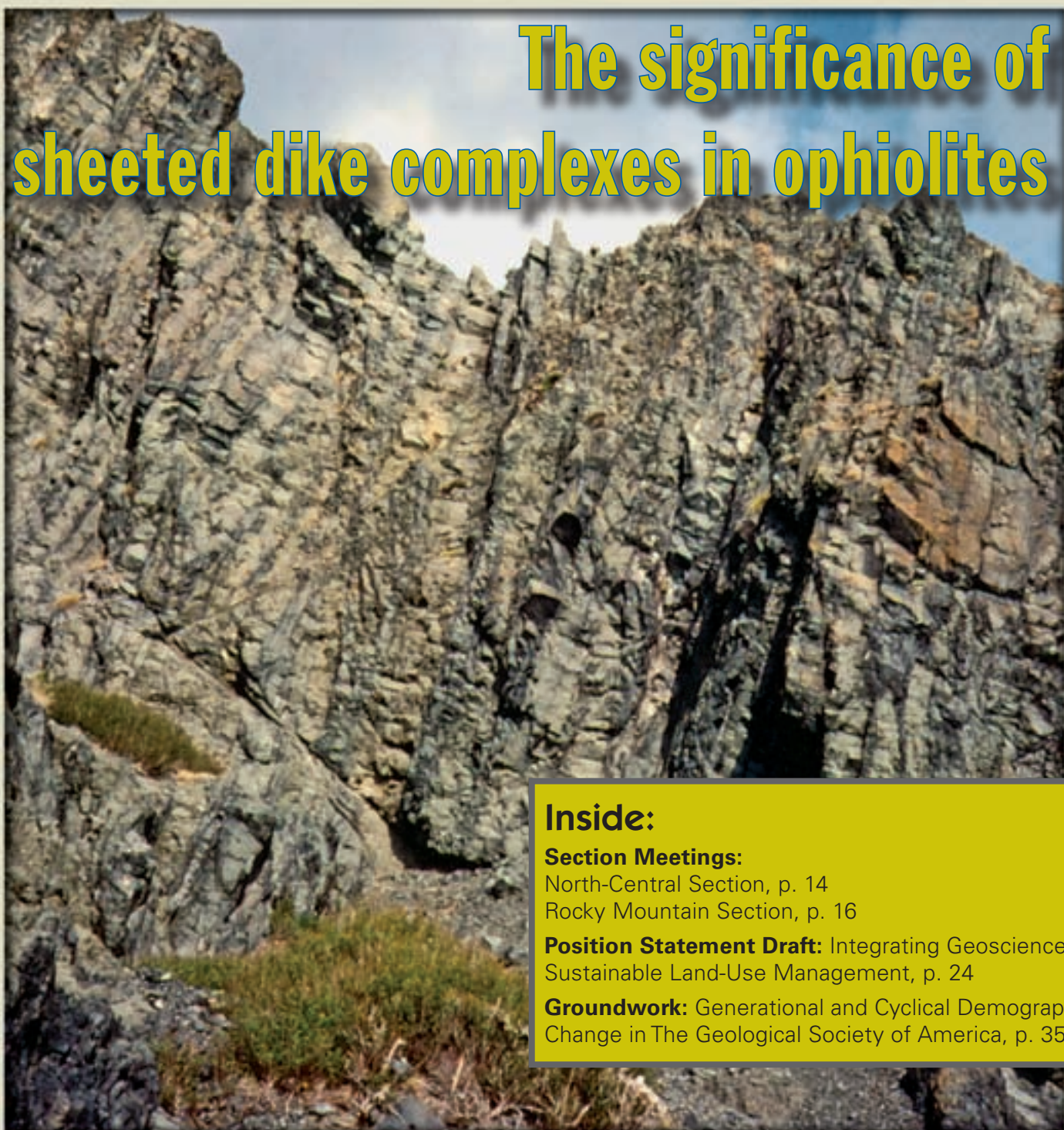


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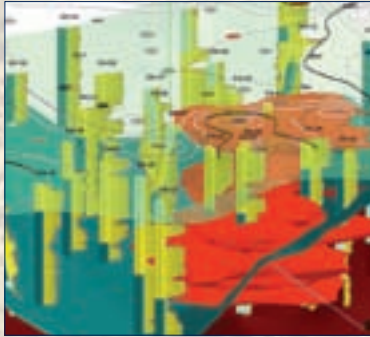
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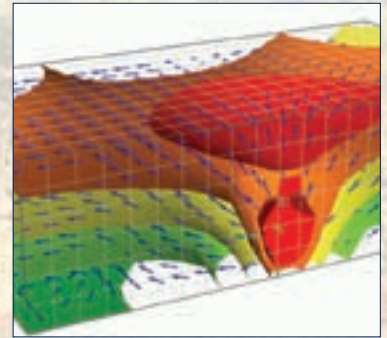
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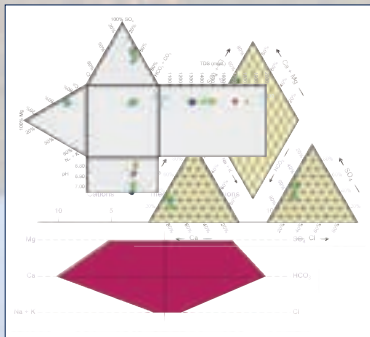


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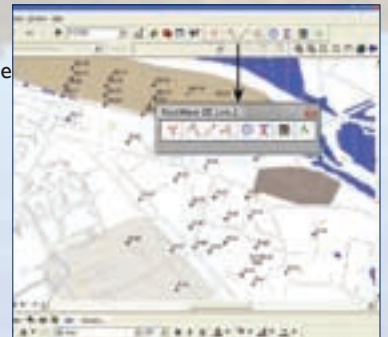
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4 **The significance of sheeted dike complexes in ophiolites**

Paul T. Robinson, John Malpas, Yildirim Dilek, and Mei-fu Zhou

**Cover:** Sheeted dike complex of the Cretaceous Kizildag ophiolite, SW Turkey. Steeply NW-dipping sheeted dikes here are truncated by dike-parallel and mineralized normal faults of an intra-oceanic origin. Photo by Y. Dilek. See "The significance of sheeted dike complexes in ophiolites" by P.T. Robinson et al., p. 4–10.



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**Errata:**

The April/May 2008 issue of *GSA Today* (v. 18, no. 4/5, p. 13) identifies a picture as "Horseshoe Canyon of the Colorado River" when in fact the photo is Horseshoe Bend, downstream of Glen Canyon Dam in the Colorado River. Horseshoe Canyon is in an arid location area west of Green River in Utah, USA.

The September *GSA Today* Foundation Update (v. 18, no. 9, p. 68) attributed the "Digging Up the Past" experience relayed there to Monte D. Williams. The experience, which was paraphrased and edited for length, was that of GSA Senior Member Monte D. Wilson of Boise, Idaho, USA.

*GSA Today* regrets these errors.

# The significance of sheeted dike complexes in ophiolites

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## ABSTRACT

Sheeted dike complexes, in which dike intrudes dike without intermediate screens of gabbro or pillow lava, have long been considered key features of oceanic lithosphere and ophiolites formed in extensional environments. The presence of a sheeted complex implies an approximate balance between spreading rate and magma supply, such that there is just enough melt to fill newly formed fractures produced by spreading. Such a balance appears to exist at mid-ocean ridges, where both the spreading rate and magma supply are probably linked to mantle convection, and thus sheeted dikes appear to be a major part of the ocean crust. In contrast, ophiolites, which are formed or modified in suprasubduction zone environments, rarely have large, well-developed sheeted dike complexes, because magma supply and spreading rate are not linked in the same way. In suprasubduction zone environments, the spreading rate is controlled largely by the rate of slab rollback, whereas the magma supply is controlled by the local temperature profile, the lithology of the subducting crust and mantle wedge, the history and degree of melting of the mantle source, and the abundance and nature of fluids. Because spreading rate and magma supply are rarely balanced in these environ-

ments, we suggest that sheeted dikes, rather than being key elements of ophiolites, may instead be unusual features in such bodies. Thus, care must be exercised in using ophiolites to investigate spreading processes at mid-ocean ridges.

## INTRODUCTION

Ophiolites are fragments of oceanic crust and upper mantle that have been uplifted and emplaced on continental margins or in accretionary prisms and island arcs. According to a 1972 GSA Penrose Conference, an idealized, complete ophiolite contains, from the base upward, mantle peridotites, layered ultramafic rocks and gabbros, isotropic gabbros, a sheeted dike complex, and an extrusive sequence, composed of pillowed and massive lavas, overlain by radiolarian chert and/or pelagic limestone (Anonymous, 1972; Dilek, 2003). The presence of a sheeted dike complex has been interpreted as an essential component of ophiolites, as exemplified by the Troodos ophiolite of Cyprus (Fig. 1A), where such complexes were first recognized (Gass, 1968). Sheeted dikes, which are tabular intrusions of magma with no intervening screens of other host rock (Fig. 1B), are believed to form in extensional environments where the faults and fractures produced by seafloor spreading are filled with new magma flowing laterally and vertically along a narrow axial zone beneath the spreading center (Vine and Matthews, 1963; Gass, 1968; Kidd and Cann, 1974; Dilek et al., 1998). In 1968, when Gass correctly identified the sheeted complex in Troodos, mid-ocean ridges were the only environment where such spreading was known to occur; thus, he suggested a mid-ocean ridge environment for the formation of this ophiolite.



Figure 1. Sheeted dikes of the Cretaceous Troodos ophiolite, Cyprus. (A) A typical outcrop of sheeted dikes in which dike intrudes dike with no intervening host rock. Individual dikes range from a few centimeters to ~0.5 m in this outcrop (Baragar et al., 1989). Note the inclined dikes on the right side of the picture. These earlier dikes were probably tilted by listric faulting along the spreading axis (Varga and Moores, 1985) and then intruded by the younger vertical dikes in the center. (B) Close-up view of sheeted dikes in Troodos showing contact relationships. Arrows point to one-sided chilled margins.

Sheeted dikes similar to those in ophiolites have since been observed in the walls of oceanic fracture zones (e.g., at Hess Deep; Stewart et al., 2002, 2003) and have been drilled at Deep-Sea Drilling Project–Ocean Drilling Project (DSDP-ODP) Hole 504B south of the Costa Rica Rift (e.g., Alt et al., 1996; Bach et al., 1996; Dilek et al., 1996; Dilek, 1998). Although not widely exposed on the seafloor, such dikes are believed to be a major component of the ocean crust, forming the lower part of seismic layer 2 and perhaps the upper part of layer 3 (Detrick et al., 1994), where they are interpreted to form the plumbing system between sub-rift magma chambers and the overlying extrusive rocks.

Oceanic lithosphere is produced at different rates along modern spreading centers, leading to different structural architectures (Karson, 1998). Fast-spreading mid-ocean ridges are generally characterized by a voluminous magma supply and have well-defined convex axial highs, whereas slow-spreading ridges have a lower magma supply and are characterized by axial grabens and extensive tectonic disruption (Phipps Morgan et al., 1994; Cannat et al., 1995). Based on these observations, many workers have interpreted ophiolite complexes in the same manner. Thus, well-developed sheeted complexes showing little tectonic disruption have been interpreted as the products of fast-spreading centers, whereas poorly developed complexes with extensive disruption were thought to have formed at slow-spreading ridges (e.g., Nicolas et al., 1999).

We suggest that such a generalization is probably not valid and that direct correlations between in situ oceanic lithosphere and ophiolites are rarely possible. Although probably well developed in modern ocean crust, sheeted dikes are rare in ophiolites. Large, well-developed sheeted complexes are found only in a few bodies, such as the Troodos ophiolite of Cyprus (Gass, 1968; Baragar et al., 1989), the Semail ophiolite of Oman (Searle and Cox, 1999; Umino et al., 2003), the Kizildag ophiolite of Turkey (Dilek and Thy, 1998), and examples from Newfoundland (Church and Riccio, 1974; Strong and Malpas, 1975); most other ophiolites lack sheeted dikes entirely or contain only small, discontinuous bodies. Some ophiolites contain sill complexes rather than dikes (Hopson et al., 2008). The paucity of sheeted dikes in many ophiolites implies either that they did not form originally as part of the ancient oceanic lithosphere or that they were selectively removed during tectonic disruption of the crust, either during seafloor spreading or during ophiolite emplacement. However, ophiolites that lack sheeted dike complexes commonly have the other characteristic lithologies included in the Penrose Conference (Anonymous, 1972) definition, such as ultramafic rocks, gabbros, lavas, and pelagic-hemipelagic sedimentary rocks, and display no significant strain associated with emplacement tectonics. Because it is difficult to envisage the widespread, selective tectonic removal of the portion of an ophiolite that originally existed between the volcanic and plutonic rocks, we suggest that well-developed sheeted dike complexes rarely form in such bodies because the tectonic environment of formation of many ophiolites is different from that of mid-ocean ridges.

In this paper, we discuss the evidence for the formation of ophiolites in suprasubduction zones, consider the processes involved in the development of sheeted dikes, and show why such complexes are rare in ophiolites. We suggest that sheeted

dikes, rather than being considered necessary elements of ophiolites, should be viewed as possible—but not essential—features in such bodies.

## FORMATION AND EMPLACEMENT OF OPHIOLITES

Increasingly detailed tectonic and geochemical studies over the past 30 years have shown that most ophiolites contain volcanic and plutonic rocks with clear suprasubduction zone geochemical signatures (Pearce, 2003, and references therein). For example, ophiolitic lavas are dominated by arc tholeiites, back-arc basalts, andesites, dacites, and depleted lavas resembling boninites, most of which are distinctly different from mid-ocean ridge and ocean island basalts (Table 1) and are found only in modern suprasubduction zone environments. Some tholeiitic basalts erupted in suprasubduction zone environments have major oxide contents similar to those of mid-ocean ridge lavas but can easily be distinguished on the basis of their trace element compositions (Fig. 2). Compared to typical mid-ocean ridge basalt (MORB), suprasubduction zone magmas are characterized by significant enrichment in large ion lithophile elements (LILE: K, Rb, Cs, Th) and light rare earth elements (LREE) (Pearce, 1982) and depletion in high field strength elements (Ti, Nb, Ta, Hf) (Pearce, 1982; Shervais, 1982). Island arc basalts, for example, are easily recognized on mantle-normalized trace element spider diagrams by their marked negative Nb and Ta anomalies (Fig. 2). Many ophiolites also contain high MgO–high SiO<sub>2</sub> lavas, such as boninites, that in modern environments are restricted to forearc regions.

A few rare occurrences of lavas with arc signatures are currently being erupted at modern ridge axes, such as in the Woodlark Basin (Perfit et al., 1987) and on the southern Chile Ridge (Klein and Karsten, 1995; Karsten et al., 1996); however, these are anomalous features in the ocean basin. The arc-like lavas being erupted in the Woodlark Basin are due to subduction reversal, so that seafloor spreading is now taking place in what used to be a backarc basin above a subduction zone dipping SW beneath the Solomon islands (Abbott and Fisk, 1986; Johnson et al., 1987). The collision of the Ontong Java Plateau with this subduction zone at about the middle or late Miocene halted the subduction and caused a subduction jump and polarity reversal beneath the Solomon Islands (Weissel et al., 1982). The southern Chile Ridge is being subducted beneath

Table 1. Average compositions of common oceanic basaltic rocks

	N-MORB	E-MORB	OIB	Alk-Oliv	Arc Thol	Bon
SiO <sub>2</sub>	50.4	51.2	49.2	47.6	51.7	53.6
TiO <sub>2</sub>	1.36	1.69	2.57	3.23	1.36	0.26
Al <sub>2</sub> O <sub>3</sub>	15.2	16	12.8	15.7	16.57	13.5
FeO <sub>t</sub>	9.31	8.46	11.4	13.4	8.4	8.6
MnO	0.18	0.16	0.17	0.19	0.16	0.15
MgO	9	6.9	10	5.6	6.6	10.2
CaO	11.4	11.5	10.8	7.9	10.8	12.2
Na <sub>2</sub> O	2.3	2.7	2.1	4.0	3.0	0.92
K <sub>2</sub> O	0.09	0.4	0.5	1.5	0.34	0.41
P <sub>2</sub> O <sub>5</sub>	0.14	0.15	0.25	0.35	0.18	0.04
Total	99.38	99.16	99.79	99.47	99.11	99.88

Note: N-MORB—normal mid-oceanic ridge basalt; E-MORB—enriched mid-oceanic ridge basalt; OIB—oceanic island basalt; Alk-Oliv—alkali-olivine basalt; Arc Thol—arc tholeiitic basalt; Bon—boninite.

A

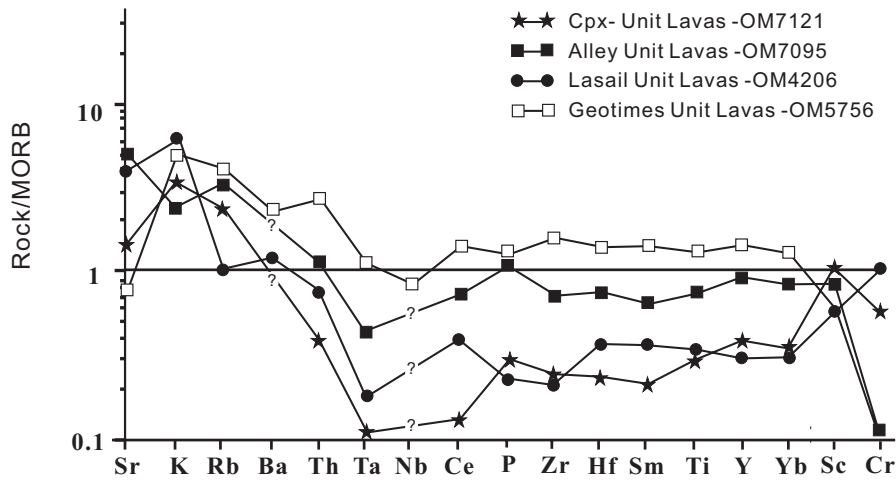
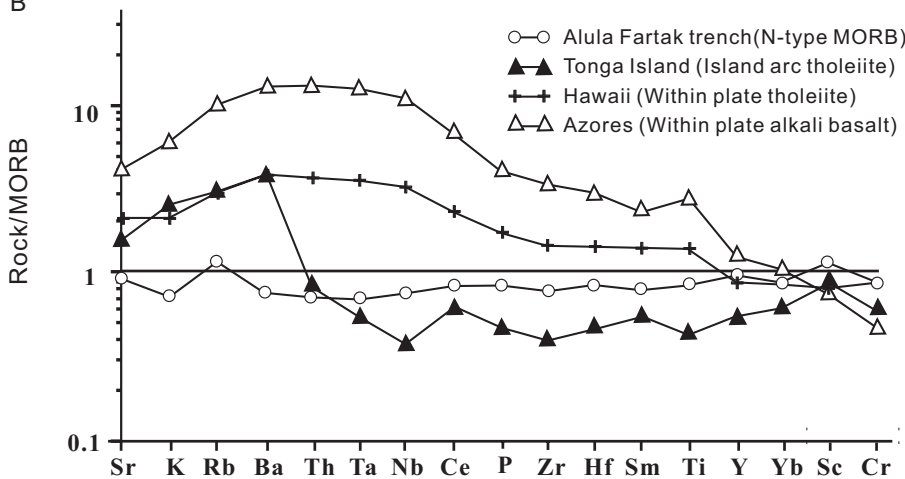


Figure 2. Mid-ocean ridge basalt (MORB)-normalized trace element diagrams comparing lavas of the Cretaceous Oman ophiolite to those of modern oceanic environments (after Alabaster et al., 1982). Only lavas of the oldest Geotimes unit of the Oman ophiolite have compositions similar to MORB, but even these are enriched in large ion lithophile elements, such as Ba, K, and Rb (Fig. 2A), indicating subduction influence. The other units compare closely with island arc tholeiites of the Tonga Islands in the SW Pacific (Fig. 2B), which are characterized by negative Nb and Ta anomalies. The Oman volcanic rocks look distinctly different from other within-plate type ocean island basalts. Most other ophiolites show suprasubduction zone geochemical signatures comparable to the Oman ophiolite. N-type MORB—normal MORB.

