamation established the week of May 4–11 as "Wetumpka Impact Crater Week" in Alabama.

Day 3, 10 March: The group departed Wetumpka for an area in Wilcox County to view exposures of the K-T boundary that include distal ejecta with impact spherules from the Chicxulub impact. With special cooperation and help of local plantation owners, we visited one site near the Alabama River. We arrived in time for lunch, held at a small pavilion on the plantation and provided by the Crater Commission. The pavilion also served as an excellent locality for invited and volunteered poster presentations of topics related to the issue to be discussed at the outcrop. An introductory overview of the K-T boundary was given by Jan Smit, Vrije Universiteit, Netherlands, which was followed by brief comments on the formation of impact spherules from Bruce Simonson (Oberlin College) and others. The group spent several hours discussing the K-T boundary section and sampling the outcrop, which is well exposed in that area. Upon return to Wetumpka, we were seated at a farewell dinner in an historic venue, which was arranged by a local utility company. The following day was largely consumed by participant departures.

The field excursions and discussions at meals generated a plentiful exchange of ideas, and this was augmented by four informal poster sessions and some brief formal and informal talks. The "posters in the field" concept used during this field forum was particularly effective in communicating ideas and stimulating discussions. Central Alabama is well-suited for this type of field forum because within a short distance are a well-exposed marine impact crater (Wetumpka) and excellent outcrops of the K-T boundary (ejecta from the Chicxulub marine impact).

ACKNOWLEDGMENTS

We want to thank the members of the Wetumpka Impact Crater Commission (Hazel Jones, chair, and Marilee Tankersley, chair for the 2007 Field Forum arrangements) for their essential support of this field forum

and all the planning and coordination they provided for us. We also thank the City of Wetumpka (Jo Glenn, Mayor) and the Elmore County Commission (Joe Faulk, chair) for their help and support. Finally, we thank Auburn University (College of Sciences and Mathematics and Department of Geology and Geography) for their support, as well as the several local businesses that helped the Crater Commission conduct this field forum.

NOTE: This field forum would not have been possible without the kind cooperation and permission of private landowners in Elmore and Wilcox counties. These landowners have stated that geologists should not venture on their land without prior notice and without specific written permission. We are most grateful for their help.

FURTHER READING

For readers wanting to know more about the Wetumpka impact structure and the Cretaceous-Tertiary boundary in western Alabama, we provide the following references.

- King, D.T., Jr., and L.W. Petruny, 2007, Impact spherule-bearing, Cretaceous-Tertiary sand body, Shell Creek stratigraphic section, Alabama, USA, *in* Evans, K., et al., eds., *The Sedimentary Record of Impacts: Boulder, Colorado*, Geological Society of America and the Society for Sedimentary Geology Special Paper (in press).
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Participants: Natasha Artemieva, Bob Baker, Jonathan Bryan, Carl Campbell, Mark Cocker, William Cordua, Ben Dattilo, Alex Deutsch, Lucy Edwards, Joe Fandrich, Sherry Fandrich, Bevan French, Steven Goderis, David Griscom, Scott Harris, Wright Horton, Steven Jaret, Argo Jöeleht, Elin Kalleson, Dan Larson, James Lowery, Keith Milam, Jared Morrow, Gordon Osinski, Elisabetta Pierazzo, David Powars, David Rajmon, James Rice, Andrew Rindsberg, Jean Self-Trail, Bruce Simonson, Jan Smit, Elizabeth Stephens, Kalle Suuroja, Mark Thompson, Filippos Tsikalasb, John Warne.

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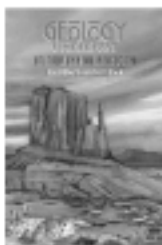


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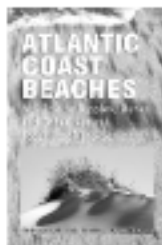
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About People

GSA Fellow **Michael Hochella** has been appointed University Distinguished Professor in the College of Science at Virginia Tech. A Virginia Tech press release notes that this rank is bestowed upon no more than 1% of its faculty for scholarly achievement that has attracted national and/or international recognition. Hochella's awards include the Geochemical Society's Distinguished Service Medal and the Alexander von Humboldt research award.

GSA Field Guide 7, *1906 San Francisco Earthquake Centennial Field Guides; Field trips associated with the 100th Anniversary Conference, 18-23 April 2006, San Francisco, California*, has received the Geoscience Information Society (GSIS) Best Guidebook Award for 2007. The field guide was edited by GSA Fellows **Carol S. Prentice, Judith G. Scotchmoor**, and **Eldridge M. Moores**, and Jon P. Kiland. The book and its editors will be honored at the GSIS awards luncheon at the 2007 GSA Annual Meeting in Denver on Tuesday, 30 October, from noon to 2 p.m.



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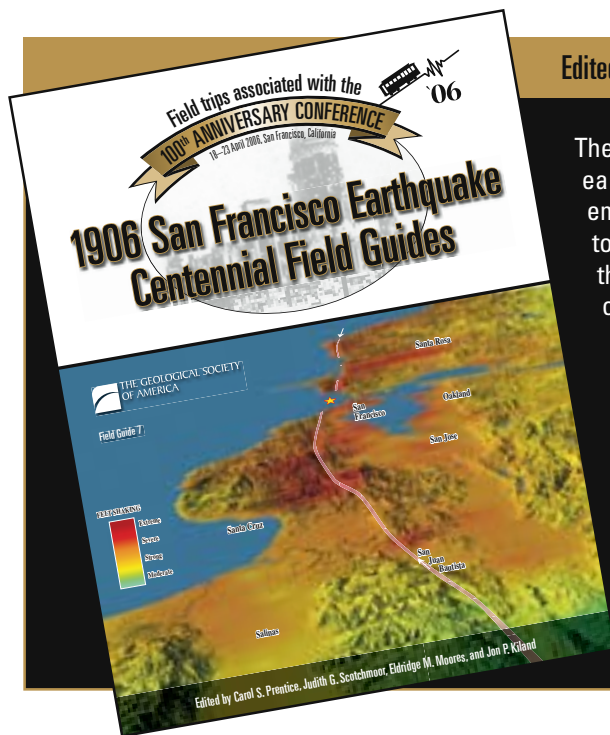
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The Department of Geology at Baylor University invites applications for the W.M. Keck Professorship in Geophysics, beginning August 2008. A Ph.D. in Geophysics, Geology or a related field is required at the time of appointment. The Department currently consists of 13 geoscientists, including geologists, geophysicists and geographers (please see the Department Web site at www.baylor.edu/Geology/ for further information).

