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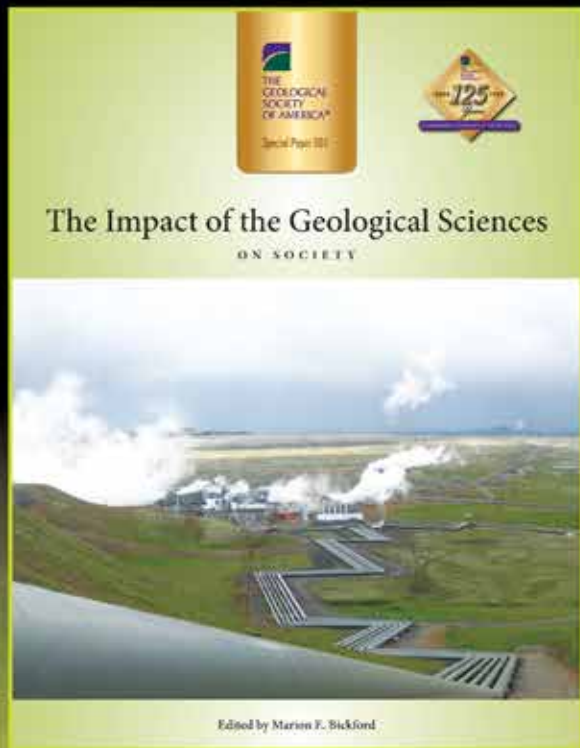
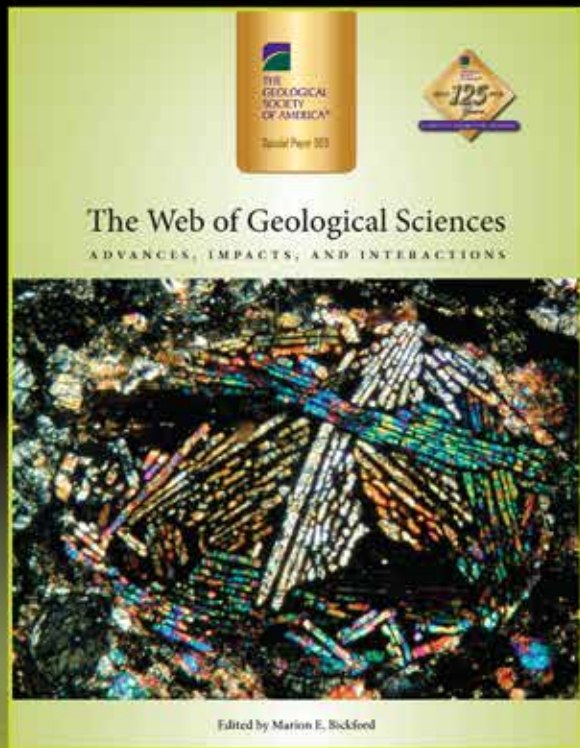
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Cover: Hurricane Irene makes landfall in Onslow Bay, North Carolina, 27 Aug. 2011. Image courtesy NASA. See related article, p. 4–10.



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GSA marks its actual 125th Anniversary on 27 December. Thanks for all you've done to help us celebrate this landmark year.



The geological legacy of Hurricane Irene: Implications for the fidelity of the paleo-storm record

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ABSTRACT

Paleotempestology has become more contentious in recent years because the exact nature of storm deposition and preservation is still poorly understood. Whereas historical records of hurricanes along the Atlantic coast are limited to the past 300 years, and reliable instrumental records extend back only half that length of time, proxy records taken from coastal sedimentary archives offer the potential to extend this record several thousand years, offering better statistical constraints on hurricane prediction. Two primary proxies have been the most studied during the last decade: sedimentary criteria and microfossils. In this study, we used a microfossil-based proxy—displaced marine foraminifers—to investigate a 1500-year paleostorm record of Onslow Bay, North Carolina, USA, and to compare marsh sediments and foraminifers pre- and post-Hurricane Irene, which made landfall in Onslow Bay on 27 August 2011. We found fewer hurricanes archived in the 1500 years of back-barrier marsh strata than have made landfall in Onslow Bay since 1950. This absence of preserved hurricane deposits, as well as the lack of a definitive signature from Hurricane Irene, suggests that caution should be used with respect to the sensitivity of sedimentological or micropaleontological proxies in paleotempestology studies. We conclude that, at best, only direct strikes from intense storms are being preserved, and it is likely Hurricane Irene's landfall will not be detectable in the future in the marginal-marine sediments from this region.

INTRODUCTION

As coastal populations continue to grow, and as recent Gulf Coast hurricanes have dramatically demonstrated, there is a need for a better long-term record of storm frequency and impact. Such a record can be used to determine recurrence intervals, guide coastal infrastructure and commercial planning, and set cost-effective insurance rates. The unfortunate paucity of historical records for hurricane landfall along the southern Atlantic coast limits their use as a predictive tool. Only three Category 5 hurricanes have made landfall in the United States since 1900; as a result, the probability of such an extreme storm impacting this region cannot be accurately determined using instrumental records. At best, forensic (historical) records of hurricanes along the Atlantic coast are limited to the past 300 years (Elsner et al., 2000, 2008; Chenoweth, 2006, 2007; Nyberg et al., 2007), and reliable instrumental records extend back only half that length of time (Neumann et al., 1999). Proxy records taken from marginal-

marine environments offer the potential to extend this record through the late Holocene, offering better statistical constraints on hurricane prediction.

Paleotempestology, the study of prehistoric tropical cyclone landfalls using geological proxies, is a relatively new and, in many instances, controversial science. One of the underlying goals of paleotempestological research is the compilation of landfall record of storms of all intensities (Categories 1–5) with high spatiotemporal resolution from the last several millennia from a disparate geographic region in order to better understand the recurrence interval of these natural hazards (Fig. 1). Assessment of the role of the El Niño Southern Oscillation (ENSO) (Goldenberg et al., 2001), the strength and position of the Bermuda High (Xie et al., 2005), and the role of increasing sea-surface temperatures on hurricane frequency (Kossin and Vimont, 2007) are also reliant on the development of an accurate and complete record of prehistoric storms.

Two paleotempestological proxies, based either on sedimentological or micropaleontological criteria (and rarely both), have received significant attention during the past decade, although other proxies, such as erosional indicators (Buynevich et al., 2007) and geochemical anomalies (McCloskey and Liu, 2012; Das et al., 2013) are being assessed. Many of these methodologies were discussed and debated during the well-attended theme session



Figure 1. Recent paleotempestology studies from the marginal-marine environments along the Atlantic, Caribbean, and Gulf coasts.

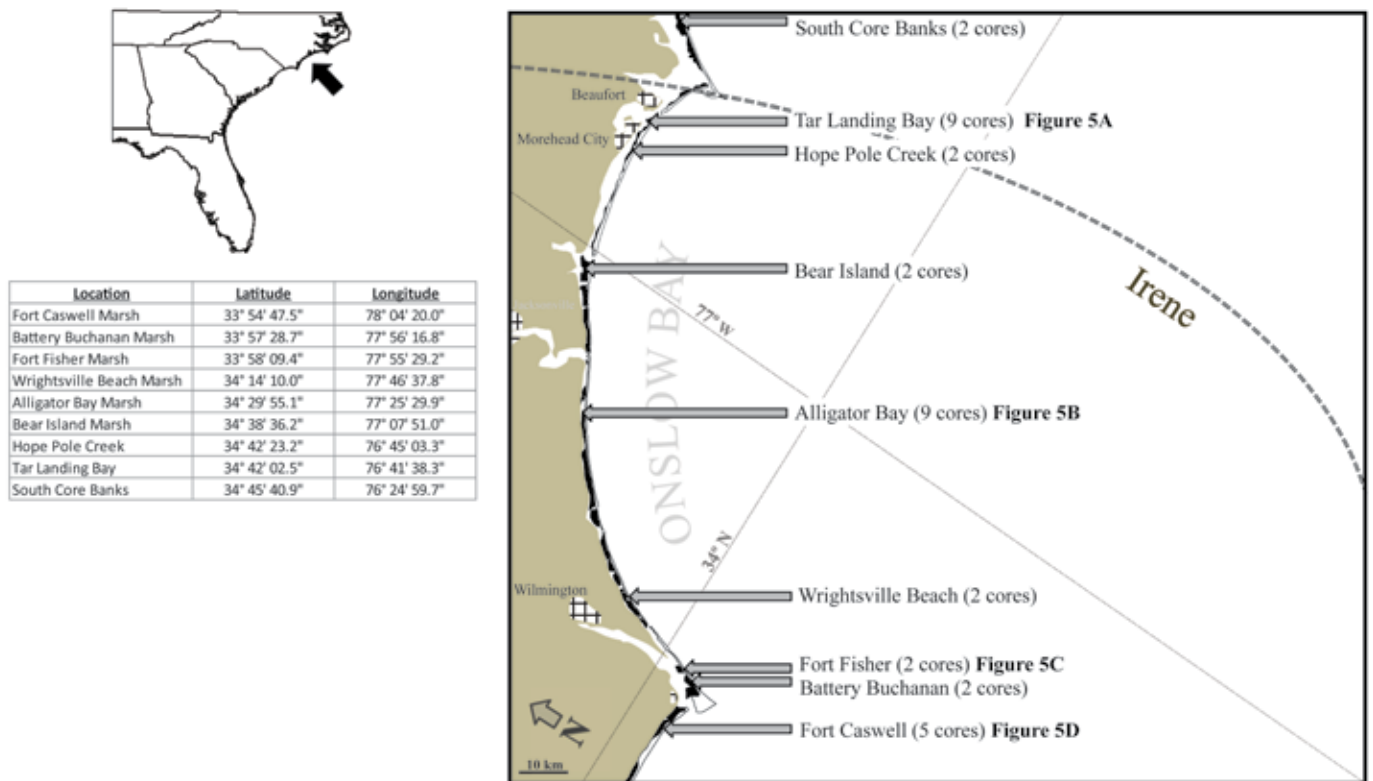


Figure 2. Location of the nine marshes cored in search of paleostorm deposits and the path of Hurricane Irene (28–29 Aug. 2011).

“Paleotempestology: Proxy Record Development and Climate Forcing Mechanisms” at The Geological Society of America’s 2012 Annual Meeting and Exposition in Charlotte, North Carolina, USA. The sedimentological proxy is based on identification of sediment transported into marshes and coastal lakes by hurricanes; it has been derided as “sand layer counting” and has been the subject of decade-long debates regarding the accuracy of the methodology (Liu and Fearn, 1993, 2000; Liu et al., 2008, 2009; Otvos, 2002, 2009, 2011). The micropaleontology method relies on transport of marine foraminifers into marshes during hurricane landfall. The micropaleontological proxy has also been the subject of several arguments—the exact taxa that are indicative of storm deposition and the completeness of the microfossil-derived storm records are still not well established (Hippensteel and Martin, 1999, 2000; Scott et al., 2003, 2005; Hippensteel et al., 2005; Hippensteel, 2011).

Previous sedimentological and micropaleontological approaches are problematic with respect to their actualistic approach, interpreting ancient storm deposits without a complete understanding of the modern dynamics of event deposition across marginal-marine environments. Geological signatures of recent hurricanes such as Rita, Katrina, and Ike have demonstrated that deposition varies greatly with respect to sedimentary characteristics and microfossil content (or lack thereof) (Horton et al., 2009; Williams 2009, 2010). Without a more complete understanding of hurricane deposition in marginal-marine environments, and the resulting archived storm record, criticism of “sand layer counting” or

detection of “peripheral hurricane strikes” or minor hurricane landfalls will most likely continue.

In this study, we report on the Late Holocene hurricane record of Onslow Bay, North Carolina, and the modern sedimentological and foraminiferal signature of Hurricane Irene to provide insights into the preservation potential of storm deposits along the U.S. Atlantic Coast. Our underlying goal was to assess the usefulness of microfossils for the documentation of ancient hurricane strikes and to determine the suitability of such a proxy for creating an accurate record of prehistoric hurricanes of differing magnitudes.

THE PALEO-STORM RECORD OF ONSLOW BAY

During 2010, nine back-barrier marshes from Onslow Bay were cored to a 3-m depth in search of paleo-storm deposits (Fig. 2; see the GSA Supplemental Data Repository¹ for details regarding field and laboratory methodology). Marginal-marine sites were selected at different latitudes and distances from Onslow Bay to maximize the potential for finding a site with a large number of preserved storm deposits and minimize site sensitivity to storm deposition. Only two marshes, Alligator Bay and Tar Landing Bay, contained displaced marine foraminifers interpreted as storm deposits (Table 1). A total of ten storm layers, representing a minimum of four storms, were recovered at Tar Landing Bay, and 16 storm deposits (a minimum of five storms) were obtained at Alligator Bay (Fig. 2). Offshore indicative taxa from these storm layers included, in descending order of abundance, *Quinqueloculina*

¹GSA supplemental data item 2013357, field and laboratory methodology and radiocarbon analysis, is online at www.geosociety.org/pubs/ft2013.htm. You can also request a copy from GSA Today, P.O. Box 9140, Boulder, CO 80301-9140, USA; gsatoday@geosociety.org.

Table 1. Record of storm deposits from nine marshes along Onslow Bay, North Carolina, USA, and the displaced offshore indicative foraminifers they contain

Location		3-m auger cores	Composite (total) storm deposits	Storms
North	South Core Banks	3	0	0
	Tar Landing Bay	7	10	5
	Hope Pole Creek	3	0	0
	Bear Island	3	0	0
	Alligator Bay	9	16	4
	Wrightsville Beach	3	0	0
	Fort Fisher	3	0	0
	Battery Buchanan	3	0	0
South	Oak Island/Fort Caswell	7	0	0

seminula, *Cibicides* sp., *Nonionella* sp., *Spirulina* sp., *Wiesnerella* sp., *Quinqueloculina laevena*, and *Patellina* sp. Although *Elphidium* spp. and *Ammonia* spp. are also common nearshore and shelf taxa in this region, their cosmopolitan nature prohibited their use as an indicator of storm transport and deposition. Sponge spicules, echinoid spines, and pteropods were also present in the sand layers. Radiocarbon analyses indicate that these layers were deposited during the past 1500 years (Fig. 3; see supplemental data [footnote 1]). No deposits that could be interpreted as tempestites were detected in the upper 3 m of the auger cores taken from the following back barrier localities: Battery Buchanan marsh, Fort Fisher marsh, Wrightsville Beach marsh, Bear Island marsh, and South Core Banks marsh.

Historically, Onslow Bay has had a similar or perhaps greater number of hurricane strikes as any other portion of the Atlantic and Gulf coastline. More than ten hurricanes made landfall in Onslow Bay since 1950, and a further 29 made landfall near or passed within 200 km of the shoreline (Table 2). Despite such historical storm activity, the prehistoric storm record archived in the marshes from Onslow Bay is poor. In Onslow Bay, only five to eight storm deposits have survived from the past 1500 years. Only two of these (at ~0.80 and ~2.30 m) are found at both Tar Landing Bay and Alligator Bay, and neither was detected at the other seven Onslow Bay marshes. The diminutive storm record could be the result of one or more of the following factors: (1) a lack of landfalls, (2) the destruction of storm signatures via bioturbation or

Table 2. Record of hurricane to strike or pass through Onslow Bay since 1950

Year	Storm	SS Category	Impact Type
1953	Barbara	Category 2	Landfall—Near
1954	Carol	Category 2	Offshore
1954	Edna	Category 3	Offshore
1954	Hazel	Category 3	Landfall—Near
1955	Connie	Category 1/2	Landfall—Onslow
1955	Diane	Category 1	Landfall—Onslow
1955	Ione	Category 2/3	Landfall—Near
1958	Helene	Category 4	Offshore
1960	Donna	Category 2	Landfall—Onslow
1963	Ginny	Category 1/2	Offshore
1964	Isbell	Category 1	Landfall—Near
1968	Gladys	Category 1	Offshore
1969	Gerda	Category 1	Offshore
1971	Ginger	Category 1	Landfall—Onslow
1984	Diana	Category 3/4	Landfall—Onslow
1985	Gloria	Category 2	Landfall—Near
1986	Charley	Category 1	Landfall—Onslow
1991	Bob	Category 2	Offshore
1993	Emily	Category 3	Offshore
1994	Gordon	Category 1	Offshore
1996	Bertha	Category 2	Landfall—Onslow
1996	Fran	Category 3	Landfall—Onslow
1998	Bonnie	Category 2/3	Landfall—Onslow
1999	Dennis	Category 2	Offshore
1999	Floyd	Category 2	Landfall—Onslow
1999	Irene	Category 1/2	Offshore
2003	Isabel	Category 2	Landfall—Near
2004	Alex	Category 2	Offshore
2005	Ophelia	Category 1	Offshore
2011	Irene	Category 1	Landfall—Onslow

Notes: Landfall—Onslow Bay: Hurricane center crossed NC coast within Onslow Bay; Landfall—Near: Hurricane center NC/SC coast within 100 km of Onslow Bay; Offshore: Hurricane center remained offshore but passed within 200 km of Onslow Bay; SS—Saffir-Simpson (hurricane wind scale).

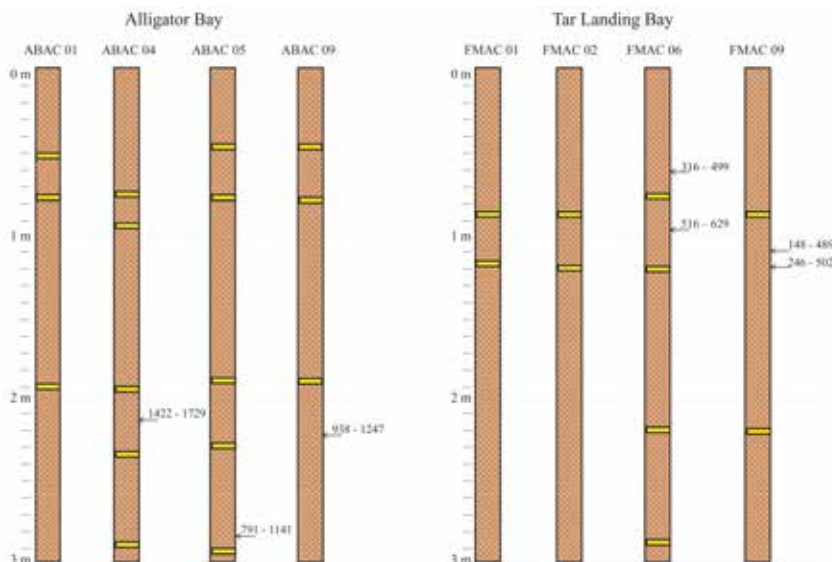


Figure 3. Composite storm history for Alligator Bay (ABAC) and Tar Landing Bay (adjacent to Fort Macon) (FMAC) for the previous ~1500 years. Yellow bars represent storm layers enriched with displaced marine foraminifers.