B



the South American continent, and this process may account for the anomalous trace element signatures (i.e., weak Nb anomaly, slight enrichment of LILE) and modest variations in the Pb, Sr, and Nd isotope ratios (consistent with contamination of its mantle source by subducted terrigenous sediment and altered oceanic crust) of the erupted lavas (Sturm et al., 2000).

These isolated examples cannot explain the widespread occurrence of suprasubduction zone lavas in ophiolites. For example, the Troodos ophiolite of Cyprus, long considered to be a fragment of normal oceanic lithosphere, contains only arc tholeiites, andesites, dacites, and rhyodacites accompanied by boninitic lavas (Robinson et al., 1983; McCulloch and Cameron, 1983; Malpas and Langdon, 1984; Robinson and Malpas, 1990; Bednarz and Schmincke, 1994; Dilek and Flower, 2003); the Oman ophiolite contains a range of lava compositions, most with suprasubduction zone signatures (Alabaster et al., 1982; Ishikawa et al., 2002), and the rocks of the Bay of Islands ophiolite of Newfoundland have trace element signatures typical of suprasubduction zone environments (Jenner et al., 1991; Suhr and Edwards, 2000).

Some ophiolites also contain remnants of volcanic and plutonic rocks comparable to those found in modern ocean crust, suggesting a compound origin (e.g., Shervais and Kimbrough, 1985; Batanova and Sobolev, 2000; Zhou et al., 2000; Malpas et al., 2003). In such cases, it is generally postulated that fragments of oceanic lithosphere that formed originally at mid-ocean ridges were trapped above intraoceanic subduction zones, where they were invaded by, reacted with, and partially replaced by, suprasubduction zone melts (Dilek and Flower, 2003; Malpas et al., 2003). In other cases, such as in the Coast Range ophiolite of California and the Josephine ophiolite of Oregon, MORB lavas intrude suprasubduction rocks, possibly as the result of ridge collision and/or rift propagation into an arc or forearc region (Shervais et al., 2004; Harper, 2003). However, it is now generally accepted that the majority of ophiolites are both formed and emplaced in suprasubduction zone environments (e.g., Stern and Bloomer, 1992; Shervais, 2001; Pearce, 2003).

Moore's (1982) classification of ophiolites into Cordilleran and Tethyan types (now referred to as Sierran and Mediterranean types,

respectively—see Dilek, 2003) based on their emplacement mechanisms. Sierran-type ophiolites occur in accretionary-type orogenic belts where they structurally overlie subduction-accretion complexes and are incorporated into active continental margins through the growth and uplift of the underlying accretionary prisms. Mediterranean ophiolites structurally overlie passive continental margins and micro- and ribbon continents and are emplaced by partial subduction of these buoyant crustal entities beneath them. Ophiolites that evolved in restricted Mediterranean-type marginal basins may have a typical Penrose Conference-type (Anonymous, 1972) pseudostratigraphy, and the time difference between their igneous accretion and tectonic emplacement is commonly short, perhaps >10 m.y. (Dilek et al., 2005). In contrast, Sierran-type ophiolites are believed to have formed in active margins facing large ocean basins, such as the modern western Pacific region, where continuous subduction persisted for prolonged periods. Such ophiolites display a highly heterogeneous internal structure with igneous ages spanning 50 m.y. or more. However, many of these differences may simply reflect different stages of evolution of the ophiolites rather than fundamental differences in their formation. What is apparent is that most Sierran-type ophiolites lack sheeted complexes entirely; others may have isolated dike swarms or small enclaves of sheeted dikes (Dilek et al., 1991; Beccaluva et al., 2004). Sheeted dikes are commonly better developed in Mediterranean-type ophiolites, but even in these bodies, large, well-developed sheeted complexes, such as those observed in Cyprus and Oman, are rare. Why do sheeted dikes occur in some ophiolites and not in others, and why are such complexes rare?

### SPREADING VERSUS MAGMA SUPPLY RATES IN OCEANIC CRUST FORMATION

Sheeted dikes form when magma is intruded into cracks and fissures produced by tensile stresses. These magma-filled fractures propagate vertically and laterally beneath narrow rift axes. When the roof of the magma chamber ruptures because of reservoir replenishment from a buoyant melt zone near the Moho, mafic melt that has accumulated along the neutral buoyancy region (dike-gabbro boundary) starts ascending to form dike injections (Ryan, 1994). Thus, for a large, well-developed sheeted complex to form, there must be an approximate balance for an extended period between spreading rate and magma supply so that sufficient melt is available to keep pace with spreading. If the rate of spreading exceeds the rate of magma supply, the crust will be disrupted tectonically via amagmatic extension, and few or no sheeted dikes will form. If the magma supply exceeds the spreading rate, excess melt may form plutons underplating the extrusive sequence and the sheeted dikes or may cause local thickening of the crustal section by magmatic inflation.

In mid-ocean ridge environments, the rate of spreading appears to be approximately related to the rate of magma supply. Thus, fast-spreading ridges (e.g., portions of the East Pacific Rise) produce voluminous magma over a wide area beneath the ridge (Fig. 3A) (Phipps Morgan et al., 1994). The high magma supply rates produce an axial rift zone that is marked by the existence of a temporally continuous magma lens (Sinton and Detrick, 1992) and a topographically well-defined

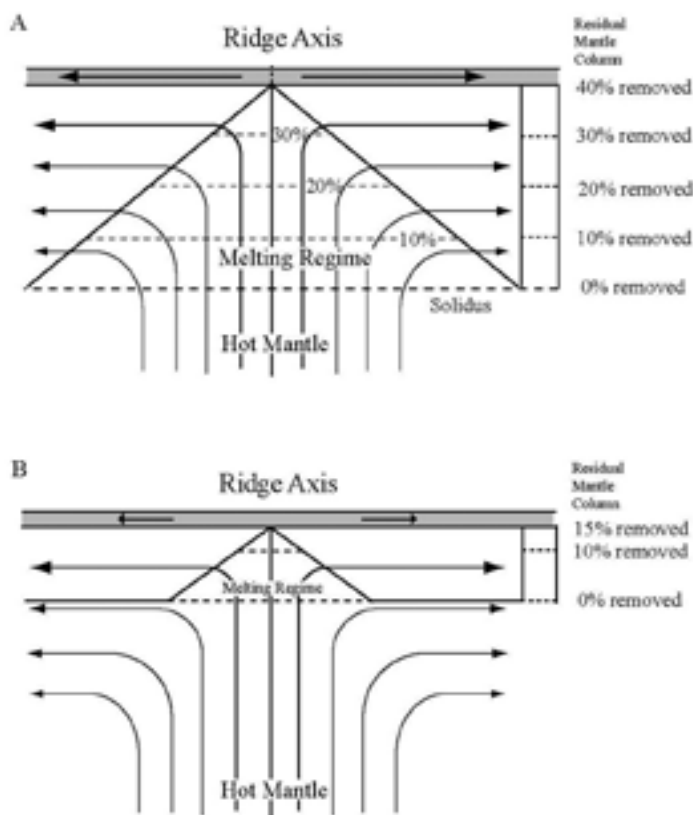


Figure 3. Melting relationships beneath fast- and slow-spreading ridges (after Malpas and Robinson, 2000). (A) Upwelling of mantle beneath a fast-spreading ridge produces partial melting over a large area and results in removal of 30%–40% of the mantle column, feeding large magma supply rates in a sustained mode and tempo. (B) Beneath slow-spreading axes, there is a diminished partial melting regime with removal of 10%–15% of the mantle column. This regime is responsible for a magma-poor spreading environment, in which magma chambers are small and ephemeral.

ridge crest reminiscent of shield volcanoes (e.g., Macdonald et al., 1993a, 1993b; Scheirer and Macdonald, 1993). On the other hand, slow-spreading ridges are associated with more restricted melting, and the magma supply is greatly reduced, creating an environment in which tectonic extension via crustal stretching and faulting predominates, so that the axial zone is marked by a deep graben. At ultraslow-spreading ridges, such as the Southwest Indian Ridge or the Gakkel Ridge, magma supply is small and episodic, and the crust is tectonically disrupted by detachment faulting, leading to exposures of the lower crust and upper mantle on the seafloor (Dick, 1989; Dick et al., 1991; Michael et al., 2003; Jokat et al., 2003).

There appears to be, therefore, an approximate balance between spreading and magma supply rates at modern mid-ocean ridges. Such a balance is also suggested by the relatively uniform seismic thickness of in situ oceanic crust (~6 km), although it is clear that the seismic Moho and petrologic Moho (i.e., crust-mantle lithologic boundary) do not always correlate with one another, as determined in some ophiolitic complexes (Malpas, 1973; Malpas and Stevens, 1978) and in modern oceanic lithosphere (Muller et al., 1997; McClain, 2003).

The correlation between spreading rate and magma supply at mid-ocean ridges probably reflects the relatively simple

nature of the system. Mid-ocean ridge lavas are sourced from a dry, relatively homogeneous mantle with a constant geotherm in which melting is almost entirely dependent on decompression.

It is difficult to apply a spreading-rate-controlled model of igneous accretion to ophiolites that form in suprasubduction zone environments. In such environments, the spreading rate and magma supply are not so clearly linked. Suprasubduction zone spreading rate is controlled largely by subduction rollback, which is the major cause of lithospheric extension at a convergent plate boundary (Hamilton, 1995). The edge force of "trench suction" places the overriding lithosphere in a state of tension as the subduction zone moves oceanward under the influence of the negative buoyancy of the cold, dense descending slab. The rate of slab rollback may be related to a number of factors (see summaries by Forsyth and Uyeda, 1975; Jarrard, 1986), amongst which the most important may be the angle of subduction; steeply dipping zones such as those of the western Pacific Ocean might be expected to retreat more rapidly than the more shallow-dipping zones of the eastern Pacific (Schellart et al., 2006). The angle of subduction must itself be related to the age and density of the subducted oceanic lithosphere, with younger, hotter material being more buoyant than older, colder material (Stern and Bloomer, 1992). However, the overall rate of convergence and the absolute speed of the overriding plate (Cross and Pilger, 1982) may also be controlling factors—shallow-dipping subduction is invariably associated with high convergence rates. Whatever the specific mechanisms of subduction rollback may be, the multitude of competing forces present along a convergent margin negate the likelihood of rollback being as regular and steady-state as mid-ocean ridge spreading.

### FORMATION OF SHEETED COMPLEXES

While the rate of spreading in the upper plate within subduction environments is linked directly to the rate of subduction rollback, the magma supply rate is not. Suprasubduction zone magma supply rates are related to the local temperature profile, the lithology of the subducting crust and mantle wedge, the history and degree of melting of the mantle source, and the abundance and nature of fluids (Kincaid and Hall, 2003). The paucity of sheeted dikes in many ophiolites suggests that spreading rates in suprasubduction zone environments are commonly not matched by equal rates of magma supply. This inference is consistent with the thin nature of ophiolitic crust compared to modern oceanic crust in present-day major ocean basins (Coleman, 1977); that is, spreading in suprasubduction zones is dominated by tectonic extension, which results in crustal thinning.

Although magma supply in suprasubduction zones can be voluminous, eruptions are concentrated in the arc portions of the zones and are focused on individual volcanoes. Magma supply rates are generally lower in fore-arc and backarc regions, which are characterized by high extensional strain. These are the regions in which most ophiolites are believed to form, because ophiolites rarely contain the explosive volcanic materials characteristic of arc volcanoes.

Many ophiolites lack a coherent internal structure due to tectonic disruption during their formation and emplacement,

and in some cases, pillow lavas rest directly in eruptive contact on mantle peridotites with no intervening gabbros or sheeted dikes (Dilek and Thy, 1998), a situation similar to that at modern ultraslow-spreading axes (e.g., Gakkel Ridge). In these cases, the pillow lavas must have been fed from magma sources, perhaps represented by gabbroic rocks in the mantle sequence (cf. Cannat et al., 1995), resulting in the appearance of individual dikes. Recognition of consanguineous magmatism and tectonic disruption is difficult, and synmagmatic deformation might not be as obvious as in those cases where dismemberment of the crustal sequence took place later—i.e., during emplacement of the ophiolite. The recognition of undeformed magmatic intrusions that cut deformed and extended crustal sequences in some ophiolites confirms the timing of deformation and structural omission as intra-oceanic and pre-emplacment on land.

### CONCLUSIONS

The presence of large and well-developed sheeted dike complexes, such as those in Cyprus and Oman, is not a common feature of ophiolites. Indeed, it can be argued that the recognition of a sheeted complex should not be a requirement for the definition of this suite of rocks. The formation of a sheeted complex requires a balance between spreading rate and magma supply over a period of millions of years, a situation that is probably unusual in suprasubduction zone environments, where the two are at least partly decoupled.

Ophiolites were once considered direct analogues of oceanic lithosphere developed at mid-ocean ridges, but this view is incompatible with the geochemical characteristics of ophiolitic rocks, which indicate a strong subduction component in their melt evolution. However, it has been argued that even though ophiolites form in an anomalous spreading environment above subduction zones, they record structural and igneous processes similar to those occurring at mid-ocean spreading centers and can be considered proxies for studies of some aspects of in situ ocean crust. Such comparisons cannot be pursued too far, however. The relationship between tectonic and magmatic activities in suprasubduction spreading is controlled by different factors than those operating at mid-ocean ridge spreading centers. Care must be exercised when using features like sheeted dike complexes in ophiolites to investigate spreading processes at mid-ocean ridges.

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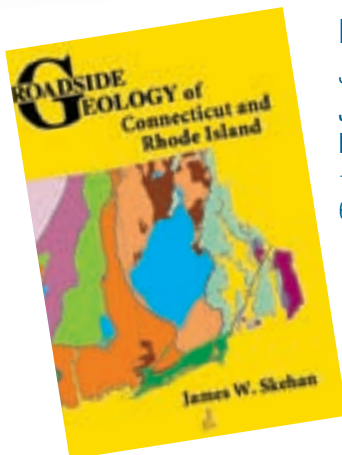
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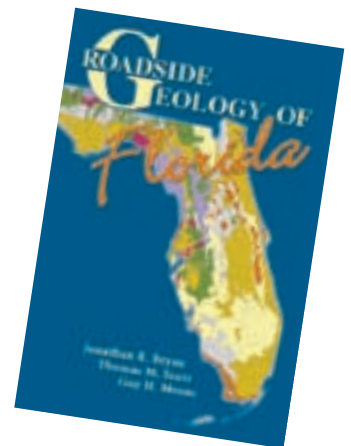
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## 2009 GSA ANNUAL MEETING & EXPOSITION

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Portland, Oregon, USA

*You make the meeting—Save the date!*

18–21 October 2009

## Call for Proposals

### Technical Sessions

Submit technical sessions proposals at <http://gsa.confex.com/gsa/2009AM/sessionproposals.epl> by 6 January 2009.

### Field Trips

Know of a great geoscience excursion near Portland? Teach your colleagues and peers about the ground-breaking research in this region. Trips can be anywhere from a half day to five days long.

Submit your idea for a fun, interesting, and educational field trip for the 2009 Annual Meeting online at <http://gsa.confex.com/gsa/2009AM/fieldtrip.htm>. Please submit your proposals by 2 December 2008. Questions? Please contact Eric Nocerino, +1-303-357-1060, [enocerino@geosociety.org](mailto:enocerino@geosociety.org).

### Short Courses

Have something that your peers, students, or earth science teachers need to know? Share your unique knowledge and experience in our dynamic annual meeting setting.

Learn how to submit your short course proposal at [www.geosociety.org/meetings/2009/scProposals/](http://www.geosociety.org/meetings/2009/scProposals/). Questions? Please contact Jennifer Nocerino, +1-303-357-1036, [jnocerino@geosociety.org](mailto:jnocerino@geosociety.org). Please submit your proposals by 2 December 2008.



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## Call for Applications

# 2009–2010 GSA-USGS CONGRESSIONAL SCIENCE FELLOWSHIP



**Work directly with national leaders, and bring your experience and expertise to bear on science and technology policy on Capitol Hill.**

This Congressional Science Fellowship provides a rare opportunity to work at the interface between geoscience and public policy. Prospective candidates are GSA Members with a broad geoscience background and excellent written and oral communication skills. Minimum requirements: a master's degree with at least five years of professional experience or a Ph.D. at time of appointment. The fellowship is open only to U.S. citizens or permanent U.S. residents.

Find application information at [www.geosociety.org/csf](http://www.geosociety.org/csf) or contact Ginger Williams, +1-303-357-1040, [gwilliams@geosociety.org](mailto:gwilliams@geosociety.org). **Deadline for application:** 1 February 2009; selection of the next GSA-USGS Congressional Science Fellow will be made soon thereafter.

Put your academic and professional background, experience applying scientific knowledge to societal challenges, and passion for shaping the future of the geoscience profession to work in this coveted arena: *Apply today!*

[www.geosociety.org/csf](http://www.geosociety.org/csf)



# UPCOMING AWARD, RECOGNITION & GRANT DEADLINES

For details, see the October 2008 *GSA Today* or go to [www.geosociety.org/aboutus/honors-awards.htm](http://www.geosociety.org/aboutus/honors-awards.htm).

Nomination forms and instructions may also be obtained from GSA Grants, Awards, and Recognition, P.O. Box 9140, 3300 Penrose Place, Boulder, CO 80301-9140, USA, +1-303-357-1028, [awards@geosociety.org](mailto:awards@geosociety.org).

---

GSA is now accepting nominations for the following awards and medals:

- **Penrose Medal**
- **Day Medal**
- **Young Scientist Award (Donath Medal)**
- **Honorary Fellows**
- **GSA Public Service Award**
- **GSA Distinguished Service Award**
- **Bromery Award for the Minorities**
- **Subaru Outstanding Woman in Science Award**  
(Sponsored by Subaru of America, Inc.)

Nomination deadline: **1 February 2009**.

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## GSA Fellowship

The GSA Committee on Membership requests nominations of GSA Members to be elevated to GSA Fellow status. Any GSA Fellow may nominate up to two members per year (only **one** as a primary nominator), and a **GSA Member** who is not a Fellow may be a secondary nominator for up to **two** nominees per year.

Nomination deadline: **1 February 2009**.

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## AGI Medal in Memory of Ian Campbell

The AGI Medal in Memory of Ian Campbell recognizes singular performance in and contribution to the profession of geology. To submit a nomination, go to [www.agiweb.org/direct/awards.html](http://www.agiweb.org/direct/awards.html).

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## John C. Frye Environmental Geology Award

*Supported by endowment income from the GSA Foundation's John C. Frye Memorial Fund.*

In cooperation with the Association of American State Geologists, GSA makes an annual US\$1,000 cash prize award for the best paper on environmental geology published either by GSA or by one of the state geological surveys.

Nomination deadline: **31 March 2009**.

---

## 2009 National Awards

GSA Members are invited to nominate colleagues for the following awards, which are coordinated by the American Geological Institute (AGI).

- **William T. Pecora Award**
- **National Medal of Science**
- **Vannevar Bush Award**
- **Alan T. Waterman Award**

Nomination deadline: **1 February 2009**.

---

## 2009 Student Research Grants

Grants applications may be made online only; no paper applications or letters will be accepted. Go to [www.geosociety.org/grants/gradgrants.htm](http://www.geosociety.org/grants/gradgrants.htm) to apply beginning the end of November.