Research: The Department seeks a nationally recognized individual who has a strong research agenda in geophysics or the use of geophysical data. Potential areas of interest may include, but are not limited to, earthquake or reflection seismology, potential fields, geodynamics, or geophysically oriented aspects of petroleum geology. We encourage communication and collaboration with a subset of the Geology faculty members that are currently engaged in studies in the general areas of petroleum geology, stratigraphy, structural geology, hydrogeology, and environmental geology and geophysics, and the successful candidate is expected to carry out a vigorous research program that involves both undergraduates and graduates. Research space is available in the 500,000 ft² "state-of-the-art" Baylor Sciences Building.

Teaching: We seek an individual with a strong commitment to excellence in teaching, and require that he/she contribute significantly to both the undergraduate programs in Geology and Earth Science by teaching a freshman course, a senior-level course, as well as contribute to the graduate (M.S. and Ph.D.) programs in Geology by teaching graduate courses or seminars in his/her areas of specialization. A laboratory that includes high-performance computers and software, as well as two large plotters, is available for both instruction and research.

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. Steven Dworkin, Geophysics Search Committee Chair, Department of Geology, Baylor University, One Bear Place #97354, Waco, TX 76798-7354 (Tel: 254-710-2361; e-mail: Steve_Dworkin@Baylor.edu). The review of applications will begin December 1, 2007 and applications will be accepted until the position is filled. To ensure full consideration, application must be completed by December 15, 2007. 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.

**TENURE-TRACK HYDROGEOLOGIST
DEPARTMENT OF GEOLOGY, BAYLOR UNIVERSITY**

The Department of Geology at Baylor University invites applications for a full-time, tenure-track Assistant or Associate Professor in hydrogeology, beginning in August 2008. We seek a dynamic person with expertise in groundwater flow dynamics and processes involving such aspects as quantitative modeling, groundwater geochemistry, geomicrobiology, and basin-scale fluid flow. Experience with field-based research in groundwater pollution and contaminant transport is highly desirable. Preference will be given to candidates whose expertise complements existing departmental teaching and research areas. The successful candidate will be expected to pursue a vigorous externally-funded research program, aspire to teaching excellence, and engage in interdisciplinary collaboration. Teaching of both undergraduate and graduate level courses, including hydrogeology, environmental geology, and in area of expertise, is required. A Ph.D. in Hydrogeology or related area is required.

The Department offers undergraduate degrees in Geology and Geography and M.S. and Ph.D. degrees in Geology (www.baylor.edu/Geology/). Candidates should submit CV, letter of intent including statements of research and teaching interests, examples of published work, teaching evaluations (if available) and contact information (with e-mail addresses) of three references to: Dr. Joe C. Yelderman, Jr., Hydrogeology Search Committee Chair, Dept. of Geology, One Bear Place #97354, Baylor University, Waco, TX 76798-7354 (Joe.Yelderman@baylor.edu). Review of applications will begin on 1 December 2007, and applications will be accepted until the position is filled. To ensure full consideration, application must be completed by January 15, 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.

**U.S. GEOLOGICAL SURVEY (USGS)
POSITIONS AVAILABLE, RESEARCH GEOLOGIST**

The USGS, Central Region Energy Resources Team, is soliciting interest from qualified individuals for two positions of Research Energy Geologists in Lakewood, Colorado. These positions will conduct fundamental geologic research to evaluate and characterize the geologic framework and occurrence of a variety of geologic energy resources, including conventional and unconventional oil and gas, coal, and uranium. The unconventional oil and gas applications may include oil shale, oil sands, basin-centered gas, shale gas, and coalbed methane. Candidates must be able to work as part of a multidisciplinary team of geologists, geochemists, geophysicists, and engineers. Excellent skills in writing and oral presentation of scientific findings are also required.

Applications (resume and application questions) for this vacancy must be received on-line via the USGS Online Automated Recruitment System (OARS) BEFORE midnight Eastern Time (Washington, D.C. time) on the closing date of this announcement. If you fail to submit a complete online resume, you will not be considered for this position. Requests for extensions will not be granted. If applying online poses a hardship for you, you must speak to someone in the Servicing Personnel Office listed on this announcement PRIOR TO THE CLOSING DATE for assistance. Contact Jennifer Farrell at +1-303-236-9566 or jfarrell@usgs.gov.

The OARS system can be accessed at www.usgs.gov/ohr/oars/. The announcement number is: CR-2007-0589. The salary range is \$67,572-\$87,847 depending upon qualifications. The closing date is October 26, 2007.

U.S. citizenship is required. USGS is an Equal Opportunity/Affirmative Action Employer.

**COLLECTION MANAGER, FOSSIL INVERTEBRATES
FIELD MUSEUM, CHICAGO**

The Department of Geology of the Field Museum of Natural History has an immediate opening for a Collection Manager of Fossil Invertebrates. This collection encompasses all major phyla of metazoans and is ranked among the top paleontology collections in the world. We seek candidates at the Masters level (Bachelors in exceptional cases) in invertebrate paleontology who are also taxonomically oriented, familiar with database systems, adept in communicating with scientists and the public and eager to participate in fundraising initiatives and public learning programs. Screening will begin Sept. 1, 2007. To apply send CV and contact information for 3 references to: Dr. Scott Lidgard, Collection Manager Search Committee, Dept. of Geology, The Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, IL 60605. E-mail: slidgard@fieldmuseum.org.