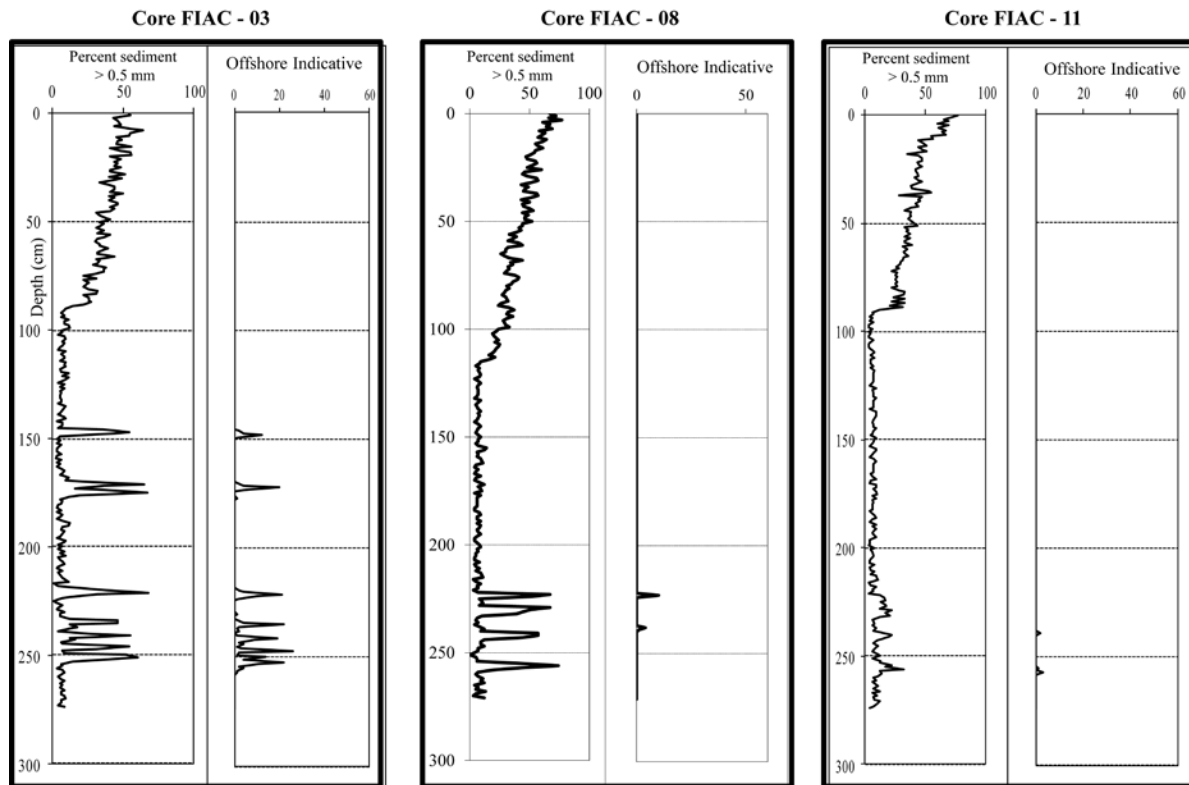


Figure 4. Downcore abundance of coarse sand and offshore-indicative foraminifers from three cores taken 10 m apart on Folly Island, South Carolina, USA. Core FIAC-03 contained sedimentological and foraminiferal evidence of seven hurricane deposits while Core FIAC-08 contained sedimentological evidence of four hurricane strikes and offshore foraminifers were rare. Core FIAC-11 contained little or no evidence of hurricane strikes. The missing foraminifers in FIAC-08 were probably destroyed through dissolution, and the hurricane record of FIAC-11 was probably destroyed through a combination of dissolution (foraminifers) and bioturbation (sediments).

erosion, or (3) the sensitivity of the sites to storm deposition (i.e., the distance [or elevation] between the marshes and the source of the sediments and foraminifers).

QUIESCENCE OR DESTRUCTION?

Storm layer preservation has recently been studied in the back-barrier system from Charleston, South Carolina (Hippensteel, 2011). Significantly different event horizons were found in cores only 10 m apart, and the lack of storm-layer preservation was attributed to a combination of bioturbation and dissolution of the calcareous foraminifers (Fig. 4).

Millennial periods of hurricane inactivity have been documented using sedimentary proxies (Liu and Fearn, 1993, 2000; Donnelly et al., 2004). Several reports discuss one landfall along Alabama and Florida during the past 1,000 years, in contrast to the previous 3,000 years in which as many as 12 Category 4 and 5 storms made landfall (Liu and Fearn, 1993, 2000). Similar records of dormancy from latitudes as disparate as Puerto Rico (Woodruff et al., 2008) and Massachusetts (Buynevich and Donnelly, 2006; Buynevich et al., 2007) have also been reported.

The lack of offshore indicative foraminifers in the cores, other than in the four or five storm layers, may be due to a number of reasons. For example, the lack of marine foraminifers in the sediments from Hurricanes Katrina and Rita was explained through possible post-burial alteration of the assemblages or on the

minimal size of the standing crop of the source material (Horton et al., 2009).

The scarcity of storm deposits in the nine marshes from Onslow Bay can be attributed to the complex interaction of numerous pre- and post-burial mechanisms. These include the scarcity in foraminifers in the storm source material, ebb-tidal flow removing foraminifers from the deposit, the rate of retreat of many of the islands over the previous 1,500 years, as well as post-depositional destruction of the foraminiferal assemblage through dissolution. Bioturbation further hindered the preservation of the storm layers by both mixing the discrete sandy deposits into the overlying and underlying marsh deposits and increasing the rates of dissolution to the calcareous tests (Fig. 4). To further investigate potential causes for the lack of preserved tempestites, we assessed the composition of the deposits left behind by Hurricane Irene on the previously studied marshes from Onslow Bay, as well as the meteorological parameters across the depositional environments during the hurricane.

GEOLOGICAL LEGACY OF HURRICANE IRENE

Foraminifers were collected from multiple subenvironments from four marshes along Onslow Bay before and immediately after Hurricane Irene made landfall on 27 Aug. 2011 (Category 3 diminishing to Category 1 as it made landfall in Onslow Bay, 26–28 Aug. 2011) to determine the micropaleontological signature



Figure 5. Locations of core samples collected in this study. White dots represent cores taken at each locality; arrows indicate the range of wind directions 24 hours before and 24 hours after landfall of Hurricane Irene. (A) Tar Landing Bay; (B) Alligator Bay; (C) Fort Fisher; (D) Oak Island. Images courtesy Google Earth.

left by the storm (Fig. 2). These marshes had been repeatedly sampled during the earlier paleotempestology study, during which surface samples were collected for use as an analog for determining downcore paleoenvironments. As a result, we had both pre- and post-storm samples for comparison. Irene did not form sandy overwash deposits similar to those archived in many Atlantic coast marshes, nor did it produce back-barrier horizons containing significant numbers of displaced marine foraminifers indicative of storm deposition. Only one subenvironment, the tidal creek at Alligator Bay, received transported shallow-marine foraminifers, and this was the sole marsh with meteorological conditions that were ideal for transport of offshore foraminifers into back-barrier environments: a relatively high maximum onshore wind (18.5 m/s), a significant storm surge (0.94 m), and offshore winds. This spatio-laterally limited storm signature will probably not be detectable in the marsh strata from Onslow Bay in the future, even if it were to survive future bioturbation.

Although the four marshes in this study had different meteorological conditions during the hurricane (wind speed and direction, storm and ebb flow), the transport of foraminifers and post-storm change in their populations were similar (Figs. 5 and 6). Three trends were detected in the foraminifer populations: first, a

decrease by a large factor after the hurricane (Fig. 6); second, after Irene made landfall, the pre-storm tidal creek and estuary taxa were mixed. This mixing was especially prevalent in the lower-elevation subenvironments; and finally, a general increase in *Q. seminula* in the tidal creek subenvironments after the storm. This species has apparently been increasing in abundance in recent decades in the nearshore estuaries of North Carolina (Pruitt et al., 2010).

As Hurricane Irene passed through Onslow Bay in August 2011, it first produced a peripheral strike (at Oak Island, Fort Fisher, and Alligator Bay) and then a direct, if minor, hurricane strike to Tar Landing Bay (Fig. 2). Regardless, based upon the foraminiferal signature, it appears the storm record will not be archived in the marsh strata from Onslow Bay. The paleostorm deposits that were preserved in the Tar Landing Bay and Alligator Bay marshes were probably larger storms that produced more robust and distinct sedimentary deposits that were capable of surviving bioturbation. It is also likely that there were numerous other small hurricane strikes that were not detected in the strata because the signature left behind (a mixing of the estuarine and marsh taxa such as was observed with Hurricane Irene) was not diagnostic of an event (i.e., definitively caused by storm activity) and may not

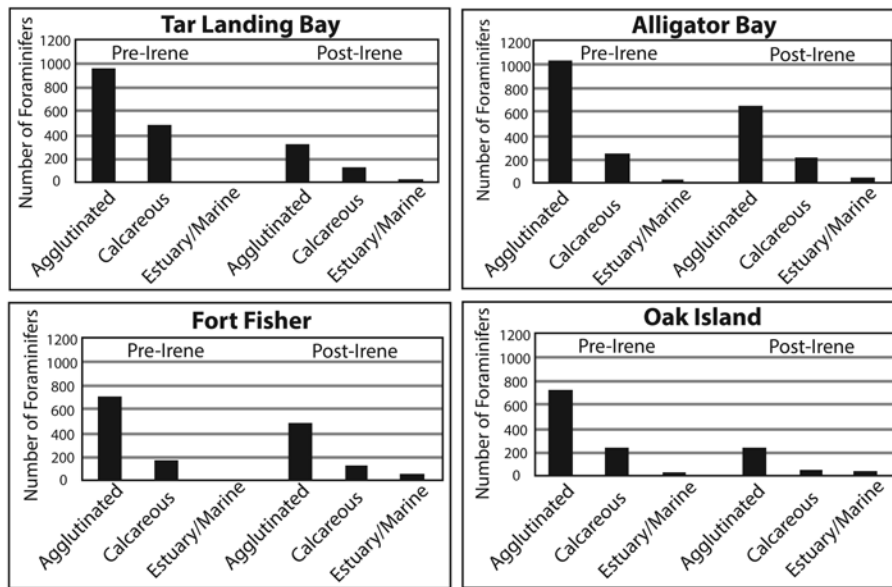


Figure 6. Abundance of agglutinated, calcareous, and estuarine/marine foraminifers from four coring localities in Onslow Bay before and after landfall of Hurricane Irene.

be recognized as a sedimentological or micropaleontological signature of a storm.

Reports regarding the variability of storm signatures and the lack of preservation of storm deposits, whether the result of bioturbation or foraminiferal dissolution, call for caution regarding the reliability of sedimentological and micropaleontological paleotempestology proxies. The lack of storm records in the marsh sediments from Onslow Bay suggests only the most robust storm deposits are archived; the lack of a definitive hurricane signature from Irene, except under ideal meteorological conditions, raises concerns about our current understanding of hurricane deposition and preservation in marginal-marine environments. Nevertheless, future hurricane strikes of greater magnitude, with their resulting sedimentological and micropaleontological signatures, may provide insights into the validity of these proxies for archiving larger storms.


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EXPLORE HAWAIIAN VOLCANOES FOR
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THE GEOLOGY OF CANYON COUNTRY, MOAB, UTAH: 11–17 May

EXPLORE AUSTRALIA'S GEOLOGY FOR
K–12 TEACHERS: 14–26 June

SURVEY OF COLORADO'S MINING GEOLOGY,
COLORADO SPRINGS, COLORADO: 22–28 June

EXPLORE SOUTHERN AUSTRALIA (extension trip): 26 June–3 July

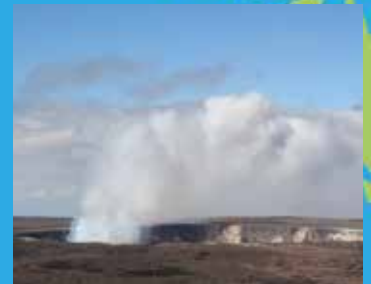
EXPLORE DYNAMIC ICELAND*: 27 July–7 August

EXPLORE HAWAIIAN VOLCANOES FOR
COLLEGE STUDENTS II*: 27 July–4 August

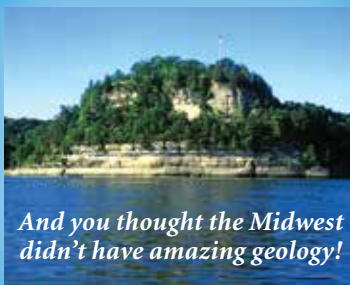
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Upcoming Awards & Recognition Deadlines



For details on the following awards and grants, see the October *GSA Today* or go to www.geosociety.org/awards/nominations.htm. Information and nomination forms can 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.

2014 GSA MEDALS AND AWARDS

Nomination deadline: 1 Feb. 2014

- Penrose Medal
- Day Medal
- Young Scientist Award (Donath Medal)
- GSA Public Service Award
- The Bromery Award for the Minorities
- GSA Distinguished Service Award
- Subaru Outstanding Woman in Science Award

GSA FELLOWSHIP

Nomination deadline: 1 Feb. 2014

GSA Fellowship is an honor bestowed on the best of our profession at each spring GSA Council meeting. **GSA Fellows** may support two nominees each year but only **one** as a primary nominator, and **GSA members** who are not Fellows may be secondary nominators for up to **two** nominees.

AGI MEDAL IN MEMORY OF IAN CAMPBELL

Nomination deadline: 1 Feb. 2014

This award recognizes singular performance in and contribution to the profession of geology. To submit a nomination, go to www.agiweb.org/direct/awards.html.

AGI MARCUS MILLING LEGENDARY GEOSCIENTIST MEDAL

Nomination deadline: 1 Feb. 2014

This medal is given to a recipient with consistent contributions of high-quality scientific achievements and service to the earth sciences having lasting, historic value; who has been recognized for accomplishments in field(s) of expertise by professional societies, universities, or other organizations; and who is a senior scientist nearing completion or has completed full-time regular employment. To submit a nomination, go to www.agiweb.org/direct/awards.html.

2014 NATIONAL AWARDS

- **William T. Pecora Award:** <http://remotesensing.usgs.gov/pecora.php>
- **National Medal of Science:** www.nsf.gov/od/nms/medal.jsp
- **Vannevar Bush Award:** www.nsf.gov/nsb/awards/bush.jsp
- **Alan T. Waterman Award:** www.nsf.gov/od/waterman/waterman.jsp
- **G.K. Warren Prize:** www.nasonline.org/site/PageServer?pagename=AWARDS_warren

JOHN C. FRYE ENVIRONMENTAL GEOLOGY AWARD

Nomination deadline: 31 March 2014


In cooperation with the Association of American State Geologists and supported by endowment income from the GSA Foundation's John C. Frye Memorial Fund, GSA makes an annual award for the best paper on environmental geology published either by GSA or by a state geological survey.

2014 POST-DOCTORAL RESEARCH AWARDS

Application deadline: 1 Feb. 2014

The following post-doc research awards are managed by the GSA Foundation. Learn more at 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 on geomorphology.
- The **W. Storrs Cole Memorial Research Award** for research on 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.



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Submission deadline: 3 Feb. 2014 at 11:59 p.m. (MST)

GSA is proud to offer research grants to its highly qualified student members. Last year, GSA awarded 307 grants, totaling US\$582,340. Graduate students may receive two grants during their academic career, regardless of the program in which they are enrolled. The standard maximum award per grant is US\$2,500.

New! Starting in 2014, ExxonMobil will sponsor 10 research grants at US\$7,500 per grant. All applicants in the GSA Student Research Grant Program are eligible for these awards, regardless of the topic or location of their research. ExxonMobil will select the top ten proposals based on merit as recommended by the GSA Research Grant Review Committee.

Applications should be submitted *online only* beginning later this month at www.geosociety.org/grants/gradgrants.htm. Paper applications and letters will not be accepted.

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About People



GSA Fellow and benefactor **Robbie Gries**, founder and president of Priority Oil & Gas LLC, has been awarded the Warner College of Natural Resources

Award from the Colorado State University Alumni Association. Gries graduated with a bachelor's degree in geology from Colorado State University in 1966—the first woman to do so there.



GSA Executive Director **Jack Hess** was recently selected to receive the Distinguished Eagle Scout Award from the Boy Scouts of America, for which he is

an active long-time volunteer. The award honors distinguished service in his profession and to his community for a period of at least 25 years after attaining the level of Eagle Scout.

Preliminary Announcement and Call for Papers

JOINT SECTION MEETING

66th Annual Meeting of the Rocky Mountain Section, GSA

110th Annual Meeting of the Cordilleran Section, GSA

Bozeman, Montana, USA

19–21 May 2014

www.geosociety.org/Sections/rm/2014mtg/



Grinnell Glacier, Glacier National Park, Montana, USA. Image by Mountain Walrus, Wikimedia Commons.

LOCATION

The Rocky Mountain and Cordilleran Sections of GSA are combining forces for a joint meeting in Bozeman, Montana, USA, on 19–21 May 2014. The meeting will be hosted by Montana State University and held on the university campus. Bozeman is a beautiful town located in the Gallatin Valley of southwest Montana (Montana's fly fishing epicenter), just north of Yellowstone National Park. It is surrounded by world-class geology, and an outstanding group of pre- and post-meeting field trips will highlight local and regional aspects of the geology of the Northern Rocky Mountains.

CALL FOR PAPERS

Abstract deadline: 11 Feb. 2014

TECHNICAL SESSIONS

Please submit your abstract online at www.geosociety.org/meetings. An abstract submission fee of \$10/students and \$15/all others will be charged. If you cannot submit the abstract online, please contact Nancy Wright, +1-303-357-1061, nwright@geosociety.org.

