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Featured Article

SCIENCE:

- 4 **New insights into debris-flow hazards from an extraordinary event in the Colorado Front Range**
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Cover: House damaged by a September 2013 debris flow in Big Thompson Canyon in the Colorado Front Range; deposit (foreground) covers U.S. Highway 34. Photo by Jonathan Godt, 20 Sept. 2013. See related article, p. 4–10.

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Erratum

In the August 2014 issue of *GSA Today*, science article co-author Mark R. Besonen was incorrectly listed with a middle initial of "T." The correct middle initial is "R." Please make a note of this for future citation; *GSA Today* regrets this error.

New insights into debris-flow hazards from an extraordinary event in the Colorado Front Range

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and creek channels. The Office of Emergency Management, and local law enforcement and fire districts are worried, and are anxious for any data that can help them to prepare for future landslide incidents.

—Dan Barber, Boulder County Office of Emergency Management, 10 Jan. 2014 (pers. commun.)

ABSTRACT

Rainfall on 9–13 September 2013 triggered at least 1,138 debris flows in a 3430 km² area of the Colorado Front Range. The historical record reveals that the occurrence of these flows over such a large area in the interior of North America is highly unusual. Rainfall that triggered the debris flows began after ~75 mm of antecedent rain had fallen, a relatively low amount compared to other parts of the United States. Most flows were triggered in response to two intense rainfall periods, one 12.5-hour-long period on 11–12 September, and one 8-hour-long period on 12 September. The maximum 10 min. intensities during these periods were 67 and 39 mm/hr. Ninety-five percent of flows initiated in canyons and on hogbacks at elevations lower than a widespread erosion surface of low slope and relief (<2600 m). These flows were on steep (>25°), predominantly south- and east-facing slopes with upslope contributing areas <3300 m². Flows with the largest scars and longest travel distances occurred at elevations above 2600 m on steep slopes with contributing areas >3300 m². Areal concentrations of debris flows revealed that colluvial soils formed on sedimentary rocks were more susceptible to flows than soils on crystalline rocks. This event should serve as an alert to government authorities, emergency responders, and residents in the Front Range and other interior continental areas with steep slopes. Widespread debris flows in these areas occur infrequently but may pose a greater risk than in areas with shorter return periods, because the public is typically unprepared for them.

The dichotomy of these statements illustrates the issue of debris-flow hazards in the Colorado Front Range. On one hand, geologists recognize where hazardous debris flows are most likely to occur. On the other hand, the localized nature of debris flows and their infrequent occurrence compared to other natural hazards create a situation in which residents and government officials are generally unaware of the threats they pose. During the week of 9–13 September 2013, the Front Range received a harsh reminder of the dangers posed by debris flows. During that five-day period, nearly continuous rainfall caused widespread debris flows and flooding in a 3430 km² area of the northern Front Range (Fig. 1). The combination of debris flows and flooding was responsible for eight fatalities and caused extensive damage to buildings, highways, railroads, and infrastructure. In Larimer, Boulder, and Jefferson Counties, the three mountainous counties affected by flooding and debris flows, 125 houses were destroyed and another 3,773 were damaged (Federal Emergency Management Agency [FEMA], written comm., 24 Feb. 2014). Three fatalities were attributed to debris flows (Godt et al., 2014). Most major canyon roads were closed from 12 September until the end of November 2013, causing major disruptions to the transport of people and goods and an adverse impact on tourism. Roads were rebuilt using US\$450 million from the Federal Highway Administration Emergency Assistance Fund (Bennet, 2013a). Other recovery efforts in the three counties were funded by US\$62.8 million from the Department of Housing and Urban Development (Bennet, 2013b), US\$102.1 million from FEMA, and US\$57.4 million from the National Flood Insurance Program.

INTRODUCTION

Most of the hazardous mass wasting along the Front Range is restricted to clearly defined geomorphic settings where problems have a rather high element of predictability. —Wallace R. Hansen, U.S. Geological Survey, 1976, p. 106

We knew from our hydrology, meteorologists, and computer modeling how much rain in a given time period would result in specific cubic feet per second stream flow, and the flooding that would result from this stream flow. What took me by surprise were all of the side-hill landslides and debris flows that came into the main canyons

Widespread, rainfall-triggered debris-flow events such as the one in the Front Range are expected in active orogenic mountain belts (e.g., Sidle and Ouchai, 2006), as well as in tectonically inactive mountain belts along coastlines (e.g., Wicczorek and Morgan, 2008). Hillslopes in active orogenic belts are presumed to be preferentially susceptible because they are uplifted, steepened, and loosened from ground shaking by earthquakes (e.g., Petley, 2012), whereas coastal areas are regularly impacted by large, intense storms fed by tropical moisture (e.g., Porter et al., 2011). The Colorado debris-flow event was extraordinary because (1) the Front Range is not an active orogenic mountain belt, and (2) a very large area well within the continental interior

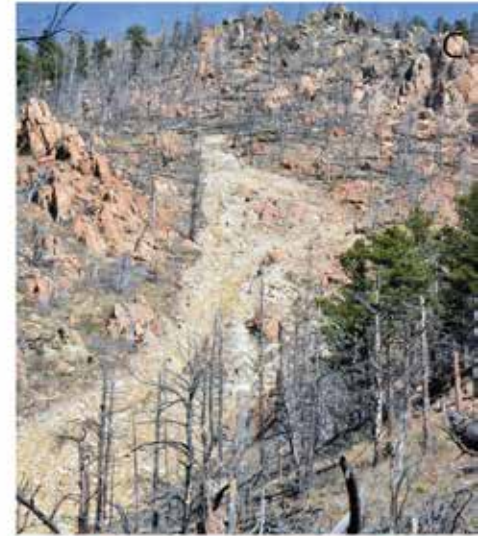
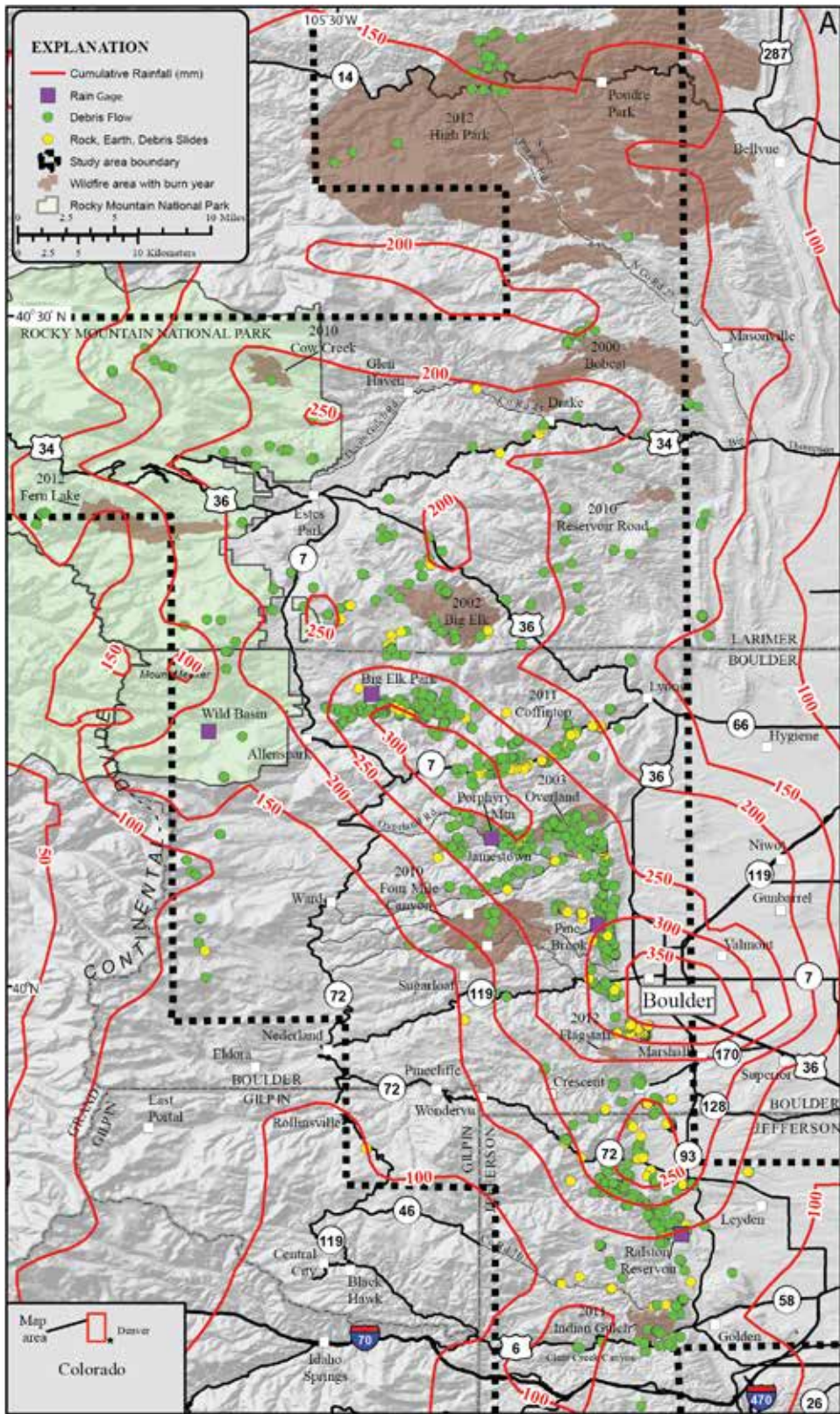


Figure 1. Diagram showing debris flows triggered by September 2013 rainfall. (A) Map of debris-flow locations (as well as rock, earth, and debris slides) overlain by contours of cumulative rainfall from 10 September at 6 p.m. to 13 September at 6 p.m. Number of mapped debris flows was 1138. Number of mapped rock, earth, and debris slides was 212. (B) Debris flows at the contact between the Morrison Formation and Dakota Group on the southwest side of a hogback near Ralston Reservoir; visible relief is ~90 m. (C) Debris flow in the Overland wildfire burn area on Porphyry Mountain; visible relief is ~150 m. (D) Debris flow on the east side of Twin Sisters Peaks near Allenspark; visible relief is ~1000 m.

of North America was impacted by prolonged rainfall fed by tropical moisture. We know of only one other similar-sized debris-flow event within the continental interior of the United States: the 1983 snowmelt-induced event along the Wasatch Front in Utah (Brabb et al., 1989). Historical debris flows in the Colorado Front Range have been triggered by rapid snowmelt and localized rainstorms—often thunderstorms fed by moisture from the North American Monsoon, which caused debris flows over relatively small geographic areas (<250 km²; Shroba et al., 1979; Coe and Godt, 2003; Godt and Coe, 2007) compared to the area impacted in 2013.