**DEPARTMENT OF COMMUNICATIONS, ENERGY AND NATURAL RESOURCES
AN ROINN CUMARSÁIDE, FUINNIMH AGUS ACMHAINNÍ NÁDÚRTHA**

GRIFFITH GEOSCIENCE RESEARCH AWARDS

- 13 Researcher Posts
- 13 PhD Studentships
- 1 Research Assistant
- 31 Student Placements

This innovative scheme was established by the Minister for Communications, Energy and Natural Resources of Ireland with the objective of developing Irish geoscience research capacity. It seeks to attract mobile early stage researchers from abroad to Ireland and to encourage Irish researchers to visit and work in international centres of geoscience research. See <http://www.gsi.ie/Geoscience+Initiatives/Griffith+Geoscience+Research+Awards.htm> for additional information on the scheme.

The following research groups / centres, following international evaluation, are being supported under the scheme and they are located at Higher Education Institutions in Ireland and Northern Ireland:

- **BIOGEOSCIENCE RESEARCH GROUP, NATIONAL UNIVERSITY OF IRELAND GALWAY.**
Contact: Dr. Colin Brown. email: Colin.Brown@nuigalway.ie Tel: +353 (0)91 492691
Website: <http://www.nuigalway.ie/eos/biogeo-sciencegroup.html>
Research Group requires 3 Researchers (7 years), 6 PhD Studentships (4 years) and 18 Student Placements (over 6 years)
- **MARINE AND PETROLEUM GEOLOGY RESEARCH GROUP, UNIVERSITY COLLEGE DUBLIN.**
Contact: Prof. Pat Shannon. email: p.shannon@ucd.ie Tel: +353 (0)1 7162331
Website: <http://www.ucd.ie/geology/research/marine.html>
Research Group requires 2 Researchers (5 years), 4 PhD Studentships (4 years) and 5 Student Placements
- **GEOPHYSICS GROUP, UNIVERSITY COLLEGE DUBLIN.**
Contact: Prof. Chris Bean. email: Chris.bean@ucd.ie Tel: +353 (0)1 7162140
Website: <http://www.ucd.ie/geology/research/geophysics.html>
Research Group requires 1 Researcher (5 years), 1 PhD Student (4 years) and 2 Student Placements
- **GEOPHYSICS RESEARCH GROUP, UNIVERSITY OF ULSTER.**
Contact: Prof. John McCloskey. email: j.mccloskey@ulster.ac.uk Tel: +44 (0)28 70 324428
Website: <http://www.science.ulster.ac.uk/geophys/>
Research Group requires 1 Researcher (5 years) and 2 Student Placements
- **GROUNDWATER RESEARCH GROUP, QUEEN'S UNIVERSITY BELFAST.**
Contact: Dr. Gerard Hamill. email: g.a.hamill@qub.ac.uk Tel: +44 (0)48 9097 4197
Website: <http://www.qub.ac.uk/veer/>
Research Group requires 2 Researchers (7 years), 2 PhD Students (4 years) and 4 Student Placements
- **COASTAL AND MARINE RESOURCES CENTRE, UNIVERSITY COLLEGE CORK.**
Contact: Dr. Valerie Cummins. email: v.cummins@ucc.ie Tel: +353 (0)21 4703100
Website: <http://www.ucc.ie/research/crc/>
Research Group requires 3 Researchers (3 years)
- **IRISH GEOSCIENCE GRADUATE PROGRAMME, DUBLIN INSTITUTE FOR ADVANCED STUDIES.**
Contact: Prof. Alan Jones. email: alan@cp.dias.ie Tel: +353 (0)1 662 1333
Website: <http://www.dias.ie/index.php?section=cosmic&subsection=index>
Research Group requires 1 part-time Researcher (7 years)
- **GEOSCHOL GROUP, TRINITY COLLEGE DUBLIN**
Contact: Dr. Patrick Wyse Jackson. email: wysejcknp@tcd.ie Tel: +353 (0)1 8961477
Website: <http://www.tcd.ie/Geology/MAIN-PAGE/museum.php>
Research Group requires 1 Research Assistant (1 year)

The research groups / centres will shortly be advertising for the above positions. Researchers with PhD and 3 years postdoctoral research experience are recruited on the salary scale €55,000 to €80,486 per annum and may come from any relevant discipline. Stipends of €18,000 per annum plus tuition fees are available for PhD Studentships and funding is available for stays in international centres of excellence. Contact the leaders of the research groups / centres for more information on the application process.



FACULTY POSITIONS IN CLIMATE DYNAMICS, LITHOSPHERIC DYNAMICS, MARINE ORGANIC/BIOGEOCHEMISTRY, AND SCIENCE EDUCATION NORTH CAROLINA STATE UNIVERSITY

The Department of Marine, Earth, and Atmospheric Sciences at North Carolina State University is seeking applications to fill four tenure-track faculty positions.

Global Climate Dynamics: The Department is seeking to fill a tenure-track faculty position at the assistant professor level, except for exceptional candidates, with an emphasis in global climate dynamics. Candidates with expertise in any of the following areas will be favorably considered: coupled global climate models, climate variability and climate change, as well as climate prediction. Applicants must hold a Ph.D. degree in the atmospheric or related physical sciences.

Marine Organic Chemistry-Biogeochemistry: The Department is seeking to fill a tenure-track faculty position in the field of Marine Organic Geochemistry at the assistant professor level. Candidates with backgrounds in all areas of marine organic geochemistry will be considered, however, expertise in stable isotope biogeochemistry (an IRMS was recently purchased by our department) is of particular interest, along with microbiology, carbon cycling, and diagenesis. Applicants must hold a Ph.D. degree in marine chemistry or related field.