Theme Sessions

- T1. **Snoko Session 1: The Eclectic Tectonic Legacy of Arthur W. Snoko—Metamorphic Core Complexes at Age 35.** Allen McGrew, Univ. of Dayton, amcgrew1@udayton.edu; Josh Schwartz, California State Univ. Northridge, joshua.schwartz@csun.edu; Phyllis Camilleri, Austin Peay Univ., camillerip@apsu.edu; Walter A. Sullivan, Colby College, wassulliv@colby.edu; Thomas Kalakay, Rocky Mountain College, kalakayt@rocky.edu; Cal Barnes, Texas Tech Univ., cal.barnes@ttu.edu. This session is associated with Field Trip 7.
- T2. **Snoko Session 2: The Eclectic Tectonic Legacy of Arthur W. Snoko—Comparative Anatomy and Tectonic Evolution of Continental Margins from the Precambrian to Recent.** Allen McGrew, Univ. of Dayton, amcgrew1@udayton.edu; Josh Schwartz, California State Univ. Northridge, joshua.schwartz@csun.edu; Phyllis Camilleri, Austin Peay Univ., camillerip@apsu.edu; Walter A. Sullivan, Colby College, wassulliv@colby.edu; Thomas Kalakay, Rocky Mountain College, kalakayt@rocky.edu; Cal Barnes, Texas Tech Univ., cal.barnes@ttu.edu.
- T3. **Precambrian I: Archean and Paleoproterozoic Crustal Evolution of Western Laurentia.** David Mogk, Montana State Univ., mogk@montana.edu; Paul Mueller, Univ. of Florida, pamueller@ufl.edu.
- T4. **Precambrian II: Meso- and Neoproterozoic Evolution of Western Laurentia: In Honor of Don Winston.** Paul Link, Idaho State Univ., linkpaul@isu.edu; Reed Lewis, Idaho Geological Survey, reedl@uidaho.edu. This session is associated with Field Trip 8.
- T5. **Session Honoring Kenneth L. Pierce and the Breadth of His Research in Greater Yellowstone.** Cathy Whitlock, Montana State Univ., whitlock@montana.edu; Joe Licciardi, Univ. of New Hampshire, joe.licciardi@unh.edu; Lisa Morgan, USGS, lmorgan@usgs.gov; Jennifer Pierce, Boise State Univ., jenpierce@boisestate.edu; Cal Ruleman, USGS, cruleman@usgs.gov. This session is associated with Field Trip 11.
- T6. **Yellowstone–Snake River Plain–Columbia River Volcanic Province: Geology, Petrology, Geophysics, and Geodynamics.** Bill Phillips, Idaho Geological Survey and Univ. of Idaho, phillips@uidaho.edu; Dan Moore, Brigham Young Univ.–Idaho, dmoore@byui.edu.
- T7. **Recent Advances in Structure, Tectonics, and Metamorphism of the Northern Rockies.** Julie Baldwin, Univ. of Montana, julie.baldwin@umontana.edu; David Foster, Univ. of Florida, dafoster@ufl.edu.
- T8. **Geology and Geophysics of the Greater Blue Mountains Province, Salmon River Suture Zone, and Western Idaho Shear Zone: Late Paleozoic through Cenozoic Evolution of a Key Location of the Cordilleran Orogen (Posters).** Todd LaMaskin, Univ. of North Carolina–Wilmington, lamaskint@uncw.edu; Joshua Schwartz, California State Univ. Northridge, joshua.schwartz@csun.edu; Basil Tikoff, Univ. of Wisconsin, basil@geology.wisc.edu; Reed Lewis, Idaho Geological Survey, reedl@uidaho.edu. Posters only. This session is associated with Field Trip 1.

- T9. **Paleogene Topography, Basin Evolution, and Sediment Dispersal in the Northern Rocky Mountain Region.** Robert Schwartz, Allegheny College, bschwartz@allegheny.edu.
- T10. **The Early Tertiary Magmatic Firestorm of the U.S. and Canadian Cordillera: Geochemical, Petrological, and Tectonic Constraints.** Richard Gaschnig, Univ. of Maryland, gaschnig@umd.edu; Genet Duke, Arkansas Tech Univ., gduke1@atu.edu.
- T11. **Cenozoic Evolution of the Southwest: From the Relatively Undeformed Colorado Plateau to Central Basin and Range Complexities.** Melissa Lamb, Univ. of St. Thomas, malamb@stthomas.edu; Paul Umhoefer, Univ. of Northern Arizona, paul.umhoefer@nau.edu; Tom Hickson, Univ. of St. Thomas, tahickson@stthomas.edu; Sue Beard, USGS Flagstaff, sbeard@usgs.gov.
- T12. **Mesozoic Paleogeography of the North American Cordillera.** Joshua Bonde, Univ. of Nevada–Las Vegas, joshua.bonde@unlv.edu; Sean Long, Nevada Bureau of Mines and Geology, Univ. of Nevada, splong@unr.edu; James Schmitt, Montana State Univ., jschmitt@montana.edu.
- T13. **Geology and Paleontology of the Two Medicine–Judith River Clastic Wedge.** Jack Horner, Museum of the Rockies and Montana State Univ., jhorner@montana.edu; Ray Rogers, Macalester College, rogers@macalester.edu. This session is associated with Field Trip 10.
- T14. **Beyond the Bakken, Three Forks, and Red River “B”: New Insights into Williston Basin and Central Montana Trough Petroleum Systems.** Dave Bowen, Vecta Oil and Gas, dbowen@vectaoilandgas.com; Dave Eby, Eby Petrography, epceby@aol.com.
- T15. **Beyond the Bakken, Three Forks and Red River “B”: New Insights into Williston Basin and Central Montana Trough Petroleum Systems (Posters/Core Posters)** Dave Bowen, Vecta Oil and Gas, dbowen@vectaoilandgas.com; Dave Eby, Eby Petrography, epceby@aol.com.
- T16. **Hydrogeology of the Williston Basin: Toward a Greater Understanding of Aquifer Dynamics, Water Availability, and Risk Potential from Energy Extraction in the United States and Canada.** Kyle Blasche, USGS Montana Water Science Center, kblasch@usgs.gov; Joanna Thamke, USGS Montana Water Science Center, jothamke@usgs.gov.
- T17. **Tectonic and Climatic Drivers in Geomorphology and Landscape Evolution.** Jean Dixon, Montana State Univ., jean.dixon@montana.edu.
- T18. **Paleogene and Neogene Climate of Western North America.** Tom Hickson, Univ. of St. Thomas, tahickson@stthomas.edu; Melissa Lamb, Univ. of St. Thomas, malamb@stthomas.edu.
- T19. **Holocene Climate of Western North America.** Lesleigh Anderson, USGS, land@usgs.gov; Greg Pederson, USGS, gpederson@usgs.gov; Andrea Brunelle, Univ. of Utah, andrea.brunelle@geog.utah.edu.
- T20. **Surface Process Interactions in Riverine Landscapes of the U.S. Rocky Mountains.** Rebekah Levine, Univ. of New Mexico, rebekahl@unm.edu.
- T21. **Geomicrobiology: Microbially Mediated Weathering and Biomineralization in Modern and Ancient Environments.** Mark Skidmore, Montana State Univ., skidmore@montana.edu; Scott Montross, Montana State Univ., smontross@montana.edu.
- T22. **Biophysical Interactions in Geomorphology.** Rebecca Manners, Univ. of Montana, rmanners@gmail.com; Sharon Bywater-Reyes, Univ. of Montana, sb205525@umconnect.umt.edu.
- T23. **Selenium, Uranium, and Radionuclides: Geology, Biogeochemistry, and Ecosystem Impacts from Mining and Other Activities in the Western United States and Southwestern Canada.** David Naftz, USGS–Montana Water Science Center, dlinaftz@usgs.gov; Stan Morrison, U.S. Dept. of Energy, stan.morrison@lm.doe.gov; Tony Ranalli, USGS–Colorado Water Science Center, tranalli@usgs.gov; Kyle Flynn, Montana Dept. of Environmental Quality, kflynn@mt.gov.
- T24. **EarthScope: Innovative Research, Education, and Outreach Activities.** Steven Semken, Arizona State Univ., semken@asu.edu.
- T25. **Teaching the Geology of Western North America.** *Cosponsored by National Association of Geoscience Teachers.* David Mogk, Montana State Univ., mogk@montana.edu; Basil Tikoff, Univ. of Wisconsin, basil@geology.wisc.edu; Cathy Manduca, SERC at Carleton College, cmanduca@carleton.edu.
- T26. **Geologic Maps: Record of the Past, Foundation for the Future.** Grant Willis, Utah Geological Survey, grantwillis@utah.gov; Susan Vuke, Montana Bureau of Mines and Geology, svuke@mtech.edu; Reed Lewis, Idaho Geological Survey, reedl@uidaho.edu.
- T27. **Field-Based Research Experiences for Undergraduates.** *Cosponsored by Council for Undergraduate Research (CUR); National Association of Geoscience Teachers.* Emily Ward-Geraghty, Rocky Mountain College, emily.ward@rocky.edu; Derek Sjostrom, Rocky Mountain College, derek.sjostrom@rocky.edu; David Mogk, Montana State Univ., mogk@montana.edu; Kim Hannula, Fort Lewis College, hannula_k@fortlewis.edu.
- T28. **Teaching Geoscience in the Context of Place and Culture for Sustainability and Diversity.** Steven Semken, Arizona State Univ., semken@asu.edu; David Mogk, Montana State Univ., mogk@montana.edu.

FIELD TRIPS

Pre-Meeting

1. **Hells Canyon to the Bitterroot Front: Transect from the Accretionary Margin Eastward across the Idaho Batholith.** 16–18 May. Reed Lewis, Idaho Geological Survey, reedl@uidaho.edu; Keegan Schmidt, Lewis–Clark State College, klschmidt@lcsc.edu; Richard Gaschnig, Univ. of Maryland, gaschnig@umd.edu; Todd LaMaskin, Univ. of North Carolina–Wilmington, lamaskint@uncw.edu; Basil Tikoff, Univ. of Wisconsin, basil@geology.wisc.edu; Tor Stetson-Lee, Univ. of Wisconsin, stetsonlee@wisc.edu; Karen Lund, USGS, klund@usgs.gov. This field trip is associated with Theme Session 8.
2. **Sedimentary Record of Glacial Lake Missoula Deposition and Draining, Clark Fork River Corridor from St. Regis to near Drummond, Montana.** 17–18 May. Larry N. Smith,

Montana Tech of The Univ. of Montana, lsmith@mtech.edu; Michelle A. Hanson, Saskatchewan Geological Survey, michelle.hanson@gov.sk.ca.

3. **Neotectonics and Geomorphic Evolution of the Northwestern Arm of the Yellowstone Tectonic Parabola: Controls on Intra-Cratonic Extensional Regimes, Southwest Montana.** 18 May. Cal A. Ruleman, USGS, cruleman@usgs.gov; Mort Larsen, Wyoming State Geological Survey, martin.larsen@wyo.gov; Michael C. Stickney, Montana Bureau of Mines and Geology, mstickney@mtech.edu.
4. **Tracking a Big Miocene River across Southwest Montana.** 18 May. James W. Sears, Univ. of Montana, james.sears@mso.umt.edu.
5. **A Slice through Time: Fifty Years of Field Trips to Hyalite.** 18 May. Anthony Hartshorn, Montana State Univ., soildoc@gmail.com; Stephanie Ewing, Montana State Univ., stephanie.ewing@montana.edu; Jean Dixon, Montana State Univ., jean.dixon@montana.edu.
6. **The Golden Sunlight Mine: Structural Controls on Gold-Silver Mineralization and Technical Challenges of Responsible Resource Extraction.** 18 May. Nancy Oyer, Barrick Gold Corp., noyer@barrick.com; John Childs, Childs and Associates, jfchildsgeo@msn.com.
7. **Polyphase Collapse of the Cordilleran Hinterland: Bitterroot and Anaconda Metamorphic Core Complexes of Western Montana—Snoke Symposium Field Trip.** 18 May. Thomas J. Kalakay, Rocky Mountain College, kalakayt@rocky.edu; David Foster, Univ. of Florida, dafoster@ufl.edu; Jeff Lonn, Montana Bureau of Mines and Geology, jlonn@mtech.edu. This field trip is associated with Theme Session 1.

Post-Meeting:

8. **Mesoproterozoic Tectonics and Sedimentation along the Southern Margin of the Belt Basin: In Honor of Don Winston.** 22 May. David Mogk, Montana State Univ., mogk@montana.edu; Jim Schmitt, Montana State Univ., jschmitt@montana.edu; Zach Adam, Montana State Univ., zachary.adam@msu.montana.edu; Paul Mueller, Univ. of Florida, pamueller@ufl.edu. This field trip is associated with Theme Session 4.
9. **The World-Class Talc Deposits of Southwestern Montana.** 22 May. John Childs, Childs and Associates, jfchildsgeo@msn.com; Erika Bartlett, Imerys Talc, ericka.sholey@imerys.com; Michael T. Cerino, Barretts Minerals Inc., mike.cerino@mineralstech.com; Helen B. Lynn, Childs Geoscience Inc., helenblynn@gmail.com; Sandra Underwood, Childs Geoscience Inc., sandyunderwood903@hotmail.com; Chad P. Walby, Childs Geoscience Inc., cwalbygeo@gmail.com; Zackary S. Wall, Childs Geoscience Inc., zwall@childsgeoscience.com.
10. **Geology and Paleontology of the Two Medicine–Judith River Clastic Wedge: Field Trip to The Rocky Mountain Front and North-Central Montana, Including Type Sections of The Two Medicine and Judith River Formations.** 22–23 May. Jack Horner, Museum of the Rockies and Montana State Univ., jhorner@montana.edu; Ray Rogers, Macalester College, rogers@macalester.edu; David Lageson, Montana State Univ., lageson@montana.edu. This field trip is associated with Theme Session 13.

11. **Quaternary Geology of the Upper Yellowstone River in Paradise Valley, Montana.** Ken Pierce, USGS, kpierce@usgs.gov. This field trip is associated with Theme Session 5.
12. **Structural and Stratigraphic Characteristics of the Sappington, Three Forks, and Jefferson Formations (Mississippian-Devonian), Western Montana.** Eric Easley, Montana State Univ., eric.easley@msu.montana.edu; Jack Borski, Montana State Univ., jack.borski@msu.montana.edu.

REGISTRATION

Early registration deadline: 14 April

Cancellation deadline: 21 April

Online registration begins: Early March

ACCOMMODATIONS

A block of rooms has been reserved at the Hilton Garden Inn Bozeman, 2023 Commerce Way, Bozeman, MT 59715, USA; +1-406-582-9900; fax: 1-406-582-9903. The conference rate is US\$115 plus tax. The hotel is just 14 minutes from Bozeman Yellowstone International Airport and offers complimentary transportation to and from the airport. Please call +1-406-582-9900 and request a reservation under **MSU Conference Services—Geological Society of America Conference.**

TRAVEL GRANTS

The GSA Rocky Mountain and Cordilleran Sections offer a travel grant program for students in need. You must be a GSA Member and registered for the meeting *before* applying for a travel grant. The application period opens March 2014.

MENTOR PROGRAMS

Roy J. Shlemon Mentor Program in Applied Geoscience:
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CONTACT INFORMATION

Detailed information on theme sessions, field trips, workshops, the guest program, and other activities for this meeting is listed at www.geosociety.org/Sections/rm/2014mtg/. For further information, please contact the meeting co-chairs, technical program co-chairs, or field trip co-chairs for this joint meeting.

Meeting Co-Chairs: Dave Lageson, Montana State Univ., lageson@montana.edu; Jeff Vervoort, Washington State Univ., vervoort@wsu.edu

Technical Program Co-Chairs: Jim Schmitt, Montana State Univ., jschmitt@montana.edu; Michael Wells, michael.wells@unlv.edu

Field Trip Co-Chairs: Colin Shaw, Montana State Univ., colin.shawl@montana.edu; Basil Tikoff, Univ. of Wisconsin, basil@geology.wisc.edu

2014 Section Meeting Calendar

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SOUTH-CENTRAL SECTION
Fayetteville, Arkansas, USA
17–18 March 2014
 University of Arkansas Global
 Local Committee chair: Steve Boss
 Abstracts deadline: 3 Dec. 2013
 Early registration deadline: 10 Feb. 2014



NORTHEASTERN SECTION
Lancaster, Pennsylvania, USA
23–25 March 2014
 Lancaster Marriott
 Local Committee co-chairs: Noel Potter
 and Roger Thomas
 Abstracts deadline: 10 Dec. 2013
 Early registration deadline: 18 Feb. 2014



SOUTHEASTERN SECTION
Blacksburg, Virginia, USA
10–11 April 2014
 Skelton Conference Center at Virginia Tech
 Local Committee chair: Robert Tracy
 Abstracts deadline: 7 Jan. 2014
 Early registration deadline: 10 Mar. 2014



NORTH-CENTRAL SECTION
Lincoln, Nebraska, USA
24–25 April 2014
 Cornhusker Marriott
 Local Committee chair: Matt Joeckel
 Abstracts deadline: 14 Jan. 2014
 Early registration deadline: 24 Mar. 2014



**ROCKY MOUNTAIN/
 CORDILLERAN SECTIONS**
Bozeman, Montana, USA
19–21 May 2014
 Montana State University,
 Strand Union Building
 Local Committee chairs: Dave Lageson
 and Jeff Vervoort
 Abstracts deadline: 11 Feb. 2014
 Early registration deadline: 14 Apr. 2014



Wilson Park, Fayetteville, Arkansas; used with permission of Wikimedia Commons.

Ohioyle falls at Ohioyle State Park, Ohioyle, Pennsylvania; used with permission of Wikimedia Commons.

Blue Ridge Mountains, Shenandoah National Park, Virginia. Photo by Amrinder Arora; used with permission of Wikimedia Commons.

Chimney Rock National Historic Site, Morrill County, Nebraska. Photo by Allen Stutheit; used with permission of Wikimedia Commons.

Grinnell Glacier, Glacier National Park, Montana. Public domain.

Final Announcement

SOUTH-CENTRAL SECTION MEETING

47th Annual Meeting of the South-Central
Section, GSA
Fayetteville, Arkansas, USA

17–18 March 2014

www.geosociety.org/sections/sc/2014mtg/

LOCATION

The University of Arkansas in Fayetteville, Arkansas, USA, will host the 2014 GSA South-Central Section meeting at the Hotel Chancellor on the historic Fayetteville town square. Nestled in the Ozarks of Northwest Arkansas, Fayetteville is part of a metropolitan area of about 420,000 people that retains its small college-town atmosphere.

REGISTRATION

Be sure to register early!