The September 2013 event offers a historically unprecedented opportunity to examine and characterize debris flows that occurred over an extremely broad range in elevation, geology, and ecosystems. To begin this process, we examined debris flows in the field and mapped the flows using high-resolution (0.5 m pixel size), orthorectified satellite imagery available from Digital Globe Inc. For each debris flow, we mapped the initiation location and travel distance. For each initiation location, we recorded the topographic setting (i.e., open slope, swale, or channel) and whether the debris flow entered the channel network. Elevation, slope angle, and slope aspect for each initiation location were extracted from U.S. Geological Survey (USGS) 10-m digital elevation models (DEMs). Geologic units for ~95% of initiation locations were extracted from 1:100,000-scale geologic maps (Kellogg et al., 2008; Cole and Braddock, 2009). The remaining 5% were extracted from the 1:500,000-scale geologic map of Colorado (Tweto, 1979). We collected debris-flow timing information by interviewing residents and local authorities. We used cumulative rainfall estimates compiled and interpolated by the National Center for Atmospheric Research and storm rainfall from rain gages operated by the Urban Drainage and Flood Control District and the National Resources Conservation Service. The cumulative, spatially continuous rainfall was derived from the U.S. National Weather Service (NWS) Multi-Sensor Precipitation Estimate (MPE; Kitzmiller et al., 2013). Our analysis focused on identifying and characterizing the most important rainfall, topographic, and geologic variables that controlled debris-flow initiation locations, timing, and travel distances. We conclude with the implications of our work for future debris flows in the Front Range and similar steep settings.

THE COLORADO FRONT RANGE

The Colorado Front Range was formed by orogenic uplift related to regional compression during the Laramide orogeny in the Late Cretaceous to early Tertiary (e.g., Dickinson et al., 1988). Since the early Tertiary, the occurrence, timing, and mechanisms of uplift are uncertain and controversial (e.g., Karlstrom et al., 2012). If uplift is currently ongoing, it appears to be epeirogenic in origin (e.g., Eaton, 2008).

The topography of the northern Front Range east of the Continental Divide consists of four major elements progressing from high to low elevations (Anderson et al., 2006): (1) the divide itself, which ranges in elevation from 3350 to 4300 m and was shaped by Pleistocene glaciers (Madole et al., 1998); (2) a widespread erosion surface of low slope and relief (Epis and Chapin, 1975) at elevations between ~2200 and 2750 m (Kellogg et al., 2008); (3) steep-walled canyons that cut this surface and drain

eastward across the edge of the range front and onto the High Plains; and (4) hogbacks at the range front at elevations between 1550 and 1800 m. The core of the Front Range is composed of Proterozoic and Tertiary crystalline rocks, whereas the hogbacks are a sequence of upturned Pennsylvanian through Cretaceous sedimentary rocks.

The broad range in elevations spans five ecosystem zones: grassland (~<1830 m), lower montane (~1830–2440 m), upper montane (~2440–2835 m), subalpine (~2835–3475 m), and alpine (~>3475 m) (Marr, 1961). The dominant vegetation is coniferous forest between 1830 and 3475 m. Vegetation density, soil development, and regolith production are dependent on slope aspect, particularly on north- versus south-facing slopes in the montane zones. North-facing slopes have a higher density of trees (Marr, 1961) and more leached, colder soils (Birkeland et al., 2003) than south-facing slopes.

Previous research on debris flows in Colorado has indicated that slope aspect and elevation play a role in the frequency of debris-flow occurrence, but, because of a lack of widespread historical events, neither topic has been fully explored. Coe et al. (2003) analyzed debris-fan stratigraphy and historical records from 19 fans at elevations between 2200 and 3350 m along the east-west-trending Interstate-70 in the Front Range. They found that mean debris-flow recurrence intervals were consistently long (450–2640 yr) on north-facing slopes and wide ranging (7–2900 yr) on south-facing slopes. Costa and Jarrett (1981) separated Colorado into two debris-flow environments based on an elevation threshold of ~2300 m. They found that below 2300 m, frequent intense rainfall caused large water floods. Above 2300 m, they found that intense rainfall was less frequent and that both debris flows and water floods occurred in response to rainfall.

ANTECEDENT RAINFALL

Observations indicate that moderate-to-intense rainfall is required to induce debris flows. Rainfall prior to moderate-to-intense periods of rain often plays a critical role in determining whether debris flows occur (e.g., Wieczorek and Glade, 2005), particularly debris flows that are mobilized from shallow landslides, as was the case in September 2013. Antecedent rainfall controls the initial moisture content of slope materials, which in turn affects the rate and depth of wetting during subsequent rainfall, as well as soil pore-water pressure. Minimum amounts of antecedent rainfall are a representation of the minimum field moisture capacity required of slope materials before moderate-to-intense storms can trigger debris flows (Wieczorek and Glade, 2005). Previous work has shown that minimum antecedent rainfall values are highly variable and depend on regional climate, soil properties, and vegetation. Because of the limited number of historical debris-flow events in the Colorado Front Range, the minimum amount of antecedent rainfall required for debris-flow initiation is undefined.

To evaluate the influence of antecedent rainfall in September 2013, we analyzed rainfall data from five rain gages at progressively increasing elevations (Fig. 2A). From lowest to highest elevations, the distribution of rain gages trended to the northwest, starting at Ralston Reservoir and ending at Wild Basin (Fig. 1A). The four lowest gages are event-recording gages, whereas the Wild Basin gage records data hourly. Cumulative summer rainfall prior

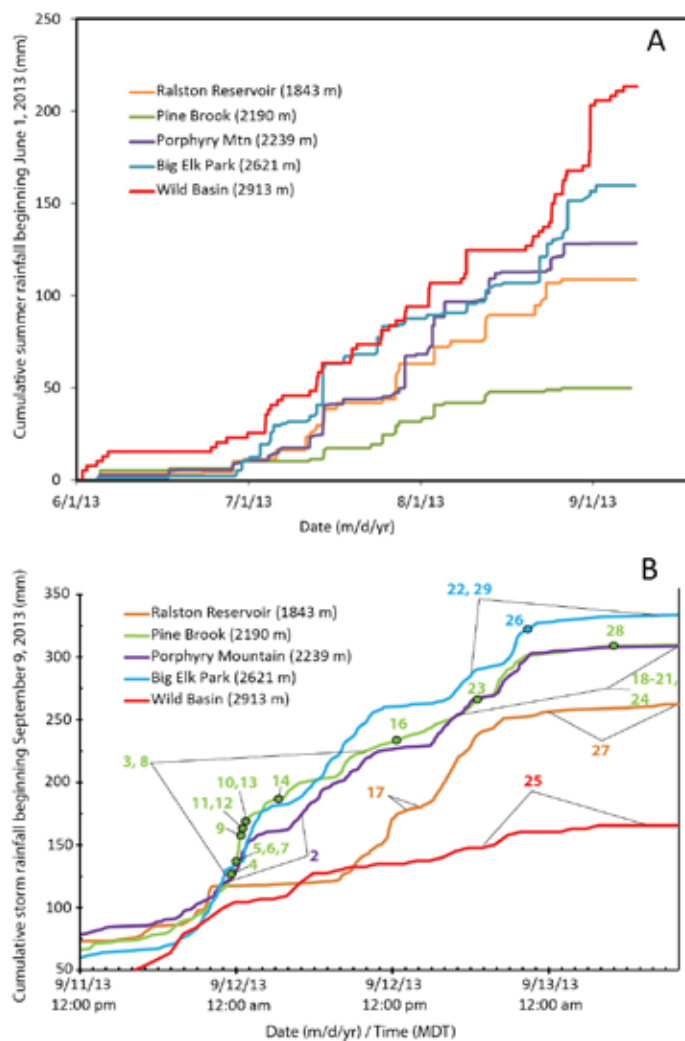


Figure 2. Rainfall measured at rain gages in the Front Range during the summer of 2013. (A) Cumulative antecedent rainfall prior to 9 September. (B) Rainfall and debris-flow occurrence from 11 to 13 September. Numbered circles are precise times of debris flows. Numbered zones are time ranges where debris flows were observed. Numbers correspond to descriptions of flows in Table DR1.

to 9 September ranged from 45 mm to 185 mm, with cumulative rainfall generally increasing with elevation (Fig. 2A). From 26 August to 8 September, elevations below ~2250 m were dry, but this period of dryness was progressively shorter at higher elevations (Fig 2A, ~1 week at 2621 m, ~2 days at 2913 m).

Based on the lack of rainfall in the two weeks prior to 9 September, we assume that the colluvial soil mantle at elevations below ~2250 m was “dry” prior to the start of rainfall at ~2:30 p.m. on 9 September. At these elevations, debris flows began at ~11:30 p.m. on 11 September (Table DR1 in the Data Repository¹). In the 50 h time period between the start of rainfall on 9 September and the beginning of the moderate-

to-intense triggering rainfall at ~4:30 p.m. on 11 September, from 75 to 85 mm of rain fell at elevations below 2250 m (Fig. 2B). We consider 75 mm a reasonable estimate of the minimum antecedent rainfall needed for subsequent debris flows. This amount of antecedent rainfall is relatively low compared to other regions of the United States where debris flows have been studied (e.g., western Oregon [>200 mm]; San Francisco [>250 mm]; Seattle [>180 mm] [Baum and Godt, 2010]).