Submission deadline: **11:59 p.m. (MST)** on Sunday, **1 February 2009**.

---

## 2009 Post-Doctoral Research Awards

The following research awards are managed by the GSA Foundation. Learn more at [www.geosociety.org/grants/postdoc.htm](http://www.geosociety.org/grants/postdoc.htm).

- **The Gladys W. Cole Memorial Research Award** for research on the geomorphology of semiarid and arid terrains in the United States and Mexico is awarded annually to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers in geomorphology. 2009 award: US\$9,900.
- **The W. Storrs Cole Memorial Research Award** for research in invertebrate micropaleontology is awarded annually to a GSA Member or Fellow between 30 and 65 years of age who has published one or more significant papers on micropaleontology. 2009 award: US\$9,100.

Deadline for application: **1 February 2009**.



THE GEOLOGICAL SOCIETY  
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# NORTH-CENTRAL

43rd Annual Meeting  
Rockford, Illinois, USA

2–3 April 2009

## CALL FOR PAPERS

Abstract Deadline: 30 December 2008

### Technical Sessions

Please submit your abstract online at [www.geosociety.org/meetings](http://www.geosociety.org/meetings). An abstract submission fee of US\$10 will be charged. If you cannot submit the abstract online, please contact Nancy Wright, +1-303-357-1061, [nwright@geosociety.org](mailto:nwright@geosociety.org).



View west across the Rock River toward downtown Rockford, Illinois, USA. Photo courtesy Rockford Area Convention & Visitors Bureau.

## LOCATION

We will meet in Rockford, Illinois, USA, on the campus of Northern Illinois University (NIU). The third largest city in Illinois, Rockford was originally named Midtown in 1834 but was renamed ca. 1837 because of its location at a rock outcrop popular for fording the Rock River. Our welcoming reception will be held at the Burpee Museum of Natural History, which has an ongoing paleontologic research program with NIU centered on the Hell Creek Formation in Montana and the Morrison Formation in Utah. This program led to the excavation and restoration of Jane, a juvenile *Tyrannosaurus rex*, on display in the museum, and Petey, another juvenile *T. rex*, now being restored. A museum-sponsored excavation this year near Hanksville, Utah, USA, unearthed a number of Late Jurassic dinosaur specimens, including *Camarasaurus* and *Allosaurus*, and some of these finds are also on display.

Technical program co-chairs: James Walker, [t60jaw1@wpo.cso.niu.edu](mailto:t60jaw1@wpo.cso.niu.edu), +1-815-753-7936, and Douglas Walker, [ddwalker@uiuc.edu](mailto:ddwalker@uiuc.edu), +1-217-333-1724.

## Symposia Sessions

1. **Hydrogeology in Fractured Rocks.**
2. **Water Resources in Karst Terranes of the Midwestern U.S.**
3. **International Development and Geoscience.**
4. **Application of Modern Techniques to Address Fundamental Problems in Planetary Geology.**
5. **Central American Volcanism.**
6. **Carbon Sequestration.**
7. **Bioremediation.**
8. **Water Availability and Use in the Great Lakes Basin.**
9. **Cultural Geology: Building Stones, Archaeological Materials, Terrain, Terroir, and More.**

## Theme Sessions

1. **Applied Geology: Environmental, Hydrogeological, and Geotechnical.**
2. **Coal as a Viable Energy Resource.**
3. **Quaternary Research in Wisconsin.**
4. **Medical Geology.**
5. **Polar Climate Change.**
6. **Vertebrate Paleontology.**
7. **Environmental Biogeochemistry: Isotopes and Microorganisms.**
8. **Easy-to-Incorporate Inquiry-Based Activities for the K–16 Classroom.** *Cosponsored by the National Association of Geoscience Teachers.*
9. **Backyard Field Trips: Inquiry-Based Activities within 100 Meters of Your Building.** *Cosponsored by the National Association of Geoscience Teachers.*
10. **Issues in Geoscience Education.** *Cosponsored by the National Association of Geoscience Teachers.*
11. **K–16 Collaboration, Outreach, and Engagement.** *Cosponsored by the National Association of Geoscience Teachers.*
12. **Sedimentary Event Histories and Controls on Timing and Patterns of Deposition in North American Phanerozoic Basins.** *Cosponsored by the Great Lakes Section, SEPM.*
13. **Climate Change: Causes, Consequences, and Adaptations.**
14. **Undergraduate Research (Posters).** *Cosponsored by the Council for Undergraduate Research.*
15. **Fossils in Time and Space.** *Cosponsored by the Paleontological Society.*

## REGISTRATION

**Early Registration Deadline: 2 March 2009**

**Cancellation Deadline: 9 March 2009**

Online registration begins in January 2009. Details on field trips, workshops, student opportunities, the guest program, and symposia and theme sessions for this meeting will be online at [www.geosociety.org/sectdiv/Northc/09mtg/](http://www.geosociety.org/sectdiv/Northc/09mtg/).

For further information, or if you have special requirements, please contact the local committee chair, Eugene Perry, [t60ecp1@wpo.cso.niu.edu](mailto:t60ecp1@wpo.cso.niu.edu), +1-815-753-7935, or technical program chair, James Walker, [t60jaw1@wpo.cso.niu.edu](mailto:t60jaw1@wpo.cso.niu.edu), +1-815-753-7936.

## FIELD TRIPS

If you'd like to propose a field trip, please contact field trip co-chairs Michael Konen, [mkonen@niu.edu](mailto:mkonen@niu.edu), +1-815-753-6849, and Steve Simpson, [steve.simpson@highland.edu](mailto:steve.simpson@highland.edu), +1-815-599-3474.

1. **Contaminant Hydrogeology of the Rockford Area.** Wed., 1 April.
2. **Geology and Geo-Engineering along the Chicago Lakefront.** Sat., 4 April.



Juvenile *Tyrannosaurus rex*, Jane. Photo courtesy Rockford Area Convention & Visitors Bureau.

3. **The Silurian-Ordovician Boundary in Northern Illinois and Southern Wisconsin.** Sat., 4 April.
4. **The Upper Mississippi Valley Pb-Zn District Revisited: Mining History, Geology, Reclamation and Environmental Issues 30 Years after the Last Mine Closed.** Sat., 4 April.
5. **Eolian and Glacial Environments of North Central Illinois.** Sat., 4 April.

## SHORT COURSES

1. **Introduction to Basic Map Making Using ArcGIS and Spatial Analyst.**
2. **Improving Boring Logs at Glaciated Sites.**

## STUDENT OPPORTUNITIES

### Mentor Programs

Questions? Contact Jennifer Nocerino, [jnocerino@geosociety.org](mailto:jnocerino@geosociety.org), or go to [www.geosociety.org/mentors/](http://www.geosociety.org/mentors/).

**Mann Mentors in Applied Hydrogeology Program.** *Sponsored by the GSA Foundation.* Thurs., 2 April, 11:30 a.m.–1 p.m. This FREE luncheon presents mentoring opportunities for students and recent graduates with a declared career interest in applied hydrogeology.

**Roy J. Shlemon Mentor Program in Applied Geoscience.** *Sponsored by the GSA Foundation.* Fri., 3 April, 11:30 a.m.–12:30 p.m. and 12:30–1:30 p.m. These FREE luncheons are designed to extend the mentoring reach of professionals from applied geology to geoscience students.

### Travel Grants

Find information and applications for student travel grants at [www.geosociety.org/sectdiv/](http://www.geosociety.org/sectdiv/).

### Volunteers

We rely on student volunteers to help meetings run smoothly, and are pleased to offer student volunteers free registration for the meeting in return for ~6 hours of work. Contact student volunteer coordinator Mark Frank, [t60mrf1@wpo.cso.niu.edu](mailto:t60mrf1@wpo.cso.niu.edu), for more information.

## ROCKY MOUNTAIN

61st Annual Meeting  
Orem, Utah, USA

11–13 May 2009



Orem, Utah, USA, is located in the foothills of Mount Timpanogos, the second highest mountain in Utah's Wasatch Range at 11,749 feet (3,582 m) above sea level. Photo courtesy Utah Valley Convention and Visitors Bureau.

### ***Reaching for Greater Heights: Geology in the Rocky Mountains***

This meeting will cover a broad range of topics of specific interest to geoscientists in GSA's Rocky Mountain region. Our venue will be the new library at Utah Valley University. The library features large, comfortable open spaces, sweeping views of the Wasatch Range and Utah Valley, and a full-service café, and was recognized by Utah Governor Jon Huntsman Jr. as the most energy-efficient building in the Utah higher education system.

### **CALL FOR PAPERS**

**Abstract Deadline: 3 February 2009**

### **Technical Sessions**

We plan to have three to four sessions running concurrently each day, along with a poster session, and will have general sessions in addition to the following.

### **Theme Sessions**

#### ***Stratigraphy, Sedimentology, Paleontology***

1. **Neoproterozoic Geology of the Rocky Mountains.** Paul Link, Idaho State University, linkpaul@isu.edu; Carol Dehler, Utah State University, chuaria@cc.usu.edu.
2. **New Developments and Discoveries in Paleozoic Stratigraphy and Paleontology in the Rocky Mountains and Basin and Range.** Scott Ritter, Brigham Young University, scott\_ritter@byu.edu; Forest Gahn, Brigham Young University–Idaho, gahnf@byui.edu.
3. **Mesozoic Paleontology, Sedimentology, and Geochronology of the Rocky Mountains and Colorado Plateau.** Doug Sprinkel, Utah Geological Survey, d.sprinkel@comcast.net.

#### ***Hydrology, Surficial Geology, and Engineering Geology***

4. **Hydrologic Studies in the Basin and Range and Rocky Mountains.** Lucy Jordan, Utah Geological Survey, lucyjordan@utah.gov; John Bradford, Boise State University, johnb@cgiss.boisestate.edu; Stephen Nelson, Brigham Young University, stn@geology.byu.edu.
5. **Getting a Better Handle on the “Dirt” Covering the Bedrock—Mapping and Dating of Surficial Deposits.** Grant Willis, Utah Geological Survey, grantwillis@utah.gov; Joel Pederson, Utah State University, joel.pederson@usu.edu.
6. **Quaternary Tectonics and Earthquake-Hazard Characterization in the Rocky Mountain Region.** Chris DuRoss, Utah Geological Survey, cbduross@hotmail.com; Greg McDonald, Utah Geological Survey, gregmcdonald@utah.gov; Ivan Wong, URS Corp., ivan\_wong@urscorp.com; Mike Bunds, Utah Valley University, bundsmi@uvsc.edu.
7. **Geologic Hazards in the Rocky Mountain Region and Their Impacts on Development: A Tribute to the Career of Gary Christensen.** Danny Horns, Utah Valley University, hornsda@uvsc.edu.

#### ***Structure and Tectonics***

8. **Compression and Extension—Thrusts and Normal Faults and Their Interplay in the Rocky Mountains and Basin and Range.** Adolph Yonkee, Weber State University, ayonkee@weber.edu.
9. **Contributions from Geophysics to Better Understanding the Structure and Tectonics of the Western United States.** John McBride, Brigham Young University, john\_mcbride@byu.edu.

#### ***Energy and Economic Geology***

10. **Energy Resources and Developments in the Rocky Mountain Region.** Michael Vanden Berg, Utah Geological Survey, mvandenber@mines.utah.edu; Bill Keach, Brigham Young University, bill\_keach@byu.edu.



11. **Ore Deposits in the Great Basin and Rocky Mountains.** Ken Krahulec, Utah Geological Survey, kenkrahulec@utah.gov.
12. **Industrial Mineral Deposits of the Rocky Mountains Region.** Bryce Tripp, Utah Geological Survey, brycetripp@utah.gov.

#### *Igneous and Metamorphic Rocks*

13. **Volcanic and Plutonic Activity from the Mesozoic to the Present in the Rocky Mountains Region.** Eric Christiansen, Brigham Young University, eric\_christiansen@byu.edu.
14. **New Developments in Understanding Metamorphic Rocks in the Rocky Mountains and Great Basin.** Bill Dinklage, Utah Valley University, dinklawi@uvsc.edu; Mark Colberg, Southern Utah University, colberg@suu.edu.

#### *Other Theme Sessions*

15. **Geologic Mapping Supported by EDMAP and STATEMAP in the Rocky Mountains Region.** Bart Kowallis, Brigham Young University, bkowallis@byu.edu; Grant Willis, Utah Geological Survey, grantwillis@utah.gov.
16. **Geological Studies in National Parks and Monuments of the Rocky Mountains Region.** David Wilkins, Boise State University, dwilkins@boisestate.edu.
17. **Geoinformatics.** Walt Snyder, Boise State University, wsnyder@boisestate.edu.
18. **Geology and Public Policy in the West.** Christine Turner, U.S. Geological Survey, ctturner@usgs.gov.
19. **Undergraduate Research (Posters).** *Cosponsored by the Council on Undergraduate Research.* Bill Dinklage, Utah Valley University, dinklawi@uvsc.edu.

#### REGISTRATION

**Early Registration Deadline: 6 April 2009**

**Cancellation Deadline: 13 April 2009**

Find complete and up-to-date information at [www.geosociety.org/meetings](http://www.geosociety.org/meetings). If you have questions or special requirements, please contact the general meeting co-chairs, Bart Kowallis, +1-801-422-2467, bkowallis@byu.edu, and Daniel Horns, +1-801-863-8064, hornsda@uvsc.edu.

*Continued on p. 18*



Triassic and Early Jurassic strata, Capitol Reef National Park, 2007. Photo by B. Kowallis.

# 2009

## GSA Section Meeting Calendar

### **Southeastern Section**

St. Petersburg, Florida, USA  
12–13 March

#### **Abstract deadline:**

9 December 2008

### **South-Central Section**

Dallas, Texas, USA  
16–17 March

#### **Abstract deadline:**

9 December 2008

### **Northeastern Section**

Portland, Maine, USA  
22–24 March

#### **Abstract deadline:**

16 December 2008

### **North-Central Section**

Rockford, Illinois, USA  
2–3 April

#### **Abstract deadline:**

30 December 2008

### **Cordilleran Section**

Kelowna, British  
Columbia, Canada  
7–9 May

#### **Abstract deadline:**

3 February 2009

### **Rocky Mountain Section**

Orem, Utah, USA  
11–13 May

#### **Abstract deadline:**

3 February 2009



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## ROCKY MOUNTAIN *continued*

### FIELD TRIPS

1. **Hot Springs of Utah Valley and the Wasatch Range.** Sun., 10 May. Steven H. Emerman.
2. **Stratigraphy and Correlation of Lower and Middle Jurassic Rocks, Utah: Transition from a Sand Sea to Marine Embayment and Back.** Fri.–Sun., 8–10 May. Doug Sprinkel, Helmut Doelling, Bart Kowallis.
3. **Behind the Scenes at the Museum of Paleontology.** Tues., 12 May. Brooks Britt, Rod Scheetz.
4. **Geologic Hazards of the Southern Wasatch Front.** Thurs., 14 May. Christopher DuRoss.
5. **Tectonics and Stratigraphy of the Western Colorado Plateau.** Thurs.–Sat., 14–16 May. Bill Keach, Tom Morris, Scott Ritter.
6. **Classic Geology of the Central Wasatch Mountains: Almost Two-Billion Years of Geologic History.** Thurs.–Fri., 14–15 May. Grant Willis, Robert Biek.
7. **Geology of the Kennecott Open-Pit Mine.** Thurs., 14 May. David Simon, Geoff Bedell.

### WORKSHOP

**Climate Change: Causes, Consequences, and Adaptations.** *Cosponsored by National Association of Geoscience Teachers.* Allen Macfarlane, dowser@kgs.ku.edu; Sallie Greenberg, greenberg@isgs.illinois.edu.

### ACCOMMODATIONS

Rooms have been reserved at the following hotels. Please call the hotel directly to make reservations, and reference the 2009 GSA Rocky Mountain Section Meeting for the group rate.

**Hampton Inn & Suites**, 851 West 1250 South, Orem, UT 84058, USA, +1-801-426-8700; standard room: \$104+tax, <http://oremhamptoninn.com/>.

**Comfort Inn & Suites**, 427 W. University Pkwy, Orem, UT 84058, USA, +1-801-431-0405; standard room: \$79.99+tax, [www.comfortinn.com](http://www.comfortinn.com).

**LaQuinta Inn & Suites**, 521 W. University Parkway, Orem, UT 84058, USA, +1-801-226-0440; standard room: \$89+tax, [www.lq.com/lq/properties/propertyProfile.do?ident=LQ962&propId=962](http://www.lq.com/lq/properties/propertyProfile.do?ident=LQ962&propId=962).

### OPPORTUNITIES FOR STUDENTS

#### Mentor Programs

Questions? Contact Jennifer Nocerino, [jnocerino@geosociety.org](mailto:jnocerino@geosociety.org) or go to [www.geosociety.org/mentors/](http://www.geosociety.org/mentors/).

**Roy J. Shlemon Mentor Program in Applied Geoscience.** *Sponsored by the GSA Foundation.* Mon., 11 May, 11:30 a.m.–1 p.m. This FREE luncheon is designed to extend the mentoring reach of professionals from applied geology to geoscience students.

**The John Mann Mentors in Applied Hydrogeology Program.** *Sponsored by the GSA Foundation.* Tues., 12 May, 11:30 a.m.–1 p.m. This FREE luncheon presents mentoring opportunities for students and recent graduates with a declared career interest in applied hydrogeology.



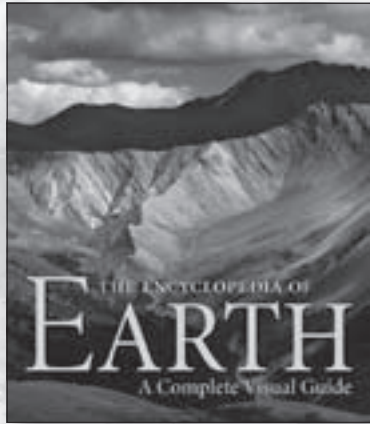
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—Jeff Lovich, Deputy Director, U.S. Geological Survey, Southwest Biological Science Center

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# GeoCorps™

GeoCorps™ America places geoscientists of all levels—university students, professionals, and retirees—in short-term science projects at public lands throughout the country. These projects, hosted by the National Park Service, the U.S. Forest Service, and the Bureau of Land Management (BLM), range from geology, hydrogeology, and paleontology, to mapping, GIS, soils, geohazards, and interpretation. This year, 66 highly qualified individuals worked on geoscience projects in 25 National Parks, 13 BLM Units, and 11 National Forests.