Early registration deadline: 10 February

Cancellation deadline: 18 February

REGISTRATION (all fees are in U.S. dollars)

	EARLY		STANDARD	
	Full Mtg.	One Day	Full Mtg.	One Day
Professional Member	\$140	\$100	\$200	\$150
Professional Member 70+	\$90	\$700	\$140	\$100
Professional Nonmember	\$170	\$120	\$220	\$150
Student Member	\$60	\$40	\$100	\$65
Student Nonmember	\$70	\$50	\$110	\$65
K–12 Professional	\$45	\$35	\$60	\$45
Guest or Spouse	\$35	n/a	\$45	n/a
Field Trip or Short Course Only	\$35	n/a	\$45	n/a

ACCOMMODATIONS

The Hotel Chancellor is ideally located on the Fayetteville Town Square. Rooms have been affordably priced at US\$99/night so that attendees will be able to take advantage of staying on site. Please contact the Hotel Chancellor toll free at +1-855-285-6162 to make reservations, and identify yourself as part of the South-Central GSA meeting to get the discounted group rate. We will have free parking for all conference attendees staying at the conference hotel and parking options for those who will be staying elsewhere.

TECHNICAL SESSIONS

Symposia

- S1. Midcontinent Mississippian Surface and Subsurface Studies.** Christopher L. Liner, University of Arkansas.
- S2. Recent Induced/Triggered Seismicity in the Central and Eastern United States.** Scott Ausbrooks, Arkansas Geological Survey; Austin A. Holland, Oklahoma Geological Survey.
- S3. Late Cretaceous Tectonics, Magmatism, and Sedimentation of the South-Central Region.** Bob Stern, The University of Texas at Dallas; Peter D. Clift, Louisiana State University; Asish Basu, The University of Texas at Arlington.

Theme Sessions

- T1. Investigating Urban Karst Systems.** Douglas Gouzie, Missouri State University; Marcus Gary, Edwards Aquifer Authority.
- T2. Karst Hydrology and Geomorphology.** Kathy Knierim, University of Arkansas; Matthew Covington, University of Arkansas.
- T3. Geothermal Energy and Its Significance as a Renewable Energy Resource.** Lea Nondorf, Arkansas Geological Survey; Bill Prior, Arkansas Geological Survey.
- T4. Innovative Methodologies and Techniques in Geoscience Education.** René A. Shroat-Lewis, University of Arkansas at Little Rock; Sandra Chandler, Arkansas Geological Survey.
- T5. GIS and Geologic Mapping.** Jason Tipton, Arkansas Geological Survey; Brian Kehner, Arkansas Geological Survey.
- T7. Groundwater Quality in Gas Production Areas.** Timothy M. Kresse, USGS; Phillip D. Hays, University of Arkansas.



Strawberry River in northern Arkansas, USA, is an ~115-mile-long tributary of the Black River; photo courtesy Arkansas Dept. of Parks & Tourism.

T8. **Quaternary Geology and Geomorphology.** Amanda Keen-Zebert, Desert Research Institute; Stephanie L. Shepherd, Bloomsburg University.

Themed Poster Sessions

- T6. **Undergraduate Research.** *Cosponsored by Council for Undergraduate Research.* Diane Smith, Trinity University.
- T9. **Geological Maps.** Angela Chandler, Arkansas Geological Survey; Daniel Rains, Arkansas Geological Survey.

FIELD TRIPS

1. **Hydro Days! Karst Hydrogeology of the Southern Ozarks.** 15–16 March. J. Van Brahana, University of Arkansas.
2. **Middle and Late Morrowan Depositional History and Sequences, Northwest Arkansas.** Angela Chandler, Arkansas Geological Survey; Doy Zachry, University of Arkansas.
3. **Lower to Middle Mississippian.** Darwin Boardman, University of Oklahoma.
4. **Uppermost Mississippian Strata in the Ozarks—Recent Mapping of the Imo Interval in Northwest Arkansas.** Richard Hutto, Arkansas Geological Survey; Erin Smart, Weatherford Laboratories; Angela Chandler, Arkansas Geological Survey.
5. **Quaternary Geology and Geomorphology of the Buffalo National Scenic River.** Stephanie Shepherd, Bloomsburg University; Amanda Keen-Zebert, Desert Research Institute; Mark Hudson, USGS.

6. **Slaughter in the Rocks and Other Geological Aspects of the Battle of Pea Ridge.** Joe Hannibal, Cleveland Museum of Natural History; Kevin R. Evans, Missouri State University; Angela Chandler, Arkansas Geological Survey; Gary Michelfelder, Missouri State University.

OPPORTUNITIES FOR STUDENTS

Learn more at www.geosociety.org/Sections/sc/2014mtg/students.htm.

Mentor Programs

Roy J. Shlemon Mentor Program in Applied Geoscience: Mon., 17 March, lunchtime: www.geosociety.org/mentors/shlemon.htm.

Mann Mentors in Applied Hydrogeology Program: Tues., 18 March, lunchtime: www.geosociety.org/mentors/mann.htm.

Travel Grants

We have student travel grants available—You cannot get one if you do not apply! Deadline: 10 February 2014.

Poster Competition

CASH PRIZES! Separate awards for best graduate and best undergraduate poster presentation.



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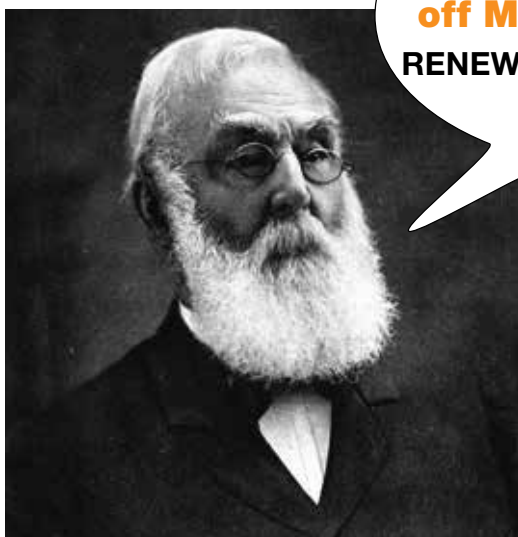


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2012–2013 GSA-USGS Congressional Science Fellow Final Report



Todd Anthony Bianco

A Typical, Life-Changing Experience

My time as the GSA-USGS Congressional Fellow is winding down, and the new class is already

on the Hill. Looking back on my orientation last year, I remember that the thing most on my mind was what I would actually be doing on a day-to-day basis. So in this report, I would like to give a more specific idea of my experience in a Congressional office.

It's useful to start with office structure. A member of Congress will have at least one office in the home district or state and at least one personal office on the Hill. Depending on the member's position, there may also be a committee or leadership office on the Hill. My placement was in the personal office of Senator Sheldon Whitehouse of Rhode Island, and most of my interaction was with other personal offices, so I'll review a general personal office structure.

In a D.C. personal office, a member typically has (at least) a chief of staff, an office manager and office staff, an executive assistant and scheduler, a communications team, and a legislative team. Congressional Fellows serve on the legislative team, which is headed by the legislative director—always referred to as the “LD.”

The LD manages the individuals who work on various policy issues, like healthcare, energy and environment, or education. In that effort, below the LD are the legislative assistants (LAs). Of course, depending on the size of the office and its culture, there may be a title or two between the LD and the LAs, like “Senior Policy Advisor,” but to keep it simple these can be grouped as LAs. Just below the LAs are the legislative correspondents (LCs) who are most often responding to constituents' letters and supporting the LAs. Congressional Fellows can expect to find themselves under the mentorship of an LA.

The LAs are the staffers who are developing and advancing policy, as well as keeping their boss updated on Congressional activity. To do this effectively, LAs need to be quickly and

constantly acquiring information. This is one place a scientist can make a difference; a well-trained scientist is an expert and trusted researcher. The rest of the recipe is communication and speed.

Given that, here's what a typical day might include for a Congressional Fellow. The morning often starts with reading the news. I go through the same clips my boss gets and also check the headlines of a handful of other news sources and headline aggregators in my issue area (energy and environment) and read anything that catches my attention.

Often, LAs and fellows need to address a question or issue raised by the senator or update their boss for a meeting. This is usually done by writing a memo. Whatever the topic of the memo is, it is always important to find the best information quickly. The benefit of being a strong researcher is that while you may not know the best information off hand, you likely know you've found good information when you see it. Because speed is just as important as depth, it's okay to start simple; I jump on the Internet for most small matters. For more comprehensive work, or for issues related directly to the government and legislation, offices look to the Congressional Research Service, which is named for its mission, or the Government Accountability Office, which investigates how the federal government is performing.

While legislative staff is constantly gathering information, the communications team is constantly disseminating it. Fellows often help generate content that supports the communications staff. This might be for a speech, a press release, talking points, or some other product. In this case, the real work is simplifying complicated information, while keeping it extremely accurate.

Fellows can also expect to have a handful of constituent and staff meetings throughout the week to hear and discuss policy. A mentor may assign a fellow to many meetings, covering a range of topics that the fellow will do some work on, but allow the fellow to find which issues on which to focus. Other fellows may experience that their office already has a particular piece of legislation for them to develop. Either way, once a fellow's issue portfolio is more refined, these meetings give staff a better idea of what problems are out there, what are the concerns of their constituents, and if there is a good role for federal action.

On top of these common responsibilities, fellows in personal offices work as support for hearings, briefings, floor debates, events, and whatever else might appear on the boss's calendar. But instead of reviewing these, I want to close with some thoughts for scientists who have an interest in public policy.

As I already noted, the legislative team is constantly acquiring information to help improve policy decisions. Senator Whitehouse has an excellent legislative team, as do most senators. However, the number of staffers supporting legislative decisions drops quickly across the Capitol to the House of Representatives. For example, one House office I interviewed with last year had two legislative staffers. In many locations, state and local government is a part-time position for the lawmakers themselves. Therefore, there is a need for expert researchers and science advisors. You do not need to be a Congressional Fellow to send a letter volunteering your skills to your state representative, city council, or school board. You simply need to find the time.

I encourage GSA members to listen to a 2011 National Public Radio interview, *A Case for a Presidential Science Debate*, which included former Congressman Vernon Ehlers. Ehlers explains how he wrote such a letter to then-Congressman Gerald Ford, offering to set up a science advisory committee to answer any questions the Congressman might have—free of charge. The rest is history, and I echo Ehlers' point: likely you'll receive a nice letter declining your offer, but maybe you'll find a chance to do something good for your community while broadening your life experience.

As always, I would like to close by encouraging anyone to contact me directly about my year on the Hill. I would also like to thank our members and leadership for their support in the fellowship. It has been an honor to serve as the GSA-USGS Congressional Science Fellow, and the experience has been life-changing.

This manuscript is submitted for publication by Todd Anthony Bianco, 2012–2013 GSA-USGS Congressional Science Fellow, with the understanding that the U.S. government is authorized to reproduce and distribute reprints for governmental use. The one-year fellowship is supported by GSA and by the U.S. Geological Survey, Department of the Interior, under Assistance Award No. G12AP20120TDD. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. government. Todd is working in the office of Senator Whitehouse (D-Rhode Island) and can be reached at Todd_Bianco@whitehouse.senate.gov.



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Bring your science and technology expertise to Capitol Hill to work directly with national leaders at the interface between geoscience and public policy. The GSA-USGS Congressional Science Fellowship provides a rare opportunity for a geoscientist to spend a year working for a Member of Congress or congressional committee. If you are an earth scientist with a broad geologic background, experience applying scientific knowledge to societal challenges, and a passion for helping shape the future of the geoscience profession, GSA and the USGS invite your application. The fellowship is open to GSA members who are U.S. citizens or permanent residents, with a minimum requirement of a master's degree with at least five years of professional experience or a Ph.D. at the time of appointment. Learn more at www.geosociety.org/csf or by contacting Susan Lofton, +1-303-357-1040, slofton@geosociety.org.

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Making a Difference with On To the Future

In a professional society as large as GSA, with the weight of 125 years of history and a global reach to every corner of the world, it may seem that an individual or small group of individuals can have little impact on the Society's direction or priorities. In fact, nothing could be farther from the truth. And, for once, I am not talking just about financial support, though I will return to that ever-important matter.

At the 2012 GSA Annual Meeting, a group of concerned volunteers on the GSA Diversity in the Geosciences Committee came to a collective realization that GSA needs to do more to advance, in a sustainable manner, the diversification of our discipline. I think most of us are familiar with the unsettling evidence that as society becomes more diverse, geology, like all the physical sciences, has made but glacial progress toward creating a workforce that resembles the greater society we serve and from which we will draw the next generation of scientists.

This group of volunteers did more than wring their hands. They crafted a plan and set ambitious goals for GSA. They "lobbied" the leadership of the Society and the GSA Foundation, challenging them to develop a program that would bring 125 first-time student attendees from diverse backgrounds to the 125th Annual Meeting in Denver. They proposed that this become a tangible legacy of the 125th Anniversary event so that every year thereafter there would be 125 new attendees whose presence and eventual engagement in our science will alter the demographics of our profession.

The volunteers wanted this group to be racially and ethnically diverse but also to include first-generation college-goers, students from economically disadvantaged backgrounds, veterans, non-traditional students, and individuals with disabilities. They wanted these students to be able to attend at minimal cost and, while at the meeting, to be mentored to take full advantage of the

professional and intellectual opportunities that a GSA Annual Meeting provides in abundance.

Quite a challenge from a group of concerned members who felt and continue to feel passionate about this issue! And thus was born the "On To the Future" program, which we now call "OTF."

As I write this, some three weeks before the first OTF cohort arrives in Denver, I realize how much impact this group of a half-dozen or so concerned and passionate members of GSA has had. In a matter of only six to eight months, they galvanized GSA leadership and staff to create a new program. It wasn't easy, and many people deserve kudos for their energy and commitment. In that same period of time, as you can see from the pie chart, associated societies, corporations, GSA Sections and Divisions, GSA staff, and nearly fifty individual GSA members stepped forward to contribute more than US\$50,000 to realize this dream. And, GSA's leadership, its elected officers and Council, have provided funds designated to support GSA's strategic initiatives to match member support.

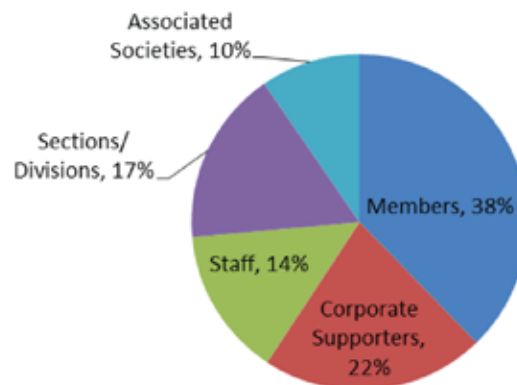
As you read this, many of the same people who made this happen are gathering to assess the 2013 OTF experience and to assure that this program can grow and thrive.

The lessons for me are these:

1. GSA is a Society capable of mobilizing for change when challenged to do so by its members;
2. The leadership of the Society listens to the concerns of its members and responds to them; and
3. A small group of dedicated member/volunteers *can* make a big difference.

So, I challenge each of you to think about those aspects of our profession that you feel passionate about. What is your "OTF idea?" Your commitment and contributions as a volunteer, advocate, and financial donor can create and sustain opportunities that *you* care deeply about.

Sources of Support for OTF 2013



SCIENCE EDITOR

OPENINGS FOR 2015

GSA is soliciting applications and nominations for science co-editors for *GSA Bulletin*, *GSA Today*, *Lithosphere*, and GSA books with four-year terms beginning 1 January 2015. Duties include: ensuring stringent peer review and expeditious processing of manuscripts; making final acceptance or rejection decisions after considering recommendations of reviewers; and maintaining excellent content through active solicitation of diverse and definitive manuscripts or book proposals.

POSITIONS AVAILABLE

GSA BOOK EDITORS' duties include soliciting high-quality book proposals as well as ensuring that proper peer review procedures have been followed by volume editors. In the case of authored volumes, book editors handle the entire peer-review process. The successful candidate will have a wide range of interests and expertise, prior editing experience, and a strong publication record.

GSA Books ▶ 2 positions

GSA TODAY The editor of *GSA Today*, one of the most widely read earth science publications in the world, must have a wide range of interests and expertise along with the ability to identify research topics of both high quality and broad appeal. Prior editing experience and a publication record in a wide range of journals is key.

GSA Today ▶ 1 position

GSA BULLETIN For the *GSA Bulletin* position, research interests that would best complement those of the continuing editors include—but are not necessarily limited to: geobiology, geochemistry, geomicrobiology, paleobotany, paleoclimatology, paleontology, sedimentology, and geomorphology.

GSA Bulletin ▶ 1 position

LITHOSPHERE For the *Lithosphere* position, research interests that would best complement those of the continuing editors include—but are not necessarily limited to: petrology, deformation, structural geology, Precambrian geology, thermochronology, isotope geochemistry, and geochronology.

Lithosphere ▶ 1 position

Note that the volume of papers received or other circumstances may mean *GSA Bulletin* and *Lithosphere* science editors will sometimes need to handle papers outside of their main areas of expertise.

A SUCCESSFUL EDITOR WILL HAVE

- ▶ a broad interest and experience in geosciences, including familiarity with new trends;
- ▶ international recognition and familiarity with many geoscientists and their work;
- ▶ a progressive attitude and a willingness to take risks and encourage innovation;
- ▶ experience with online manuscript systems and the ability to make timely decisions; and
- ▶ a sense of perspective and humor.

INTERESTED?

Please submit a curriculum vitae and a letter describing why you are suited for the position. To nominate another, submit a nomination letter and the person's written permission and CV. Send nominations, applications, or questions to Jeanette Hammann, jhammann@geosociety.org, GSA Publications, P.O. Box 9140, Boulder, CO 80301, USA. Editors work out of their current locations at work or at home. GSA provides an annual stipend and funds for office expenses. Nominations or applications received by 15 February 2014 will be given first consideration.

Classified Ads

Positions Open

ASSISTANT PROFESSOR IN FLUID FLOW UNIVERSITY OF KANSAS

The Dept. of Geology at the University of Kansas invites candidates to apply for a tenure-track or tenured faculty position; rank from assistant professor to Foundation Distinguished Professor, depending on experience and program needs; appointment is expected to begin as early as Aug. 18 2014. KU is vigorously investing in its future by creating 64 new faculty positions, 12 of which will be Foundation Professors. We are seeking an individual with a research specialty of fluid flow in and around fractures, who will contribute to research in reservoir characterization (e.g., CO₂ storage/Enhanced Oil Recovery, geothermal energy, petroleum, shale gas, waste-water disposal, water resources and contaminant transport). This position is part of a coordinated cluster of 12 new faculty hires within the College of Liberal Arts and Sciences and the School of Engineering focusing on water and energy resources, and technology and social questions related to the extraction of fossil fuels from unconventional reservoirs. Initial review of applications will begin on Feb. 3 2014 and continue as long as needed to identify a qualified pool. Refer to www.geo.ku.edu/misc/jobAd.shtml for additional information about the position, qualifications and how to apply. Questions may be referred to the Committee Chair Randy Stotler (rstotler@ku.edu) or the Department Chair Luis Gonzalez (lgonzlez@ku.edu).