RAINFALL THAT TRIGGERED DEBRIS FLOWS

Rainfall from 9 to 15 September was exceptional because of its duration (7 days), large spatial extent, and record-breaking cumulative amounts (e.g., 230.6 mm, 292.6 mm, and 429.3 mm for 1-, 2-, and 7- day periods within the City of Boulder) (Lukas et al., 2013). This prolonged rainfall was caused by a nearly stationary low-pressure system centered near the southwest corner of Utah. (See Gochis et al., 2014, for a detailed meteorological description of the event.) Counterclockwise circulation of this system pulled monsoonal moisture from both the Pacific Ocean and the Gulf of Mexico. In northern Colorado, circulation around the low caused the flow of moisture to impact the Front Range from the east and southeast. Most of the rain fell between the afternoon of 11 September and the morning of 13 September (Fig. 2B). Documented times of 27 debris flows (Table DR1) were all during this time period.

The first period of rainfall that triggered debris flows was in the 12.5 h between 4:30 p.m. on 11 September, and 5 a.m. on 12 September (Fig. 2B). Rainfall during this period reached maximum 10 min intensities of 51, 67, 38, and 63 mm/hour at the Ralston Reservoir, Pine Brook, Porphyry Mountain, and Big Elk Park gages, respectively (Fig. 2B). Maximum 1 hr intensities at the Wild Basin gage were 15 mm/hr. Nearly half of the debris flows (12 of 27) with known times were near the Pine Brook rain gage during this period. Another 11 debris flows occurred during and after a second period of heavy rainfall in the eight hours between 3 p.m. and 11 p.m. on 12 September. Maximum 10 min intensities during this period were 22, 35, 30, and 39 mm/hour at the Ralston Reservoir, Pine Brook, Porphyry Mountain, and Big Elk Park gages, respectively (Fig. 2B). Maximum 1 h intensities at the Wild Basin gage were 8 mm/hr. Documented debris flows associated with this period of rainfall were more dispersed in elevation and time compared to debris flows associated with the first period (Fig. 2B). These dispersed debris flows included some of the largest (deepest scars and longest travel distances) in the study area (e.g., Fig. 1D, and numbers 25, 26, and 27 in Table DR1).

DEBRIS-FLOW CHARACTERISTICS

All September 2013 debris flows began as discrete sliding masses of colluvial soil (slides) that liquefied and moved rapidly downslope. About 90% of slides had upslope contributing areas <3300 m² (Fig. DR1). Slopes measured at headscarps in the field ranged from 26 to 43°. Ninety-seven percent of slides initiated on

¹GSA supplemental data item 2014323, timing data for 27 debris flows and 2 rock slides, data from sediment collected at debris-flow headscarps and deposits, and Figures DR1–DR3, is online at www.geosociety.org/pubs/ft2014.htm. You can also request a copy from *GSA Today*, P.O. Box 9140, Boulder, CO 80301-9140, USA; gsatoday@geosociety.org.

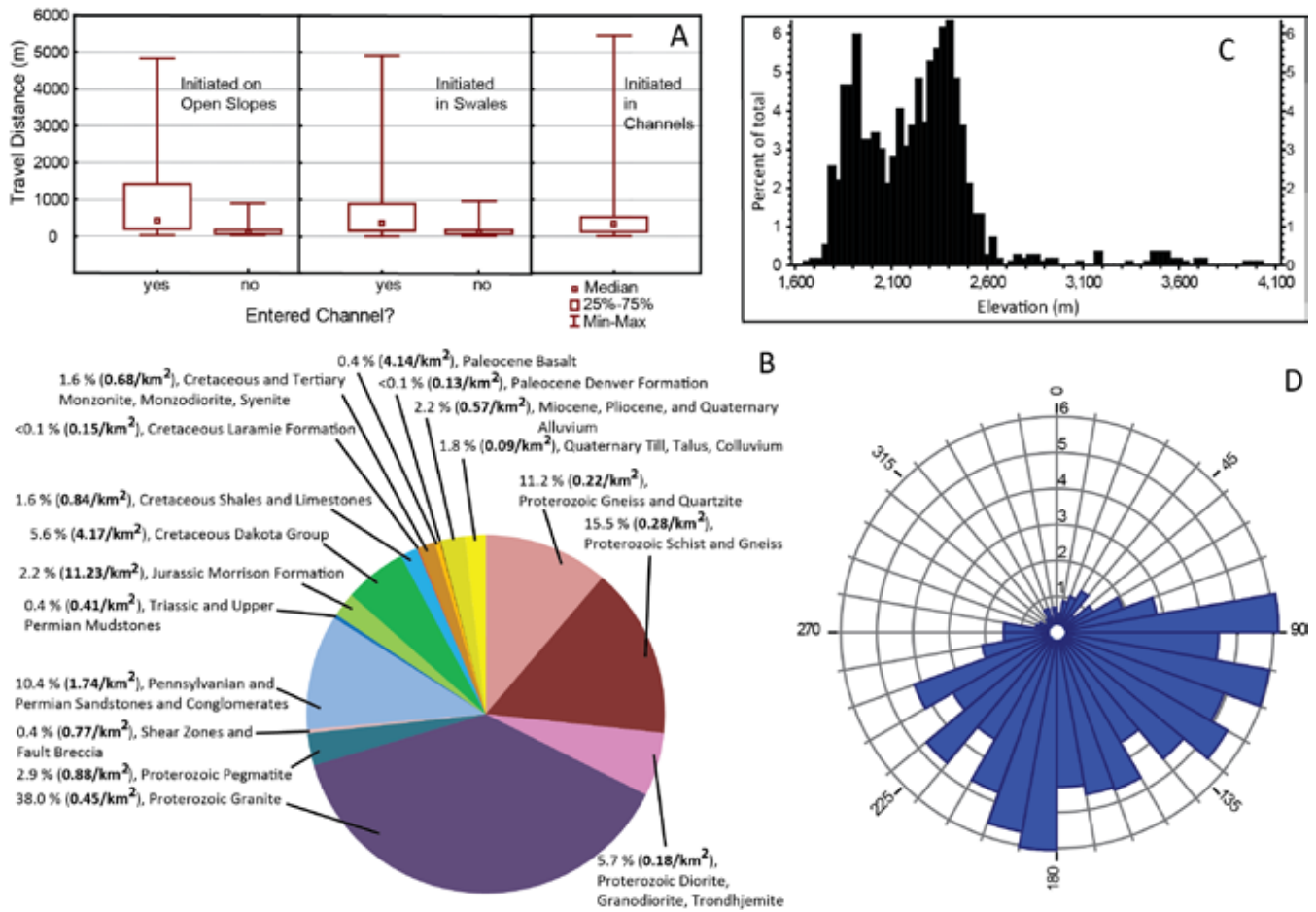


Figure 3. Characteristics of debris flows. (A) Box and whisker plots showing travel distance data, grouped by planform morphology at headscarps, and whether or not the flows entered channels. (B) Pie chart showing distribution of headscarps by geologic unit. Percentage of total number of flows and areal concentrations (bold) are shown. Flows in Paleocene Basalt were in quarry spoil. (C) Histogram of elevations of headscarps. (D) Rose diagram showing slope aspect at headscarps. Numbers on circles are percentages of total.

open slopes (48%) and swales (49%), with the remaining 3% initiating in channels (Fig. 3A). Debris-flow travel distances did not vary substantially between open slopes and swales, but were strongly influenced by the flows' interaction with channels. Flows that initiated in or entered channels traveled at least five times farther than flows that did not interact with channels (Fig. 3A). Field observations immediately after the event indicated that this effect was related to the availability of surface water and readily erodible sediment in channels as compared to hillslopes. Both of these factors enhanced sediment entrainment, debris-flow volume, and travel distance.

Debris flows initiated in colluvial soils formed on essentially every geologic unit in the Front Range (Fig. 3B). Seventy-three percent of debris flows initiated from soils on Proterozoic crystalline rock units. However, because these units encompassed a large percentage of the overall study area, the areal concentration of debris flows was low, ranging from 0.18 to 0.88 debris flows/km². Younger sedimentary units that form the hogbacks at the range front had a much lower total percentage of debris flows, but higher areal concentrations. For example, the Morrison Formation had the highest concentration of debris flows (11.23/km²) in the study area. Debris flows on the Morrison Formation initiated near the

contact with the younger Dakota Group (Fig. 1B), reflecting differences in soil properties that influenced rainfall infiltration and shallow groundwater flow. Results from 18 grain-size analyses of soil from debris-flow headscarps and deposits indicate that the Morrison Formation has distinctly finer-grained soils (loam and sandy loam, Fig. DR2 and Table DR2) compared to other geologic units (sand and loamy sand, Fig. DR2).

Debris flows occurred across a wide range of elevations from 1650 m to 4050 m (Fig. 3C), although most flows were located lower than the widespread erosion surface at elevations <2600 m in the grassland and montane ecological zones. Debris flows occurred in about equal amounts above and below 2300 m, indicating that this previously identified threshold (Costa and Jarrett, 1981) should not be used to differentiate varying levels of debris-flow hazard. Recent wildfire burn areas in the montane zone (burns from 2000 to 2012, Fig. 1) were only slightly more susceptible to debris flows (0.35 debris flows/km²) than non-burn areas (0.28 debris flows/km²). This similarity in susceptibility is in contrast to the dramatic increase in debris-flow susceptibility typically observed in the first 2–3 years after a fire (e.g., Cannon et al., 2011). The apparent discrepancy likely is because all of the burn areas had at least one growing season to establish grass and

other herbaceous vegetation before the storm; this partial recovery made the burn areas more similar in susceptibility to unburned, but sparsely vegetated slopes. The 10-year-old Overland burn area, which is now predominantly grass covered, accounted for 70% of all burn area debris flows (e.g., Fig. 1C), due in part to its close proximity to the area of highest cumulative rainfall (Fig. 1).