Lithospheric Dynamics/Earth Surface Interactions: The Department is seeking to fill a tenure-track, faculty position in Earth Science with an emphasis in lithospheric dynamics and earth surface interactions at the assistant professor level. Examples of interests include, but are not restricted to, geomorphology, geodynamics, geohazards, neotectonics, and paleoclimate, utilizing applications such as cosmogenic isotopes, GPS geodesy, and InSAR. Applicants must hold a Ph.D. degree in the geosciences or related physical sciences.

Geoscience Education: The Department is seeking to fill a tenure-track faculty position in the field of Geoscience Education at the assistant professor level. We are particularly interested in candidates who focus on improving learning of science by non-science majors. The successful candidate will design and teach large introductory geoscience classes. A record and/or strong promise of creativity in teaching methods is desired, with the goal of adapting cutting-edge pedagogy for undergraduate science courses. North

Carolina State University has begun a focused STEM (Science, Technology, Education and Mathematics) Education Initiative. Applicants must hold a Ph.D. degree in the geosciences or in Science Education with a strong emphasis in the geosciences

Information on Application: The successful candidate for each position must demonstrate high potential for outstanding accomplishments in research, including development of a sponsored research program, graduate student mentoring, and teaching courses that range from introductory survey courses for non-majors to advanced courses.

Opportunities exist for the successful candidate for disciplinary and interdisciplinary interactions with more than 30 other faculty in the Marine, Earth, and Atmospheric Sciences. Additional information about the department and its facilities can be found on our web page: www.meas.ncsu.edu.

Further details on each position and instructions for application are provided on our Web site at www.meas.ncsu.edu/Jobs/05-faculty_searches.html. We welcome the opportunity to work with candidates to identify suitable employment opportunities for spouses or partners. Review of applications will begin September 15th, 2007; the position will remain open until filled.

NC State University is an equal opportunity and affirmative action employer. All qualified applicants will receive consideration for employment without regard to race, color, national origin, religion, sex, age, veteran status, or disability. In addition, NC State University welcomes all persons without regard to sexual orientation. Applications from women, minorities, and persons with disabilities are encouraged. Individuals with disabilities desiring accommodations in the application process should contact Tami Talmadge via e-mail at tami_talmadge@ncsu.edu, phone +1-919-515-7773 or fax +1-919-515-7802.

U.S. GEOLOGICAL SURVEY (USGS) POSITION AVAILABLE, GEOLOGIST

The USGS, Central Region Energy Resources Team, is soliciting interest from qualified individuals for a position of Energy Geologist in Lakewood, Colorado. This position will provide technical support to geologic studies of sedimentary basins in support of national and worldwide

energy resource assessments. Candidates must be able to work as part of a multidisciplinary team of geologists, geochemists, geophysicists, and engineers. Excellent skills in writing and oral presentation of scientific findings are also required.

Applications (resume and application questions) for this vacancy must be received on-line via the USGS Online Automated Recruitment System (OARS) BEFORE midnight Eastern Time (Washington, D.C., time) on the closing date of this announcement. If you fail to submit a complete online resume, you will not be considered for this position. Requests for extensions will not be granted. If applying online poses a hardship for you, you must speak to someone in the Servicing Personnel Office listed on this announcement PRIOR TO THE CLOSING DATE for assistance. Contact Jennifer Farrell at +1-303-236-9566 or jfarrell@usgs.gov.

The OARS system can be accessed at www.usgs.gov/ohr/oars/. The announcement number is: CR-2007-0587. The salary range is \$46,597-60,574, depending upon qualifications. The closing date is October 26, 2007.

U.S. citizenship is required. USGS is an Equal Opportunity/Affirmative Action Employer.

DEPARTMENT OF GEOLOGICAL SCIENCES COLLEGE OF NATURAL SCIENCE & MATHEMATICS CALIFORNIA STATE UNIVERSITY-FULLERTON HYDROGEOCHEMIST, TENURE TRACK

The Department of Geological Sciences at California State University Fullerton invites applications for a tenure-track, Assistant Professorship that will begin August 2008. The successful candidate is expected to develop an active, field-based, externally-funded research program in Hydrogeochemistry involving undergraduate and Master's students and must be committed to excellence in teaching the diverse student population at CSU Fullerton. A Ph.D. in Geological Sciences is required at the time of appointment.

Teaching responsibilities will include general education classes (e.g., oceanography, physical geology) and upper-division/graduate courses (e.g., aqueous geochemistry and/or contaminant transport, hydrogeology/hydrology) in the candidate's field of expertise. The department places a strong emphasis on field-

**USGS Mendenhall Postdoctoral Research Fellowship Program (Fiscal Year 2009)**

The U.S. Geological Survey (USGS) invites applications for the Mendenhall Postdoctoral Research Fellowship Program for Fiscal Year 2009. The Mendenhall Program provides opportunities to conduct research in association with selected members of the USGS professional staff. Through this Program the USGS will acquire current expertise in science to assist in implementation of the science strategy of its programs. Fiscal Year 2009 begins in October 2008.