The University of Kansas is especially interested in hiring faculty members who can contribute to four key campus-wide strategic initiatives: (1) Sustaining the Planet, Powering the World; (2) Promoting Well-Being, Finding Cures; (3) Harnessing Information, Multiplying Knowledge; and (4) Building Communities, Expanding Opportunities. See www.provost.ku.edu/planning/themes/ for more information. More information about Foundation Professors at KU may be found at www.foundation.ku.edu. EOE M/F/D/V.

HYDROLOGIST AND DEPARTMENT CHAIR DEPT. OF GEOLOGICAL SCIENCES THE UNIVERSITY OF TEXAS AT SAN ANTONIO

The Dept. of Geological Sciences at The University of Texas at San Antonio seeks a senior scholar and academic leader in the field of Hydrology to serve as Department Chair and to fill a tenured position at the Professor or Associate Professor level, subject to qualifications, beginning Fall 2014. The position includes appointment to the Dr. Weldon W. Hammond Jr. Endowed Distinguished Professorship in Hydrogeology. The successful candidate is expected as Chair to facilitate research growth, provide leadership in academic program planning and program review, foster collegial participation in departmental governance, and oversee all aspects of department administration. Information on the geoscience program and details on what to include in an application can be viewed at www.utsa.edu/geosci/positions.html. Review of completed applications will

begin on Dec. 15 2013 and continue until position is filled. UTSA is an AA/EEO employer.

ASSISTANT PROFESSOR IN GEOPHYSICS ELECTRICAL/ELECTROMAGNETIC METHODS UNIVERSITY OF KANSAS

The Dept. of Geology at the University of Kansas invites candidates to apply for a tenure-track, faculty position at the Assistant Professor level in Geophysics; appointment is expected to begin as early as Aug. 18 2014. We are seeking an individual with a research specialty in the areas of Electrical and Electromagnetic Methods. This position is part of a university-wide cluster of 15 new faculty positions that focus on "Water Resources." Areas of study could include aquifers, geothermal and hydrocarbon reservoirs, polar environments (ice sheets; permafrost), and monitoring of hydrological and biogeochemical processes as they relate to water, energy, and environment. The successful candidate will be expected to establish an externally funded research program, direct graduate students, and participate in teaching at graduate and undergraduate levels. A Ph.D. or ABD in geophysics, geology, natural sciences, engineering, or a closely related discipline with an emphasis on electrical and electromagnetic methods is expected by the start date of the appointment. Initial review of applications will begin Feb. 3 2014 and will continue as long as needed to identify a qualified pool. Refer to www.geo.ku.edu/misc/jobAd.shtml for additional information about the position, qualifications and how to apply. Questions may be referred to the Committee Chair George Tsofilias (tsofilias@ku.edu) or the Department Chair Luis Gonzalez (lgonzlez@ku.edu). The University of Kansas is especially interested in hiring faculty members who can contribute to four key campus-wide strategic initiatives: (1) Sustaining the Planet, Powering the World; (2) Promoting Well-Being, Finding Cures; (3) Harnessing Information, Multiplying Knowledge; and (4) Building Communities, Expanding Opportunities. See www.provost.ku.edu/planning/themes/ for more information. EOE M/F/D/V.

ASSISTANT PROFESSOR OF GEOLOGY UNIVERSITY OF NEBRASKA AT OMAHA

We seek a geologist with expertise in surface processes and geohazard risk assessment to fill a full time, tenure track position at the assistant professor level in the Dept. of Geography and Geology, starting in Fall 2014. The successful candidate will be expected to teach geomorphology, introductory geology courses, and to develop a research program and upper division curriculum in the area of her or his specific expertise. The 12-hour workload typically consists of 9 hours for teaching and 3 hours of release time for research per semester. We are an undergraduate only program with a strong emphasis on undergraduate research and are involved in campus STEM and sustainability initiatives. We are looking for a candidate who could contribute to these efforts through research and through working collaboratively with others on campus and in the community. The Geology Program supports majors in both Geology and Environmental Studies. The University of Nebraska at Omaha (UNO) is a metropolitan university with about 15,000 students including both traditional

and non-traditional students. Candidates must hold a Ph.D. in a geoscience discipline or be ABD with an expected completion date prior to fall semester 2014.

Applicants must apply online at <http://careers.unomaha.edu> and provide a cover letter describing teaching and research interests and experience, transcripts from their graduate institutes, a copy of their vitae, and a list with contact information of 3 to 5 people who are willing to serve as references. Consideration of applicants will start on Jan. 31 2014 and continue until the position is filled. Contact information for this search is: Search Committee, Dept. of Geography/Geology, DSC 260, University of Nebraska at Omaha, Omaha, NE, 68182-0199. E-mails can be sent to Harmon Maher at harmon_maher@unomaha.edu.

The university and department have a strong commitment to achieving diversity among faculty and staff. We are particularly interested in receiving applications from members of under-represented groups and strongly encourage women and persons of color to apply for this position.

ASSISTANT/ASSOCIATE PROFESSOR ENVIRONMENTAL SCIENCE, HYDROLOGY SCHOOL OF NATURAL SCIENCES AND MATHEMATICS, THE RICHARD STOCKTON COLLEGE OF NEW JERSEY BEGINNING SEPT. 1 2014

The Richard Stockton College of New Jersey is an innovative liberal arts and sciences college and is currently ranked among the top ten public Masters institutions in the northeast. The college is located on 1600 acres in the Pinelands National Preserve in southern New Jersey about one hour from Philadelphia, two hours from New York City, three hours from the Baltimore/Washington area, and 20 minutes from Atlantic City. The College has a diverse array of undergraduate programs and the School has several masters programs including a Professional Science Masters in Environmental Science. Stockton provides vast opportunities for interdisciplinary academic, scholarly, and pedagogic development in the sciences and mathematics. **We are seeking an outstanding, broadly-trained Hydrologist with a strong dedication to teaching and scholarship in a natural science and liberal arts environment to join us as of Sept. 1 2014.** Academic experience with culturally diverse populations is desired.

Ph.D. required and post-doctoral experience would be a plus. Teaching load is 12 credit hours/semester, with most courses carrying 4 to 6 hours of teaching credit. Primary teaching responsibilities will include the teaching of undergraduate and graduate field-oriented courses in hydrology/water resources (including quantitative hydrogeology and surface water hydrology), an undergraduate program core course in Physical Geography (lecture and lab), an undergraduate course in remote sensing/GIS, and participation in the College's General Studies offerings.

Existing research facilities include hydrology, soils and environmental chemistry laboratories as well as GIS and HPC facilities. Additional analytical equipment is also available in the newly opened 66,500 sq. ft. Unified Science Center. We are located in the relatively undeveloped Pine Barrens, a region that is undergoing pressures on water resources that create

opportunities for collaborative research with federal, state, and local agencies as well as a wide array of non-profit conservation organizations and private consultants. The successful candidate will also be encouraged to develop a research program supported by external grants and fostering faculty-mentored student collaboration. The College provides several competitive internal grant programs to provide project initiation.

Screening of applications begins Jan. 13 2014 and will continue until the position is filled.

Send a letter of application, a resume, brief statements about your teaching and learning philosophy, and your research interests, and have three letters of recommendation sent to: NAMS-ENVL@stockton.edu or Dean Dennis Weiss, School of Natural Sciences and Mathematics, The Richard Stockton College of New Jersey, AA 317, 101 Vera Farris Drive, Galloway, NJ 08205.

The Richard Stockton College of New Jersey is an equal opportunity institution encouraging a diverse pool of applicants, visit www.stockton.edu/affirmative_action. Individuals with disabilities desiring accommodations in the application process should contact Sharon Hunt, Recruitment Manager, at 609-652-4384.

ASSISTANT PROFESSOR HYDROGEOLOGY/APPLIED GEOLOGY PURDUE UNIVERSITY

In support of its existing strengths in geodynamics, biogeochemistry, meteorology, and climate science, the Dept. of Earth, Atmospheric and Planetary Sciences (EAPS), within the College of Science, Purdue University, invites applications for a tenure track faculty position at the rank of Assistant Professor in the area of hydrogeology/applied geology. The position is open to all areas of EAPS, with a particular focus on candidates who investigate the links between land use, resource extraction, hydrogeology and natural hazards. Preference will be given to candidates whose research involve novel approaches to working across scales using tools such as field data or numerical models, emphasize the integration of observations and models, and/or complements existing water related initiatives at Purdue (water community, c4e, DEEE). Candidates must have completed the Ph.D. in Geological Sciences or related field at the time of employment. The appointee is expected to develop and maintain a vigorous, externally funded, internationally recognized research program and to teach and mentor students at the undergraduate and graduate levels.

To Apply: Submit (1) a cover letter, including the names of three people who have been asked to send letters of reference; (2) a curriculum vita; and (3) a statement of research and teaching experience and interests, electronically to <https://hiring.science.purdue.edu>. Review of applications will begin Dec. 1 2013, and continue until the position is filled. Additional information on EAPS can be found at HTwww.eaps.purdue.edu. Questions should be addressed to Search Committee Chair Dr. Lucy Flesch (lmflesch@purdue.edu). A background check is required for employment in this position.

Purdue University is an equal opportunity/equal access/affirmative action employer fully committed to achieving a diverse workforce.

LSU

ASSOCIATE/FULL PROFESSOR

**(ENDOWED CHAIR – JOHN FRANKS CHAIR/TENURED/TENURE-TRACK)
DEPARTMENT OF GEOLOGY AND GEOPHYSICS**

The Department of Geology and Geophysics at Louisiana State University seeks an outstanding individual to fill the endowed position of the John Franks Chair at the rank of Associate or Full Professor in a field that will support, and strengthen the mission of the department. Candidates should have internationally recognized scientific reputations and are expected to maintain a high-level, externally funded research programs, and provide leadership both on campus and beyond.

LSU is designated a Carnegie Research I University and one of a handful of distinguished universities to enjoy Land, Sea, and Space Grant status. The Department of Geology and Geophysics currently consists of 15 tenure-track faculty members having a wide range of geoscience expertise covering field, experimental, analytical and theoretical components and offers B.S., M.S., and Ph.D. degrees in geology. The Department has a strong record of success in research and graduate training, synergistic interactions with other academic units at LSU, federal and industry-funded research and teaching programs, and a large and active alumni base. (See <http://geology.lsu.edu> for more information.) Opportunities for a broad range of research interactions are available within the Department and throughout the University. The University actively promotes interdisciplinary research clusters including materials science and engineering, coastal sustainability and environment, conventional and renewable energy, biological, biotechnology and biomedical, and high performance computing. (See: <http://research.lsu.edu> for more information).

The successful candidate will be expected to lead a research team, supervise graduate student research, publish in highly ranked journals, and teach undergraduate and graduate courses in his/her area of specialization. Chair appointments would normally be made at the rank of Full Professor. However, exceptional candidates at the Associate Professor level will be considered. We encourage applications from underrepresented groups.

Required Qualifications: Ph.D. or equivalent degree in geological sciences or other relevant disciplines; a strong record of published research, and demonstrated ability to attract funding.

Additional Qualifications Desired: Internationally recognized scientific reputation. An offer of employment is contingent on a satisfactory pre-employment background check. The review process will begin October 1, 2013 and continue until a candidate is selected. Nominations or inquiries should be directed to Endowed Chair Search Committee, at 225-578-3353 or geology@lsu.edu. Apply online and view a more detailed ad at: www.lsusystemcareers.lsu.edu. Position #002395.

Quick link to ad URL: <https://lsusystemcareers.lsu.edu/applicants/Central?quickFind=56488>

LSU IS AN EQUAL OPPORTUNITY/EQUAL ACCESS EMPLOYER

TENURED OR TENURE-TRACK PROFESSOR IGNEOUS AND/OR METAMORPHIC PETROLOGY DEPARTMENT OF GEOLOGICAL SCIENCES THE UNIVERSITY OF TEXAS AT AUSTIN

The Dept. of Geological Sciences at The University of Texas at Austin seeks to hire a faculty member in the field of igneous and/or metamorphic petrology. We seek an outstanding scientist who will establish an innovative, world class, externally funded research program in the petrological evolution of the Earth's crust and/or mantle. The field of interest is open, but preference will be given to candidates who would complement and interact with our existing strengths in structural and metamorphic evolution of the lithosphere, magmatic processes, and/or mantle dynamics. We seek a candidate who will take advantage of the existing geochemical analytical capabilities of the Jackson School, and in particular the electron microprobe, scanning electron microscopes, laser ablation single and multi-collector ICP-MS, TIMS, stable isotope laboratories, and High Resolution Computed X-Ray Tomography facility, as well as interact with and possibly utilize the existing experimental petrology and high-pressure mineral physics laboratories. The search is open rank, with a preference for those at the Assistant Professor level. A Ph.D. is required by the expected start date (Aug. 18 2014).

The Dept. of Geological Sciences is part of The

Jackson School of Geosciences (JSG), which also includes two research units, the Institute for Geophysics and the Bureau of Economic Geology. The JSG is home to more than 190 research scientists and faculty members, and one of the largest combined graduate and undergraduate enrollments of any major Earth science program in the country. At JSG, petrology is a part of the Solid Earth and Tectonic Processes research theme and the Petrology and Mineral Physics discipline.

Review of applications will begin Dec. 17 2013, and continue until the position is filled. All interested applicants should submit cover letter, CV, research statement, teaching statement, and complete contact information for three letters of reference via e-mail to dgs@jsg.utexas.edu. Questions regarding the search may be addressed to the head of the search committee, Dr. James Gardner, at gardner@jsg.utexas.edu.

Background check conducted on applicant selected.

The University of Texas at Austin is an Affirmative Action/Equal Opportunity Employer.

ASSISTANT PROFESSOR IN GEOSCIENCES TARLETON STATE UNIVERSITY

Tarleton State University in Stephenville, Texas seeks applicants for a tenure-track Assistant Professor position to start Sept. 2014. Applicants must have a

Ph.D. in Geosciences with expertise in Paleontology. ABD's will be accepted if degree will be completed by Sept. 2015. Teaching duties will not only include advanced Geosciences courses in your discipline, but also Geology and Earth Sciences at the Freshmen level. A successful candidate will be expected to establish a research program at the undergraduate level. All submissions must be made electronically through Tarleton's Human Resources site, <https://jobs.tarleton.edu>, requisition #0601441. Review of applications will begin on Feb. 1 2014 and continue until the position is filled. Tarleton State University, an Equal Opportunity and Affirmative Action Employer and Educator, is committed to excellence through diversity. Tarleton State University with an enrollment over 10,000 students is a proud member of the Texas A&M University System.

**TENURE TRACK ASSISTANT PROFESSOR
IN ENVIRONMENTAL GEOSCIENCES
DEPT. OF EARTH & ENVIRONMENTAL
SCIENCES, RENSSELAER POLYTECHNIC
INSTITUTE, TROY, NEW YORK**

The Dept. of Earth & Environmental Sciences at Rensselaer Polytechnic Institute invites applications for a tenure-track position of Assistant Professor in Environmental Geosciences, broadly defined, with emphasis on individuals with research interests in the areas of subsurface imaging, hydrogeology, hazard prediction/mitigation, environmental remote or local sensing, global climate science/modeling (paleo or future), environmental data analysis, environmental field-imaging visualization, and environmental geochemistry.

The successful candidate will have duties that include teaching graduate and/or undergraduate courses in the Dept. of Earth & Environmental Sciences, developing and maintaining robust programs of research and scholarship, as well as service to the department, the School of Science, and to Rensselaer.

Rensselaer has recently initiated several bold, new initiatives, and our goal is to hire an individual who will interface with one or more of these areas. These include the Rensselaer Institute for Data Exploration and Applications (IDEA; <http://tiny.cc/c4zz4w>) and The Jefferson Project at Lake George: A strategic partnership among Rensselaer, IBM, and the Fund for Lake George (<http://tiny.cc/qn5s1w>). In addition, the Institute is conceptualizing an "Earth Systems Collaborative" to bring together research and education activities in water, environment, ecology and sustainability.

The successful candidate will have a Ph.D. degree, or foreign degree equivalent, in geosciences or a related discipline, along with the ability to demonstrate, through accomplishments, promise of future distinction in teaching, research and scholarship. All degree requirements must be complete at the time the appointment starts. To apply, applicants must submit a curriculum vitae, a brief outline of career plans, a statement of research and teaching interests, copies of select publications, and a list of four professional references to: E&ES Faculty Search, Dept. of Earth and Environmental Sciences, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY 12180-3590, e-mail: spearf@rpi.edu (electronic submissions are preferred). Consideration of candidates will begin upon receipt of application. The nominal

deadline for application is midnight, Dec. 24th, but recruiting will continue until the position is filled.

We welcome candidates who will bring diverse intellectual, geographical, gender, and ethnic perspectives to Rensselaer's work and campus communities. Rensselaer Polytechnic Institute is an Affirmative Action/Equal Opportunity Employer.

**ASSISTANT PROFESSOR OF EARTH
SCIENCES, DEPT. OF GEOGRAPHY
AND EARTH SCIENCES, UNIVERSITY OF
NORTH CAROLINA AT CHARLOTTE**

The Dept. of Geography and Earth Sciences at the University of North Carolina-Charlotte (UNC-Charlotte) is recruiting a tenure-track Assistant Professor of Earth Sciences specializing in surface water and/or groundwater hydrology. The successful candidate is expected to maintain an active, scholarly research agenda and contribute to the Department's undergraduate and graduate programs in geographical and natural sciences. Candidates with interests in groundwater/surface water interactions; aqueous flow in porous media or fractured reservoirs; contaminant transport and reactions on a range of scales; geochemistry of vadose and near-surface fluid systems; ecohydrology; hydrologic consequences and impacts of climate variability and climate change are encouraged to apply. Required qualifications are (1) Ph.D. in Geology, Earth Sciences, Physical Geography or a related discipline by 15 Aug. 2014; (2) the ability to develop and maintain an externally funded research program; (3) the ability to contribute to undergraduate and graduate curricula consistent with departmental needs; and (4) the ability to contribute to the Department's interdisciplinary mission. UNC Charlotte is an AA/EOE and an ADVANCE institution. Applications from women, minorities, veterans, and other underrepresented groups are strongly encouraged. A full description of the position and application details can be found at <https://jobs.uncc.edu>. Review of applications will begin on 1 Dec. 2013 and continue until the position is filled. All applications are subject to criminal background checks. For additional information contact Dr. Craig Allan, Department Chair at 1-704-687-5999 or cjallan@uncc.edu.