Slope aspect played a critical role in controlling debris-flow locations. Seventy-eight percent of debris flows initiated on south-facing slopes and another 6% initiated on east-facing slopes with azimuths from 80 to 90° (Fig. 3D). The strong south-facing control was not due to a bias in favor of south-facing slopes in the study area (Fig. DR3). Although the strong south-facing control is consistent with previous work on debris-flow frequency in the Front Range (Coe et al., 2003), the exact reasons for such control are unclear. Field observations indicate that south-facing slopes lack thick tree cover and have an abundance of rock outcrops compared to north-facing slopes. We expect that soils would also be thinner on south-facing slopes (e.g., Sidle and Ouchai, 2006), but this assumption has yet to be demonstrated in the Front Range. Another possibility is that the north- and westward-moving storm produced more intense rainfall on south- and east-facing slopes. Unfortunately, the positions of rain gages operating during the storm were inadequate to address this question.

IMPLICATIONS FOR DEBRIS-FLOW HAZARDS

Our results have important implications for debris-flow hazards in the Front Range and for general debris-flow forecasting. Assessments of debris-flow hazards typically analyze two key factors: frequency and magnitude (volume, velocity, and travel distance). Relative frequency is often expressed in the form of susceptibility maps. In the Front Range, the well-defined topographic and geologic characteristics of debris flows shown in Figures 3 and DR1 should be used to create debris-flow susceptibility maps. In the grassland and montane ecological zones, the preferentially susceptible zone consists of steep, south- and east-facing hillslopes with small upslope contributing areas. In the subalpine and alpine zones, steep slopes with a wider range of upslope contributing areas define the susceptible zone.

The strong influence of slope aspect on controlling debris-flow locations is one of the more intriguing results from our study. A key currently unanswered question concerns differences in expected debris-flow magnitudes from south- versus north-facing slopes. We did not find a significant difference in the size of flows from south- and north-facing slopes in this study, but our sample of flows from north-facing slopes was small. An equally important question concerns the amount of rainfall (or snowmelt) required to generate widespread debris flows from north-facing slopes. Clearly, the exceptional rainfall in September 2013 was inadequate. Wildfire may be the key ingredient required to increase the susceptibility of north-facing slopes to debris flows.

For general debris-flow forecasting, the Front Range event serves as an alert to government authorities, emergency responders, and residents in interior continental areas with steep (>25°) slopes. Debris flows in these areas (i.e., where they occur infrequently) may pose a greater risk than in areas with shorter return periods because the public is less aware of and unprepared for them. For example, debris flows along the west coast of

the United States (e.g., the Coast Range of Oregon) occur locally every year and are widespread about every 10 years. This frequency is short enough such that government agencies plan for the hazard and issue warnings in the most susceptible areas. This is not the case in the Front Range or elsewhere in the interior continental United States, where return periods for widespread debris-flow events are on the order of 50 years or more. A risk analogy can be drawn to the New Madrid seismic zone in the central United States, where earthquakes occur infrequently. There, recent research and educational campaigns have led to a greater understanding of the hazard and an increased level of public awareness. A similar effort is needed for debris flows in interior continental areas.

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Hotel Reservations/Changes/Cancellations

The deadline has passed to make, change, or cancel a reservation through the GSA Housing Block/MCI Group Canada, so please contact the hotel(s) directly for all changes, cancellations, or new reservations. A list of hotels that might have availability will be posted at community.geosociety.org/gsa2014/vancouver/lodging, but group rates are no longer guaranteed.

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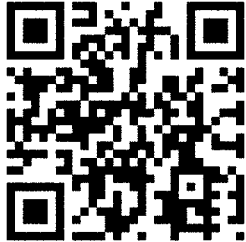
If you haven't registered yet, there's still time! You can register online throughout the meeting, or visit the onsite registration desk in the Vancouver Convention Centre. You can pick up your badge starting at 7 a.m. on Saturday, 18 October.

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David Gallo

2014 Subaru Outdoor Life Lecture

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Vancouver Convention Centre–West, Ballroom B

David Gallo is an American oceanographer and director of special projects at the Woods Hole Oceanographic Institution. For more than 25 years, David has been at the forefront of ocean exploration, participating in and being witness to the development of new technologies and scientific discoveries that shape our view of planet Earth. He has been described by TED Conferences as “an enthusiastic ambassador between the sea and those of us on dry land.” With more than eight million views, his TED presentation “Underwater Astonishments” is among the top three TED Talks viewed to date.

Gallo received B.S. and M.S. degrees in geology from the State University of New York at Albany and a Ph.D. in oceanography from the University of Rhode Island. In 1987, he joined Robert Ballard's team at Woods Hole Oceanographic Institution as assistant director of the Center for Marine Exploration.

Gallo has participated in expeditions to all of the world's oceans and was one of the first scientists to use a combination of robots and submarines to explore the deep seafloor.





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Field Trip Proposals

Deadline: 1 Dec. 2014

Know of a great geoscience excursion in the Baltimore (Maryland, USA) area? Submit your idea for a fun, interesting, and educational field trip, and show off the ground-breaking research in this region. Trips can be anywhere from a half day to five days long. Questions? Please contact Beth Engle, +1-303-357-1006, bengle@geosociety.org.

<https://gsa.confex.com/gsa/2015AM/fieldtrip.htm>

Technical Session Proposals

Deadline: 1 Feb. 2015

Ensure that your area of research and expertise is represented in next year's technical program. Any individual or geosciences organization is welcome to suggest topics and submit proposals for both Topical Sessions and Pardee Keynote Symposia. Pardee Symposia are high-profile sessions on significant scientific developments, with invited speakers only. Topical Sessions are a combination of invited and volunteered papers. Unique formats are allowed, but they must be outlined in the proposal, along with the technical support needs. Sessions that promote spirited discussion are encouraged.

<https://gsa.confex.com/gsa/2015AM/sessionproposals.epl>

Short Course Proposals

Deadline: 2 Feb. 2015

Share the wealth (of knowledge)—lead a Short Course. Courses can be run to develop professional, teaching, and research skills at all levels. Proposal guidelines are available online or by contacting Jennifer Nocerino at jnocerino@geosociety.org.

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Propose Technical Sessions, Plan a Field Trip, and/or Offer a Short Course



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CALL FOR NOMINATIONS

2015 GSA Medals & Awards



Penrose Medal

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

Day Medal

The Arthur L. Day Medal was established in 1948 through a donation by Arthur L. Day, founding director of the Geophysical Laboratory of the Carnegie Institution of Washington. It is awarded in recognition of outstanding distinction in the application of physics and chemistry to the solution of geologic problems, with no restriction to the particular field of geologic research. It was Dr. Day's wish to provide an award to recognize outstanding achievement in research and to inspire further effort, rather than to reward a distinguished career, and so it has been the longstanding practice of the Society to award this medal to geoscientists actively pursuing a research career.

Young Scientist Award (Donath Medal)

The Young Scientist Award was established in 1988 to be awarded to a young scientist (35 years or younger throughout the year in which the award is to be presented—for 2015, *only those candidates born on or after 1 Jan. 1980 are eligible*) for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences. The award consists of a gold medal (the Donath Medal) and an honorarium.

How to Nominate

To ensure thorough consideration by the respective committees, please follow these nomination instructions carefully; additional information supplied will not enhance the nomination. Paper submissions will still be accepted; however, electronic submission is encouraged. For each candidate please submit the following:

1. **Nomination form:** Please go to <https://rock.geosociety.org/forms/Awardform.asp> to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents,** to be submitted as e-mail attachments or via post; for Penrose, Day, and Donath, the following supporting documents are required:
 - Curriculum vitae;
 - Summary (300 words or less) of the scientific contributions to geology that qualify the candidate for the award;
 - Selected bibliography of no more than 20 titles (for the Donath medal, only 10 titles are required); and
 - Letters of support from each of five GSA Fellows or members *in addition* to the person making the nomination. **For the Day Medal only:** letters from five scientists with at least three of those being from GSA Fellows or members and up to two from fellows or members of the Mineralogical Society of America, the Geochemical Society, or the American Geophysical Union.



The deadline for receipt of all GSA medal, award, and recognition nominations is 1 Feb. 2015.



CALL FOR NOMINATIONS

2015 GSA Medals & Awards



GSA Public Service Award

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

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

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

How to Nominate

Paper submissions will still be accepted; however, electronic submission is encouraged.

1. **Nomination form:** Please go to <https://rock.geosociety.org/forms/Awardform.asp> to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents,** to be submitted as e-mail attachments or via post:
 - Curriculum vitae;
 - Letter of nomination (300 words or less);
 - Brief biographical sketch that clearly demonstrates the applicability of the selection criteria; and
 - Selected bibliography of no more than 10 titles.

Bromery Award for Minorities

The Bromery Award for Minorities should be given to any minority, preferably African Americans, who qualify under at least one of these two categories:

1. Nominee has made significant contributions to research in the geological sciences, as exemplified by one or more of the following:
 - Publications that have had a measurable impact on the geosciences;
 - Outstanding original contributions or achievements that mark a major advance in the geosciences; and/or
 - Outstanding lifetime career that demonstrates leadership in geoscience research;
2. Nominee has been instrumental in opening the geoscience field to other minorities, as exemplified by one or more of the following:
 - Demonstrable contributions in teaching or mentoring that have enhanced the professional growth of minority geoscientists;
 - Outstanding lifetime career service in a role that has highlighted the contributions of minorities in advancing the geosciences; and/or
 - Authorship of educational materials of high scientific quality that have enjoyed widespread use and acclaim among educators or the general public.

How to Nominate

Paper submissions will still be accepted; however, electronic submission is encouraged.

1. **Nomination form:** Please go to <https://rock.geosociety.org/forms/Awardform.asp> to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents,** to be submitted as e-mail attachments or via post:
 - Curriculum vitae;
 - Letter of nomination (300 words or less);
 - Letters of support from three scientists with at least two from GSA Fellows or members and one from a member of another professional geoscience organization; and
 - Optional selected bibliography of no more than 10 titles.

The deadline for receipt of all GSA medal, award, and recognition nominations is 1 Feb. 2015.