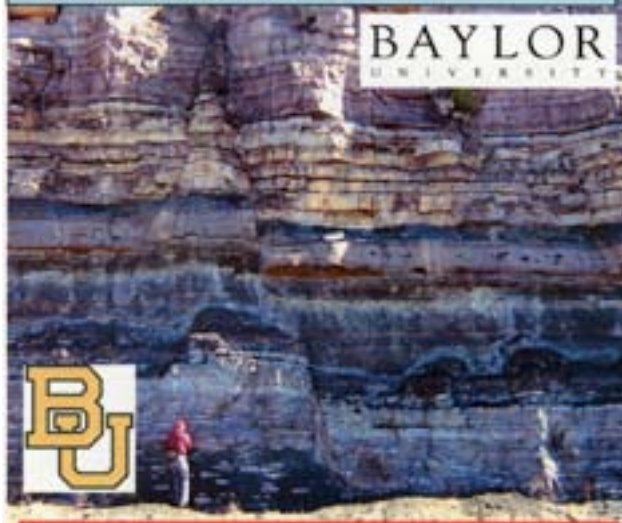
Opportunities for research are available in a wide range of topics including: shale-gas resource potential; climate change; karst geomorphology and hydrology; greenhouse gas fluxes from the land/sea margin; coastal change; mapping 3D distribution of hydrogeologic properties; geological materials and human health; applications of airborne gravity gradient measurements; petroleum system processes; unconventional energy resources; earthquake simulations; uncertainty assessments; tsunamigenic earthquakes; detection of anomalous hydrothermal and volcanic activity; rates of magma production; geologic storage of carbon dioxide; modeling debris flows and rock avalanches; urban hazards; slip rate indicators; risk and vulnerability of communities to natural hazards; applied remote sensing; dynamics of volcanic tephra plumes; landforms associated with active faults; landscape change; valuating landscape and ecological services.

The postdoctoral fellowships are 2-year appointments. The closing date for applications is November 9, 2007. Appointments will start October 2008 or later, depending on availability of funds. A description of the program, research opportunities, and the application process are available at <http://geology.usgs.gov/postdoc>. The U.S. Geological Survey is an equal opportunity employer.

Program Contacts: Dr. Rama K. Kotra, rkotra@usgs.gov, 703-648-6271; Ms. Sarah Griffin-Bemis, sgriffin@usgs.gov, 703-648-7395.

U.S. Department of the Interior
U.S. Geological Survey

Baylor Geology offers M.S and Ph.D. research in a variety of subjects and in outstanding teaching and research facilities. Come visit our booth #615 at the 2007 GSA meeting in Denver, or visit our website at: <http://www.baylor.edu/Geology/>



BAYLOR UNIVERSITY

We are interviewing for 3 new tenure-track faculty positions at the GSA meeting – please see our ad in *GSA Today!* (1) contaminant hydrogeology, (2) Keck Professorship in Geophysics, and (3) paleoclimatology

based instruction in all class offerings. For a complete description of the requirements, go to <http://diversity.fullerton.edu/>

The Department currently has approximately 80 undergraduate majors, 25 MS students and 12 full-time faculty. Fullerton's location offers convenient access to coastal, mountain, and desert environments, providing many opportunities for field-based research and instruction. Abundant collaborative research and teaching opportunities exist within the Departments of Geological Sciences, Biological Sciences, Chemistry and Biochemistry and the Environmental Studies Program. Applicants are encouraged to visit <http://geology.fullerton.edu/> for additional information regarding research and curriculum.

To apply, please send (1) a detailed curriculum vita; (2) a letter of application; (3) a teaching statement that includes: a discussion of relevant course work and/or experience in preparation for teaching, a list of courses you would feel comfortable teaching, and a statement of your teaching philosophy; (4) a statement of your future research plans and goals; and (5) letters of recommendation from at least three references familiar with your teaching and research potential. Applicants and referees should send materials directly to: Search Committee Chair, Department of Geological Sciences, California State University, 800 N. State College Blvd., Fullerton, California 92834-6850.

Applications will be accepted until the position is filled. To insure full consideration, submit all application materials by November 19, 2007.

CSU Fullerton is an Equal Opportunity/Title IX/503/504/VEVRA/ADA Employer.

GEODYNAMICS, UNIVERSITY OF VERMONT

Department of Geology at the University of Vermont seeks an individual with experience in large scale tectonic systems for a tenure-track position available for the 2008 academic year. We seek to enhance the solid earth component of our program and compliment existing department strengths. Technical expertise could include: geophysics, petrology/geochemistry, rock-fluid interactions and isotope geology. Candidates should have experience in quantitative studies and field-data collection. The strongest candidates will possess a record of successful external funding, publications and teaching experience. The successful candidate will be expected to undertake an active program of research that leads to publication and presentation in

peer-reviewed scholarly outlets, and to seek extramural funding for that research. A Ph.D. in the geosciences is required at time of application. Appointment will be made at the Assistant or Associate level, commensurate with experience. Please send cover letter, CV and the names of three references as a pdf to geology@uvm.edu before Jan. 4, 2008. See www.uvm.edu/geology for further information. The University of Vermont is an Affirmative Action/Equal Opportunity employer. The Department is committed to increasing faculty diversity and welcomes applications from women and under-represented ethnic, racial and cultural groups and from people with disabilities. Applicants are requested to include in their cover letter information about how they will further this goal.

POSTDOCTORAL POSITION IN CARBON CAPTURE AND STORAGE, DUKE UNIVERSITY

The Duke University Climate Change Policy Partnership (www.env.duke.edu/institute/ccpp/) is seeking a Postdoctoral candidate to help carry out a comprehensive study of options for CO₂ sequestration on a national scale, including technical and economic feasibility, environmental implications, and social, political, and regulatory barriers. The ideal candidate will have expertise in carbon capture and storage technology, including one or more of the following areas: reservoir geology, economic geology, pipeline engineering, IGCC technology, and/or post-combustion capture technology. The Postdoctoral researcher will work with a team of other geologists, economists, policy/legal experts and engineers and is expected to translate findings into appropriate policy proposals that can complement national climate change legislation.

The position is located in Durham, NC, and is fully funded for two years, with potential for extension based on funding and mutual interest. Minimum salary is \$37,000, plus benefits. The position will remain open until filled.

TO APPLY: Send cover letter, CV and contact information for 3 references to Hallie Knuffman, hakk@duke.edu.