The majority of my time at Rocky Mountain National Park was spent helping researchers with their field work. In many cases, I was the only person who knew anything about geology, so I frequently stressed the connection between geology and other field sciences. Working with so many kinds of researchers was good preparation for working on a collaborative scientific investigation. —Ansel Bubel

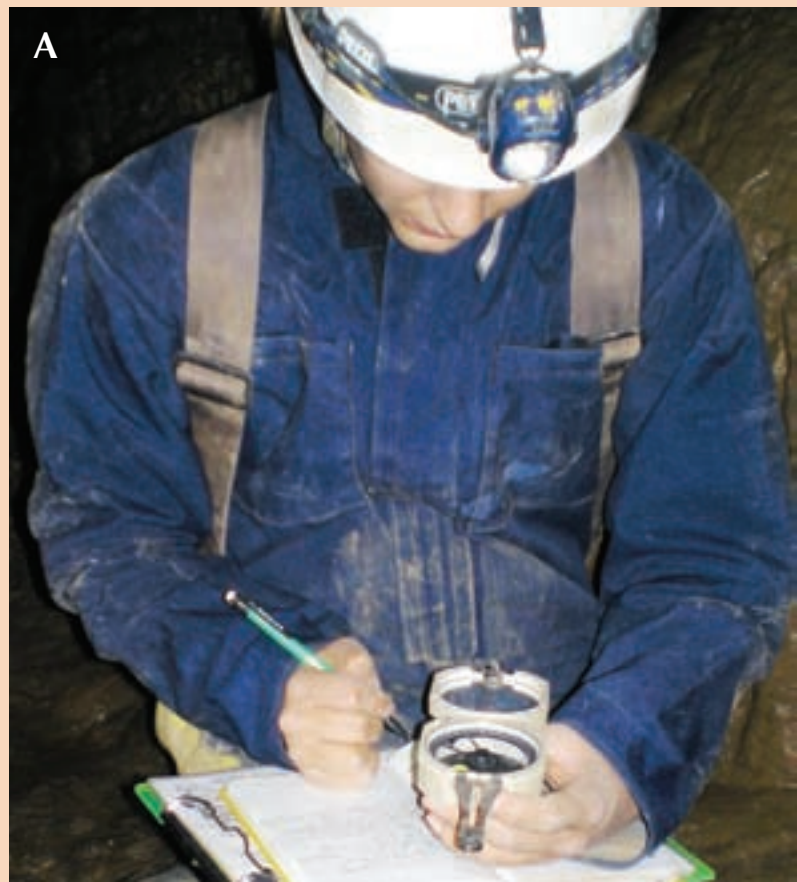
GeoCorps™ America is proudly supported by the ENVIRON Foundation and the America Institute of Professional Geologists.



As a geology education specialist at Rocky Mountain National Park, my responsibility was to develop and deliver education programs within the park and the surrounding school districts. This involved doing research, writing outlines (modified lesson plans), designing appropriate hands-on activities, and presenting the program. I found that no matter the age, it was important to have a related hands-on activity that truly engaged the students. —Nancy Dickinson



The Florissant Fossil Beds National Monument protects and preserves countless fossil specimens preserved in lake shale and mud flows from 34 million years ago. Working as the paleontologist this summer, I was fortunate enough to work closely with these fossils and in some cases I was able to participate in test excavations to discover more specimens. One of the most exciting things about my summer was the discovery of the first-ever fossilized ginkgo leaf for the monument; I unearthed it during one of the paleontology crew's test excavations. To be the first to discover a ginkgo here at the monument has been quite exhilarating and has only served to fuel my passion for paleontology. —Bret Buskirk



# America

My benefit from the program is indisputable. I will forever carry the experience gained while working in the park, preparing me for a future career in paleontology. Working in Denali National Park has had many moments of awe and inspiration that I could never capture from any book or detailed account. Out of every course I have taken on natural history, no lesson hits harder than the one you witness yourself silently, with no instructor other than Mother Nature herself. —Todd Jacobus



Badlands National Park staff had begun the process of inventorying and assessing fossil localities within park boundaries to gain a better understanding of stratigraphic position, depositional environment, degree of preservation, and vulnerability to poachers and visitors. The goal of completing a park paleontological inventory database continues; vulnerable fossil localities are identified during the assessment, allowing park management to protect the localities from poachers. —Darrin Strosnider

## 2008 Highlights



A and B: Our GeoCorps project at Oregon Caves National Monument involved a very large field component requiring us to crawl into remote areas of the cave taking strike and dips of bedding, faults, and fractures as well as learning how to use ArcPad to input our data into ArcMap remotely. Once our raw data had been collected from the cave (we also created a small data set of surface measurements), we created GIS maps as well as rose diagrams and stereonet plots in an effort to find patterns, trends, and averages in our data. —Lynn Galston and Kat Compton

### *Special thanks to all of this year's GeoCorps™ America participants!*

Justy Alicea	Benjamin Haring	Nellie Olsen
Evan Batton	Kristin Harms	Kyle Rybacki
Sabrina Belknap	Anthony Harper	Robert Sas Jr.
Glenda Besana-Ostman	Zoe Harrold	Christine Saulsbury
Ansel Bubel	Joel Hartmann	Anne Schumacher
Bret Buskirk	Rory Hunter	Barry Shaulis
Kathleen Compton	Justin Hynicka	Kevin Stack
Peter Dennehy	Nick Inzinna	Lydia Staisch
Meagan DeRaps	Raymond Jacobus	Katie Stehli
Margie DeRose	Erich Junger	Kirsten Stokes
Nancy Dickinson	Sophia Kast	Darrin Strosnider
Dylan Duverge	Anya Kircher	Nicholas Sullivan
Lisa Fay	Justin Knudson	Lidya Tarhan
Catherine Foley	Hillary Kruger	Teagan Tomlin
Hilton Freed	Adam Lee	Justin Tweet
Logan Fusso	Hugh Lewis	Zachary Walter
Lynn Galston	Bradley Markle	Adam Wanta
Gilbert Garcia	April Mattox	Anna Weber
Connie Garrett	Brian McDonald	Stephanie Welch
Dianah Grubb	Katy McGuire	Adam Willett
Wheeler	Brina Mocsny	Rayna Winters
Sarah Hanson	Patrick Moran	
	Gary Motz	





## 2008 Year-End Giving

As you plan your “end of year” gifts, I want to remind you of some easy ways to make your donation to the GSA Foundation:

- Use the coupon below.
- Donate when you renew your GSA Membership.
- Visit the Foundation’s Web site, [gsafweb.org](http://gsafweb.org). You’ll find a complete list of Foundation funds on the “Make a Donation” page. Online donation is easy, secure, and takes just a few minutes!

I encourage you to donate to the Foundation’s **Greatest Needs Fund**—this fund has been a source of support for many GSA programs and projects over the years, and its flexibility allows contributions to be used in a wide variety of ways.

Perhaps you’re interested in donating to a more specific fund? We’re happy to send you a detailed list describing each

Foundation Fund and its purpose—just contact me, Donna Russell, at [drussell@geosociety.org](mailto:drussell@geosociety.org) or +1-303-357-1054.

The GSA Foundation exists to promote the science of geology and to provide funds for programs of the Geological Society of America that are consistent with the Society’s mission. Thus, the Foundation seeks to fund education, research, publications, student opportunities, public outreach, and other GSA geoscientific programs that the Foundation, in consultation with the Society, considers necessary to accomplish GSA’s purposes of advancing the geosciences, enhancing the professional growth of its members, and promoting the geosciences in the service of humankind.

*Most memorable early geologic experience:*

In 1964 I experienced first-hand the Alaska Good Friday Earthquake in Anchorage, and in the following couple of weeks I participated in a volunteer preliminary survey of the quake’s local geologic effects.

—Glen L. Faulkner



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## Panel Seeks Input on GSA Position Statement Draft Integrating Geoscience with Sustainable Land-Use Management

Snake River, Twin Falls, Idaho. Photo by K.E. Asmus.

**Please submit your comments and suggestions** regarding the content of the following *position statement draft* by **14 November 2008** to Richard Berg at [berg@isgs.uiuc.edu](mailto:berg@isgs.uiuc.edu). Go to [www.geosociety.org/positions/](http://www.geosociety.org/positions/) to learn more.

### Position Statement

To improve the scientific basis for land-use decisions, The Geological Society of America (GSA) supports the integration of geoscience information with land-use planning processes. Government agencies have a special responsibility to integrate geoscience information with land-use planning to address such issues as natural hazards (e.g., earthquakes, floods, or droughts), natural resources (e.g., energy, water and mineral resources), environmental issues (e.g., climate change and pollution), and human-induced hazards. The geosciences provide a unique contribution to land-use issues because they address the origin and character of materials at or near Earth's surface and the varied natural and human-induced processes that have redistributed these materials over time.

### Purpose

This position statement (1) summarizes the consensus views of GSA regarding the integration of geoscience into the land-use decision-making process; (2) provides information that can raise awareness among policy makers and land managers of the important contributions that geoscientists can make in crafting sustainable land-use policies, implementing those policies, and evaluating their short- and long-term consequences; and

(3) encourages geoscientists to participate in land-use decision-making at local, regional, state, and national levels.

### Rationale

Earth's water, air, and land are essential natural resources. Land affords humanity with places to build communities and associated infrastructure, generates most of its food resources, serves as a major carbon sink, and provides mineral and soil resources vital for society. The land surface also imparts both aesthetic satisfaction and habitat value to humanity. Water sources for domestic, municipal, industrial, and agricultural uses include lakes, rivers, and groundwater, and lakes and rivers also provide water for transportation, recreation, and ecosystem habitat. The quality of the air we breathe is determined by interactions between activities on Earth's surface and the atmosphere. Water, air, and land resources are inherently linked. These resources must be sustained for society's future generations and the health of the planet.

Human land-use practices affect Earth's vital resources, and the ecosystems supported by these resources. Land-use practices are wide-ranging and include, but are not limited to, agriculture, ranching, logging, mining, river management (including dam and levee building and urban/suburban development. Land-use practices affect hydrologic and biogeochemical cycles, as well as fundamental ecosystem structure. Changes in these highly dynamic cycles and structures affect all living things.

Because land use is so diverse, land management decisions are inherently multifaceted and interdisciplinary. The geosciences provide a unique contribution to land-use issues because



they address the origin and character of materials at or near Earth's surface and the varied natural and human-induced processes that have redistributed these materials over time. The geosciences provide an understanding of potential short- and long-term changes to Earth's surface that can result from past, present, and future land-use practices. Human activity interacts daily with Earth's natural processes, and these processes are threatened constantly by expanding populations, pollution, and natural hazards. Geoscience-based information must be integrated with land-use planning so that various, often conflicting, land-use scenarios are evaluated on the basis of sustaining natural resources as well as for socioeconomic purposes.

Land resources, and our ability to manage and protect them, inevitably will be affected by climate change. For example, a rise in sea level could result in the displacement of millions of people from coastal regions. Increasing temperatures have already led to thawing permafrost in arctic regions, which affects wildlife and infrastructure and diminishes the suitability of these lands for human habitat. Climate change also affects the water cycle, including the amount, type, and seasonal and spatial distribution of precipitation, as well as the magnitude of extreme events. These changes have the potential to increase the risk of extreme flooding, drought, and wildfires, alter groundwater recharge patterns and availability, and intensify many other problems due to ecosystem interconnectedness.

### **Public Policy Aspects of Integrating Geoscience with Land-Use Decision Making**

Land-use planning and management decisions should (1) reflect a comprehensive understanding of the potential impacts on resources that sustain communities; (2) provide measures to avoid the over-allocation of depleted resources and to decrease competition for remaining resources; and (3) consider the wider community and future populations to avoid widespread disruption of and damage to natural systems that may be difficult, expensive, or even impossible to restore. Without careful planning and integrated resource management, inappropriate land-use practices may proceed on an unsustainable course and at an accelerated rate even without the threat of climate change.

Scientific understanding, using the best available geological, hydrological, ecological, and biogeochemical information on the long-term effects of land-use change on the environment, is essential for improving management of land resources. It is this understanding that allows decision makers in industry and government to evaluate the location, extent, and availability of present and future soil, water, mineral, and energy resources and to concurrently optimize resource utilization while minimizing land-use conflicts and potential environmental problems.

As the human population continues to grow, the demand for land resources will increase, as will the need for science-based land-management decisions to support future populations in a sustainable manner. Geoscience research contributes to the further understanding of past natural changes and better prediction of future changes, including natural hazards affecting the land surface. The geosciences have an important and unique role to play in understanding the potential long-term

consequences associated with past and future land-use changes and evaluating strategies for the mitigation of detrimental changes.

### **Recommendations**

- To improve the scientific basis for land-use decisions, appropriate geoscience information should be integrated with land-use planning processes.
- Government agencies at local, state, national, and international levels have a special responsibility to integrate geoscience information with land-use planning to address such issues as natural hazards (e.g., earthquakes, floods, droughts, landslides, subsidence, and erosion), natural resources (e.g., energy, water and mineral resources), environmental issues (e.g., climate change and pollution), and human-induced hazards (e.g., siting industrial and waste facilities).
- Private developers and community groups should have access to reliable geoscience information to reduce potential future liabilities in areas of known natural or human-induced hazards.
- Strong and growing public investments in geoscience research are needed to improve the scientific basis for land-use decisions. Appropriate geoscience information should be made available to policy makers, developers, community groups, and land managers in a useful and timely manner.
- Increased public investment in geoscience education is needed to improve the public's ability to make informed land-use decisions, such as construction of housing developments close to fault zones or along eroding coasts.

### **Opportunities for GSA and GSA Members to Help Implement Recommendations**

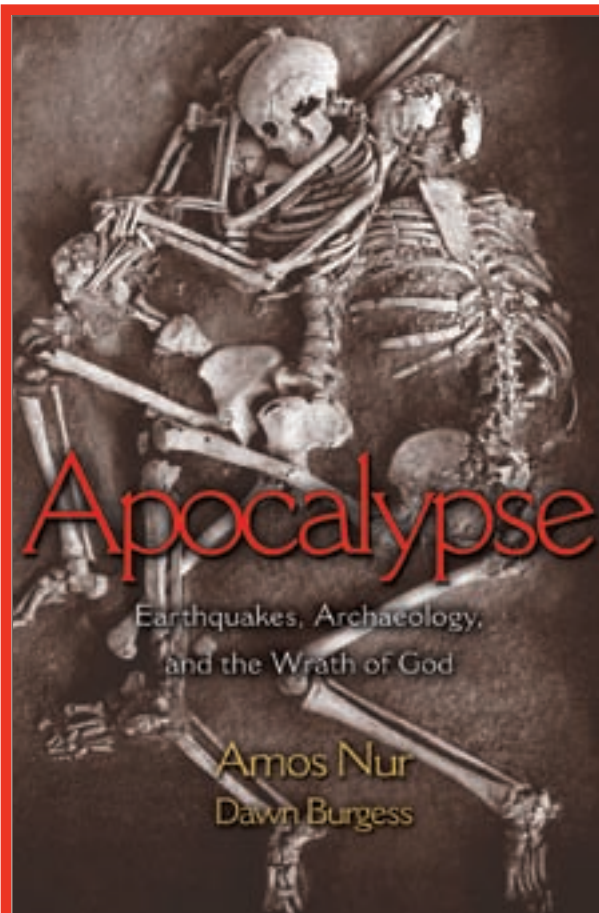
To facilitate implementation of the goals of this Position Statement, GSA recommends the following actions to increase the involvement of geoscientists in local, regional, statewide, and federal land-use policy decisions.

- We should seek opportunities to communicate effectively the value of integrating geoscience with sustainable land management to international, national, state, and local legislative bodies and government agencies, private developers, economic development corporations, professional land-use planners, chambers of commerce, and other local decision makers. GSA members are encouraged to work with print, electronic, and broadcast media in promoting the value of science-based approaches for addressing critical land-use issues. Members who participate in land-use planning are encouraged to share their experiences at GSA meetings and with GSA's Director for Geoscience Policy (DGP). Local examples of how geoscience has contributed information to a land-use planning or decision-making effort are essential to this effort. What also must be made clear is how the lack of geoscientific information might have prevented or lessened the effect of a costly adverse land-use activity or the devastating consequences of a natural disaster.
- We should seek opportunities to communicate effectively to community groups the value of integrating geoscience

Position Statement Draft *continued*

with sustainable land management. The public must be able to respond in an informed manner to land-use decision making that potentially can have detrimental effects on their community and personal property; thus, there is a growing need for the public to be educated about the value of geoscientific information for land-use planning. As above, it is beneficial to provide the DGP with local examples of how geoscientific information has either contributed to land-use planning efforts or its lack resulted in costly adverse land-use activities or increased the devastating consequences of a natural disaster.

- We should participate in professional forums and town hall meetings for open community discussions on the role that geoscience plays in effective land-use planning. Our discussions should emphasize the value of geoscientific information for land-use planning and decision making and its sustainability outcomes and enable GSA members to be better-informed advocates for requesting funding for geoscientific information in support of land-use planning.
- GSA should provide readily accessible print, Web, and personnel resources to members that support geoscientists' communications with decision makers regarding the value of integrating geoscience with sustainable land management. Considerable expertise and resources are available to members through GSA's Geology and Public Policy Committee (GPPC), GSA's Geology and Society Division, and GSA's DGP in Washington, D.C. GSA expertise can help members participate in land-use policy decisions by creating talking points on common land-use problems and providing examples of how they can participate in land-use decisions by becoming members of relevant decision-making bodies. It is important that GSA and its members identify legislation that affects land use and alert the GPPC, the Geology and Society Division, and GSA's Associated Societies if action by the GSA membership and affiliated organizations can help improve the scientific base for land-management decisions. The GPPC, Geology and Society Division, and the DGP, often working with GSA members, can also bring this Position Statement to the attention of lawmakers when legislation affects land use.
- GSA can raise awareness of land-use issues by publishing articles on both the links between geoscience and land-use planning and management decisions and the successful integration of geoscience with sustainable land management.



*Apocalypse* brings the latest scientific evidence to bear on biblical accounts, mythology, and the archaeological record to explore how ancient and modern earthquakes have shaped history—and, for some civilizations, seemingly heralded the end of the world. Through earthquakes the book explores also societal and philosophical issues related to natural disasters and catastrophies. Amos Nur bridges the gap that for too long has separated archaeology and seismology. He examines tantalizing evidence of earthquakes at some of the world's most famous archaeological sites in the Mediterranean and elsewhere, including Troy, Jericho, Knossos, Mycenae, Armageddon, Teotihuacán, and Petra. As Nur shows, recognizing earthquake damage in the shifted foundations and toppled arches of historic ruins is vital today because the scientific record of world earthquake risks is still incomplete. *Apocalypse* explains where and why ancient earthquakes struck—and could strike again.

**Amos Nur** is the Wayne Loel Professor of Earth Sciences and professor of geophysics at Stanford University. **Dawn Burgess** is a writer and editor based in Bar Harbor, Maine. She earned a PhD in geophysics from Stanford.