CALL FOR NOMINATIONS

2015 GSA Medals & Awards



GSA Distinguished Service Award

GSA Council established the GSA Distinguished Service Award in 1988 to recognize individuals for their exceptional service to the Society. GSA members, Fellows, associates, and employees may be nominated for consideration, and any GSA member or employee may submit a nomination for the award. GSA's Executive Committee will select awardees, and GSA Council must ratify all selections. Awards may be made annually, or less frequently, at the discretion of Council.

How to Nominate

Paper submissions will still be accepted; however, electronic submission is encouraged.

1. **Nomination form:** Please go to <https://rock.geosociety.org/forms/Awardform.asp> to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents**, to be submitted as e-mail attachments or via post:
 - Curriculum vitae;
 - Letter of nomination (300 words or less);
 - Brief biographical sketch that clearly demonstrates the applicability of the selection criteria; and
 - Optional selected bibliography of no more than 10 titles.

Doris M. Curtis Outstanding Woman in Science Award

The Doris M. Curtis Outstanding Woman in Science Award recognizes a woman who has had a major impact on the field of the geosciences based on her Ph.D. research. The generous support of the Doris M. Curtis Memorial Fund makes this award possible. GSA's 103rd president, Doris Curtis pioneered many new directions for geology, not the least of which was her tenure as GSA president after an unbroken chain of 102 men. Causes dear to her were women, public awareness, minorities, and education. Women are eligible for this award the first three years following their Ph.D. degree.

How to Nominate

Paper submissions will still be accepted; however, electronic submission is encouraged.

1. **Nomination form:** Please go to <https://rock.geosociety.org/forms/Awardform.asp> to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents**, to be submitted as e-mail attachments or via post:
 - Curriculum vitae, including dissertation title and abstract;
 - Letter of nomination that clearly states how the Ph.D. research has impacted the geosciences in a major way;
 - Letters of support from three scientists with at least two from GSA Fellows or members and one from a member of another professional geoscience organization; and
 - Selected bibliography of no more than 10 titles.

Award Notes

Candidates whose names are submitted by the respective award committees to GSA Council but who do not receive an award will remain under consideration by those committees for three years. For those still under consideration, it is recommended that an updated nomination letter be sent to GSA.

All nomination forms and submission instructions can be found online at www.geosociety.org/awards/. Nomination forms and instructions may also be obtained from: GSA Grants and Awards, P.O. Box 9140, 3300 Penrose Place, Boulder, CO 80301-9140, USA, +1-303-357-1028, awards@geosociety.org.

The deadline for receipt of all GSA medal, award, and recognition nominations is 1 Feb. 2015.



CALL FOR NOMINATIONS

2015 GSA Medals & Awards



Honorary Fellows

Established by the GSA Council in 1909, Honorary Fellowship may be bestowed on individuals who have made outstanding and internationally recognized contributions to geoscience, or in rare circumstances, provided notable service to the Society. In practice, nearly all candidates are non-North Americans who live and work outside of North America. The most noteworthy exceptions were astronauts. The awardee does not have to be a member of the Society to receive the award. No more than two Honorary Fellows will be awarded annually. Honorary Fellows will be recognized during the GSA Annual Meeting and will receive complimentary life-time membership to the Society.

How to Nominate

Paper submissions will still be accepted; however, electronic submission is encouraged.

1. **Nomination form:** Please go to <https://rock.geosociety.org/forms/Awardform.asp> to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents**, to be submitted as e-mail attachments or via post:
 - Curriculum vitae;
 - Letter of nomination (300 words or less);
 - Brief biographical sketch that clearly demonstrates the applicability of the selection criteria;
 - Selected bibliography of no more than 20 titles; and
 - Letters of support (optional).



Geologic Mapping Award

The Geologic Mapping Award's concept was approved by GSA Council in October 2013, and the first award will be presented in 2015. This award acknowledges contributions in published high-quality geologic mapping that led the recipient to publish significant new scientific or economic-resource discoveries, and to contribute greater understanding of fundamental geologic processes and concepts. The objective is to encourage training and support toward production of excellent, accurate, detailed, purposeful geologic maps and cross sections. With respect to size or scale, there are no restrictions on map products.

The recipient will have authored high-quality geologic maps, cross sections, and summary reports that have received scientific acclaim and are available to both peers and the public, through federal or state agencies or major scientific societies. In evaluating the merits of nominees for this award, scientific achievements should be considered rather than contributions in teaching, administration, or service. Nominees do not need to be members of the Society, and they may be from any nation.

How to Nominate

Paper submissions will still be accepted; however, electronic submission is encouraged.

1. **Nomination form:** Please go to <https://rock.geosociety.org/forms/Awardform.asp> to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents**, to be submitted as e-mail attachments or via post:
 - Curriculum vitae;
 - Letter of nomination (300 words or less);
 - Letters of support from three scientists with at least two from GSA Fellows or members and one from a member of another professional geoscience organization; and
 - Selected bibliography of no more than 20 titles.

The deadline for receipt of all GSA medal, award, and recognition nominations is 1 Feb. 2015.



CALL FOR NOMINATIONS

2015 GSA Medals & Awards



GSA Fellowship

Fellowship is an honor that is bestowed on the best of our profession once per year at the GSA Spring Council meeting and is recognized at our yearly Annual Meeting. GSA members are elected to Fellowship in recognition of distinguished contributions to the geosciences. A **GSA Fellow** may support *only two* nominees per election cycle and only **one** as a primary nominator. A **GSA member** who is not a Fellow may not be a *primary* nominator, but may be a secondary nominator for no more than **two** nominees per election cycle.

The primary nominator is responsible for collecting the entire nomination packet (including letters of support) and must submit the nomination as one e-mail (with supporting documents as attachments) or as one package via post. Letters of support sent separately will not be accepted.

How to Nominate

Paper submissions will still be accepted; however, electronic submission is encouraged.

1. **Nomination form:** Please go to www.geosociety.org/members/fellow.htm to submit the form online or to download a hardcopy to submit via post.
2. **Supporting documents**, to be collected by the primary nominator and submitted as one package as e-mail attachments or via post:
 - Curriculum vitae;
 - Letter of nomination, including a summary of the nominee's significant contributions supporting the selected criteria for election (up to two pages);
 - Supporting letter of nomination from each of the secondary nominators; and
 - Paragraph stating the nominee's total number of publications and a selected bibliography (up to four pages).

John C. Frye Environmental Geology Award

Deadline: 31 March 2015

In cooperation with the Association of American State Geologists (AASG), GSA makes an annual award for the best paper on environmental geology published either by GSA or by one of the state geological surveys.

Anyone can nominate a paper as long as it is selected from a GSA or state geological survey publication and published during the preceding three full calendar years. The nomination must include a paragraph stating the pertinence of the paper.

Each nominated paper will be judged on its uniqueness or significance as a model of its type of work and its overall worthiness for the award. The paper must (1) establish an environmental problem or need; (2) provide substantive information on the basic geology or geologic process pertinent to the problem; (3) relate the geology to the problem or need; (4) suggest solutions or provide appropriate land-use recommendations based on the geology; (5) present the information in a manner that is understandable and directly usable by geologists; and (6) address the environmental need or resolve the problem. It is preferred that the paper be directly applicable to informed laypersons (e.g., planners, engineers).

Please send your nominations to GSA Grants and Awards, P.O. Box 9140, Boulder, CO 80301-9140, USA. For more information, please visit www.stategeologists.org/awards_honors.php.

2014 Award Recipients Named

The 2014 Frye Award will be presented at the GSA Annual Meeting in Vancouver, British Columbia, Canada, to **Jesse T. Korus, Leslie M. Howard, Aaron R. Young, Dana P. Divine, Mark E. Burbach, J. Michael Jess, and Douglas R. Hallum** (with contributions from **R.F. Diffendal Jr.**) for *The Groundwater Atlas of Nebraska*; Resource Atlas no. 4b, 2013; third (revised) edition.

The deadline for receipt of all GSA medal, award, and recognition nominations is 1 Feb. 2015.



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CALL FOR NOMINATIONS

2015 Medals & Awards

2015 AGI Awards

AGI Medal in Memory of Ian Campbell

The AGI Medal in Memory of Ian Campbell recognizes singular performance in and contribution to the profession of geology. Candidates are measured against the distinguished career of Ian Campbell, whose service to the profession touched virtually every facet of the geosciences. Campbell was a most uncommon man of remarkable accomplishment and widespread influence, and in his career as a geologist, educator, administrator, and public servant, he was noted for his candor and integrity.

AGI Marcus Milling Legendary Geoscientist Medal

The Marcus Milling Legendary Geoscientist 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 is a senior scientist nearing completion or has completed full-time regular employment.

To submit nominations for these and other AGI awards, go to www.agiweb.org/direct/awards.html.

2015 National Awards

GSA members are encouraged to nominate colleagues for the following awards:

The **William T. Pecora Award**, sponsored jointly by NASA and the U.S. Dept. of the Interior, recognizes outstanding contributions by individuals or groups toward understanding Earth by means of remote sensing. The award recognizes the work of those in the scientific and technical community as well as those involved in the practical application of remote sensing. Consideration will be given to sustained or single contributions of major importance to the art and/or science of understanding Earth through observations from space. Learn more at <http://remotesensing.usgs.gov/pecora.php>.

The **National Medal of Science** is awarded by the President of the United States to individuals “deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, engineering, or social and behavioral sciences.” The award committee gives special attention to younger U.S. scientists and engineers, who may now be reaching a point at which their contributions merit recognition, as well as to outstanding women and minority scientists. Learn more at www.nsf.gov/od/nms/medal.jsp.

The **Vannevar Bush Award** is presented periodically to a senior statesperson of science and technology who, through public service in science and technology, has made an outstanding contribution toward the welfare of humankind and to the United States. Nominations should be accompanied by a complete biography and a brief citation summarizing the nominee’s scientific or technological contributions to our national welfare in promotion of the progress of science. Learn more at www.nsf.gov/nsb/awards/bush.jsp.