**IGNEOUS PROCESSES
DEPARTMENT OF EARTH SCIENCES
SYRACUSE UNIVERSITY**

The Dept. of Earth Sciences at Syracuse University seeks applicants for a tenure-track Assistant Professorship in the general area of igneous processes. We seek a broadly-trained petrologist with expertise in data acquisition (field and/or experimental), and interpretation of magmatic processes on a variety of scales. The successful applicant will balance an aggressive research program with both discipline-specific graduate and innovative undergraduate majors' courses, as well as introductory courses. We seek an individual with the capacity to collaborate across interdisciplinary boundaries, and interact with faculty and students in areas of existing strength particularly those in geodynamics, tectonics, thermochronology, isotope geochemistry, and paleoclimate studies. The Department houses extensive analytical research facilities. More information about the department is available at <http://earthsciences.syr>

.edu. Applicants must possess a Ph.D. with expertise in igneous processes. Applicants must submit their curriculum vitae, statements of research and teaching interests, and names and contact information of three referees via <https://www.sujobopps.com>. Applications will be reviewed starting Nov. 1 2013. The search will remain open until the position is filled. Syracuse University is an equal opportunity employer. The University is committed to building a diverse faculty, and a vibrant, family-friendly community in Syracuse and surrounding areas. Candidates who have the communication skills and cross-cultural abilities to maximize their effectiveness with diverse groups of students, colleagues and community members are especially encouraged to apply.

**TENURE TRACK
ASSISTANT PROFESSOR POSITION,
COMPUTATIONAL/QUANTITATIVE
HYDROGEOLOGIST
THE UNIVERSITY OF ALABAMA**

The Dept. of Geological Sciences at The University of Alabama invites applications for a tenure-track faculty position in Hydrogeology, beginning Aug. 2014. The position will be filled at the Assistant Professor level. Candidates must have a strong record of research and a Ph.D. in hydrogeology or a closely related field, preferably with specialization in computational and numerical approaches, by the time of appointment. The successful candidate will be expected to establish a strong, externally-funded research program and to attract high-quality Ph.D. and M.S. graduate students. The successful candidate also will be expected to teach introductory geology courses and undergraduate and graduate courses in groundwater modeling and quantitative hydrogeology, advise graduate students, and contribute to the Department's research program in hydrogeology and environmental geology. Opportunities for research collaboration also exist with the Geological Survey of Alabama, the newly established NOAA National Water Center, and the Center for Freshwater Studies, all located on The University of Alabama campus. The Department has a broad range of resources and existing facilities, including modeling and computational resources, field and laboratory equipment, and chemical and stable isotope analytical facilities. Details regarding existing department research programs, equipment, and facilities can be found at www.geo.ua.edu. Questions should be directed to Dr. Geoff Tick (gtrick@ua.edu), Chair of the Hydrogeology Search Committee. Applicants should submit a cover letter, curriculum vitae, research statement, teaching statement, and names and contact information for at least three referees through the UA Jobs website at facultyjobs.ua.edu. Review of applications will begin Dec. 2 2013, and will continue until the position is filled.

The University of Alabama is an equal opportunity/affirmative action employer and actively seeks diversity in its employees.

**GEOSCIENCE AND
ENVIRONMENTAL SUSTAINABILITY
UNIVERSITY OF PITTSBURGH**

The Dept. of Geology and Planetary Science (www.geology.pitt.edu) at the University of Pittsburgh invites applications for a tenure-track position at the assistant professor level to expand and enhance our

current research expertise in Geoscience and Environmental Sustainability. We seek an individual working on global-scale issues that tie geoscience research to quantitative sustainability themes. Research directions that integrate well with current departmental expertise include, but are not limited to, global geospatial analysis, remote sensing of atmospheric composition and natural disasters, climate change and glacial processes, and the relationship between hydrology, geomorphology, (bio)geochemistry in coupled natural-human systems.

We are particularly interested in individuals that integrate quantitative field measurements with emerging research tools such as climate change/geohazard related modeling using orbital/airborne LiDAR and/or thermal IR, landscape evolution modeling, and modeling/measurements of regional to global-scale atmospheric fluxes. It is expected that this hire will strengthen our existing interdisciplinary collaborations with local and regional institutions including the Mascaro Center for Sustainability and Innovation at the University of Pittsburgh, Carnegie Mellon University, the DOE-National Energy and Technology Laboratory, and the NASA-Goddard Space Flight Center.

The successful candidate will be expected to develop an active, externally funded research program, including the supervision of M.S. and Ph.D. students and undergraduate research projects. Teaching duties include undergraduate and graduate courses in the candidate's area of expertise.

Applicants should email the following materials to the Environmental Sustainability Search Committee at geolsrch@pitt.edu: (1) a CV (including past and current grant support); (2) statements of research and teaching interests; (3) copies of three relevant publications; and (4) names and contact information of four references. Questions regarding the position should be directed to Mark Abbott at mabbott1@pitt.edu, 412-624-8783.

Review of applicants will begin on Jan. 1 2014 and proceed until the position is filled. A Ph.D. is required at the time of appointment, and the position begins in the fall term of 2014, subject to budgetary approval.

The University of Pittsburgh is an equal opportunity/affirmative action employer. Applications from women and members of minority groups are especially encouraged.

**TENURE-TRACK FACULTY POSITION
SEDIMENTOLOGY/STRATIGRAPHY
THE UNIVERSITY OF ALABAMA**

The Dept. of Geological Sciences at The University of Alabama invites applications for a tenure-track faculty position in sedimentology and stratigraphy, beginning Aug. 2014. The position will be filled at the Assistant Professor level. Candidates must have a strong record of research and teaching, and must have received their Ph.D. in Geology, or a related field, at the time of appointment. The successful candidate will be expected to teach introductory geology courses and undergraduate and graduate courses in sedimentology and stratigraphy, attract and supervise graduate students, and establish a vigorous externally-funded research program in sedimentology and/or stratigraphy. The department has a broad range of geophysical, modeling, isotopic and geo-

**GEORGE MASON
UNIVERSITY**


**PROFESSOR/ASSOCIATE PROFESSOR OF GEOLOGY
EARTH SURFACE PROCESSES OR PALEOCLIMATOLOGY**

The Department of Atmospheric, Oceanic and Earth Sciences in Fairfax, Va., invites applications for an Associate or Full Professor beginning August 2014. We seek a dynamic person with broad expertise in one or more of the following areas: hydrogeology, paleoclimatology, geochemistry, geomorphology, or related areas. Preference will be given to candidates whose expertise complements existing departmental teaching and research areas. Demonstrated excellence and leadership in research and education is a requirement. The successful candidate is expected to have a robust externally funded research program and take a leadership role in the development of a geology graduate program. A Ph.D. in geology or a closely related geoscience field is required. Experience with field-based research is a plus.

The department offers undergraduate degrees in Geology and Earth Science and a Ph.D. in Climate Dynamics. We are particularly interested in candidates whose expertise and/or research will synergistically link these disciplines of climate and geology. Also, the department plans to offer an Atmospheric Sciences B.S. and Geology M.S. in the near future. Our faculty includes geologists, atmospheric scientists, and oceanographers.

For full consideration, applicants must apply online at <http://jobs.gmu.edu> for position F9637z by January 20, 2014. Candidates should submit a CV, a letter of intent including statements of research and teaching interests, up to five digital examples of published work, teaching evaluations, and contact information of four references. Review of applications will begin on January 20, 2014, and continue until the position is filled.

AA/EOE



chemical research facilities available, in addition to University shared facilities at CAF (www.caf.ua.edu). Details regarding existing research programs, equipment and facilities, and departmental activities can be found at www.geo.ua.edu. Questions should be directed to Dr. Alberto Pérez-Huerta (aphuerta@as.ua.edu). Applicants should go to facultyjobs.ua.edu to electronically apply for this position. When submitting an application, candidates must provide a cover letter, CV, research and teaching statements, and a list with the contact information for at least three referees. Applications will be reviewed beginning Jan. 1 2014, and will continue until the position is filled.

The University of Alabama is an Equal Opportunity Affirmative Action Employer. Women and minorities are encouraged to apply.

**ASSISTANT PROFESSOR, HYDROGEOLOGY
DEPARTMENT OF GEOLOGY,
WICHITA STATE UNIVERSITY**

The Dept. of Geology at Wichita State University invites applications for a faculty position in hydrogeology beginning Aug. 2014. We are seeking to hire a tenure-eligible assistant professor. In particular, we seek a candidate with research expertise in environmental and ground water issues, complemented with a knowledge of computer modeling and an interest in sustainability. In addition to developing an externally funded research program, successful candidates will

be expected to teach introductory, major, and graduate level classes. The candidate must have a Ph.D. in the Geosciences, an established record of publication commensurate with the applicant's career stage, and is expected to complement our existing departmental strengths in low-temperature geochemistry, paleontology, petroleum geology, sedimentology, stratigraphy, and structural geology and interact with broader segments of the WSU community.

Candidates must go on line at <http://jobs.wichita.edu> to apply for the position. Interested applicants should submit cover letter, curriculum vitae, statements of research and teaching interests, and contact information for at least three references. Applicants should also send copies of relevant publications to the Search Committee Chair, Dept. of Geology, 1845 Fairmount Ave., Wichita State University, Wichita, KS 67260-0027. We will begin review of applications after Nov. 30 2013; however, applications will be accepted until the position is filled. Wichita State University is an equal employment opportunity/affirmative action employer. Applicants with an interest in broadening participation in higher education and members of underrepresented groups are encouraged to apply. Offers of employment are contingent upon completion of a satisfactory criminal background check as required by Board of Regents policy. Additional details of the Dept. of Geology may be viewed at our web page www.wichita.edu/geology.

**ASSISTANT PROFESSOR
STRUCTURAL GEOLOGY
DEPARTMENT OF GEOLOGY
WICHITA STATE UNIVERSITY**

The Dept. of Geology at Wichita State University invites applications for a faculty position in Structural Geology beginning Aug. 2014. We are seeking to hire at the assistant professor level (tenure-track) and exceptional candidates may be considered to fill the department's Abercrombie Distinguished Professorship. Skills that include field work, modeling, GIS, and/or 3D visualization and research expertise in geophysics would be particularly advantageous. In addition to developing a productive, externally funded research program, the new faculty member will teach courses at the introductory, major, and graduate levels as well as supervise graduate students. Applicants are expected to complement our existing departmental strengths in low-temperature geochemistry, paleontology, petroleum geology, sedimentology, and stratigraphy as well as interact with broader segments of the WSU community. The successful candidate must have a Ph.D. and an established publication record in Structural Geology.

Applications should be submitted at <http://jobs.wichita.edu> and should include a cover letter, curriculum vitae, statements of research and teaching interests, and contact information for at least three references. Applicants should also send copies of relevant publications to the Search Committee Chair, Dept. of Geology, 1845 Fairmount Ave., Wichita State University, Wichita, KS 67260-0027. Review of applications will begin 30 Nov. 2013; however, applications will be accepted until the position is filled. Wichita State University is an equal employment opportunity/affirmative action employer. Applicants with an interest in broadening participation in higher education and members of underrepresented groups are encouraged to apply. Offers of employment are contingent upon completion of a satisfactory criminal background check as required by Board of Regents policy. Additional details of the Dept. of Geology and Wichita State University may be viewed at our web pages: www.wichita.edu/geology and www.wichita.edu.

**TECTONICS, TENURE-TRACK
ASSISTANT PROFESSOR
DEPARTMENT OF GEOLOGICAL SCIENCES
UNIVERSITY OF SASKATCHEWAN**

College of Arts & Science, www.artsandscience.usask.ca; Dept. of Geological Sciences, www.artsandscience.usask.ca/geology/.

The Dept. of Geological Sciences at the University of Saskatchewan is accepting applications for a tenure-track position at the Assistant Professor level in the broad area of Tectonics. The department seeks a versatile researcher who takes an integrative approach to elucidating the structural and tectonic evolution of the Earth's crust. The successful candidate will be expected to develop a vigorous, externally funded research program, and participate broadly in undergraduate and graduate student teaching and research, including introductory courses, structural geology, and field schools. Candidates must hold a Ph.D. when appointed, which is expected to be July 1 2014.

The Dept. of Geological Sciences in the Division of Science has 15 full-time faculty, including two Canada Research Chairs and two endowed research chairs, and houses advanced analytical and computing facilities. For detailed information about the Department, the applicants are encouraged to visit <http://artsandscience.usask.ca/geology/>.

The College of Arts & Science offers a dynamic combination of programs in the humanities and fine arts, the social sciences and the sciences. There are over 8,000 undergraduate and graduate students in the College and 325 faculty, including 14 Canada Research Chairs. The College emphasizes student and faculty research, interdisciplinary programs, community outreach and international opportunities.

The University of Saskatchewan is located in Saskatoon, Saskatchewan, a city with a diverse and thriving economic base, a vibrant arts community and a full range of leisure opportunities. The University has a reputation for excellence in teaching, research and scholarly activities and offers a full range of undergraduate, graduate, and professional programs to a student population of about 21,000. The university is one of Canada's leading research-intensive universities.

Applications, including a curriculum vitae, statement of research interests, which should include a summary research plan for the next five years, statement of teaching philosophy, and three letters of reference should be sent to: Search Committee, Dept. of Geological Sciences, College of Arts and Science, University of Saskatchewan, 114 Science Place, Saskatoon, SK S7N 5E2, Canada, e-mail: jim.merriam@usask.ca; fax: 306-966-8593

Review of applications will begin after Jan. 31 2014.

The University of Saskatchewan is strongly committed to a diverse and inclusive workplace that empowers all employees to reach their full potential. All members of the university community share a responsibility for developing and maintaining an environment in which differences are valued and inclusiveness is practiced. The university welcomes applications for those who will contribute to the diversity of our community. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be given priority.

**CHAIR IN HARD ROCK GEOLOGY
DEPARTMENT OF GEOLOGICAL SCIENCES
UNIVERSITY OF SASKATCHEWAN**

College of Arts & Science, www.artsandscience.usask.ca; Dept. of Geological Sciences, www.artsandscience.usask.ca/geology/.

The Dept. of Geological Sciences at the University of Saskatchewan is accepting applications for an open-rank tenure-track or tenured position as the Murray W. Pyke Chair, which is a newly established named Chair in Geological Sciences. The appointment will be at the Assistant, Associate or Full Professor level (depending on experience) in the broad area of Hard-Rock Geology, with recognized expertise in one or more of the following areas: mineral deposit systems, petrology, mineralogy and geochemistry. The successful candidate will be expected to develop a vigorous, externally funded research program, and to participate broadly in undergraduate and

graduate student teaching and research, including introductory courses, field schools, core geology and specialist courses in their area of expertise. The successful candidate will be encouraged to enhance analytical infrastructure in the Department or within the University. Appointment is expected to be July 1 2014, at which time the candidate must hold a Ph.D.

The Dept. of Geological Sciences in the Division of Science has 15 full-time faculty, including two Canada Research Chairs and two endowed research chairs, and excellent analytical and computing facilities. For detailed information about the Department, the applicants are encouraged to visit <http://artsandscience.usask.ca/geology/>.

Murray Pyke was a distinguished graduate of the Department and a founder, executive and director of Complex Resources and Bonterra Energy, both of Calgary. A prominent figure in minerals and petroleum exploration in Canada, Murray spent many summers mapping the Precambrian Shield in northern Saskatchewan, the Northwest Territories and Nunavut. This work reflected his love of the outdoors, satisfied his scientific curiosity and nurtured a deep respect for the indigenous peoples of Canada with whom he worked and lived during those years.

The College of Arts & Science offers a dynamic combination of programs in the humanities and fine arts, the social sciences and the sciences. There are over 8,000 undergraduate and graduate students in the College and 325 faculty, including 14 Canada Research Chairs. The College emphasizes student and faculty research, interdisciplinary programs, community outreach and international opportunities.

The University of Saskatchewan is located in Saskatoon, Saskatchewan, a city with a diverse and thriving economic base, with a strong focus on mineral exploration and mining, a vibrant arts community and a full range of leisure opportunities. The University has a reputation for excellence in teaching, research and scholarly activities. It offers a full range of undergraduate, graduate and professional programs to a student population of about 20,000 and is one of Canada's leading research-intensive universities.

Applications, including a curriculum vitae, statement of research interests, which should include a summary research plan for the next five years, statement of teaching philosophy, and three letters of reference should be sent to: Murray W. Pyke Chair Search Committee,

Dept. of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, SK S7N 5E2, Canada; e-mail: jim.merriam@usask.ca; fax: 306-966-8593.

Review of applications will begin after 31 Jan. 2014.

The University of Saskatchewan is strongly committed to a diverse and inclusive workplace that empowers all employees to reach their full potential. All members of the university community share a responsibility for developing and maintaining an environment in which differences are valued and inclusiveness is practiced. The university welcomes applications from those who will contribute to the diversity of our community. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be given priority.

**LECTURER, GEOSCIENCE
MIAMI UNIVERSITY**

The Dept. of Geology and Environmental Earth Science at Miami University invites applications for a full time Lecturer faculty position on the Oxford campus beginning Aug. 2014. This position requires instruction of undergraduate foundation level courses such as physical geology and environmental geology, and intermediate level courses. Preference will be given to candidates with expertise in one or more of the following areas: environmental geoscience, climate/energy, high-temperature geochemistry and igneous/metamorphic petrology, and paleobiology/paleontology. The successful candidate will advise undergraduate students and provide professional service to the department and university. We encourage applications from geoscientists with interests in contributing to supervision of undergraduate student research and field-based experiences. Require: M.S. in geoscience by date of appointment and documented teaching experience. Desire: Ph.D. in geoscience. Miami University's Oxford Campus, with nearly 15,000 undergraduate and over 1,800 graduate students, is located in a small-town setting adjacent to the Cincinnati and Dayton urban areas. More information on Miami and on the department may be obtained via www.miamioh.edu and www.miamioh.edu/geology. Interested candidates should submit a packet containing a letter of application; curriculum vitae; statement of teaching philosophy, objectives and accomplishments (as "other document") and transcripts (as "list of references") to: www.miamiohjobs.com/applicants/Central?quickFind=53195; and arrange for three letters of reference to be sent to GLGSearch@MiamiOH.edu. Review of applications will begin Jan. 13 2014 and continue until the position is filled. Miami University is an EOE/AA employer with smoke- and tobacco-free campuses. Miami's Annual Security and Fire Safety Report with information on campus crime, fires, and safety may be found at www.MiamiOH.edu/campus-safety/annual-report/index.html. Hard copy available upon request. Employment will require a criminal background check according to University guidelines.