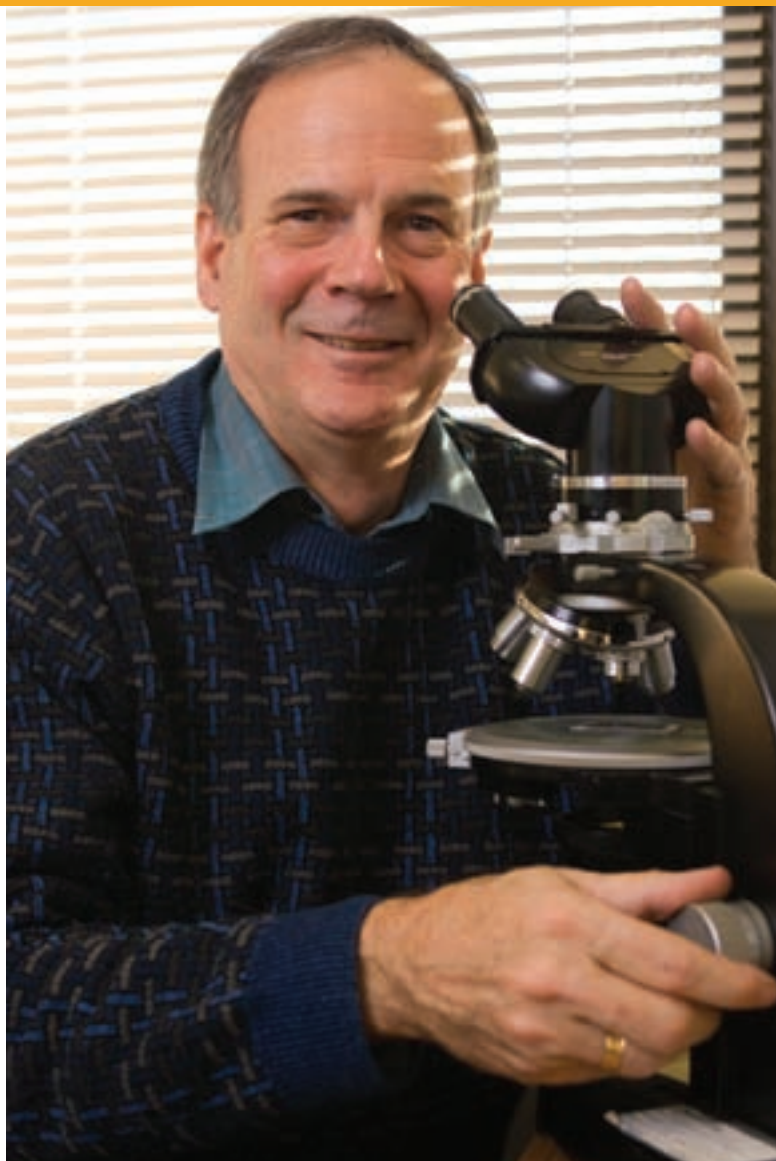
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Ads (or cancellations) must reach the GSA Advertising office no later than the first of the month, one month prior to issue. Contact Advertising Department: [advertising@geosociety.org](mailto:advertising@geosociety.org); +1.800.472.1988 x1053; +1.303.357.1053.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

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## Positions Open

### ASSISTANT PROFESSOR IN EARTH SCIENCE MORAVIAN COLLEGE

The Dept. of Physics and Earth Science at Moravian College invites applications for a tenure-track appointment at the level of assistant professor beginning in August 2009. The profile of the applicant should include experience in teaching earth science (geology and either meteorology, climatology, or oceanography) and geographic information systems. Experience with science education and astronomy will be considered a plus. Applicants must have a Ph.D. and a demonstrated potential for excellence in teaching and research involving undergraduates. Applications must include a letter of application, curriculum vitae, a detailed description of teaching philosophy and research interests, and contact information for three references; sent to Prof. Kelly Kriebel, Dept. of Physics and Earth Science, Moravian College, 1200 Main St., Bethlehem PA 18018-6650 or via e-mail to [kriebelk@moravian.edu](mailto:kriebelk@moravian.edu). Application deadline is January 19, 2009. Moravian College is a small liberal arts college situated in the beautiful Lehigh Valley region of Eastern Pennsylvania in the city of Bethlehem. Moravian College is an equal opportunity employer. We value diversity and encourage individuals from underrepresented populations to apply.

### ASSISTANT PROFESSOR, GEOLOGY DEPT. OF GEOLOGY, UTAH STATE UNIVERSITY USU-UINTAH BASIN REGIONAL CAMPUS

The Dept. of Geology in the College of Science at Utah State University offers a tenure-track Assistant Professor position with an emphasis on sedimentary systems, paleoecology, low temperature geochemistry, or petroleum geology. The successful candidate will be encouraged to foster collaborations with partners in the active energy industry in the Uintah Basin. As part of USU's mission to make its academic programs accessible throughout the state, this position will be physically located at USU-Uintah Basin Regional Campus in northeastern Utah. This is a 9-month, tenure-track position. The initial appointment will be approximately 70% teaching, 25% research, and 5% service, but may be adjusted in the future to meet changing needs of the Geology Department and the Uintah Basin Regional Campus. A full position description may be found at [www.usu.edu/geo/](http://www.usu.edu/geo/).

Application review will begin 1 December 2008 and will continue until the position is filled. We anticipate that funding for the position will be available for a start date of August, 2009. Applicants should submit a letter describing their qualifications for the position including a statement of teaching philosophy, a current curriculum vita, samples of scholarly work, and contact information for a minimum of three references. To apply, go to <https://jobs.usu.edu/applicants>.

### ASSISTANT PROFESSOR OF FORESTRY NATURAL RESOURCES MANAGEMENT DEPARTMENT NEW MEXICO HIGHLANDS UNIVERSITY

The Natural Resources Management Department at New Mexico Highlands University invites applicants for a nine-month, tenure-track appointment with teaching, research, and service responsibilities. We seek a dynamic teacher and broadly trained researcher with a strong commitment to undergraduate and graduate

education, mentoring student-oriented research at the master's degree level, and interacting with students at a small institution in a rural setting. We look for someone who can contribute soil science and/or hydrology expertise to our Forestry and Environmental Geology Programs and develop an innovative and extramurally funded student-involved field-based research program that emphasizes forest health, ecological restoration, ecosystem science, watershed management, and land-surface morphology. Responsibilities will include teaching upper division and graduate courses in Soil Science and Hydrology, sharing in the delivery of the introductory forestry classes, and contributing additional courses within the applicant's specialty to the Forestry and Geology curricula. Minimum Qualifications: Ph.D. at the time of appointment, Demonstrated research productivity or potential, Demonstrated commitment to undergraduate and graduate teaching or potential. For a complete job description see: [www.nmhu.edu/jobs](http://www.nmhu.edu/jobs). To Apply: Applicants must submit a letter of application, vita, three letters of recommendation, complete contact information of 4 professional references, transcripts, a one-page statement of teaching philosophy with ideas regarding program building, and a statement of research interests and needs. Send all materials to New Mexico Highlands University Academic Affairs Office, Assistant Professor of Forestry Search, Box 9000, Las Vegas, New Mexico 87701. Application review begins 15 October 2008 and we hope to fill this position by January 2009. For more detailed information and application procedures, please contact Michael Petronis, [mspetro@nmhu.edu](mailto:mspetro@nmhu.edu). For disabled access or services call +1-505-454-3311 or TDD# +1-505-454-3003. EOE

### FACULTY POSITION IN SEDIMENTARY GEOLOGY UNIVERSITY OF WISCONSIN-MADISON

The Dept. of Geology and Geophysics invites applications for a tenure-track assistant professor, beginning August 2009. We seek outstanding candidates within the broad area of sedimentary geology, including (but not limited to) interactions among sediments, climate, and life; carbonate sedimentology; sedimentary archives of landscape evolution; and numerical modeling of sedimentary processes. The evaluation of candidates will focus primarily on their potential for innovative scientific research and teaching. We encourage applicants who would engage in interdisciplinary research and complement the current research strengths of the department (see [www.geology.wisc.edu](http://www.geology.wisc.edu)). Teaching responsibilities are at both the graduate and undergraduate level. Ph.D. required by start of appointment. Applicants should submit a vita, statement of research and teaching interests, and names of three or more references to Sedimentary Geology Search Committee Chair, Dept. of Geology and Geophysics, University of Wisconsin-Madison, 1215 W. Dayton St., Madison, WI 53706, e-mail: [sedsearch@geology.wisc.edu](mailto:sedsearch@geology.wisc.edu).

To ensure full consideration, applications must be received by December 15, 2008.

The University of Wisconsin-Madison is an equal-opportunity/affirmative action employer and encourages applications from women and minorities. Employment may require a criminal background check.

### GEOCHEMISTRY RESEARCH LAB MANAGER DEPT. OF EARTH AND ATMOSPHERIC SCIENCES UNIVERSITY OF ALBERTA

The Dept. of Earth and Atmospheric Sciences requires a research scientist to manage its Geochemistry research laboratories and develop, through research, new techniques to enhance the department's analytical capabilities in geochemistry. The incumbent reports to the Chair of the department.

The appointment is an academic position at the Faculty Service Officer level. The position will involve overseeing the continued development and implementation of new technology and techniques in geochemistry and for the multi-collector and quadrupole ICP-mass spectrometers in areas such as, but not limited to, U-Pb, Lu-Hf, Sm-Nd, Rb-Sr, isotopic and elemental analysis of a variety of materials. The position will also involve overseeing the application of laser ablation isotopic and elemental analysis using the two existing NewWave 213nm UV lasers. The incumbent will play a significant role in grant and contract applications and is expected to support the development of new technologies generally in geochemistry. The incumbent is also responsible for the administration of the geochemistry facilities including supervision of laboratory technicians, scheduling, budgeting and costing of services.

A Ph.D. in geochemistry or analytical chemistry is required and the ideal candidate will have advanced knowledge of geochemical analytical techniques. Operational experience with multi-collector and quadrupole ICP-mass spectrometers, laser ablation tech-

niques, chemical extraction methodologies used in isotope and geochemical research, isotopic data reduction and analysis are assets. This position involves the coordination, supervision and interaction with a large number of students and faculty both within and external to the university. As such, the candidate must possess superior organizational, inter-personal and written/verbal communication skills in English and have demonstrated competency using standard research software such as Excel.

The salary range for this position is \$64,087-\$89,071. The appointment is a continuing position with opportunity to progress through the FSO ranks.

Applications must be received by December 15, 2008. Applicants should send a letter of application with a detailed curriculum vitae and arrange for three confidential letters of reference.

Interested applicants may apply to Dr. Martin Sharp, Chair, Dept. of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta T6G 2E3, Canada.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. If suitable Canadian citizens or permanent residents cannot be found, other individuals will be considered.

The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

### GEOLOGY FIELD CAMP DIRECTOR AND ASSISTANT TEACHING PROFESSOR UNIVERSITY OF MISSOURI

The University of Missouri invites applications for a permanent, non-tenure track faculty position to serve as Director of our geology field camp (Branson Field Laboratory) located near Lander, Wyoming (<http://Web.missouri.edu/fieldcamp/>). The position includes administrative and teaching responsibilities for the summer field camp, teaching two courses each semester during the nine-month academic year at MU, and advising undergraduate students. Applicants must have completed a Ph.D. The ideal candidate will have a strong background in field geology, a general knowledge of the geologic history of the Rocky Mountains, and both teaching and administrative experience. The successful candidate will begin the position in August of 2009 and will have a full year of overlap with the current Director to provide experience in the position. The initial appointment will be for a period of two years, renewable following positive review. This is an eleven-month position with a salary of \$54,000 and an additional annual stipend of \$7,500.

Our field course operates from a permanent facility with a full-time caretaker, and is open to students from across the country and from the state of Missouri. Administrative responsibilities of the Director include: marketing, logistics, accounting, hiring faculty & staff, overseeing facility maintenance, involvement in development activities, and curriculum design. Our current academic program includes a broad spectrum of projects that are completed within easy driving distance of our camp, and are described on our Web site.

Application materials should include a letter describing your geologic interests and qualifications for the position, a teaching portfolio, a curriculum vitae, and a list of three references (including contact information) sent to Dr. Robert Bauer, Field Camp Director Search Committee, 101 Geological Sciences Building, University of Missouri, Columbia, MO 65211 (e-mail [bauer@missouri.edu](mailto:bauer@missouri.edu)). Initial screening of applicants will begin 5 January 2009 and will continue until a suitable candidate is hired. Information about our department is available at <http://geology.missouri.edu>.

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

### GEOSCIENCE EDUCATION, ASSISTANT PROFESSOR GRAND VALLEY STATE UNIVERSITY

The Geology Department at Grand Valley State University invites applications for a tenure-track position to begin in the fall 2009. Candidates must hold a Ph.D. in geoscience with demonstrated interest/experience in K-12 science education or a Ph.D./Ed.D. in science education with a strong Earth science background (ABD will be considered but hired at Instructor level). We seek a creative and dynamic educator with expertise that complements the existing strengths of the department's faculty, a demonstrated commitment to effective teaching, academic experiences with culturally diverse populations, and a record of active scholarship. Primary teaching responsibilities will be a new set of Integrated Science courses for elementary education majors, and courses that serve the Integrated Science (elementary

education) and Earth Science (secondary education) majors. Additional teaching responsibilities may include introductory courses, upper-level general education theme courses, and/or courses for Geology majors in area of expertise.

The successful candidate is expected to develop courses and field experiences; conduct research with undergraduate students; advise pre-service teachers; contribute to in-service teacher education; and act as the Geology Department liaison with the State Department of Education, the College of Education, and K-12 teachers. The Geology Department includes 10 tenure-track faculty and ~90 majors (geology and earth science) and serves ~200 integrated science majors ([www.gvsu.edu/iscj](http://www.gvsu.edu/iscj)). The department values field experiences and collegial faculty-student interactions ([www.gvsu.edu/geology](http://www.gvsu.edu/geology)).

Apply online at [www.gvsujobs.org](http://www.gvsujobs.org). Attach a letter of application, vitae, statements of teaching philosophy and research interests, and the names and contact information of at least three references familiar with your teaching and/or research potential. Review of applications to begin 1 December 2008 and continue until the position is filled. Grand Valley is an affirmative action, equal opportunity institution.

**HYDROLOGIST—GEOHYDROLOGY SECTION  
KANSAS GEOLOGICAL SURVEY  
THE UNIVERSITY OF KANSAS, LAWRENCE**

Full-time position at faculty-equiv. rank of assistant or associate scientist for basin-scale, water-cycle studies. Requires Ph.D. with hydrology emphasis, research on processes relevant for semi-arid basins, and scientific leadership potential. Background in recharge, stream-aquifer interactions, remote sensing/GIS, and integrated water-cycle models is desirable. Individual expected to develop research program of national stature and relevance to Kansas. The Geohydrology Section has 9 full-time professionals with additional support personnel. Emphasis on state-of-the-science field studies and complementary theoretical research. Sabbatical-eligible position. Complete announcement/application info at [www.kgs.ku.edu/General/jobs.html](http://www.kgs.ku.edu/General/jobs.html). First consideration deadline: 6 Feb. 2009. For further information contact

Jim Butler ([jbutler@kgs.ku.edu](mailto:jbutler@kgs.ku.edu)) or Marios Sophocleous ([marios@kgs.ku.edu](mailto:marios@kgs.ku.edu)). KU is an EO/AA employer.

**DEPARTMENT OF EARTH SCIENCES  
ASSISTANT PROFESSOR  
BRIDGEWATER STATE COLLEGE**

The Dept. of Earth Sciences at Bridgewater State College invites applications for a tenure-track position in sedimentary geology/stratigraphy to begin September 2009. The ideal candidate should be committed to excellence in teaching at the undergraduate level, strongly field-oriented, and focused on integrative research in sedimentary geology and physical stratigraphy. Preference will be given to those candidates that also have a strong background in invertebrate paleontology. The successful applicant will develop a junior level course in sedimentary geology/stratigraphy, a senior level course in paleontology, advanced course/s in the applicant's area of expertise as well as introductory geology courses. The candidate is also expected to develop and mentor undergraduate research activities. Other responsibilities include academic advising and service on College-wide committees. This position will be filled at the assistant professor level; candidates should possess a Ph.D. by June of 2009.

**Required Minimum Qualifications:** A completed Ph.D. degree in the Geological Sciences with a specialization in Sedimentary Geology.

**Preferred Qualifications:** Ability to develop undergraduate courses in the sedimentary geology and invertebrate paleontology. Research mentoring of undergraduate students. Strong field orientation.

Applicants should be strongly committed to excellence in teaching and advising, and to working in a multicultural environment that fosters diversity. They should also have an ability to use technology effectively in teaching and learning, the ability to work collaboratively, evidence of scholarly activity, and a commitment to public higher education.

**TO APPLY:** Please apply online at <http://jobs.bridgew.edu>.

Please attach the following documents to your online application: Cover Letter; Resume; A Teaching Philosophy statement.

Bridgewater State College is an affirmative action/equal opportunity employer which actively seeks to increase the diversity of its workforce.

**ASSISTANT RESEARCH SPECIALIST  
RESEARCH SPECIALIST I  
INTEGRATED OCEAN DRILLING PROGRAM  
WITH TEXAS A&M UNIVERSITY**

**Assistant Research Specialist/Research Specialist I position [NOV#090005].** For review of the full position announcement, refer to our Web site [www.ioldp.usio.org/Employment/default.html](http://www.ioldp.usio.org/Employment/default.html) as well as the Texas A&M University Web site <http://tamujobs.tamu.edu>. The Integrated Ocean Drilling Program with Texas A&M University invites applications for the position of Research Specialist with the Tools & Analytical Services department. The responsibilities include the development of scientific equipment and methodology relevant to IODP. The specialist will focus in one of three major areas:

- geology, which includes stratigraphy, sedimentology, petrography, and paleontology,
- geophysics and physics, and
- geochemistry, chemistry, and microbiology.

The specialist will coordinate the activities of the laboratory working group assigned to the respective area as well as the application of this knowledge to the development, documentation, instruction, operation, and maintenance of methods and equipment related to these areas. This includes the collection, compilation, and analysis of data. In addition, the specialist will be expected to sail on IODP expeditions approximately twice per year, approximately 2 months apiece, and will be responsible for support, operation, and maintenance of specialized laboratory systems on-board the research vessel as well as continuing ongoing development projects while at sea. The successful applicant will be required to pass a new employee physical exam and annual seagoing exams, and must be able to obtain a passport and travel visas on a continuing basis.

The applicant must have a bachelor's degree in a science- or engineering-related field with five years experience in a relevant field and proficiency in at least one relevant laboratory measurement technique. We



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**Slope Stability Geologist  
Washington/Oregon**

Located in the Pacific Northwest, you will conduct research and provide technical support as part of a multidisciplinary environmental research team focusing on slope stability in forested landscapes including road and timber harvesting permitting.

Requires WA Engineering Geologist License and Washington DNR qualified slope stability expert status (or ability to obtain within 18 months of hire); advanced degree in geomorphology, geology or a related field; commitment to safety; strong ability to work in steep terrain; and excellent team, research and communication skills. Job-related physical, drug screen and U.S. citizenship are necessary.

To release the potential in you, visit [www.wy.com/careers](http://www.wy.com/careers) and "Search Jobs" under job number **01004574**. Weyerhaeuser is an Equal Opportunity Employer building a capable, committed, diverse workforce.



LOUISIANA STATE UNIVERSITY

**ASSISTANT PROFESSOR  
(Two Tenure-track Positions in Geochemistry and Sedimentary Geology)  
Department of Geology and Geophysics**

The Department of Geology and Geophysics at Louisiana State University invites applications for two tenure-track Assistant Professor positions to begin Fall semester of 2009.

**Geochemistry:** We seek geochemists who work on fundamental processes and mechanisms, and the evolution of isotopic and geochemical systems. Analytical approaches include, but not limited to, non-traditional stable isotope systems, innovative mass spectrometric techniques, or radio isotopic chronometry. Geochemists whose research programs may utilize our Class 100/1000 ultraclean laboratory and/or wet-chemistry/stable-isotope (TIMS) facilities are encouraged to apply.

**Sedimentary Geology:** We are looking for a sedimentary geologist who studies sedimentary processes and the evolution of sedimentary systems. Research may include modern and/or ancient examples. The successful candidate will be expected to teach an undergraduate course in sedimentation and depositional environments. Applicants whose research program can utilize our Landmark/Petrel laboratory, geophone, and/or microscopy laboratory are encouraged.

Two interrelated focus areas: "Evolution of Sedimentary Systems" and "Earth Materials and Solid Earth Processes" have been developed within the LSU Department of Geology and Geophysics to enhance existing strengths of the Department and allow the Department to interface synergistically with other academic units at LSU. See [www.geol.lsu.edu](http://www.geol.lsu.edu) for more information regarding these focus areas, faculty, facilities, and research programs.

**Required Qualifications:** (Both Positions) Ph.D. at the time of appointment; development of a strong research program, including supervision of graduate student research, active publication in highly ranked journals, and the generation of external funding. **Additional Qualification Desired:** postdoctoral experience. The new faculty members are expected to contribute to our undergraduate and graduate teaching programs, and develop courses in their areas of specialization. Interaction with other faculty within the Department and across the University is strongly encouraged.

An offer of employment is contingent on a satisfactory pre-employment background check. The review process will begin November 17, 2008. The search will continue until a suitable candidate is found. Interested persons should send a copy of their vita (including e-mail address), a statement of their research and teaching interests, and the names, postal and email addresses, and phone numbers of at least three references to: **Faculty Search Committee, Department of Geology and Geophysics, Louisiana State University, Ref. #002835, Baton Rouge, LA 70803.** Note: Representatives of the Department will be present at the 2008 GSA Annual Meeting in Houston and AGU Fall Meeting at San Francisco.