DEPARTMENT OF GEOLOGY AND GEOGRAPHY AUBURN UNIVERSITY

The Department of Geology and Geography at Auburn University invites applications for a tenure track **Assistant Professor** position in the field of **igneous petrology**. The successful candidate will be expected to



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

CHANGING THE WORLD OF GEOSCIENCES

teach at the undergraduate and graduate levels and to establish a productive record of independent research, extramural funding, and publication. The ideal applicant will have a strong balance of field and analytical research expertise in igneous petrology, with research and teaching interests in allied fields such as economic geology and tectonics.

A Ph.D. in Geology is required at the time of appointment. The candidate selected for this position, which begins August 2008, must meet eligibility requirements to work in the United States on the date the appointment is scheduled to begin and be able to communicate effectively in English.

Applicants should submit a detailed curriculum vitae, letter of application (1–2 pages) describing professional experience and research and teaching interests, copies of transcripts, and the names and contact information of at least three references. Applications should be sent to: Dr. Willis Hames, Geology Search Committee Chair, Department of Geology and Geography, 210 Petrie Hall, Auburn University, AL 36849-5224, USA. Applicants are encouraged to visit the AU Web site to learn more about Auburn University and the Geology program (www.auburn.edu/cosam/departments/geology_geography/index.htm). Review of applications will begin November 1, 2007 and will continue until a candidate accepts appointment.

Auburn University is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

BRYN MAWR COLLEGE GEOLOGY/LAB COORDINATOR

The Geology department seeks to fill an ongoing non-tenure track position beginning August 2008. Primary responsibilities include teaching the laboratory sections of three introductory courses each year in physical, historical and environmental geology and supervising advanced undergraduate teaching assistants. The successful candidate may also supervise undergraduate research projects and will offer one course each year in her or his specialty. The field of specialization is open, but should complement that of present faculty.

Candidates should have a strong interest in teaching. Those holding a Ph.D. are preferred.

Members of the department will be at the Denver GSA meeting in October. Applicants should send a letter describing teaching interests, a *curriculum vitae*, and addresses of three references by December 6, 2007, to Search, Department of Geology, Bryn Mawr College, 101 North Merion Avenue, Bryn Mawr, PA 19010.

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

GEOCHEMISTRY/PETROLOGY UNIVERSITY OF CALIFORNIA AT BERKELEY

The Department of Earth and Planetary Science at UC Berkeley invites applications for a tenure-track position in geochemistry/petrology at the Assistant Professor level. We seek an individual with research interests and/or approaches that will complement or add to our existing strengths (see <http://eps.berkeley.edu/>), and who will contribute to our core teaching in geology, geochemistry and petrology. We especially encourage applications from scientists whose research involves field or laboratory studies of Earth materials and processes, including qualified women and underrepresented minorities.

Please self-register and upload PDFs of, or email PDFs of, or mail a curriculum vitae, bibliography, statement of teaching and research interests, and the names and addresses (email and postal) of at least three references to: The self-registration URL: <http://gold.berkeley.edu:80/candidate/selfRegister.php?i=14>. After you self-register and upload your material, you should

see a URL you may provide to your letters of reference writers where they may upload PDFs of those letters. Please request that referees read the University's confidentiality statement, <http://apo.chance.berkeley.edu/evaltr.html> prior to uploading letters Email address: geosrch@eps.berkeley.edu

Mailing address: Geochemistry-Petrology Search Committee, University of California, Berkeley, 307 McCone Hall MC 4767, Berkeley, CA 94720-4767.

Applications should be postmarked by December 5, 2007; late applications mailed or posted to the URL after December 5, 2007, will not be considered. Fax applications will not be accepted. The University of California, Berkeley is an Affirmative Action Employer/Equal Opportunity Employer.

CLIMATE SCIENTIST ENVIRONMENTAL STUDIES DEPARTMENT MACALESTER COLLEGE

The Environmental Studies Department of Macalester College invites applications for a tenure-track climate scientist to begin Fall 2008. Appointment will be at the Assistant, Associate or Full Professor rank. We seek applicants who are committed to participating in a broadly interdisciplinary department. Specific areas of climate related interest could include climate dynamics, biosphere-climate interaction (including agricultural systems), biogeochemical cycles, climatology, meteorology, oceanography, geochemistry, and geophysics, among others. The successful candidate is expected to build and maintain an active research program with students. Teaching duties include Environmental Science, courses in the area of specialty, including climate change, and rotating responsibility for the Senior Seminar course. Competitive start-up funds are available. Send letter of application, CV, statement of teaching philosophy and research plans, and 3 letters of reference to Dr. Dan Hornbach, Chair, Department of Environmental Studies, Macalester College, 1600 Grand Ave., St. Paul, MN 55105. Applications received by October 15, 2007, will receive first consideration.

More information is at www.macalester.edu/provost/positions/index.html.

Macalester College is an Equal Opportunity/Affirmative Action Employer strongly encourages applications from women and members of underrepresented minority groups.

TENURE-TRACK ASSISTANT PROFESSOR OF GEOLOGY, ANGELO STATE UNIVERSITY

The Department of Physics at Angelo State University invites applications for a Tenure-track Assistant Professor of Geology to start on August 22, 2008. A Ph.D. in Geology is required. Demonstrated excellence in undergraduate teaching is required. Expertise in hydrogeology, geophysics, environmental geology, or mineralogy is preferred. Demonstrated excellence in distance education and the use of web-based technologies is desirable. The successful applicant will teach undergraduate classes in geology and physical science. We expect this faculty member to conduct research involving undergraduates. This growing university with 6,000 students has a scholarship endowment exceeding \$70 million and attracts many excellent students. Angelo State University is an Affirmative Action/Equal Opportunity Employer.

Women and minorities are encouraged to apply. For more information see www.angelo.edu/publications/employment/ or send e-mail to Andy.Wallace@angelo.edu.