The **Alan T. Waterman Award** is presented annually by the National Science Foundation (NSF) and the National Science Board to an outstanding young researcher in any field of science or engineering supported by the NSF. Candidates must be U.S. citizens or permanent residents 35 years of age or younger OR not more than five years beyond receipt of a Ph.D. by 31 Dec. of the year in which they are nominated. Candidates should have completed sufficient scientific or engineering research to have demonstrated outstanding capability and exceptional promise for significant future achievement through personal accomplishments. The Waterman Award complements the Vannevar Bush Award; both are designed to encourage individuals to seek the highest levels of achievement in science, engineering, and service to humanity. Learn more at www.nsf.gov/od/waterman/waterman.jsp.

The **G.K. Warren Prize** is awarded by the National Academy of Sciences for noteworthy and distinguished accomplishment in fluvial geology and closely related aspects of the geological sciences. Learn more at www.nasonline.org/about-nas/awards/g-k-warren-prize.html.



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2015 Section Meetings



SOUTH-CENTRAL

19–20 March

Stillwater, Oklahoma, USA

Oklahoma State University

Local Committee Chair: Todd Halihan

Abstracts deadline: 16 Dec. 2014

Early registration deadline: 17 Feb. 2015

www.geosociety.org/Sections/sc/2015mtg/



SOUTHEASTERN

19–20 March

Chattanooga, Tennessee, USA

Chattanooga Hotel

Local Committee Chair: Jonathan Mies

Abstracts deadline: 9 Dec. 2014

Early registration deadline: 17 Feb. 2015

www.geosociety.org/Sections/se/2015mtg/



NORTHEASTERN

23–25 March

Bretton Woods, New Hampshire, USA

Omni Mount Washington Resort

Local Committee Chair: Brian Fowler

Abstracts deadline: 9 Dec. 2014

Early registration deadline: 17 Feb. 2015

www.geosociety.org/Sections/ne/2015mtg/



CORDILLERAN

11–13 May

Anchorage, Alaska, USA

Univ. of Alaska

Local Committee Chair: Chris Waythomas

Abstracts deadline: 10 Feb. 2015

Early registration deadline: 6 Apr. 2015

www.geosociety.org/Sections/cord/2015mtg/



NORTH-CENTRAL

19–20 May

Madison, Wisconsin, USA

Monona Terrace Community and Convention Center

Local Committee Chair: Jean Bahr

Abstracts deadline: 17 Feb. 2015

Early registration deadline: 13 Apr. 2015

www.geosociety.org/Sections/nc/2015mtg/



ROCKY MOUNTAIN

21–23 May

Casper, Wyoming, USA

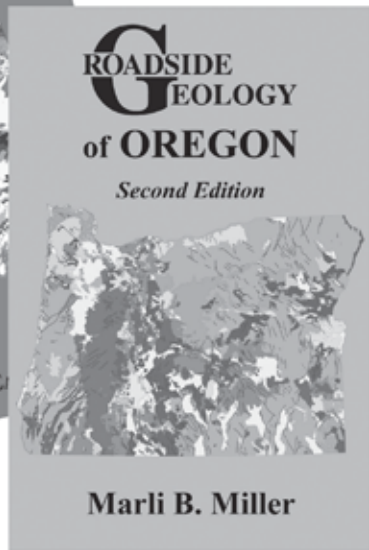
Ramkoda Inn

Local Committee Chair: Kent Sundell

Abstracts deadline: 17 Feb. 2015

Early registration deadline: 20 Apr. 2015

www.geosociety.org/Sections/rm/2015mtg/



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GSA FOUNDATION UPDATE

P. Geoffrey Feiss, GSA Foundation President

The GSA Foundation staff is busy preparing to serve members at the Annual Meeting. We invite you to take a break during the meeting to visit with Foundation staff and learn about GSA programs, priorities, and services for donors, and to peruse the Silent Auction. We will be easy to find—our booth adjoins the GSA Headquarters area. Please stop by to say “Hello” and get more information about the following:

GSA Programs

- Take the opportunity to speak with program managers and recent **GeoCorps™ America** volunteers about how to apply for one of more than 100 GeoCorps jobs.
- Many GSA members are aware of GSA’s remarkable **Research Grants Program**. Since 1933, the research grants program has distributed more than US\$10 million to fund student research projects. In 2014, the number of applications increased by 26%. This surge in interest represents an opportunity for GSA members who would like to support student research.
- The Foundation can direct student members to the popular **Mentor Luncheons** (now called “Career Pathways”) at the meeting.
- As in 2013, the Foundation will host the main information station for the **On To the Future** program. Members of the GSA Diversity Committee will be on hand to assist On To the Future participants and answer your questions about this exciting program.

Annual Meeting Services and Events

- The GSA Foundation has partnered with GSA to provide a new guest service experience with expanded offerings. Guests and members of the Penrose Circle (by invitation) will enjoy admittance to the **Penrose Guest Hospitality Suite**. This suite

will offer complimentary refreshments, entertaining and educational seminars, and local experts ready to answer your questions about Vancouver. Local tours and activities will also be offered for an additional fee. We hope that you take advantage of the tours to get out-of-doors and learn about the area.

- The ever-popular **GSA Silent Auction** will feature rock and mineral specimens, antique books and maps, field gear, wine, jewelry, and more. Proceeds from your purchases will support the On To the Future program. Please stop in to browse, bid, and buy!
- **Student donors** should stop by the Foundation booth to receive a special pin designating them as Foundation supporters.
- The **GSA Foundation Board of Trustees** will hold its semi-annual business meeting on Sat., 18 Oct. GSA members interested in participating in the Foundation and learning about the work of the Foundation on behalf of the Society are invited to attend.
- The **Pardee Coterie Breakfast** (by invitation) on Sun., 19 Oct., is for members who have included GSA in their estate plans.
- The **GSA Foundation Senior Fellows Reception** (by invitation) is on Mon., 20 Oct., and will feature a backdrop a spectacular view of Vancouver Harbour.

Of course, the GSA Foundation welcomes all inquiries regarding financial support of GSA programs and priorities through your philanthropy. We can assist you with gifts made by check or credit card, discuss your ideas on how to strengthen Society programs, and offer guidance on including GSA in your estate plans. GSA members are incredibly generous, and we are here to help shape your priorities into meaningful outcomes.

See you at the GSA Foundation Booth!

GIVING TO THE GSA FOUNDATION

- Give online at www.gsafweb.org/makeadonation.html;
- Transfer securities: Contact Ed Smith, Merrill Lynch Senior Financial Adviser, +1-866-834-0756;
- Give when renewing your membership;
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- Mail a donation to the GSA Foundation, P.O. Box 9140, Boulder, CO 80301-9140, USA.

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Connecting modern soil and paleosol communities: Improving climate proxies and our understanding of Earth's Critical Zone

Michael H. Young, Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas 78712, USA

Steven G. Driese, Dept. of Geology, Baylor University, Waco, Texas 76706, USA

Eric C. Brevik, Dept. of Natural Sciences, Dickinson State University, Dickinson, North Dakota 58601, USA

A scientific challenge shared between The Geological Society of America (GSA) and the Soil Science Society of America (SSSA) is connecting our understanding of Earth's modern soils and paleosols to changes in Earth's climate. These two scholarly organizations, leaders in their respective fields, overlap in this area of science, but the scientists themselves and their research interests are generally separated by time—"deep time" for paleosol scientists (pre-Quaternary) and "shallow time" for modern-day soil scientists. Both groups tackle these noble questions largely in isolation of each other. At the same time, increases in human population, need for food, energy, and water security, and risks associated with climate extremes (e.g., droughts and floods) call out for a better understanding of the soils' role in providing sufficient food and energy stocks and moderating (or controlling) regional and global weather and climate patterns. All these processes—and risks—exist in the Critical Zone, which has recently received substantial attention and research funding from the U.S. National Science Foundation (NSF). Much has been written about the Critical Zone (also known as the regolith) over the past 10 to 15 years, where geoscientists and soil scientists are key players in these efforts. Apart from members of GSA and SSSA, climate modelers seek to address issues of climate change/extremes using tools that rely heavily on the calibrated instrumented record that dates back only 100–200 years. Climate predictions would benefit from a longer calibration record and a deeper appreciation of the processes in the Critical Zone, like soil water dynamics, carbon exchange, energy balance, vegetation

structure, etc. We suggest that the scientific communities represented by GSA and SSSA work more closely **together** to substantially improve how modern soil processes inform paleosol interpretations and vice versa, so that paleoclimate proxies used in climate models incorporate geological frameworks and modern soil processes.

We see recent developments within GSA and SSSA as harbingers of improved collaboration. In the last year, GSA has approved the formation of a Soils and Soil Processes Interdisciplinary Interest Group (IIG) that crosses multiple Divisions and Themes. This group is sponsoring several technical sessions at the 2014 GSA Annual Meeting in Vancouver, British Columbia, Canada. SSSA has recently reorganized around scientific themes and has made great strides in establishing connections to other scholarly groups (including GSA, AGU, EGU, etc.) and promoting SSSA as a scientific clearinghouse of soil-related expertise. We suggest closer communication in the form of cross-pollinating special sessions at respective annual meetings, a targeted meeting cohosted by each group, and a general increase in the engagement between these scientific communities.

In particular, we suggest a follow-up to a successful meeting sponsored by SEPM (The Society for Sedimentary Geology; organized by co-author Driese) titled "Paleosols and Soil Surface Analog Systems," which was held in Arizona in September 2010. The outcome of the meeting identified the "refinement and calibration of existing paleoclimate proxies, as well as development of new proxies from surface (modern) soil systems useful for interpreting changes in environmental conditions recorded in paleosols..." as an area of needed productive scientific growth (Nordt and Driese, 2013). This call for appreciation of modern soil systems as a means to refine the calibration of paleoclimate proxies, and hence the predictability of climate models themselves, speaks to the need for collaborating with present-day soil scientists. This follow-up meeting could emphasize the value of a deep-time critical zone observatory and how the geological context of paleosols can inform modern-day soil scientists who focus on carbon, energy, and water exchange, often (but not always) in agricultural systems. We hope to provoke the scientific communities dealing with near-surface processes, both modern and paleo, to combine efforts and intellectual energies, and to cross the great divide between geosciences and soil sciences. Substantial activities are being undertaken by these two scholarly groups, and they can be more successful with collaborative interest and ideas from the communities that drive answers to scientific questions.