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prefer a B.S. degree or an advanced degree, especially in a science- or engineering-related field. The applicant must have a demonstrated fluency in written and spoken English, be able to work professionally, harmoniously, and cooperatively with other technical staff and visiting scientists, and must be detail-oriented, be able to work independently, and be able to multi-task and prioritize their own work.

This position is a permanent position and is contingent upon the continuation of funding of this program.

For more information, refer to the IODP and TAMU employment sites listed above. Applicants may access the TAMU application the TAMU jobsite and may apply online with reference to [NOV#090005]. Please attach the names and addresses of three references (required). If available, please also attach a resume, a curriculum vita, and a list of authored/published papers. Integrated Ocean Drilling Program, Texas A&M University, 1000 Discovery Drive, College Station, TX 77845.

#### POSTDOCTORAL RESEARCH SCIENTIST STANFORD ROCK FRACTURE PROJECT

The Stanford Rock Fracture Project has an opening for a Postdoctoral Research Scientist to participate in a project on characterizing the basic architecture of a reservoir analog. We are interested in a candidate with a Ph. D. in Structural Geology with a focus on brittle deformation, preferably faults and their damage zones in sedimentary rocks. Ability in detailed mapping of outcrop-scale features, recognizing their distribution pattern, and inferring and rationalizing their formation mechanisms is desirable. Additional experience in petrophysical properties of fault rocks, 3D visualization techniques, and geomechanical modeling would be given priority.

The position is for one year but may be extended for another year depending on the availability of funding. The annual base salary is US\$42K. Applications will be reviewed until the position is filled. Vita and other supporting material should be sent to Atilla Aydin at [aydin@stanford.edu](mailto:aydin@stanford.edu). EOE.

#### VISITING ASSISTANT PROFESSOR SEDIMENTOLOGY AND STRATIGRAPHY DICKINSON COLLEGE

The Dickinson College Geology Department invites applications for a one-year position as a Visiting Assistant Professor to begin fall 2009. The successful candidate will be committed to teaching excellence in the liberal arts tradition and will be field-oriented with broad interests in geosciences beyond their specialty. Teaching responsibilities will include sedimentology/stratigraphy and topical introductory courses. Demonstrated success in student-faculty undergraduate research is highly desirable. Completion or near completion of a Ph.D. in the earth sciences is required.

Our curriculum emphasizes project-based learning with a strong field component. This is greatly facilitated by our location in the folded Appalachians, at the northern terminus of the Blue Ridge, and near the Triassic rift basins. The department has excellent analytical (GFAAS, SEM-EDS, XRD, XRF, TC-IC, digital 3-component seismometer, and well field for hydrogeologic investigations) and computing facilities including a GIS lab. More information can be found on the college and department Web pages at [www.dickinson.edu/departments/geol](http://www.dickinson.edu/departments/geol). Dickinson College is a highly selective private liberal arts college in south-central PA within easy drive of the New York-Washington, D.C., Metro corridor. Dickinson is committed to diversity and we encourage candidates who will contribute to meeting that goal to apply. Applications and nominations for women and minorities are strongly encouraged.

To begin the application process, please go to the following Web site: <https://jobs.dickinson.edu/applicants/Central?quickFind=50518>.

Applications should include a cover letter describing teaching and research interests and philosophy, curriculum vitae, and addresses for three referees. For further information please contact Dr. Jeff Niemitz at [niemitz@dickinson.edu](mailto:niemitz@dickinson.edu). Review of applications will begin on 1 March 2009.

#### ISOTOPE GEOCHEMIST UNIVERSITY OF WISCONSIN-MILWAUKEE

The Dept. of Geosciences at the University of Wisconsin-Milwaukee invites applicants for a faculty position in Isotope Geochemistry at the rank of Assistant or in exceptional cases, Associate Professor with a start date of August 2009. Applicants must hold a Ph.D. in geology or related field at the time of appointment, and have demonstrated research experience in isotope geochemistry. Post-doctoral experience is desirable. The successful candidate is expected to conduct an active, internationally recognized, externally

funded research program. The successful candidate will teach an undergraduate/graduate course in isotope geology (stable and radiogenic), introductory courses and upper level undergraduate and graduate level courses in their field of expertise, and advise graduate student thesis projects. A normal teaching load is 3 courses per academic year. Information is available online regarding the Dept. of Geosciences at [www.uwm.edu/Dept/Geosciences/](http://www.uwm.edu/Dept/Geosciences/) and the College of Letters and Sciences at [www.uwm.edu/letscli/](http://www.uwm.edu/letscli/).

The application deadline is January 16, 2009. To apply, please go to [www.jobs.uwm.edu/applicants/Central?quickFind=50610](http://www.jobs.uwm.edu/applicants/Central?quickFind=50610). Candidates will upload a cover letter, curriculum vitae, statement of teaching philosophy and research interests, and names and contact information of at least three current references. Examples of published work should be directed to Dr. Barry Cameron, Search Committee Chair, Dept. of Geosciences, UWM, P.O. Box 413, Milwaukee, WI 53201 or [bcameron@uwm.edu](mailto:bcameron@uwm.edu).

The University of Wisconsin-Milwaukee is a large research oriented institution located on the north side of Milwaukee. The Dept. of Geosciences offers B.S./B.A., M.S., and Ph.D. degree programs and is staffed by 12 full-time faculty. The University of Wisconsin-Milwaukee is an Equal Opportunity/Affirmative Action Employer.

#### ASSISTANT PROFESSOR MINERALOGY/PETROLOGY DEPT. OF GEOLOGICAL SCIENCES BALL STATE UNIVERSITY, MUNCIE, INDIANA

Tenure-track position with specialization in mineralogy/petrology with a secondary area of igneous, metamorphic, sedimentary, economic geology, earth science education, or geoinformatics available August 21, 2009. Responsibilities: teaching introductory mineralogy course and advanced coursework in specialty area(s); regularly teaching introductory geology and/or oceanography; performing and advising scholarly research; developing external funding and publishing in appropriate refereed outlets; participating in service functions of the department. Minimum qualifications: Ph.D. in geology or closely related field; appropriate background to teach mineralogy and at least one of the secondary areas defined above. Preferred qualifications: college teaching and/or professional experience; research demonstrating potential for extramural funding; record of effective interaction with students and faculty on individual projects and research. Excellent benefits, including retiree health care and 100% pension contribution for eligible employees.

Send letter of application, curriculum vitae, statement of teaching and research interests and goals, transcript of highest degree earned, and the names and contact information for at least three professional references to Dr. Kirsten Nicholson, Search Committee Chair, Dept. of Geological Sciences, Ball State University, Muncie, IN 47306; [knichols@bsu.edu](mailto:knichols@bsu.edu). If sent electronically, applications materials should be in PDF format. Review of applications will begin immediately and will continue until the position is filled. ([www.bsu.edu/geology](http://www.bsu.edu/geology)).

The Dept. of Geological Sciences seeks to attract a culturally and academically diverse faculty of the highest caliber. Ball State University is an equal opportunity, affirmative action employer and is strongly and actively committed to diversity within its community.

#### ASSISTANT PROFESSOR / HYDROGEOLOGY DEPARTMENT OF GEOLOGICAL SCIENCES BALL STATE UNIVERSITY, MUNCIE, INDIANA

Tenure-track position with specialty in subsurface hydrogeology, preferably with an associated area such as environmental geophysics, engineering geology, computational geology/modeling, water quality, or earth science education available August 21, 2009. Responsibilities: teaching hydrogeology and other upper level/graduate offerings depending on qualifications; regularly teaching introductory geology and/or oceanography; performing and advising scholarly research, including active participation in the university's interdisciplinary environmental/ aqueous science research group; developing external funding and publishing in appropriate refereed outlets; participating in service functions of the department. Minimum qualifications: Ph.D. in geology or closely related field; research specialty in subsurface hydrogeology; ability to teach introductory geology and/or oceanography. Preferred qualifications: college teaching and/or professional experience; research demonstrating potential for extramural funding; appropriate background to teach advanced coursework in an associated area; record of effective interaction with students and faculty on individual projects and research. Excellent benefits, including retiree health care and 100% pension contribution for eligible employees.

Send letter of application, curriculum vitae, statement of teaching and research interests and goals, transcript of highest degree earned, and the names and contact information for at least three professional references to Dr. Scott Rice-Snow, Chairperson, Dept. of Geological Sciences, Ball State University, Muncie, IN 47306; [ricesnow@bsu.edu](mailto:ricesnow@bsu.edu). If sent electronically, application materials should be in PDF format. Review of applications will begin immediately and will continue until the position is filled. ([www.bsu.edu/geology](http://www.bsu.edu/geology)).

The Dept. of Geological Sciences seeks to attract a culturally and academically diverse faculty of the highest caliber. Ball State University is an equal opportunity, affirmative action employer and is strongly and actively committed to diversity within its community.

#### TENURE-TRACK ASSISTANT PROFESSOR GEOSCIENCES, UNIVERSITY OF ARKANSAS

The Dept. of Geosciences at the University of Arkansas-Fayetteville invites applications for a 9-month appointment as a tenure-track assistant professor with an anticipated start date of August 2009. We are seeking an outstanding individual with expertise in broad areas of structural geology and tectonics. Applicants must demonstrate ability and commitment to develop an independent externally funded research program as well as the potential for collaboration and synergism with ongoing research in the Dept. of Geosciences (<http://geosciences.uark.edu>). The successful applicant will be an integrated scholar with a strong commitment to teaching at all levels, including possible participation in our required summer field course, in concert with supervision of graduate research. All Ph.D. requirements must be completed at the time of the appointment.

Review of applications will begin 15 December 2008 and will continue until the position is filled. Applicants should submit their curriculum vitae, brief statements of research and teaching interests, and the names, addresses and contact information for at least three professional references to Dr. Glen S. Mattioli, Search Committee Chair, Dept. of Geosciences, 113 Ozark Hall, Fayetteville, AR 72701.

The University of Arkansas is a nationally competitive student-centered research university located in Fayetteville, Arkansas. It is the flagship campus of the University of Arkansas system. The Dept. of Geosciences offers bachelors and masters degrees in geology and geography, and participates in two interdisciplinary graduate programs, Space and Planetary Sciences and Environmental Dynamics, providing opportunity for supervision of Ph.D. students in addition to those in Geosciences. An independent Geosciences Ph.D. program has been recently approved, and is pending funding prior to submission to the Arkansas Board of Higher Education.

Fayetteville, nestled in the Ozarks of Northwest Arkansas, is part of a metropolitan area of about 420,000 people that retains its small college town atmosphere. It is the sixth fastest growing metropolitan area in the U.S. spurred by opportunities with national companies including Wal-Mart, Tyson, Inc., and J.B. Hunt. The quality of life is high and it's a great place to work, play, and raise a family.

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

#### TENURE-TRACK POSITION SUSTAINABILITY SCIENCE FURMAN UNIVERSITY

The Dept. of Earth and Environmental Sciences at Furman University invites applications for a tenure-track position at the assistant professor rank in the field of sustainability science. Candidates must be committed to excellence in undergraduate teaching and engaging undergraduates in an active research program. The successful candidate will have a Ph.D. in a field within the earth system sciences that focuses on issues of sustainability. The candidate will be responsible for teaching an introductory course in sustainability science as well as advanced undergraduate courses in the candidate's specialty. Furman University is a small, selective private liberal arts college located in a rapidly urbanizing region. For more details on the position and how to apply, see <http://ees.furman.edu>. Furman University is an equal opportunity employer and encourages applications from minorities and women.

**ASSISTANT PROFESSOR, GEOMORPHOLOGY & GIS  
DEPT. OF GEOGRAPHY AND GEOLOGY  
WESTERN KENTUCKY UNIVERSITY**

Western Kentucky University, Dept. of Geography and Geology, is seeking applicants for an **Assistant Professor of Geomorphology and GIS**. This is a tenure-track assistant professor position beginning August 2009. The successful candidate is expected to contribute to the Department's research programs, to manage the MS Geoscience program, and to provide academic leadership in GIS.

- Qualifications:
- Earned Ph.D. in Physical Geography, GIS, or a related field is required.
  - Must demonstrate a commitment to excellence in teaching and research at the undergraduate, Master's, and post-doctoral levels.
  - Will be expected to develop a strong externally funded research program in geomorphology and/or GIS.
  - Collaborative and interdisciplinary research is encouraged.

Prospective candidates should obtain additional information at [www.wku.edu/geoWeb/](http://www.wku.edu/geoWeb/).

Interested candidates must submit a letter of application, curriculum vita, the names of three references, and separate statements of (1) teaching and (2) research philosophy to Dept. of Geography and Geology, Geomorphology Search Committee, Western Kentucky University, 1906 College Heights Blvd #31066, Bowling Green, KY 42101-1066.

Review of applications will begin November 30, 2008. Position will remain open until filled.

All qualified individuals are encouraged to apply including women, minorities, persons with disabilities and disabled veterans. Western Kentucky University is committed to the promotion of stewardship and student engagement.

**TENURE-TRACK POSITION IN  
SOLID EARTH SCIENCES  
DEPT. OF EARTH AND ENVIRONMENTAL SCIENCES  
UNIVERSITY OF WATERLOO**

The Dept. of Earth and Environmental Sciences at the University of Waterloo invites applications for a tenure-track position in the area of solid earth sciences at the

level of Assistant to Associate Professor. Appointment at the Full Professor level may be considered under exceptional circumstances. We are seeking an outstanding candidate who will complement and enhance our existing strengths within a growing, dynamic solid earth science research program. We are especially interested in a candidate who is involved in field-oriented studies using multidisciplinary approaches from a regional to global perspective. Research interests may include, but not limited to, tectonics/geodynamics, metamorphic geology, geochemistry, applied mineralogy and geochronology. The successful candidate will be expected to build a vigorous and innovative, externally-funded research program involving graduate students and to participate actively in a comprehensive undergraduate curriculum that spans the breadth of the traditional and environmental earth sciences.

The Dept. of Earth and Environmental Sciences has a well-funded and diverse research program currently involving 22 full-time faculty, 7 research faculty, 35 research staff and over 100 Ph.D. and M.Sc. students. Further information about the Department can be accessed at [www.earth.uwaterloo.ca/](http://www.earth.uwaterloo.ca/).

Evaluation of candidates will begin 15 December 2008 and continue until the position is filled. A complete application must include a full curriculum vitae, a statement outlining the nature of the research program and teaching philosophy, two to five recent publications and the names and contact information of at least three referees.

The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native people and persons with disabilities. All qualified candidates are encouraged to apply; however Canadians and permanent residents will be given priority. This appointment is contingent on funding. Applications should be directed to the Geology Search Committee Chair, Dept. of Earth and Environmental Sciences, University of Waterloo, Waterloo, Ontario, N2L 3G1, Canada; e-mail: [klalbrec@uwaterloo.ca](mailto:klalbrec@uwaterloo.ca).

**GEOTECHNICAL ENGINEER  
SHN CONSULTING ENGINEERS & GEOLOGISTS INC.**  
SHN Consulting Engineers & Geologists Inc. is a growing firm, dedicated to small-company values while pro-

viding quality-driven services. We are a science-based consulting firm providing engineering, survey, planning, geoscience, and environmental services located in the rugged, pristine paradise of northern CA and southern OR. SHN offers interesting and diverse projects and has a dynamic and talented staff of 115 professional, technical and administrative staff covering a wide range of services. We have an immediate need for a **Geotechnical Engineer** in our **Eureka, California**, office. Our Geo. Engineer will be responsible for all phases of project management and execution. Must have Professional Geotechnical Engineer License (GE); ability to market technical and professional services, negotiate agreements, conduct technical investigations, produce reports, and maintain client relations. Tasks include investigating existing subsurface conditions and materials and assessing risks posed by site conditions. SHN is an equal opportunity employer. This position is open until filled. For additional information visit our Web site [www.shn-engr.com](http://www.shn-engr.com). Please submit a cover letter and resume to Taylor Marie Baker, Human Resources Manager, at [tbaker@shn-engr.com](mailto:tbaker@shn-engr.com).

**METEORITICS/PLANETARY SCIENCE  
TEXAS CHRISTIAN UNIVERSITY**

The Dept. of Geology invites applications for a tenure-track assistant professor position in meteoritics/planetary science beginning in Fall, 2009. This person will be responsible for curating the Monnig Meteorite Collection, conducting research in meteoritics, and teaching planetary science and related courses. The Monnig Collection is one of the finest university meteorite collections in the world. Curatorial duties will include acquisition of new specimens, care of the collection, and participation in outreach programs. An annual acquisition budget will be available for enhancement of the collection. An active research program in meteoritics will be expected. Although analytical facilities are limited on site, annual funding will be provided for off-campus instrument time and travel to other labs. Teaching would generally consist of one course per semester, together with supervision of graduate students. For more information about the Dept. of Geology and the Monnig Collection, see our Web sites at [www.geo.tcu.edu](http://www.geo.tcu.edu) and [www.monnigmuseum.tcu.edu](http://www.monnigmuseum.tcu.edu).



## Sedimentary Geology Faculty Positions

Texas A&M University – Department of Geology and Geophysics

**The Department of Geology and  
Geophysics at Texas A&M University**

invites applications for two tenure-track faculty positions in sedimentary geology, broadly defined. Areas of interest include but are not limited to fundamental and applied problems in sedimentary processes ranging from pore to basin scale, depositional environments, sequence stratigraphy, basin architecture, sea level change and coastal evolution, and energy and natural resource science. At least one position will be offered to an individual working at the basin scale. We will consider applicants at all academic ranks. Successful applicants will be expected to develop and maintain vigorous, externally funded research programs and contribute to undergraduate and graduate teaching. We are a collaborative broad-based department within the College of Geosciences, which includes the Departments of Oceanography, Atmospheric Science, Geography, and the Integrated Ocean Drilling Program. Opportunities for collaboration also exist within the Department of Petroleum Engineering.

Interested candidates should submit electronic versions of a curriculum vita, statement of research interests and teaching philosophy, the names and email addresses of at least three

references, and up to four reprints by email attachments, to the Chair of the Sedimentary Geology Search Committee, [sedsearch@geo.tamu.edu](mailto:sedsearch@geo.tamu.edu). Screening of applications will begin October 31, 2008 and will continue until positions are filled. A Ph.D. is required at the time of employment.

The Department of Geology and Geophysics ([geoweb.tamu.edu](http://geoweb.tamu.edu)) is part of the College of Geosciences, which also includes the Departments of Geography, Oceanography, and Atmospheric Sciences, Sea Grant, the Geochemical and Environmental Research Group (GERG), and the Integrated Ocean Drilling Program (IODP). Texas A&M University, a land-, sea-, and space-grant university, is located in a metropolitan area with a dynamic and international community of 152,000 people. Texas A&M University is an affirmative action/equal opportunity employer committed to excellence through the recruitment and retention of a diverse faculty and student body and compliance with the Americans with Disabilities Act. We encourage applications from minorities, women, veterans, and persons with disabilities. Texas A&M University also has a policy of being responsive to the needs of dual-career partners ([hr.tamu.edu/employment/dual-career.html](http://hr.tamu.edu/employment/dual-career.html)).

To apply send a vita, statement of teaching interests, proposed research program, and contact information for three references to R.E. Hanson, Chair, Dept. of Geology, Box 298830, Fort Worth, TX 76129. Review of applications will begin February 1, 2009, and continue until the position is filled. A Ph.D. in meteoritics or related fields is required at the time of appointment and postdoctoral experience is preferred. TCU is an EOE/AA employer and encourages a diversity of applicants.