TURNER POSTDOCTORAL FELLOW THE UNIVERSITY OF MICHIGAN

The Department of Geological Sciences invites applications for the Turner Postdoctoral Fellowship, a highly competitive two-year research fellowship in any field of the geological sciences. This highly competitive fellowship provides travel and research funds, as well as the standard package of benefits. The Department is interested in innovative research with preference for proposals that have a direct connection to the ongoing research of a faculty member. Visit our Department web page for more information on faculty and research (www.lsa.umich.edu/geo/). A complete application includes: a curriculum vitae, a research proposal (3 to 5 pages) and the names and addresses of at least three references. Applications are due by October 31, 2007, and can be submitted to: turnerpdf@umich.edu or Turner Postdoctoral Committee, Department of Geological Sciences, 1100 North University Ave., University of Michigan, Ann Arbor, MI 48109-1005.

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



Energy Resources
Faculty Position
Rice University
Department of Earth Science

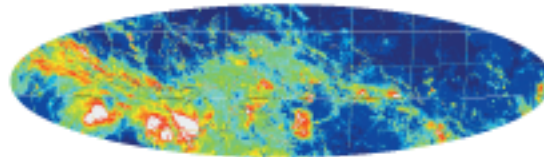
Houston is the energy capital of the world. The Earth Science department at Rice University anticipates an opening in Energy Resources and seeks an outstanding scientist at the junior level who will forge strong ties to the energy industry in one or more research areas, including basin analysis and stratigraphy, hydrocarbon systems, sedimentary processes, fluid flow in porous media, or carbon sequestration. We particularly encourage applications from and nominations of women and minorities.

Successful candidates are expected to drive active research programs, supervise graduate research and teach courses for undergraduate and graduate students. Details about the department and its facilities can be found at <http://earthscience.rice.edu>.

Applications received by November 1st, 2007 will receive fullest consideration.

Please send a resume, research and teaching statements, and names of five or more references to:
Search Committee Chair
Earth Science Department, MS-126
Rice University, PO Box 1892
Houston, TX 77251-1892.

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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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**HYDROGEOLOGY (TENURE-TRACK ASSISTANT
PROFESSOR), CENTRAL MICHIGAN UNIVERSITY**

The Department of Geology at Central Michigan University invites applications for a tenure-track Assistant Professor position in Hydrogeology beginning August 2008 or earlier. A state-supported university with an on-campus enrollment of more than 20,000 students, CMU is a Doctoral Research University recognized for strong undergraduate education and a range of focused graduate programs and research. The Geology Department (www.gel.cmich.edu) consists of nine full-time faculty and 30–40 undergraduate majors. The department has a very strong record of incorporating research into the undergraduate curriculum and has a variety of well-equipped teaching and research facilities.

The successful candidate will be appointed at the Assistant Professor level and will be expected to (1) enthusiastically and effectively teach service courses, as well as courses for majors and minors, including hydrogeology; (2) develop an active research program that merits external funding and that will involve undergraduate students; (3) consistent with one's background, develop and teach new courses as needed by the department; (4) develop collaborations with colleagues in geology and related departments; and (5) contribute to CMU's interdisciplinary environmental studies and earth science education programs.

Required qualifications include a Ph.D. in Geology or related field, excellent written and oral communication skills, demonstrated potential for teaching excellence, a demonstrated commitment to innovative field-based research involving students, and an ability to link their

research program to their teaching agenda. Applicants must have demonstrated research expertise in hydrogeology. The department is particularly interested in applicants who demonstrate expertise in the area of groundwater-surface water-atmosphere interactions; groundwater-rock interactions; environmental geochemistry, geochemical cycling, biogeochemistry or geomicrobiology; environmental geophysics, or fluid flow modeling.

Preferred qualifications include: postdoctoral experience, grant-writing experience, a record of teaching courses in hydrogeology or related areas, demonstrated ability to teach introductory geology courses as well as upper-level courses in geophysics, low temperature/environmental geochemistry, biogeochemistry, glacial geology, or geomorphology, and/or an ability to develop a research program focusing on relevant problems related to the Great Lakes.

Interested persons must submit a letter of application, curriculum vita, copies of transcripts, a statement of proposed research agenda, a statement of prior teaching experience and philosophy, and three letters of reference to: Hydrogeology Search Committee Department of Geology Central Michigan University Mount Pleasant, MI 48859.

**INDIANA UNIVERSITY-PURDUE UNIVERSITY
FORT WAYNE (IPFW), STRUCTURAL GEOLOGY/
NEOTECTONICS/APPLIED GEOPHYSICS**

IPFW seeks to fill a full-time, tenure-track position at the Assistant Professor level in structural geology/neotectonics/applied geophysics. The successful applicant for the position will have a Ph.D. and be expected to share with other faculty responsibilities for teaching introductory geology, introductory planetary geology, introductory climatology, and regional field geology. Over a multi-year cycle, the successful applicant will teach additional courses in his/her specialty, including structural geology and geomorphology. Familiarity and experience with GIS will be a plus. Geosciences faculty are expected to maintain an active research program

and to involve undergraduate students in research. IPFW's geology research program is well-supported in both equipment (e.g. thin section lab, SEM, XRD) and opportunities for new faculty.

There are four other full-time faculty in the department. IPFW is a comprehensive university. Send a letter of application, statement of teaching and research interests, curriculum vitae, copies of transcripts, and the names and contact information for three references to: Prof. J. Farlow, Search Committee Chair, Department of Geosciences, Indiana University-Purdue University Fort Wayne, 2101 East Coliseum Boulevard, Fort Wayne, IN 46805. Review of applications will begin November 1, 2007. IPFW is an equal opportunity, equal access, affirmative action university.