REFERENCE CITED

Nordt, L.C., and Driese, S.G., 2013, Application of the Critical Zone concept to the deep-time sedimentary record: *Sedimentary Record*, v. 11, no. 3, p. 4–9, doi: 10.2110/sedred.2013.3.

In Memoriam



The Society notes with regret the deaths of the following members (notifications received between 25 April and 30 July 2014).

Richard W. Berry

Avon, Connecticut, USA
Date of death: 1 Mar. 2014
GSA notified: 23 June 2014

Charles W. Betton

Grand Junction, Colorado, USA
Date of death: 25 Sept. 2013
GSA notified: 20 May 2014

Roger B. Colton

Golden, Colorado, USA
Date of death: 14 Dec. 2013
GSA notified: 3 July 2014

John M. Dennison

Chapel Hill, North Carolina, USA
Date of death: 9 June 2014

Brad E. Dingee

Prescott Valley, Arizona, USA
Date of death: 20 Apr. 2013
GSA notified: 3 June 2014

Douglas B. Howard

Shoreline, Washington, USA
Date of death: 15 Dec. 2013
GSA notified: 10 June 2014

William H. Kanes

Columbia, South Carolina, USA
Date of death: 4 Mar. 2014

Walter P. Kessinger Jr.

Lafayette, Louisiana, USA
Date of death: 14 Apr. 2014

Wann Langston Jr.

Austin, Texas, USA
Date of death: 7 Apr. 2013
GSA notified: 25 July 2014

Charles L. Matsch

Duluth, Minnesota, USA
Date of death: 18 Apr. 2014

Frederick N. Murray

Tulsa, Oklahoma, USA
Date of death: 20 July 2014

Lois K. Ongley

Unity, Maine, USA
Date of death: 16 Nov. 2013
GSA notified: 4 June 2014

Robert Ramsdell

Morrisville, Pennsylvania, USA
Date of death: 3 Mar. 2014

Ernest E. Russell

Starkville, Mississippi, USA
Date of death: 6 Oct. 2013
GSA notified: 25 Apr. 2014

Julius Schlocker

San Carlos, California, USA
Date of death: 1 May 2010
GSA notified: 25 Apr. 2014

Willard L. Sitz

Montgomery, Alabama, USA
Date of death: 26 June 2013
GSA notified: 13 May 2014

William A. Smith Jr.

Athens, Georgia, USA
Date of death: 12 Feb. 2014

David P. Stewart

Urbana, Ohio, USA
Date of death: 1 Jan. 2010
GSA notified: 27 June 2014

James B. Thompson Jr.

Cambridge, Massachusetts, USA
Date of death: 1 June 2014

William H. Tonking

Houston, Texas, USA
Date of death: 3 Mar. 2014

William W. Webber

Dallas, Texas, USA
Date of death: 19 Apr. 2014

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Positions Open

ASSISTANT PROFESSOR OF EARTH AND ATMOSPHERIC SCIENCES (EXPLORATION GEOPHYSICS) UNIVERSITY OF NEBRASKA-LINCOLN

Applications are invited for a tenure track position as Assistant Professor in the Department of Earth and Atmospheric Sciences at the University of Nebraska-Lincoln. The successful candidate will be expected to participate in teaching and curricular development of undergraduate and graduate courses, to advise and direct graduate students, and to develop a rigorous research program that is supported by external funding. It is expected that the research program will include field and subsurface-based studies of exploration geophysics. Ability to contribute to growing petroleum geoscience-related teaching and research activities within the Department of Earth & Atmospheric Sciences will be considered as an advantage. The candidate should demonstrate strong potential for research and teaching and must hold a Ph.D. in Geology or a related field at the time of appointment. Female and ethnic minority candidates are strongly encouraged to apply.

The Sedimentary Geology and Paleontology, Meteorology/Climatology, and Hydrosphere Geosciences programs serve as the three primary units within the Department of Earth & Atmospheric Sciences. The department offers B.S. degrees in Geology and Meteorology/Climatology, as well as M.S. and Ph.D. degrees in Earth and Atmospheric Sciences. Additional information about our department can be found on our website: <http://eas.unl.edu>.

To apply, go to <http://employment.unl.edu> requisition 41016 and complete the "faculty/administrative form." Applicants must attach a cover letter, curriculum vitae, a statement detailing research and teaching interests, and names of at least three references via the above website. We will begin to review applications on November 5, 2014, but the position will remain open until it is filled.

The University of Nebraska is committed to a pluralistic campus community through affirmative action, equal opportunity, work-life balance, and dual careers. For further information, contact Dr. Chris Fielding, Search Committee Chair by e-mail, phone, or mail at cfielding2@unl.edu, +1-402-472-9801, Department of Earth & Atmospheric

Sciences, University of Nebraska-Lincoln, 214 Bessey Hall, Lincoln NE 68588-0340, USA.

ASSISTANT PROFESSOR OF GEOSCIENCES, HAMILTON COLLEGE

The Geosciences Department at Hamilton College seeks applicants for a tenure-track Assistant Professor of Geosciences to begin in July 2015. The successful candidate for the position must have a Ph.D. in the geosciences with a broad background in sedimentary geology and related field experience. The candidate will be expected to establish a strong scholarly record in sedimentary geology and to advise undergraduate research projects. Teaching responsibilities will include a required course in sedimentary geology, a topical introductory course in geology, and one or more electives in the candidate's specialty. At least one of the elective courses will contribute to the interdisciplinary Environmental Studies Program as a cross-listed Geosciences/Environmental Studies course on climate change.

Our program in sedimentary geology is supported by an isotope ratio mass spectrometer with elemental analyzer, a scanning electron microscope with EDS analytical capabilities, a small research vessel for inland lake studies equipped with a variety of sonar and coring devices, a full-time departmental technician, and by four supportive faculty colleagues with diverse research interests.

A candidate interested in the position and who meets these requirements should submit: (1) a cover letter that addresses his/her qualifications for the position; (2) a statement describing his/her teaching philosophy; (3) a statement of research interests; (4) a complete *curriculum vitae*; and (5) letters from three professional referees who know the candidate well and understand the expectations of a competitive liberal arts college. Your cover letter should address ways in which issues of diversity are brought into your teaching, scholarship, and/or service. Experience teaching or working with diverse student populations is an asset. Candidates should submit these materials to Professor Todd Rayne via Interfolio at <http://apply.interfolio.com/25839>. Review of applications will begin on December 5, 2014, and continue until the position is filled.

Hamilton (www.hamilton.edu) is a residential liberal arts college located in upstate New York. Applicants with dual-career considerations can find other Hamilton and nearby academic job listings at www.upstatenyherc.org. Hamilton College is an affirmative action, equal opportunity employer and is committed to diversity in all areas of the campus community (www.hamilton.edu/diversity). Hamilton provides domestic partner benefits. Candidates from underrepresented groups in higher education are especially encouraged to apply.

TENURE-TRACK FACULTY POSITION IN STRUCTURAL GEOLOGY/TECTONICS DEPARTMENT OF GEOLOGICAL AND ATMOSPHERIC SCIENCES IOWA STATE UNIVERSITY

The Department of Geological and Atmospheric Sciences at Iowa State University, Ames, Iowa, invites applications for a tenure-track faculty posi-

tion at the assistant professor level beginning in August 2015. The position will be in the broad area of structural geology/tectonics. The selected candidate is expected to demonstrate a commitment to teaching and establish a successful, externally funded research program. It would complement existing strengths in the department, including geophysics, economic geology, sedimentary geology, groundwater and surface-water hydrology, paleoclimatology, isotope geochemistry, weather and climate modeling, glacial and Quaternary geology, surficial processes, and geoscience education. Opportunities exist for participation in the Iowa State University Geology Field Camp, located in the Big Horn Mountains near Shell, Wyoming. We also encourage interactions with researchers and faculty in other units on campus, including but not limited to the Department of Energy Ames Laboratory, ISU Bioeconomy Institute, and departments of Civil, Construction and Environmental Engineering, and Materials Science and Engineering. In addition, this faculty member will be expected to teach at the undergraduate and graduate levels and to develop courses in her/his specialty area. Information about the department may be found at www.ge-at.iastate.edu.

Candidates must hold a Ph.D. by the time of appointment. All applications must be submitted electronically at www.iastatejobs.com (search vacancy ID#: 140762). Please be prepared to attach a letter of application, including concise teaching and research statements, curriculum vitae, and the names, addresses, e-mail addresses, and phone and fax numbers of at least three references. Questions regarding this vacancy should be directed to the Search Chair (Alan Wanamaker; adw@iastate.edu) or the Department Chair (Bill Simpkins; bsimp@iastate.edu).

The position will remain open until filled. Full consideration will be given to applications received by October 31, 2014. Iowa State University is an EO/AA employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, disability, or protected Vets status.

TENURE-TRACK FACULTY POSITION GEOLOGY, ILLINOIS STATE UNIVERSITY

The Department of Geography-Geology at Illinois State University (Normal, Illinois, USA) invites applications for a tenure-track position in either (1) **Hydrogeology** or (2) **Mineralogy/Petrology** at the Assistant Professor level. The preferred starting date is August 16, 2015. A Ph.D. in Geology or closely related field is preferred, but ABD candidates who will finish before the time of appointment will be considered.

For Hydrogeology, the department seeks a candidate that possesses research and teaching interests that emphasize practical applications of field, laboratory and/or computational skills. Potential areas of expertise include, but are not limited to, one or more of the following: geophysics and fluid flow, groundwater and surface water interaction, environmental geophysics, or transport, fate, and remediation of contaminants.

For Mineralogy/Petrology, we seek a candidate who is undertaking significant field and/or laboratory-

based research in mineralogy/petrology. Potential areas of expertise include, but are not limited to, one or more of the following: igneous/metamorphic processes, ore deposits, high temperature geochemistry, or planetary geology.