**HYDROGEOCHEMIST
GEOHYDROLOGY SECTION
KANSAS GEOLOGICAL SURVEY**

THE UNIVERSITY OF KANSAS, LAWRENCE
Full-time position to lead KGS hydrogeochemical investigations. Faculty-equivalent, sabbatical-eligible position at the rank of Assistant or entry-level Associate Scientist. Requires Ph.D. with an emphasis on aqueous geochemistry related to groundwater resources, and scientific leadership potential. Background in hydrogeochemistry applied to regional-scale groundwater investigations is desired. The Geo-hydrology Section has 7 full-time professionals with additional support personnel. Emphasis on state-of-the-science field studies and complementary theoretical research. Complete announcement/application info at www.kgs.ku.edu/General/jobs.html. First consideration deadline: Feb. 7 2014. Apply online at http://jobs.brassring.com/1033/ASP/TG/cim_jobdetail.asp?partnerid=25752&siteid=5447&AREq=44BR. For further information



**Assistant/Associate Professor in Geophysics
THE UNIVERSITY OF OKLAHOMA**

The University of Oklahoma invites applications for a tenure track position in Geophysics at the Assistant or Associate Professor level. Departmental interests range from the deep lithosphere, through hydrocarbon exploration, to near surface geophysics. We search for a dynamic candidate to supervise students at all levels, and to conduct independent, externally funded research program in his/her field of expertise.

The candidate should hold a Ph.D. in Geophysics; have a demonstrated research record, and an interest in teaching undergraduate and mentoring graduate students in lithospheric and exploration geophysics. Salary, benefits, and start-up funds will be competitive and commensurate with experience. The ConocoPhillips School of Geology and Geophysics has a large, vibrant faculty with a broad range of research activities and strong ties to the petroleum industry. The student body includes about 150 undergraduates and 100 M.S. and Ph.D. students. The Mewbourne College of Earth & Energy possesses extensive software and computing labs of PC and Linux platforms networked to our own Boowulf cluster and to the OU supercomputer center (OSCAR). It hosts numerous industrial consortia, a research institute focused on seismic monitoring, and a new field campus in Colorado for field courses in geology and geophysics. The geophysics group conducts active research projects on several continents that are funded by NSF, industry, and foreign national institutes. The College maintains a comprehensive pool of geophysical equipment including GPR, seismic (active and passive), magnetic, and gravity instruments as well as extensive rock physics characterization laboratories. Through collaboration with industry, we have a suite of 3D seismic and microseismic data volumes that are used for teaching, algorithm calibration, seismic geomorphological analysis, crustal imaging, and a range of open source software for lithospheric-scale research. Information about the School and College, the facilities and the entities that it houses can be found at <http://geology.ou.edu>.

Review of applications will begin December 1, 2013, and on-campus interviews will start early 2014. The search will continue until the position is filled. The anticipated starting date is August 16, 2014. Applicants are requested to submit a complete vita/resume, statement of research and teaching interests, and a list of five references who can be contacted, including phone numbers, e-mail addresses, and mailing addresses. Questions or information requests may be addressed to Chair of the Geophysics Search Committee, at (405) 325-3253, or ougeophysicsearch@ou.edu. Applications and nominations should be addressed to: Geophysics Search Committee, The University of Oklahoma, Sarkeys Energy Center, 100 E. Boyd Street, Room 710, Norman, OK, 73019-1008.

The University of Oklahoma is an Affirmative Action, Equal Opportunity Employer. Women and minorities are encouraged to apply.

contact Geoff Bohling (geoff@kgs.ku.edu) or Don Whittemore (donwhitt@kgs.ku.edu). Equal Opportunity Employer M/F/D/V.

**THE ROY J. SHLEMON CHAIR
IN APPLIED GEOSCIENCES
DEPT. OF EARTH AND PLANETARY SCIENCES
UNIVERSITY OF CALIFORNIA, DAVIS**

The Dept. of Earth and Planetary Sciences at the University of California at Davis seeks an outstanding scholar for The Roy J. Shlemon Chair in Applied Geosciences in the College of Letters and Science. We seek an individual with a well-established, highly visible and interdisciplinary research program in Quaternary geomorphology with a strong quantitative background and an active interest in understanding the dynamics of Earth's surface through studies of the physics of surficial processes and the broad-scale interactions among tectonics, topography, and climate. Areas of interest include, but are not limited to, the dynamics of river and delta systems in response to tectonism, climate change and sea level change, the geomorphic evolution of mountain ranges and their local and regional impact on and feedback with climate dynamics, and theoretical modeling of fluid mechanics and sediment transport as applied to problems of geomorphology.

We anticipate an appointment at the Associate or Full Professor level to begin July 1 2014. The successful candidate is expected to hold the academic dis-

tion for appointment to an endowed Chair at the post-tenure level. The candidate is further expected to create a focal point for Quaternary Science research on the UC Davis campus as well as to explore links to the Center for Watershed Sciences (<http://watershed.ucdavis.edu/>) of the John Muir Institute of the Environment. An interest in policy development of water resource issues in California and/or the western United States is desirable.

For more information about the UC Davis Dept. of Earth and Planetary Sciences, see <http://geology.ucdavis.edu>.

To apply, please go to <https://recruit.ucdavis.edu/apply/JPF00159>.

Review of applications will begin on Dec. 20, and will continue until the position is filled. UC Davis is an affirmative action/equal employment opportunity employer and is dedicated to recruiting a diverse faculty community. We welcome all qualified applicants to apply, including women, minorities, individuals with disabilities and veterans.

**TENURE TRACK, ASSISTANT PROFESSOR
PALEOBIOLOGY AND/OR GEOBIOLOGY
UNIVERSITY OF NEW MEXICO**

The Dept. of Earth and Planetary Sciences at the University of New Mexico invites applications for a tenure track faculty position at the rank of Assistant Professor in Paleobiology and/or Geobiology. We seek candidates who use field, laboratory, and/or quantitative methods to reconstruct the co-

evolutionary history of the Earth and its biosphere. Candidates with demonstrated research expertise that complement existing departmental strengths (epswww.unm.edu) are especially encouraged to apply. Minimum qualifications are a Ph.D. in Geosciences or a related field at the time of appointment, targeted for Aug. 2014.

The application package, containing a letter of interest, CV, a statement of teaching and research interests, and the names of three references with contact information, should be submitted electronically to UNM Jobs: <http://unmjobs.unm.edu/applicants/Central?quickFind=74723>.

For best consideration, all materials must be received by Jan. 6 2014. However, the position will remain open until filled.

For questions regarding the application process please contact Paula Pascetti (pascetti@unm.edu), Search Coordinator, Dept. of Earth and Planetary Sciences (phone: 505-277-1633).

Women and under-represented minorities are strongly encouraged to apply.

The University of New Mexico is an equal employment/affirmative action employer and educator.

ASSISTANT PROFESSOR, DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES CALIFORNIA INSTITUTE OF TECHNOLOGY

The Division of Geological and Planetary Sciences at the California Institute of Technology is seeking applicants for a tenure-track position at the assistant professor level. We seek applicants for a position

in any area within the purview of the Division of Geological and Planetary Sciences at Caltech, with a strong commitment to high quality teaching. We solicit applicants from the broad range of disciplines within Earth and planetary science, including geology, geophysics, geochemistry, geobiology, and planetary science, and who are interested in all aspects of earth and planetary dynamics, interiors, surfaces, atmospheres, oceans, and cryospheres.

The term of the initial appointment at the assistant professor level is normally four years, with appointment contingent upon completion of a Ph.D. in a relevant field. Exceptionally well-qualified candidates may also be considered at the tenured professor level. Interested applicants should submit an electronic application at www.gps.caltech.edu/employment. Applications will be accepted until the position is filled.

If there are any questions during the search process, please contact us at gps-search@caltech.edu.

The California Institute of Technology is an Equal-Opportunity/Affirmative-Action Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

GEOLOGY, PETROLOGY

UNIVERSITY OF WISCONSIN OSHKOSH

University of Wisconsin Oshkosh, Dept. of Geology, seeks hard rock, field-oriented geologist for full-time, tenure-track assistant or associate professor position starting Sept. 1 2014. Specialty area should complement existing faculty expertise. Ph.D. required; prior

college/university teaching experience preferred. Successful candidate is expected to develop a vigorous research program, which includes publishing peer-reviewed papers. Teaching responsibilities include introductory courses, lithology, economic geology, geochemistry, field trips, and advising majors. Submit letter of application, concise statement of teaching and research interests and experience, curriculum vitae, and undergraduate and graduate transcripts (original or photocopy) by Dec. 31 2013 to Dr. William Mode, Chair, Dept. of Geology, University of Wisconsin Oshkosh, Oshkosh, WI 54901. Have three current letters of reference sent directly to department by that date. For additional information, see www.uwosh.edu/departments/geology/. Employment requires criminal background check. AA/EOE.

**CHAIR, DEPARTMENT OF GEOLOGY
STEPHEN F. AUSTIN STATE UNIVERSITY**

The Dept. of Geology at Stephen F. Austin State University (SFA) invites applications for the department chair position. We seek an individual with strong management, communication, and interpersonal skills to provide innovative and energetic leadership. Duties include managing curricula, budgets, student enrollment, personnel, program and unit assessment, and developing strong, mutually beneficial relationships with industry and alumni. The incumbent will teach a reduced load of courses and develop a research program in his/her area of expertise. Applicants must have



**Colorado School of Mines
Geology & Geological Engineering
Robert J. Weimer Chair**

Colorado School of Mines invites applications for the Robert J. Weimer Distinguished Chair in Sedimentary and Petroleum Geology. The successful candidate is expected to conduct a vigorous, externally-funded research program that includes collaboration with researchers in the petroleum industry, direct graduate student research, and teach graduate courses in his/her specialty. Candidates must possess a doctoral degree in geosciences or a closely related discipline. The successful candidate will have proven high-quality research and scholarship. The purpose of this endowed position is to support innovative research in sedimentary geology and education that are broadly aligned with petroleum geosciences. These may include sedimentology, stratigraphy, and the integration of these disciplines with tectonics, paleontology or geochemistry. The research interests should complement and support existing campus programs (e.g., conventional and unconventional resource research). Applicants must demonstrate documented successful teaching experience and possess strong interpersonal and communication skills. We particularly seek candidates who both complement our current research program and integrate across geophysics and petroleum engineering. The position is expected to be filled at the tenured Full Professor level.

For the complete job announcement and directions on how to apply, visit:
<http://inside.mines.edu/HR-Academic-Faculty>



**Colorado School of Mines
Geology & Geological Engineering
Assistant/Associate Professor –
Litho geochemistry**

Colorado School of Mines Department invites applications for an anticipated Assistant/Associate Professor position in the field of Litho geochemistry to begin in August 2014. The successful candidate will be expected to develop a strong and vibrant externally funded program and establish an international reputation through publication, in addition to teaching at the undergraduate and graduate levels, directing graduate research and supervising thesis projects. Candidates must possess a doctoral degree in geochemistry or a closely related discipline. The research interests should complement and support existing campus programs (e.g., crustal processes and ore deposit research, geothermal system research, unconventional resource research, and environmental geochemistry). Applicants must possess strong interpersonal and communication skills. Preference will be given to applicants who: Can teach courses in the geochemistry of earth materials, mineral exploration geochemistry, and analytical geochemistry; have experience with the minerals industry; have conducted research on the geochemical behavior of major and trace elements as well as isotopes in solid-rock geologic systems; or conduct research that complements and supports existing campus programs (e.g., crustal processes and ore deposit research, geothermal system research, unconventional resource research, and environmental geochemistry).

For the complete job announcement and directions on how to apply, visit:
<http://inside.mines.edu/HR-Academic-Faculty>

credentials for appointment at the associate or professor rank.

Submit a letter of application, CV, and a list of three references online at <https://careers.sfasu.edu> (posting 0602535). Also submit all official transcripts by mail to: Dr. Kenneth Farrish, Search Committee Chair, Dept. of Geology, Stephen F. Austin State University, Box 13011 SFA, Nacogdoches, TX 75962 (phone: 936-468-3701). Review of applications will begin on Dec. 1 2013 and will continue until the position is filled. Equal Opportunity Employer. Security-sensitive position; this position will be subject to a criminal history check.

**SEDIMENTARY GEOLOGY AND
PALEONTOLOGY
MINOT STATE UNIVERSITY**

The Dept. of Geosciences at Minot State University invites applications for a tenure-track faculty position in soft-rock geology at the assistant professor to start fall 2014. A Ph.D. in geological sciences or related field by time of appointment is expected. We seek someone with a broad, field-based background in sedimentology, stratigraphy, and paleontology. Teaching expectations include sedimentation-stratigraphy and paleontology; historical geology; and contribution to introductory courses (environmental geology and physical geology). Applicants for the position should demonstrate potential for excellence in undergraduate teaching and active engagement in research and scholarship, including involvement of undergraduate students. We welcome applicants with a background in energy resources who could develop new courses such as petroleum geology, well-site geology, coal geology and/or renewable energy resources. More information about this position can be found at www.minotstateu.edu/hr/jobs.shtml.

Applicants should send a cover letter, CV, copies of transcripts, statement of research interests, and statement of teaching interests/philosophy to: Dr. John Webster, Minot State University, 500 University Avenue West, Minot, ND 58707. Applicants should arrange to have three letters of reference submitted directly. Materials may be submitted electronically to john.webster@minotstateu.edu. Review of applications will begin on Jan. 10 2014. Applications will be accepted and considered until the position is filled. Minot State University is an equal opportunity employer and actively seeks diversity among its employees

**TENURE-TRACK POSITION IN
EARTH SYSTEMS (BIOSPHERIC PROCESSES)
DEPARTMENT OF EARTH AND
ENVIRONMENTAL SCIENCES
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 Earth Systems. This position, effective the Fall 2014 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 levels, and who will be attracted by opportunities at Vanderbilt for interaction with a diverse faculty and student body in the Earth and environmental sciences and

related fields. The research specialty is open, although we are particularly aimed at those studying biospheric processes and/or history, and interactions with other Earth systems. We welcome applications from candidates pursuing theoretical, experimental, and/or field-based work, and we are especially aimed at individuals with interest in both modern and ancient 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 evidence of teaching effectiveness. Applications should be submitted by e-mail in PDF format to: EESposition@vanderbilt.edu. Up to three representative papers may be sent via normal mail to: Search Committee 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 15 Dec. 2013. Vanderbilt is an equal opportunity/affirmative action employer. Women and minorities are especially encouraged to apply.

**ASSISTANT PROFESSOR
COLLEGE OF SCIENCE
DEPARTMENT OF GEOLOGICAL SCIENCES
THE UNIVERSITY OF TEXAS AT EL PASO**

The Dept. of Geological Sciences at the University of Texas at El Paso (UTEP) announces a tenure-track faculty position to conduct original research and strengthen existing expertise in the fields of geophysics, tectonics, environmental sciences, and petroleum geology. We are particularly interested in candidates who are proficient in the acquisition, processing and/or interpretation of 2 and 3D geophysical data, can conduct regional scale studies, and have experience using the latest geophysical characterization techniques to improve our understanding of physical and/or hydrological processes of the Earth.

We expect to hire at the assistant professor level; however, candidates with exceptional qualifications, including industry experience, may be considered for a higher rank.

About the Department, UTEP, and El Paso: The Dept. of Geological Sciences at UTEP has a faculty of 15 and more than 150 graduate and undergraduate students. The Department is housed in an attractive 90,000 sq. ft. building, which contains faculty and student offices, laboratories, and classroom space, with research infrastructure that includes controlled source seismometers, passive source seismometers, gravimeters, magnetometers, and extensive computational and software resources. More information about departmental activities and facilities can be found at our website: www.geo.utep.edu. The department also participates in interdisciplinary Ph.D. programs in Materials Science Engineering, Environmental Science and Engineering, and Computational Science.

UTEP is a national research university with an enrollment of over 23,000 students, the majority of whom are Mexican-American. The University, which employs nearly 3,500 faculty and staff, is located on the U.S.-Mexico border and adjacent to the State of New Mexico. El Paso, Texas, is the 19th largest and the safest big city in the United States. UTEP's strategic location, student body, and faculty research and

expertise are focused on a range of topics of emerging national interest.

Required Qualifications: A Ph.D. in the geosciences or closely related discipline is required. The successful candidate will be expected to establish a funded research program, to mentor undergraduate and graduate students in research, and to teach introductory earth science as well as higher-level courses in the candidate's specialty.

Application Procedure: Review of applications will begin on Dec. 1 2013 and will continue until the position is filled. Anticipated appointment date is Fall 2014. Applications must be submitted electronically via email in a single PDF document with "Faculty Position Application: YOUR NAME" in the subject line. Complete applications will consist of a cover letter, a detailed curriculum vitae, complete contact information for at least three references, a statement of teaching, and a statement of research. Applications should be submitted to Dr. Aaron A. Velasco, Chair of the Search Committee, Geological Sciences, e-mail: aavelasco@utep.edu.

The University of Texas at El Paso is an Equal Opportunity/Affirmative Action employer. The University does not discriminate on the basis of race, color, national origin, sex, religion, age, disability, genetic information, veteran status, or sexual orientation in employment or the provision of services.

**LECTURER POSITION
ENVIRONMENTAL GEOSCIENCE
DEPARTMENT OF PHYSICAL AND
ENVIRONMENTAL SCIENCES
UNIVERSITY OF TORONTO SCARBOROUGH**

The Dept. of Physical and Environmental Sciences at the University of Toronto Scarborough invites applications for a three-year limited term teaching-stream appointment in the field of Environmental Geosciences. The appointment will be at the rank of Lecturer and will commence on July 1 2014 and end on June 30 2017. There is a possibility of renewal.