#### SEDIMENTARY GEOLOGY/ PETROLEUM GEOLOGY TEXAS CHRISTIAN UNIVERSITY

The Dept. of Geology invites applications for a tenure-track assistant professor position in sedimentary geology/petroleum geology beginning in Fall, 2009. This person will be responsible for teaching introductory geology and advanced undergraduate and graduate courses in their specialty, as well as supervising graduate students. The normal teaching load is two courses per semester. TCU operates on a teacher-scholar model. Faculty are expected to excel in the classroom and maintain an active research program resulting in publication in peer-reviewed national and international journals. We are looking for a person who will complement existing departmental strengths in sedimentary geology applied to the field of petroleum geology. Applications from persons with research interests in the deposition and diagenesis of mudrocks are especially welcome. The successful candidate will have the opportunity to participate in research programs associated with the TCU Energy Institute. For more information about the Dept. of Geology and Energy Institute, see our Web sites at [www.geo.tcu.edu](http://www.geo.tcu.edu) and [www.energyinstitute.tcu.edu](http://www.energyinstitute.tcu.edu).

To apply send a vita, statements of teaching and research interests, and contact information for three references to John A. Breyer, Chair, Search Committee, Dept. of Geology, Box 298830, Fort Worth, TX 76129. Review of applications will begin February 1, 2009, and continue until the position is filled. A Ph.D. is required at the time of appointment. TCU is an EEO/AA employer and encourages a diversity of applicants.

#### SENIOR GEOLOGIST INSTITUTE OF EARTH SCIENCE AND ENGINEERING AUCKLAND, NEW ZEALAND

The Institute of Earth Science and Engineering (IESE) [www.iese.co.nz](http://www.iese.co.nz), based at the University of Auckland, provides expertise in earth science research and the application of this research to projects with industry, community, government, and other universities. The backbone of IESE is its engagement in pure, applied, and relevant research and professional training focused on the accessible earth.

IESE is seeking to employ an experienced Geologist with applied research interests in the geological factors that control fluid flow in the upper several km of the earth's crust. In this role, you will join a growing team of IESE earth scientists engaged in multi-disciplinary applied research in crustal fluids and fluid flows, especially in relation to fracture-controlled energy reservoirs. There is potential for this role to extend into graduate level teaching within the University and via professional short-course and training programs.

Your broad background in structural geology, hydrothermal geology, petrology, geochemistry, volcanology, crustal geophysics and related fields will be highly valued. Knowledge of the South Pacific's unique structural geology and volcanology is desirable although not essential.

As an experienced geologist this is a rare opportunity to engage in a variety of applied research in a location of incomparable geology! As part of the remuneration package we will also assist with immigration and relocation.

For more information contact either Prof. Peter Malin, Director IESE [p.malin@auckland.ac.nz](mailto:p.malin@auckland.ac.nz) or Rebecca Mowat, Senior HR Advisor, on +64 9 373 7522 or e-mail your CV and cover letter to [jobs@uniservices.auckland.ac.nz](mailto:jobs@uniservices.auckland.ac.nz).

The IESE is operated by Auckland UniServices Limited, a wholly owned company of Auckland University [www.uniservices.co.nz](http://www.uniservices.co.nz).

#### VISITING ASSISTANT PROFESSOR GEOCHEMISTRY/MINERALOGY ST. LAWRENCE UNIVERSITY

The Geology Department at St. Lawrence University invites applications for a one-year Visiting Assistant Professor position in its Geology Department. We seek a geologist with expertise and research interests in environmental geochemistry and hardrock geology who can augment the environmental science and complement the hard rock components of our curriculum.

Applicants with a demonstrated ability in teaching, and a research record in their specialty are preferred.

The successful applicant will be expected to teach Geochemistry, preferably with an emphasis on low temperature and environmental aspects. Mineralogy, contribute to the teaching of our Introductory Geology course and its labs and to teach advanced level courses in a particular area of interest.

For a detailed job description, requirements and application instructions, please visit [www.stlawu.edu/resources/job.html](http://www.stlawu.edu/resources/job.html).

Processing of applications will begin February 1, 2009, and all materials must be received by that date.

St. Lawrence University is an Affirmative Action/Equal Opportunity employer. Women, minorities, and persons with disabilities are encouraged to apply.

#### ASSISTANT PROFESSOR—GEOMORPHOLOGY ST. LAWRENCE UNIVERSITY

The Geology Department at St. Lawrence University invites applications for a tenure-track Assistant Professor position. We desire an individual with expertise in Geomorphology and, ideally, Hydrology/Hydrogeology, who will complement our existing strengths in Structural Geology, Sedimentology, Paleontology, Petrology and Geochemistry. The successful candidate will be expected to teach Geomorphology, Hydrology/Hydrogeology, and to assist in the teaching of our entry courses to the Geology program, in addition to advanced courses within their interest area.

For a detailed job description, requirements and application instructions, please visit [www.stlawu.edu/resources/job.html](http://www.stlawu.edu/resources/job.html).

Application deadline is January 2, 2009, and all materials must be received by that date.

St. Lawrence University is an Affirmative Action/Equal Opportunity employer. Women, minorities, and persons with disabilities are encouraged to apply.

#### ASSISTANT PROFESSOR, SEDIMENTARY PETROLOGY/GEOCHEMISTRY OR NEOTECTONICS BOONE PICKENS SCHOOL OF GEOLOGY AT OKLAHOMA STATE UNIVERSITY (OSU)

The Boone Pickens School of Geology at Oklahoma State University (OSU) seeks applications for a tenure-track faculty position in either sedimentary petrology/geochemistry or neotectonics. The appointment will be at the assistant professor level and effective August 2009. The applicant is required to have a Ph.D. degree in geology or related field at the time of appointment. The applicant must show promise of an outstanding research program and be committed to excellence in teaching. The successful candidate will be expected to supervise M.S. and Ph.D. level graduate students and develop courses in his or her specialty. In addition they will participate in teaching introductory geology courses.

Candidates should submit a letter of application, including a discussion of research interests and approach to teaching, along with a curriculum vitae; academic transcripts; and the names, addresses, e-mail addresses, and phone numbers of three references to Assistant Professor Position Search, Boone Pickens School of Geology, 105 Noble Research Center, Oklahoma State University, Stillwater, Oklahoma 74078-3031, phone: +1-405-744-6358, fax: +1-405-744-7841. Screening of Candidates will begin in January 2009 and continue until the position is filled.

More information on OSU and the Boone Pickens School of Geology can be found on the Web <http://osu.okstate.edu> and <http://geology.okstate.edu> respectively. Inquiries about this position may be directed to Dr. Jay Gregg ([jay.gregg@okstate.edu](mailto:jay.gregg@okstate.edu)). Committed to health and safety Oklahoma State University maintains a tobacco free work environment. Oklahoma State University is an Affirmative Action/Equal Opportunity/E-Verify employer committed to diversity.

#### DEPT. OF EARTH AND ENVIRONMENTAL SCIENCES TENURE-TRACK POSITION IN BIOGEOSCIENCE VANDERBILT UNIVERSITY

The Dept. of Earth and Environmental Sciences at Vanderbilt University invites applications for a tenure-track faculty position in the general area of Biogeochemistry. This position, effective the Fall 2009 semester, is at the Assistant Professor level.

We seek an individual who is aimed at the highest standards of scholarship in research and teaching at both the undergraduate and graduate (M.S., Ph.D.) levels, and who will be attracted by opportunities at Vanderbilt for interaction with a diverse, enthusiastic faculty and student body in the Earth and environmental sciences and related fields. We welcome applications from candidates pursuing theoretical, experimental, and/or field-based work. The specific research specialty is open. Examples of fields of interest include, but are not limited to, climate change and paleoclimate; origin and evolution of the biosphere; critical zone processes;

biogeochemical cycling; ecological processes (floral and/or faunal); and extinction patterns and processes. We seek an individual with interest in both ancient and modern biological systems.

Applications should include a vita, a statement of research and teaching interests, and names of at least three references (including mail and e-mail addresses and phone numbers). Select applicants will be later asked to provide student evaluations of teaching (if available). Applications should be submitted by e-mail in PDF or MS-Word format to [EESposition@vanderbilt.edu](mailto:EESposition@vanderbilt.edu); up to three representative papers may be attached. Address questions to Molly F. Miller, Interim Chair, Dept. of Earth and Environmental Sciences, Vanderbilt University, VU Station B Box 351805, 2301 Vanderbilt Place, Nashville, TN 37235-1805. Review of applications will begin 22 December 2008. Vanderbilt is an equal opportunity/affirmative action employer. Women and minorities are especially encouraged to apply.

#### FULL-TIME, ASSISTANT PROFESSOR, GEOSCIENCES CLIMATE SCIENCES SKIDMORE COLLEGE

**Description:** The Dept. of Geosciences invites applications for an opening in Climate Sciences at the level of Assistant Professor to begin Fall 2009. The Department seeks a candidate with strong teaching skills who will build and maintain an active research program with students. For this position we seek a teacher/scholar with background in climatology, oceanography, geochemistry, or geophysics as related to one or more of the following: climate dynamics, geochemical cycles, ocean-atmosphere interaction, climate diagnostics and analysis, and basic processes in atmospheric and ocean dynamics. Course coverage includes Introduction to Oceanography, Climatology, and upper-level courses in the candidate's area of expertise. The position also involves contribution to all-college requirements, e.g., by way of Interdisciplinary Seminar (topic open) for first-year students. The College offers start-up funds, pre-tenure sabbaticals, and internal grants, however, the successful candidate is also expected to seek and obtain external research funding. Skidmore College is a liberal arts institution of approximately 2,200 students and 200 full-time faculty, located in upstate New York. Skidmore College also seeks to attract an academically and culturally diverse faculty, welcoming application from women and men of diverse background.

**Qualifications:** A Ph.D. in the geosciences or a related field is required and preference will be given to those candidates with teaching experience. The review process of this position will begin January, 1, 2009.

Apply to Candidates should send a vitae, evidence of excellence in teaching and scholarship, and three letters for recommendation to Kyle Nichols, Chair, The Dept. of Geosciences, Skidmore College, 815 North Broadway, Saratoga Springs, NY 12866.

#### STRUCTURAL GEOLOGIST, UNIVERSITY OF AKRON

The University of Akron, Dept. of Geology and Environmental Science (GES), invites applications for a tenure-track Assistant Professor position with a structural geology focus starting 24 August 2009. This is a 9-month, tenure-track position. A Ph.D. in a geoscience related field prior to appointment, along with the ability and willingness to teach a junior level structural geology class and field camp, are required. Applicant is expected to engage in professional service and to develop an externally funded research program that engages master's-level and undergraduate students.

UA serves about 25,000 students, and is a public institution of the University System of Ohio. Our department houses 10+ faculty members with diverse research specialties that include a focus on terrestrial records of environmental change and geoscience education. We offer bachelor and masters level degrees under a variety of options. See [www.uakron.edu/geology](http://www.uakron.edu/geology) for department details. Please submit a letter of application, full C.V., statements of research and teaching interest, and names of 3 references to Dr. David Steer; Chair, Structural Search Committee; Dept. of GES; University of Akron; Akron, OH 44325-4101. Review of applications will begin on November 15th and continue until the position is filled. The University of Akron is committed to a policy of equal employment opportunity and to the principles of affirmative action in accordance with state and federal laws.

#### PETROLOGIST, OHIO UNIVERSITY

The Dept. of Geological Sciences at Ohio University invites applications for a Tenure-track Assistant Professor to begin in September 2009. We are seeking an individual whose research interests are in igneous petrology, or a closely allied field, and who is qualified to teach courses such as petrology, earth materials, and



petrography. The successful applicant will possess a Ph.D. in geology, be committed to excellence in teaching at both the undergraduate and graduate level, develop a strong research program supported by external funding, and augment our planetary and structural/metamorphic expertise. Candidates must have outstanding leadership, management, and interpersonal skills to relate to a wide diversity of faculty, staff, students and community members.

Ohio University is a Research-Extensive institution, enrolling 19,500 students on the Athens campus and more than 8,000 students on five regional campuses. The College of Arts and Sciences includes 340 tenured and tenure-track faculty members and contains 19 departments, 8 of which offer the doctoral degree. Further information about Ohio University may be found at the university's Web site: [www.ohio.edu](http://www.ohio.edu).

Applicants must apply online via the Quicklinks site ([www.ohiouniversityjobs.com/applicants/Central?quickFind=54688](http://www.ohiouniversityjobs.com/applicants/Central?quickFind=54688)) and attach a vita, description of research interests, statement of teaching philosophy, and the names and addresses of three referees. An electronic copy of the most recent paper may be attached: Search Committee Chair, Dept. of Geological Sciences, 316 Clippinger Laboratories, Athens, OH 45701-2979. Position will remain open until filled, for full consideration, apply by December 1, 2008. Ohio University is an affirmative action/equal opportunity employer. For further information concerning the department and its faculty, visit [www.ohio.edu/geology](http://www.ohio.edu/geology).

#### TENURE TRACK POSITION EARTH SYSTEM SCIENTIST SEDIMENTARY PROCESSES—BOSTON COLLEGE

The Dept. of Geology and Geophysics at Boston College seeks to hire an Assistant Professor in the broad area of Earth System Science with a focus in Sedimentary Processes to start in Fall 2009. Areas of expertise might include (but are not limited to): basin analysis, reflection seismology, sediment transport, global environmental change, and biogeochemical processes in sedimentary systems. The successful candidate will be expected to develop a vigorous externally funded research program integrated with excellence in teaching within the geology-geophysics-environmental geoscience curriculum at both the undergraduate and graduate levels, including teaching a course in Sedimentology and Stratigraphy for majors. Information on the department, faculty, and research strengths can be viewed at [www.bc.edu/geosciences](http://www.bc.edu/geosciences). Applicants should send a curriculum vita, statements of teaching and research interests, and the names and contact information of at least three references as a single PDF-file e-mail attachment to [sed\\_position@bc.edu](mailto:sed_position@bc.edu). Review of applications will begin on November 14, 2008. Dept. faculty will be available at the GSA and AGU fall meetings to meet with applicants. Boston College is an academic community whose doors are open to all students and employees without regard to race, religion, age, sex, marital or parental status, national origin, veteran status, or handicap.

## Opportunities for Students

**Ph.D. Opportunity in Alaskan paleoclimate, University of Nevada—Las Vegas.** We are seeking a Ph.D. student to complete field and laboratory research on Alaskan paleoclimate using stable isotopes in ground ice of permafrost near Fairbanks, Alaska, in the context of their stratigraphy, sedimentology and age, with lab work in the Las Vegas Isotope Science (LVIS) Lab. Previous experience in paleoclimatology and/or stable isotope geochemistry is preferred. Contact Matthew Lachniet ([matthew.lachniet@unlv.edu](mailto:matthew.lachniet@unlv.edu)) or Daniel Lawson ([dlawson@crrel.usace.army.mil](mailto:dlawson@crrel.usace.army.mil)) and see [geoscience.unlv.edu](http://geoscience.unlv.edu) for more info.

**Graduate Research Assistantships in Near-Surface Geophysics at the University of Tennessee.** Funding is currently available for several graduate research assistantships through the Environmental Geophysics Research (EGR) Lab at the University of Tennessee. The first project (sponsored by the DOD and ORNL) involves utilizing time-lapse electrical resistivity tomography with a large-array system (224 electrodes) for assessing natural recharge and contaminant remediation processes through time (days, weeks, months). The second project (sponsored by NSF) involves promoting diversity in the geosciences by providing unique opportunities to underrepresented student populations through the East Tennessee Geosciences Program (ETGP; [www.etgp.tennessee.edu](http://www.etgp.tennessee.edu)). The third project (currently pending funding through NSF) is a multi-university collaborative project involving near-surface seismic reflection, refraction tomography, and GPR for examining shallow fault



**Earth Observatory of Singapore**

**Principal Investigators**

The Earth Observatory of Singapore has been established at Nanyang Technological University to study tectonic, volcanic and climatic processes, three arenas of earth science with particular relevance to the future of societies and civilization.

We plan to make about 15 tenure-track appointments over the next few years. Most will be at the assistant-professor level, but a few will be more senior.

If being part of a new earth-science research team in tropical Asia intrigues you, please email your application package (consisting of a curriculum vitae, list of publications, statement of research and teaching interest, and the names of 3 references) to: **[EOS@ntu.edu.sg](mailto:EOS@ntu.edu.sg)** by **1st December 2008**.

For further information about the Earth Observatory of Singapore, please refer to: **<http://www.ntu.edu.sg/EarthObservatory>**.

**[www.ntu.edu.sg](http://www.ntu.edu.sg)**

structures in the Centennial Valley to assess stress field switching associated with the interaction between the Yellowstone Hotspot and Basin and Range extension. The fourth project (also currently pending funding through NSF) involves the development of high-resolution near-surface three-component (3C) seismic reflection methods (144 channels available for 48 3C stations) and azimuthal seismic refraction tomography (ASRT) for analyzing bedrock anisotropy and associated hydrologic controls.

Applicants interested in either Ph.D. or M.S. degrees are encouraged to apply, though Ph.D. candidates will be given preference. Funding is available now for students planning to begin pursuit of their graduate degree at the University of Tennessee as early as January 2009. Funding is available for applicants to travel to Knoxville for a site visit. Additionally, the EGR Director will be attending GSA and AGU, so interested candidates may contact him directly to arrange an informal onsite interview. Evaluation of candidates for assistantship positions will begin November 7th and continue until the positions are filled.

For additional information contact: Dr. Gregory Baker, Director, Environmental Geophysics Research Lab, Dept. of Earth & Planetary Sciences, e-mail: [gbaker@tennessee.edu](mailto:gbaker@tennessee.edu), Phone: 865.974.6003

For more info, go to [www.geophysics.tennessee.edu](http://www.geophysics.tennessee.edu).

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

Applications for graduate study at Case are accepted on a rolling basis, though students requesting financial

assistance in Fall 2009 are encouraged to apply by February 1, 2009. CWRU is committed to diversity and equality. Students from all backgrounds are encouraged to apply.

**Graduate Student Opportunities, Ohio University.** The Dept. of Geological Sciences at Ohio University is seeking qualified students for its graduate program beginning September 2009. The department offers programs leading to an MS degree in Geological Sciences with areas of emphasis including paleontology, stratigraphy/sedimentology, hydrogeology, geochemistry, geomorphology, planetary geology, geophysics, and tectonics. Prospective students are encouraged to contact faculty directly to discuss potential research topics. Qualified students are eligible to receive teaching assistantships that carry a full tuition scholarship and a stipend. For program and application information, visit the department Web site at [www.ohio.edu/geology/](http://www.ohio.edu/geology/) or contact the graduate chair, Greg Springer ([springeg@ohio.edu](mailto:springeg@ohio.edu)), for additional information.

**Earth Sciences Graduate Fellowship (Kottlowski/Bureau Fellowship).** The New Mexico Bureau of Geology and Mineral Resources, a division of New Mexico Tech, is soliciting candidates for the Kottlowski/Bureau Fellowship. The fellowship, for an incoming Ph.D. candidate in the Dept. of Earth and Environmental Science, offers a 12-month, \$23,000 stipend plus full coverage of tuition. The fellowship is renewable for up to three years. Additional funding is available to cover some laboratory and field expenses.

All Ph.D. applicants to the department will be considered for the fellowship. The successful candidate may have interests in any earth or environmental science specialty, but will be expected to do a project within the state or of particular interest to the state, under the direction of advisors from both the Bureau and the Department. Application deadline is January 15, 2009. Applicants will automatically be considered for other support within the department.

New Mexico Tech is a highly rated science and engineering university with more than 60 earth science

faculty shared between the academic division and the Bureau. More complete descriptions of the fellowship, of New Mexico Tech, and of the Bureau are available at [www.nmt.edu/](http://www.nmt.edu/) and <http://geoinfo.nmt.edu/>.