**DEPARTMENT OF ENVIRONMENTAL SCIENCES
THE UNIVERSITY OF TOLEDO**

The Department of Environmental Sciences at The University of Toledo invites applications for a tenure track position at the **Assistant Professor** level in **Earth Surface Processes** to complement existing university and departmental strengths in ecology, hydrology, geology, geography and environmental engineering. Competitive candidates must have a Ph.D. in the geosciences or a closely related field; postdoctoral experience is desirable. The successful candidate will be expected to provide instruction at the introductory level for non-majors as well as for the undergraduate and graduate programs in geology and environmental science.

Our department is a rapidly growing, multidisciplinary, research-oriented academic unit with 23 tenured/tenure-track full-time faculty. The primary research focus envisioned for the candidate is on physical interactions at the land-lake-air interfaces, with application to the Lake Erie Basin. Applicants should have expertise in the application and utilization of remote sensing and computerized geospatial analysis in their research. Research opportunities are particularly promising in the western Lake Erie basin, where the confluence of an intensively used agro-urban watershed and an economically and ecologically critical water body produce an ideal natural laboratory for environmental research. This person will be expected to develop an externally funded research program as well as collaborate with colleagues in ongoing large scale, multidisciplinary research projects including watershed investigations, remediation and wetlands restoration.

It is anticipated that this position will begin in mid-August 2008. Review of applications will begin October 5, 2007, and continue until the position is filled. Salary, fringe benefits and start-up funds are competitive. Applicants should submit curriculum vitae, descriptions of teaching and research interests, and the names and addresses of three references to: Alison Spongberg, Chair, Search Committee, Earth Surface Processes, Department of Environmental Sciences, Mail Stop #604, University of Toledo, Toledo, OH 43606-3390. The University of Toledo is an equal opportunity, equal access, affirmative action employer and educator. M/F/V/D are encouraged to apply. For more information visit the Departmental Web site at www.eescience.utoledo.edu.

Opportunities for Students

UCLA Ion Microprobe Student Workshop (Nov. 12–16, 2007). The W.M. Keck Foundation Center for Isotope Geochemistry at UCLA invites interested graduate or prospective graduate students to attend a five day workshop for research training in ion microprobe applications. We seek motivated applicants involved in geochemical, geochronologic, cosmochemical, biogeochemical, or environmental research that can benefit from the relatively non-destructive capability of ion microprobes to obtain high spatial resolution elemental and radiogenic/stable isotopic compositions from solid materials. The workshop will occur within UCLA's National Facility for SIMS (secondary ionization mass spectrometry) research (<http://sims.ess.ucla.edu/>) which features a high-resolution, high sensitivity CAMECA IMS 1270. SIMS theory and hands on instruction will be provided by UCLA faculty and researchers associated with the facility. NSF's Instrumentation and Facilities program will sponsor travel, accommodation costs, and course materials. Please submit applications via <http://sims.ess.ucla.edu/SIMSWORKSHOP2007.html>. Successful applicants will be notified by 9/15/07.



Earth Systems Science
Faculty Position
Rice University
Department of Earth Science

The Earth's surface is the principal interface between the lithosphere, hydrosphere, cryosphere, biosphere, and atmosphere, which interact at a variety of spatial and temporal scales. The Earth Science department at Rice University anticipates an opening in Earth Systems Science and seeks an outstanding scientist at the junior level who studies aspects of these interactions by integrating theory and observations. We particularly encourage applications from and nominations of women and minorities.

Successful candidates are expected to drive active research programs, supervise graduate research and teach courses for undergraduate and graduate students. Details about the department and its facilities can be found at <http://earthscience.rice.edu>.

Applications received by November 1st, 2007, will receive fullest consideration.

Please send a resume, research and teaching statements, and names of five or more references to:

Search Committee Chair
Earth Science Department, MS-126
Rice University, PO Box 1892
Houston, TX 77251-1892.

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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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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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Visiting Fellowships—Institute for Rock Magnetism. Applications are invited for visiting fellowships (regular and student) lasting for up to 10 days during the period from July 1 through December 31, 2008. Topics for research are open to any field of study involving fine particle magnetism, but preference will be given to projects relating magnetism to geological or environmental studies, or to fundamental physical studies relevant to the magnetism of Earth materials.

A limited number of travel grants of up to \$750 are available to cover actual travel costs. No funds are available for per diem expenses. Application forms and information necessary for proposal preparation may be obtained from IRM manager Mike Jackson at the address below, or online at www.irm.umn.edu.

Short proposals (two pages, single-spaced text plus two forms and necessary figures and tables) are due by October 30, 2007, for consideration by the IRM's Review and Advisory Committee. Successful applicants will be notified in December 2007. Proposals should be sent by e-mail to irm@umn.edu, or by post to: Facilities Manager, Institute for Rock Magnetism, University of Minnesota, 291 Shepherd Laboratories, 100 Union St. SE, Minneapolis, MN 55455-0128.

M.S. and Ph.D. Positions in Hydrogeology. Applicants are invited for new M.S. and Ph.D. student opportunities in hydrogeology in the Department of Geological Sciences at the University of Missouri—Columbia. Our research is focused on flow and transport processes in sedimentary rocks. Ongoing and new projects include carbon sequestration, groundwater flow and contaminant transport through karst aquifers, transport of sediment through karst aquifers, the formation of sediment-hosted base metal mineral deposits, flow of hydrocarbons and water in viscous and visco-elastic porous media. We use a wide range of complementary analytical geochemical, numerical modeling, and field-based tools in our research, and have excellent resources for research on site and through collaborations with other institutions. Stipends for student positions are available through both research and teaching assistantships, depending on the project, and currently pay at least a nine-month academic year salary of between \$15,000 and \$17,000. Applications are being sought for positions beginning in both January and August, 2008. For more information, please contact Dr. Martin Appold (appoldm@missouri.edu; +1-573-882-0701) or Dr. Carol Wicks (wicksco@missouri.edu; +1-573-882-3231), or visit our department Web site at <http://geology.missouri.edu/>.

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