Applicants should have teaching experience in Geological Sciences to support the department's growing undergraduate program in Environmental Geoscience. The successful candidate will teach undergraduate courses in Geology and Environmental Geoscience—including Mineralogy, Petrology, and Structural Geology. Additional duties will involve the administration and promotion of our Environmental Science programs.

The successful candidate must have a Ph.D. and expertise in Geological Sciences, strong communication and interpersonal skills, a demonstrated commitment to students' learning, and the skills required to achieve this goal through excellent teaching. The successful candidate also will be expected to perform standard professional and administrative activities typical of an academic department and to collaborate with colleagues on program development. Salary will be commensurate with qualifications and experience.

Excellence in teaching and research are two pillars of the University of Toronto's mission. Faculty in the teaching stream focus on the University's teaching mission. They are expected to combine their expertise in the discipline with best practices in teaching to create rich learning environments that embrace diversity, promote equity, and integrate research in a

manner that challenges students to develop skills and ethics to be leading citizens.

All qualified candidates are invited to apply by clicking on the link below. Application material, including curriculum vitae, a teaching portfolio and evidence of teaching excellence, must be submitted online, preferably well before our deadline date of **Dec. 20, 2013**. Applicants should also ask three referees to send letters directly to the Department Chair via e-mail to dpschair@utsc.utoronto.ca by the closing date. These letters should explicitly consider the applicant's teaching strength. If you have questions about this position, please e-mail dpschair@utsc.utoronto.ca.

The U of T application system can accommodate up to five attachments (10 MB) per candidate profile; please combine attachments into one or two files in PDF/MS Word format. Submission guidelines can be found at <http://uoft.me/how-to-apply>.

For more information about the Dept. of Physical and Environmental Sciences, University of Toronto Scarborough please visit our home page: www.utsc.utoronto.ca/~physsci/.

Fellowship Opportunities

TURNER POSTDOCTORAL FELLOWSHIP UNIVERSITY OF MICHIGAN

The Dept. of Earth and Environmental Sciences at the University of Michigan invites applications for the 2014 Turner Postdoctoral Fellowship. This highly competitive fellowship is open to all fields within Earth Sciences.

The Department is interested in innovative research proposals that can be pursued in collaboration with one or more faculty members. Interested applicants are encouraged to **contact prospective hosts** ahead of the application deadline to discuss areas of common interest and potential collaborations (www.lsa.umich.edu/earth/people/faculty).

Turner Postdoctoral Fellows receive an annual salary of \$55,000, discretionary research funds totaling \$10,000, and a generous benefits package. The fellowship is awarded for a one-year period, with an anticipated extension for a second year.

Interested applicants should send a single pdf file with the following: a curriculum vitae; research proposal (5 pages maximum excluding references); the names and addresses of at least three references no later than Jan. 15 2014. Applications should be submitted at the following website: www.earth.lsa.umich.edu/turner2014.

Regents of the University of Michigan: Mark J. Bernstein, Julia Donovan Darlow, Laurence B. Deitch, Shauna Ryder Diggs, Denise Ilitch, Andrea Fischer Newman, Andrew C. Richner, Katherine E. White, Mary Sue Coleman, ex officio. A non-discriminatory, Affirmative Action Employer. Copyright 2013 Regents of the University of Michigan.

Opportunities for Students

Lindahl Ph.D. Scholarships: The University of Alabama Dept. of Geological Sciences (DGS) seeks highly qualified Ph.D. students with specializations

in topics that complement faculty research interests. Exceptional students will receive Research or Teaching Assistantships and a Lindahl Scholarship totaling \$22,000 for a nine month appointment. The University of Alabama covers the cost of non-resident tuition and fee waivers, and health insurance. Funding is renewable for at least 4 years if expectations are met. Other fellowships are available from the Graduate School on a competitive basis. Further details on the DGS and the faculty members can be found at www.geo.ua.edu. Applicants should contact Dr. DeLores Robinson (dmr@ua.edu) to express interest. Review of applications for Fall 2014 admission will begin Jan. 15 2014.

Graduate Research Assistantship in Geoscience Education, North Carolina State University. A 12-month research assistantship (RA) is available for Ph.D. candidates in the Dept. of Marine, Earth and Atmospheric Sciences (MEAS) at North Carolina State University (NCSU). The successful applicant will work on a funded-research project in geoscience education with a focus on the use of video to support learning in "flipped" classroom environments. The position includes a monthly stipend, tuition, fees and health insurance. NCSU has a successful geoscience education program that includes two full-time faculty and approximately a dozen student researchers and postdocs. Students have access to departmental and on-campus research laboratories dedicated to the collection of qualitative and quantitative data for discipline-based STEM education research. Additional support is available for potential graduate students interested in other aspects of geoscience education. Please contact Dr. David McConnell (david_mcconnell@ncsu.edu) for more information. Further details on MEAS can be found at www.meas.ncsu.edu/. Review of applications for Fall 2014 admission will begin 1 Jan. 2014.

Jonathan O Davis Scholarship, University of Nevada, Reno. The Jonathan O. Davis Scholarship supports graduate students working on the Quaternary geology of the Great Basin. The national scholarship is \$5,000 and the University of Nevada, Reno stipend is \$1,500. The national scholarship is open to graduate students enrolled in an M.S. or Ph.D. program at any university in the United States. The Nevada stipend is open to graduate students enrolled in an M.S. or Ph.D. program at the University of Nevada, Reno. Details on application requirements can be found at: www.dri.edu/graduate-scholarships/189-jod-scholarship.

Applications must be post-marked by Feb. 2 2014. Proposal reviews will not be returned. Applications should be addressed to: Executive Director Division of Earth and Ecosystem Sciences Desert Research Institute 2215 Raggio Parkway Reno NV 89512.

Presidential Doctoral Research Fellowship, Dept. of Geology, Utah State University. The Dept. of Geology at Utah State University invites applications for a Presidential Doctoral Research Fellowship starting during the 2014–2105 academic year. This 4-year Ph.D. fellowship will pay all tuition and a stipend of ~\$20,000/year. Collaborative research will integrate fieldwork and a variety of geochemical and

geo- and thermochronologic techniques to understand processes in brittle fault zones and continental tectonics. Advisors and committee will consist of some combination of Drs. Alexis Ault, James Evans, Susanne Janecke, and Dennis Newell. Potential projects include use of new and existing labs both at USU and other universities to date paleoearthquakes in iron-bearing fault zones. We seek a motivated student with an MS, but will consider outstanding candidates with BS or BA degrees. The Dept. of Geology at USU is field oriented with a dynamic and growing faculty and graduate program. We are located in Logan, Utah, with close proximity to a wide variety of recreational and cultural opportunities. Interested candidates should contact the aforementioned faculty at james.evans@usu.edu; aault@email.arizona.edu; susanne.janecke@usu.edu; and dennis.newell@usu.edu. Please visit <http://geology.usu.edu> for more information about our program, and www.usu.edu/graduateschool/apply/ to apply before Jan. 15 2014.

Graduate Fellowships at the University of Kentucky. Pioneer Natural Resources Fellowships are available at the University of Kentucky. Pioneer Fellowships are open to M.S. and Ph.D. candidates with research interests in stratigraphy, sedimentology, and petroleum geology. These positions include salary, tuition, research support and health insurance. Field sites for research include the western United States and the East African Rift Valley. Students with interdisciplinary geoscience backgrounds (including coursework/research in sedimentary geology, exploration seismology, petroleum geochemistry, and micropaleontology) are particularly encouraged to apply. Experience in conducting remote fieldwork is a plus. Please contact Prof. Michael McGlue (michael.mcglue@uky.edu) for more information. Further details on the Dept. of Earth and Environmental Sciences at the University of Kentucky can be found at <http://ees.as.uky.edu/>. The department maintains world-class facilities and an active, student-centered research program. Review of applications for Fall 2014 admission will begin Feb. 1 2014.

Graduate Assistantship Opportunities at Indiana University–Purdue University Indianapolis (IUPUI). With broad expertise in applied geosciences and particular strengths in Geochemistry, IUPUI's Earth Sciences department provides opportunities for graduate training and research in the heart of downtown Indianapolis. Our new Ph.D. in Applied Earth Sciences, which provides opportunities for advanced interdisciplinary research at the interface of earth sciences, public health, and geospatial analysis, will prepare graduates for tackling real interdisciplinary problems and designing solutions for the 21st century. We invite applications for our Mirsky Fellowship, along with other teaching and research assistantships available in the department for Fall 2014. The department has 12 full time faculty with active research programs in topics including aqueous and microbial geochemistry, stable isotopes, paleoclimatology and global change, medical geology, surface and hard rock geology, planetary geology, remote sensing, biogeosciences, geomorphology, hydrology, and trace element geochemistry. Several new state-of-the-art geochemistry labs have been

built and equipped with stable isotope ratio mass spectrometers, cavity ring down spectrometers, GC-MS, ICP-MS, ICP-OES, electrochemical equipment, chromatographs (IC, HPLC, GC), spectroscopes, XRD, multisensor core scanner, and a full suite of wet chemical, solid state, and biological lab and field equipment. Assistantships include salary, tuition remission, and health insurance. Indianapolis is a very affordable, livable, and vibrant city with a wealth of outdoor, cultural, and sporting activities. Visit <http://earthsciences.iupui.edu/> for additional information.

GSA Today is Open Access Online

Go to www.geosociety.org/pubs/ and click on the *GSA Today* cover.

Geology—Past & Future REVISITED



Editor's note: This year, in celebration of GSA's 125th Anniversary, *GSA Today* included four installments of an encore presentation of articles highlighting the 10th anniversary of the first issue of *Geology* [first issue: 1973; article series published Dec. 1983, v. 11, no. 12, p. 679–691, doi: 10.1130/0091-7613(1983)11<679:GAF>2.CO;2]. See the Aug. 2013 *GSA Today* (v. 23, no. 8, p. 18–19, www.geosociety.org/gsatoday/archive/23/8/) for the first installment and table of contents. At two articles apiece, seven more installments will be required to reprint the series in its entirety. In future issues, this will be done on a space-available basis, rather than monthly. To read the original *Geology* article, go to <http://geology.gsapubs.org/content/11/12/679.full.pdf+html> and log in with your subscription information.

GSA Mentor Programs at the 2014 Section Meetings

Plan now to attend a **Roy J. Shlemon Mentor Program in Applied Geoscience** and/or a **John Mann Mentor Program in Applied Hydrogeology** luncheon at your 2014 Section Meeting to receive career advice chat one-on-one with practicing geoscientists. **FREE lunches** will be served! Check the Section Meetings website, www.geosociety.org/Sections/meetings.htm, for dates, times, and locations. A reminder will be included on all student badges provided at the onsite registration desk. Space is limited, so plan to arrive early: first come, first served. If you have questions or want to serve as a mentor, please contact Jennifer Nocerino at jnocerino@geosociety.org.



www.geosociety.org/Sections/meetings.htm

The Need for Geologists in Sustainable Development

Germán Mora, Director, Environmental Studies Program, Goucher College, Baltimore, Maryland 21204, USA, german.mora@goucher.edu

The challenges facing our society to become more sustainable are large and require inter- and trans-disciplinary approaches. Although geologists possess specialized problem-solving skills that make us well-suited to help society move toward more sustainable practices, we tend to be underrepresented in relation to other disciplines in national and global debates on sustainable development. This underrepresentation calls for broad-scale educational and professional training opportunities to increase our engagement with these issues, and sustainability science, in particular, provide a means to advance the involvement of geologists in these discussions.

Societal problems related to the preservation of the environment in particular and to sustainable development in general are inherently complex. This complexity is partly due to the nonlinear response of environmental and societal systems to actions rooted in historical contexts that were precipitated by multiple groups of people who can be autonomous and adaptive (Levin, 1999). Further complexity results from lag times between the initiation of an action by these autonomous individuals and the occurrence of measurable responses by environmental and societal systems, as well as feedback mechanisms that could either amplify or dampen these responses. This complexity requires innovative approaches and solutions involving multiple disciplines in the technological, natural, and social sciences. Although some important steps have recently been taken, geologists tend not to be engaged in these discussions, despite skills and proficiencies that permit us to tackle these complex issues. One mechanism that could address this gap is the inclusion of sustainability science in geology curricula and in professional development opportunities to facilitate the emergence of a new generation of professionals well-versed in understanding and addressing sustainability issues.

Sustainability science is a fairly new field of study that started in the mid-1980s and reached consensus in terms of its goals and approaches by the early 2000s (Bettencourt and Kaurc, 2011). Some researchers initially defined it as the study of the interactions between human and environmental (earth) systems, but more recently scholars have defined it as a type of applied science, in the vein of agricultural and health sciences, that seeks societal action to preserve environmental integrity through the use and application of scientific knowledge (e.g., Kates, 2011). Rather than being characterized by distinct methodologies, approaches, or questions, what differentiates sustainability science from other academic fields is its search for solutions to sustainability issues. Consequently, sustainability

science requires the use of context-specific methodologies from multiple disciplines to perform a careful examination of phenomena linked to societal and natural dimensions. It also involves the postulation of working hypotheses that explain the observed phenomena and, equally important, the development of workable solutions that could address these phenomena within human timescales.

Despite its recent emergence, sustainability science has gained considerable momentum among academic and professional institutions. For example, the U.S. National Academy, through its Board on Sustainable Development, produced an influential report on the subject (NRC, 1999), and the journal *PNAS* established a dedicated section for it in 2005. The U.S. National Science Foundation (NSF) now has a program to fund research and education on sustainability science, and a growing number of graduate programs on this subject are now in place at universities around the world, including some that have integrated geosciences and sustainability programs. Additional momentum in the international arena has resulted from the launch of the journal *Sustainability Science* in 2006 and the creation of the International Society for Sustainability Sciences in 2012. Furthermore, the number of peer-reviewed articles focusing on this new field of inquiry has been growing consistently (Bettencourt and Kaurc, 2011), thus testifying to the rapid expansion of this academic field.

A look at the different sustainability science publications, as well as the membership of the International Society for Sustainability Science, reveals a worrisome underrepresentation of geologists. However, our profession is well-suited for sustainability science, and climate change provides an example that illustrates the role that geology in particular and earth sciences in general could play in sustainable science. Geologists have provided a historical context for the climate state that has prevailed since the advent of our civilization, and we have shown the potentially catastrophic effects that rapid climate change can have on the earth system. We have also helped rule out the role of non-anthropogenic drivers on the changes in global temperature, sea level, and rainfall patterns that have been observed during the last century.

As a historical and interpretative science, geology can inform society about interactions in coupled human-environmental systems because our skills and proficiencies allow us to recognize the varying manifestations of phenomena at different spatial and temporal scales. We are also comfortable with the integration of concepts from different disciplines, albeit at present being mostly from those of other sciences. Similarly, coupled human-environmental systems render replication and the use of controlled experiments largely impractical, thus making interpretations based

on the convergence of multiple lines of evidence the best option for understanding these systems. This approach is part of our discipline, involving the simultaneous use of multiple hypotheses, thus making us well-suited to contribute to sustainability science. Because of our approach to solving problems, we are also tolerant of complexity, knowing that simple governing equations are impractical when explaining natural systems, yet also knowing that meaningful patterns can be extracted and explained, even in complex systems, by carefully observing, comparing, and contrasting phenomena (e.g., mineral and rock types, volcano shapes, tectonic settings, depositional environments, etc.). Our skills also allow us to examine the role of non-renewable and renewable resources, thus affording us the opportunity to help society move from depending on the former and toward relying on the latter.

Our role in sustainability science can also be meaningful by virtue of our acceptance of occasional unquantifiable scientific uncertainty. Although this issue has largely been unexplored by philosophers examining the nature of geology, the extreme difficulty of conducting controlled geologic experiments, the paucity of the geologic record, the impracticality of expressing a number of geological principles numerically, and the intrinsic complexity of earth systems have made geologists more agile in interpreting phenomena, even in the face of high scientific uncertainty. In this sense, geologic reasoning complements that of other scientific fields in that it largely has abandoned classical (frequentist) statistics in favor of Bayesian reasoning. For example, geologic interpretations do not require statistical proof as determined by a less than 5% chance that the occurrence of an event is due to randomness. Instead, geologic interpretations favor statistical approximation, in which the confidence in an interpretation is constantly being updated as new evidence becomes available (Horwich, 1982). Plate tectonics illustrates this point. It was accepted not because its odds for being a random occurrence were measured and determined to be exceedingly small. Rather, it was due to the growing confidence that geologists had in this interpretation as more and more evidence supported it. The focus of inquiry in sustainability science is on informing society about actions that could improve sustainability, thus making statistical approximation a more adequate tool, particularly when replication and controlled experimentation are impossible to perform. For that reason, the ability of geologists to infer underlying processes through Bayesian reasoning is a valuable skill needed to understand coupled human-environmental interactions.

Despite the built-in advantages of geologic reasoning for sustainability science, geologists are not active participants in discussions regarding sustainability, even though these discussions include issues of geological relevancy (water, soil, mineral resources, energy, natural hazards, etc.). Although some important steps have recently been taken—such as the inclusion of geologists in the NSF's Science, Engineering, and Education for Sustainability Program, the development of policy documents by our community (AGI, 2012), and the development of key professional development initiatives (e.g., Interdisciplinary Teaching of Geoscience for a Sustainable Future)—a more systematic approach must be developed to address our underrepresentation. In this sense, the inclusion of sustainability science modules or exercises in geology courses and professional development programs could address this gap by familiarizing geologists with sustainability issues and providing opportunities for us to apply our specialized

problem-solving skills to address them. The inclusion of these modules or exercises in introductory courses could also have the effect of making geology more relevant to students who are fascinated by the subject (Gilbert et al., 2010) but who do not pursue it, possibly because they see it as less salient, prestigious, or scientific than other disciplines (Hoisch and Bowie, 2010), particularly by minority students who may view geology simply as the study of rocks (e.g., Kurtis, 2009).

Although a larger involvement of geologists in sustainability issues is critical to address complex human-environmental systems, our representation is slim in relation to other scientific fields. For that reason, our professional and academic organizations should work toward the more intentional inclusion of these issues in curricula and agendas with the hope of having a new generation of geoscientists more prone to use their knowledge and skills for the development of a sustainable society.

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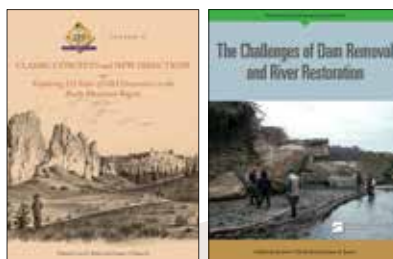
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