**Ph.D. Assistantships—Soil Carbon-Mineral Geochemistry.** We seek Ph.D. candidates to join our USDA funded project, "Acceleration of inorganic nutrient release and mineral-organic matter association by biophysical soil mixing along an earthworm invasion chronosequence." This project will quantitatively couple the ecology of earthworm invasion in the Chippewa National Forest in Minnesota with two major biogeochemical processes: mineral weathering and carbon cycling. For more information, visit <http://udel.edu/~kyoo/worm.html>.

Accepted students will be mentored by an interdisciplinary team of scientists—Kyungsoo Yoo at University of Delaware, Anthony Aufdenkampe at UD and Stroud Water Research Center, and Cindy Hale at the University of Minnesota. Degrees will be granted by the UD's Dept. of Plant and Soil Sciences, with coursework customized from extensive offerings throughout UD. We seek students who might start as soon as February 2009. We encourage interested students to e-mail Yoo ([kyoo@udel.edu](mailto:kyoo@udel.edu)) and Aufdenkampe ([aufdenkampe@stroudcenter.org](mailto:aufdenkampe@stroudcenter.org)) for details while preparing a CV, statement of academic interest, and contact information of two references. Official applications are due at UD's Graduate Office ([www.udel.edu/gradoffice/applicants/](http://www.udel.edu/gradoffice/applicants/)) on Dec. 1 2008 for Spring 2009 admission and 1 April 2009 for Summer 2009 admission.

**New Mexico Highlands University, Graduate Assistantship.** Graduate assistantships are available for students wishing to pursue an MS in Geology beginning Fall 2009 term. The NMHU Environmental Geology Program offers a field-intensive curriculum emphasizing earth materials, mineral-rock-water interactions, environmental geophysics, and natural geologic hazard assessment. Program strengths are in mineralogy, petrology, geochemistry, rock-paleomagnetism, structural geology, volcanology, and collaborative endeavors

with the Forestry Program and the New Mexico Forest and Watershed Restoration Institute. New NSF-Funded Paleomagnetic-Rock Magnetism and Water Chemistry laboratories allow for numerous student and collaborative research opportunities. Nestled in the foothills of the Sangre de Cristo Mountains, Highlands' campus has been cited as one of New Mexico's best-kept secrets. A low student:faculty ratio, state-of-the-art laboratory facilities, and committed faculty provide students with a superior learning experience. The graduate assistantship includes a stipend of \$10,100 and tuition waiver per academic year. Application review begins 01/15/08. For more information, contact Dr. Michael Petronis, Environmental Geology, Natural Resource Management Department, New Mexico Highlands University, Box 9000, Las Vegas, New Mexico 87701, [mmpetro@nmhu.edu](mailto:mmpetro@nmhu.edu). For disabled access or services call +1-505-454-3513 or TDD# +1-505-454-3003. AA/EOE Employer.

**Ph.D. Opportunity at Louisiana State University.** We seek highly qualified, motivated, and academically strong students with a bachelors or masters degree in geoscience or a closely related field for the Marathon Geosciences Diversity Enrichment program (Marathon GeoDE). Individuals must possess a strong desire to become leaders in a Ph.D. program that emphasizes scholarship, research, service, diversity, and mentoring. The program provides a \$30,000, 9-month stipend, a full tuition waiver, and additional annual support for research and travel. This program is intended to create an inclusive, respectful, and intellectually challenging climate that embraces individual diversity and enhances the participation of underrepresented groups (including but not limited to race, ethnicity, and gender) in the geosciences. For additional information, visit [www.geol.lsu.edu/marathongeode.html](http://www.geol.lsu.edu/marathongeode.html) or contact Dr. Laurie Anderson at [glande@lsu.edu](mailto:glande@lsu.edu).

**Houston Energy Fellow and Flagship Graduate Research Assistantship in Isotope Biogeochemistry and Geomicrobiology.** A four-year Ph.D. assistantship is available in the Dept. of Geology and Geophysics,

Louisiana State University. The research project will utilize multiple stable isotopes to study denitrifying and sulfate-reducing microorganisms to understand modern and ancient metabolic processes. The applicant should have a strong academic background in geology, aqueous geochemistry, and/or microbiology. Excellent oral/written communication skills and teamwork spirit are essential. The assistantship includes a stipend of \$25,000, summer support, and \$3000 for additional research expenses. Funding is in place to begin work as early as January 2009. Please contact Dr. Annette Engel ([aengel@lsu.edu](mailto:aengel@lsu.edu)) or Dr. Huiming Bao ([bao@lsu.edu](mailto:bao@lsu.edu)) for more information. Visit <http://geol.lsu.edu/aengel/Flagship%20Assistantship.htm> and [www.geol.lsu.edu/](http://www.geol.lsu.edu/) for details about our department.



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## ASSISTANT PROFESSOR

### Paleontology

The Department of Geological Sciences invites applications for a tenure-track faculty position in paleontology to be filled at the Assistant Professor level beginning August 2009. The successful applicant will teach undergraduate and graduate courses in Invertebrate Paleontology and other courses within the applicant's area of expertise. The applicant is also expected to pursue an active, externally-funded research agenda and perform service to the university and professional community.

We seek a candidate whose research is applicable to other disciplines including, but not limited to, Paleocology, Biostratigraphy, Paleobiogeography, Paleoclimatology, and/or Biogeochemistry. This position would complement the Department's existing programs in Sedimentary Basin Studies, Paleoclimatology, and Petroleum Geology. The candidate will be expected to: teach Introductory Geology, undergraduate Invertebrate Paleontology, and graduate courses in their area of expertise; attract and supervise masters and doctoral students; and establish an externally-funded research agenda.

To apply, go to <http://facultyjobs.ua.edu> and complete the online application. Attach a letter of application, curriculum vitae, and statements of research and teaching interests as well as names and contact information for at least three potential referees. Names and contact information for at least three references should be attached as "Other Document". For more information, contact Dr. Fred Andrus, Paleontology Search Committee Chair, at [fandrus@geo.ua.edu](mailto:fandrus@geo.ua.edu). Information about the Department is available on our web site at [www.geo.ua.edu](http://www.geo.ua.edu). Review of applications will begin January 15, 2009, and will continue until the position is filled.

The University of Alabama is an Affirmative Action/Equal Opportunity Employer. Applications from women and minorities are encouraged.

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# Generational and Cyclical Demographic Change in The Geological Society of America

*Dallas D. Rhodes, Dept. of Geology and Geography, Georgia Southern University, Statesboro, Georgia 30460, USA*

## INTRODUCTION

The Geological Society of America's (GSA) membership is a demographic aggregate of individuals who join the Society, age as members, and eventually leave it either voluntarily or through death. GSA's population structure bears the imprint of the major events that have shaped the geosciences during the past 85 years (the lifetimes of its membership). The current population structure also anticipates future changes in the Society's membership.

GSA provided the birth year, gender, and location (state or country) of active members in July 2006; the data analyzed here include only members residing in the United States (15,224 members; 85.4% of the Society's total) to minimize demographic variations resulting from the varied social, political, and economic histories of multiple nationalities.

## DEMOGRAPHIC CHARACTERISTICS OF THE MEMBERSHIP

Figure 1 illustrates the age and gender composition of the 2006 GSA membership sample. Members of each gender are organized into cohorts of individuals born within 5-year intervals.

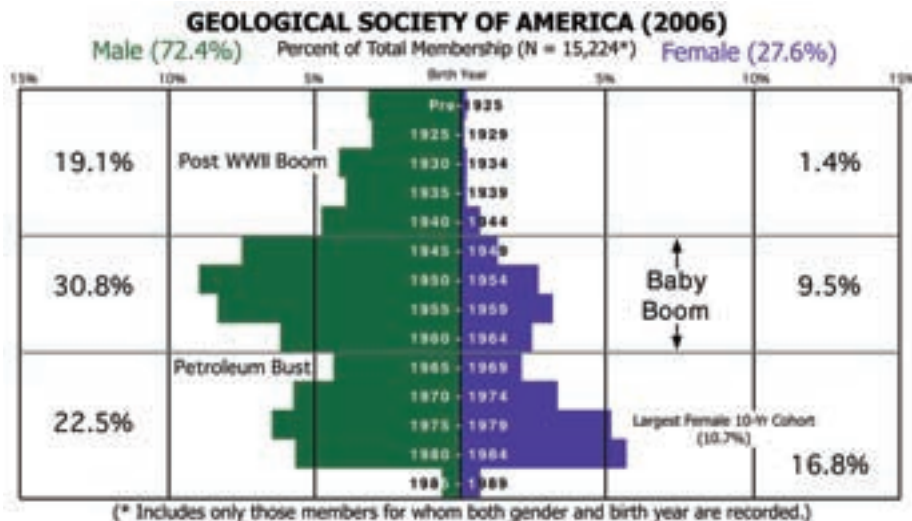


Figure 1. Population structure pyramid for 15,224 members of the Geological Society of America residing in the United States in July 2006. Five-year cohorts are scaled as a percent of the sampled membership.

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drhodes@georgiasouthern.edu

## Gender Imbalance

The most striking feature of GSA's population structure is the small percentage of women members—only 27.6%. The gender imbalance is especially notable among those born prior to 1945, when men outnumber women by more than 14 to 1. Cohorts born after 1969 have many more female members, and the number has increased with each successive 5-year cohort. This change reflects the near equity of the genders in geoscience degrees now being awarded in the United States (Holmes and O'Connell, 2007).

## Post-World War II Expansion

The bulge in GSA's membership corresponding to the timing of the Baby Boom (1946–1964) is one of the Society's most pronounced demographic features. The bulge is strongly asymmetric, with men in every cohort outnumbering women by more than 3 to 1 (30.8% to 9.5%).

Unusually large cohorts born during the Baby Boom are not observed in all academic disciplines. The membership of the Association of American Geographers, for example, does not have particularly large cohorts from the Baby Boom years. In fact, the increase in the national birthrate that led to the Baby Boom appears to be only coincidentally associated with the large number of geoscientists born during those years. Federal programs to enhance the sciences and science education appear to have been far more important.

## Petroleum Boom-and-Bust Cycles

Petroleum exploration in the United States is a story of "boom-and-bust" cycles (Deffeyes, 2001), and the two twentieth-century cycles had profound effects on GSA's membership. The first cycle began in August 1945, when the United States ended gasoline rationing. The boom, resulting from higher gas

prices, continued until 1957, when “famine had replaced feast in the exploration business” (Friedman, 1978) and employment opportunities dwindled (Fig. 2).

The effects of the boom in oil prices are reflected by the bulge in the 1930–1934 birth-year cohort (Fig. 1). After the price bubble burst in 1957, employment opportunities for the following (1935–1939) cohort were significantly reduced.

The second and most prominent gap in GSA’s membership resulted from the petroleum boom and bust of 1973–1986 driven by the Organization of Petroleum Exporting Countries (OPEC) and political unrest in the Middle East. The boom was initiated when the “oil weapon” was employed as part of the Arab strategy for the 1973 Yom Kippur War. The Iranian Revolution (began Jan. 1978) and the Iran-Iraq War (began Sept. 1980) drove the crude oil market price in “real” (uninflated) 2007 dollars to an historic high (www.wtrg.com/prices.htm) that was not exceeded until March 2008 (Fig. 2).

Writing for *Science* in 1978, Gerald Friedman proclaimed the years ahead to be “The Golden Age of the Geoscientist.” Record oil prices produced the “greatest boom of them all” (Yergin, 1991), and employment opportunities for earth scientists had never been brighter (Rosbacher, 1983). Unfortunately, this “Golden Age” was short-lived, ending only three years after Friedman’s prediction.

In the early 1980s, OPEC began to lose its power to dictate the world’s petroleum prices. Saudi Arabia broke ranks with OPEC in 1981 and increased production to regain its market share and income. The price of petroleum fell immediately and continued to plummet until 1986, by which time the price in real dollars had returned to pre-embargo levels (Fig. 2). The impacts of this

change on employment opportunities and education in the geosciences were immediate and devastating (Fig. 2).

The 1965–1969 birth cohort was college age (18–23) when the Middle East Petroleum Bust reached its nadir. Undergraduate enrollment in geoscience programs across the country plunged as jobs disappeared (AGI, 2001). In 1981, more than 7,000 geoscience undergraduate degrees were conferred in the United States, but by 1991, fewer than 2,000 were earned (Fig. 2).

### The Base of the Pyramid: After The Bust

The disastrous decline in enrollment following the most recent bust placed many academic geoscience departments in jeopardy (Feiss, 1996). With students no longer drawn to the field by the prospect of large salaries, geoscience departments began to change in order to survive. New employment opportunities for geoscientists, driven largely by environmental issues, required a new curriculum.

In concert with curricular changes, academic departments and the geosciences at large began to accept pedagogy as a legitimate research area. GSA acknowledged this important change in 1991 with the creation of the Geoscience Education Division. Pressed by regional institutional accreditation, assessment in all its varied forms, budget constraints, and simple survival, many geoscience professors have focused on the scholarship of teaching and on finding ways to make the science more accessible.

Members added to GSA since the most recent petroleum bust mark a major demographic shift. The most important change is the decline in gender imbalance, reflecting increases in the number of women entering the geosciences (Fig. 2). Between 1974

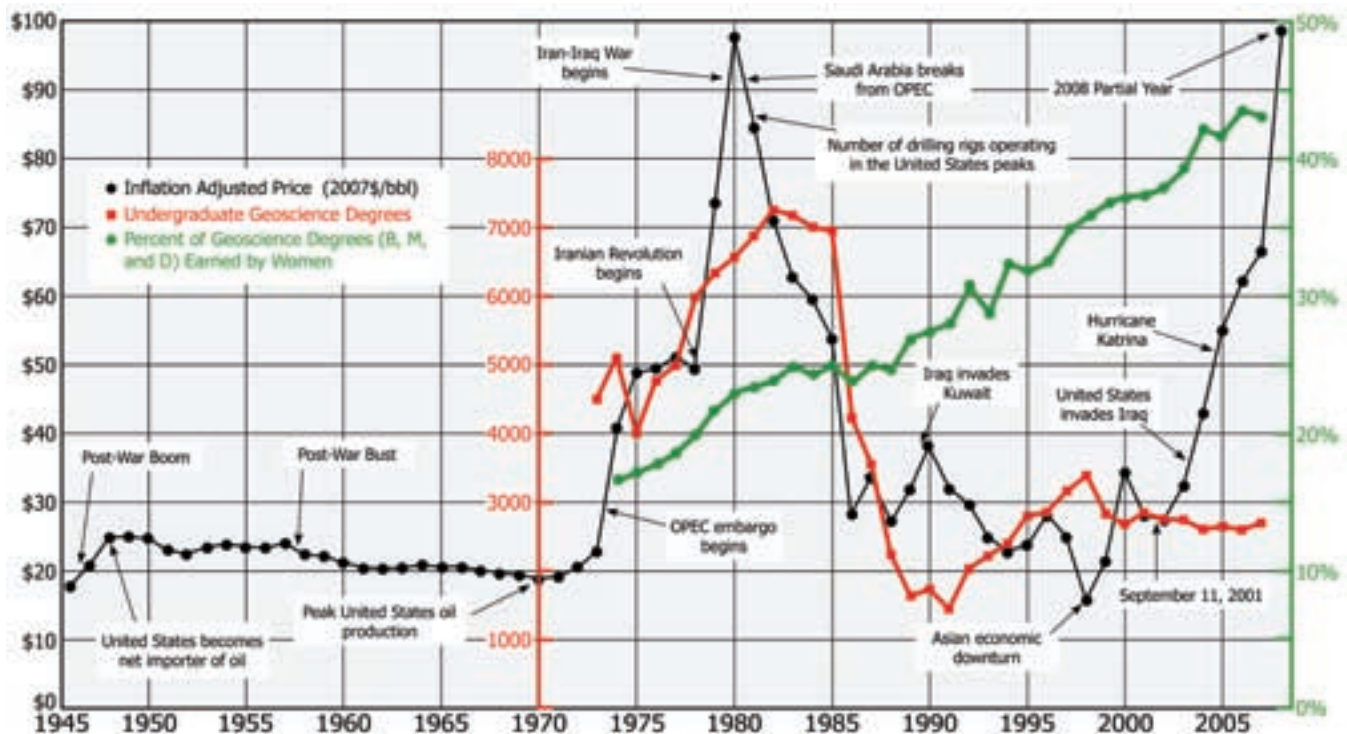


Figure 2. Geoscience degrees granted in the United States and the percentage of those degrees awarded to women from 1973 to 2007. Data compiled by the American Geological Institute and cited by Keane (2005). Inflation adjusted (in 2007 U.S. dollars) annual average price of oil from 1946 through 2008 with significant events affecting the price. Data from [http://inflationdata.com/inflation/Inflation\\_Rate/Historical\\_Oil\\_Prices\\_Table.asp](http://inflationdata.com/inflation/Inflation_Rate/Historical_Oil_Prices_Table.asp) citing as its source the United States Department of Energy (www.economagic.com) and www.imperialoil.com.

and 2000, geoscience degrees awarded to women rose from ~17% to 45% (AGI, 2001). With substantially fewer men joining GSA now than during the Baby Boomers' undergraduate and post-graduate years, the growth in women members has prevented a substantial loss in overall GSA membership.

## DISCUSSION

Nothing in the current GSA structure dictates the size or composition of future cohorts. Reasonable predictions can, however, be made as the extant cohorts continue to age.

First, as GSA's Baby-Boom generation moves into retirement and leaves the organization, the Society's membership will decline substantially unless new members are added more rapidly. In 2006, slightly more than 45% of the Society's membership was 50 or older. The three largest male cohorts (Fig. 1) will all reach retirement age in the next 15 years. This loss is inevitable and can be counterbalanced only by producing more U.S. geoscientists or by bringing in geoscientists from other countries.

Second, the 1980s Petroleum-Bust cohorts (born 1965–1975) are just entering their 40s and are assuming a much greater share of the responsibility for their profession. The small size of these cohorts means that there are fewer people to carry on the work of the science and the Society than in the past. Members of this group will, however, benefit from the increased opportunities for leadership. As well, some responsibilities that would usually be borne by this age group will probably be passed on to younger members.

Third, women are certain to play a larger role in the Society than ever before. It is critical, therefore, to retain as professionals women recruited as geoscience majors (de Wet et al., 2002).

For most of GSA's history, the societal value of geoscience has been defined by the ability of geologists to discover mineral and petroleum resources. The events of more than 50 years ago still have a recognizable imprint on GSA's membership, but the oil boom-and-bust cycles that largely shaped the geosciences throughout the twentieth century may be over (Keane, 2005). If these cycles have ceased, or at least ceased to be the most important influence on GSA, the class of events that may have this role in the future is by no means clear. Political, economic, and social changes are certain to have a profound impact on the Society and its membership.

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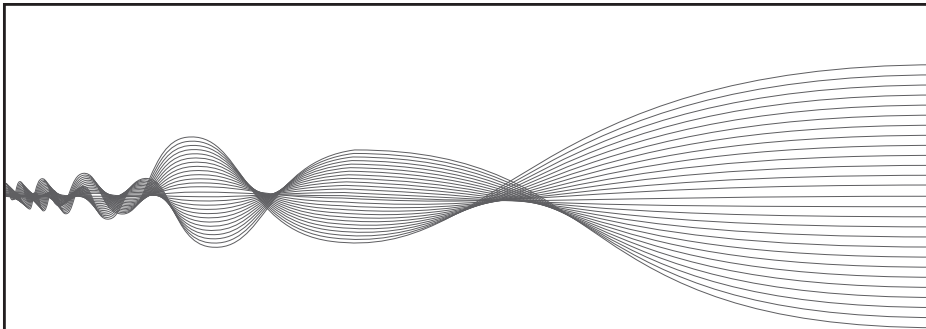
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