Successful candidates will be integrated scholars with a strong commitment to teaching and mentoring student research at the undergraduate and M.S. levels. Primary teaching responsibilities will include graduate, advanced undergraduate, and general education courses. The successful candidate will be expected to maintain an externally funded, internationally visible research program. Potential collaborative interactions exist within the department and with state agency researchers (Illinois State Geological Survey, Illinois State Water Survey, and Illinois EPA). The potential for a significant startup package exists.

Illinois State University is a research-intensive university with an annual enrollment of approximately 22,000 students. To build a diverse workforce, Illinois State University encourages applications from individuals with disabilities, minorities, females, and veterans. EOE/AA employer. The university is located in the Bloomington-Normal metropolitan area of central Illinois with a population of approximately 150,000. The Department of Geography-Geology offers B.S./B.A. degrees in Geography, a B.S. degree in Geology, and an M.S. degree in Hydrogeology.

To ensure full consideration, please attach an online faculty application along with a letter of application, curriculum vitae, statement of teaching philosophy, statement of research plans, contact information for three references (name, telephone, and e-mail), and all college and university transcripts to posting number 0706412 at www.IllinoisState.edu/jobs. Screening of applications begins November 1, 2014, and will continue until the position is filled. Inquiries about the application process should be directed to Dr. Dave Malone (dhmalon@ilstu.edu; +1-309-438-2692). Additional information about the department and the community can be found at <http://geo.illinoisstate.edu/>.

TENURE-TRACK FACULTY POSITION IN SEDIMENTARY GEOLOGY/EARTH SYSTEM SCIENCE, CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

The Geological Sciences Department invites applications for an Assistant Professor tenure-track appointment beginning September 2015. Applicants must hold a Ph.D. in Geology or a related field by August 2015. The ideal candidate will have teaching and research interests that link shallow lithosphere sedimentary processes with specialized fields such as Sedimentology, Stratigraphy, Earth History, Global Environmental Change, Critical Zone Science, Energy Resources, Basin Analysis, Marine Geology. We seek a versatile faculty member to teach Sedimentary Geology and Earth Time and Life, and contribute to instruction of courses such as Blue Planet, Petroleum Geology, Oceanography, Meteorology, Coastal Processes, Geotectonics, GIS Applications and our popular Field Modules that utilize modern digital mapping tools and instrumentation. The successful candidate is expected to ensure that our cur-

riculum in their specialty area remains current, engage students in research and supervise M.S. and senior theses. He/she should have experience with field studies and data collection using modern instrumentation. Preferred qualifications include demonstrated success with external funding, established ties to research institutions, petroleum industry or government agencies and interest in developing intradepartmental and cross-campus collaborations. Applicants must submit a signed application form (see <http://academic.csupomona.edu/faculty/docs/application.pdf>), letter of interest, CV, statement of teaching and research interests, and contact information for five professional references. A campus interview, three formal reference letters and official confirmation of degree transcripts are required of all finalists. Initial screening begins January 7, 2015. Mail application materials to Search Committee Chair, Geological Sciences Department, California State Polytechnic University, Pomona, CA 91768. Cal Poly Pomona is an affirmative action, equal opportunity employer. Full Position Description: <http://geology.csupomona.edu/employment.htm>.

GEOLOGY TENURE-TRACK POSITION HUMBOLDT STATE UNIVERSITY

Starting August 2015 / Job #7608

Seeking candidates with specialization in one or more areas of Geomorphology, Surficial Processes, Neotectonics, and/or Quaternary Geoscience. Instructional assignments may include introductory and general education geology courses, required courses in field geology and geomorphology, at least one upper division/graduate level course in the candidate's specialty, and summer field camp every two or three years.

To view complete vacancy announcement & to apply, please visit: <http://apptkr.com/479136>.

HSU is an EO/Title IX/ADA Employer.

ENVIRONMENTAL GEOPHYSICIST & LOW-TEMPERATURE GEOCHEMIST POSITIONS, DICKINSON COLLEGE

The Dickinson College Department of Earth Sciences is expanding its faculty and invites applications for TWO tenure track positions at the Assistant Professor level, ABD or Ph.D. (preferred). (1) **Environmental Geophysicist:** Teaching responsibilities for this position will include hydrogeology, an upper level course in environmental geophysics, a required introductory course and upper level electives in the candidate's field of expertise. (2) **Low Temperature Geochemist:** Teaching responsibilities include a required upper level low temperature Geochemistry course for the major, a required introductory course, upper level electives in the candidate's field of expertise (e.g., climate change, critical zone studies, environmental geochemistry).

The successful candidates will be committed to teaching excellence in the liberal arts tradition and will have broad interests in geosciences beyond their specialty. Experience in student-faculty undergraduate research is highly desirable. Applicants must demonstrate a strong potential for interacting effectively with undergraduate students and an ability to collaborate effectively with students and colleagues from diverse backgrounds.

STEPHEN F. AUSTIN STATE UNIVERSITY

NACOGDOCHES, TEXAS

CHAIR DEPARTMENT OF GEOLOGY

The Department of Geology at Stephen F. Austin State University 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 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 credentials for appointment at the associate or professor rank in geology.

Submit a letter of application, CV, and contact information for three references to <https://careers.sfasu.edu> (posting 0603046).

Also mail official transcripts to:
Dr. Kenneth Farrish
Search Committee Chair
Stephen F. Austin State University
Department of Geology
PO Box 13011 SFA Station
Nacogdoches, TX 75962-3011
(936) 468-3701

Review of applications will begin on Jan. 9 and will continue until the position is filled. Equal Opportunity Employer; Security-sensitive position; this position will be subject to a criminal history check.



The Dickinson Earth Sciences curriculum emphasizes project-based learning with a strong field component, which is greatly facilitated by our location in the Great Valley, near the folded Appalachians, the northern terminus of the Blue Ridge, and the Triassic rift basins. The department has excellent analytical (AAS, SEM-EDS, CL, XRD, XRF, TOC, laser particle size analyzer, digital 3-component seismometer, a 5-well instrumented well field for hydrogeologic investigations) and computing facilities. More information can be found on the college (www.dickinson.edu) and department (www.dickinson.edu/homepage/96/earth_sciences) web pages. Dickinson College is a highly selective private liberal arts college in south-central Pennsylvania within easy drive of the New York–Washington D.C. metro corridor.

Applicants should apply online using jobs.dickinson.edu. Review of applications will begin November 17 and continue until each position is filled. Dickinson College, an EEO Employer, is committed to building a representative and diverse faculty, administrative staff, and student body. We encourage applications from all qualified persons. We value the ability to create an inclusive classroom for an increasingly diverse student body.

**GIBSON PROFESSORSHIP IN
HYDROGEOLOGY/GEOFLUIDS
DEPARTMENT OF EARTH SCIENCES
UNIVERSITY OF MINNESOTA**

The Department of Earth Sciences in the College of Science and Engineering at the University of Minnesota–Twin Cities is soliciting applications for a faculty position, the George and Orpha Gibson Chair in Hydrogeology / Geofluids. Appointment will be at the level of Assistant Professor (tenure-track) or Associate Professor (tenured or tenure-track, depending on academic qualifications). The Gibson Chair includes additional resources from the Gibson Endowed Fund over the first five years of appointment.

The Department of Earth Sciences is a vibrant interdisciplinary department whose faculty's research ranges from paleoclimate to deep earth dynamics. The successful Gibson Chair candidate will use field, experimental, and/or theoretical approaches and could work in a range of research areas, such as environmental hydrogeology, isotope hydrology, hydrogeochemistry, atmosphere/surface water/groundwater interactions, groundwater/lake/ocean systems, hydro-geobiology, physical hydrogeology, subsurface fluid mechanics, continental and oceanic geofluids, interaction between crustal fluids and tectonics, and/or hydrothermal systems. We encourage the development of ties with industry and governmental agencies that benefit the needs of our students, the state of Minnesota, and the broader community. The appointee is expected to develop a vigorous research program, attract external funding, and contribute to the instruction, research, and service efforts of the department. A Ph.D. in earth sciences or a related field is expected at the time of appointment.

The Department is in the N.H. Winchell School of Earth Sciences (www.esci.umn.edu), which also includes the Institute for Rock Magnetism, the

Limnological Research Center/National Lacustrine Core Facility/Continental Scientific Drilling Coordination Office, the Minnesota Geological Survey, the National Center for Earth-surface Dynamics, and the Polar Geospatial Center. Other affiliated research units at the University include the Saint Anthony Falls Laboratory and the Institute on the Environment. The appointee will have access to large-scale computing facilities (Minnesota Supercomputer Institute, Digital Technology Center) and the interdisciplinary Water Resources graduate program.

Materials Required

- A one-page letter of intent;
- A CV with a list of publications;
- A statement of research and teaching interests; and
- Names and contact information of three referees who can address the candidate's research and teaching potential.

Applications must be completed online at <http://www1.umn.edu/ohr/employment/>—Search for Requisition Number 192742.

The review of applications will begin November 1, 2014. Applications will continue to be accepted until the position is filled. Questions may be directed to Prof. Christian Teyssier (teyssier@umn.edu).

The University of Minnesota provides equal access to and opportunity in its programs, facilities, and employment without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. The University supports the work-life balance of its faculty.

**ENVIRONMENTAL
BIOGEOCHEMISTRY/GEOBIOLOGY
DARTMOUTH COLLEGE**

The Department of Earth Sciences at Dartmouth College invites applications for a junior rank tenure-track position in the general areas of biogeochemistry and geobiology. We especially welcome applications from candidates with research interests that include microbially-mediated biogeochemical interactions in processes of mineralization, weathering, and sequestration of contaminants; hydrocarbon formation and degradation; biogeochemical cycling in fluvial and/or cold environments, including river-channel, floodplain, and lacustrine ecosystem response to environmental change. Particular attention will be given to candidates who combine a focus on understanding fundamental processes with state-of-the-art laboratory and/or field research programs that complement and contribute to ongoing research activities in the Department as well as in Dartmouth's Geisel School of Medicine and Thayer School of Engineering. The successful candidate will continue Dartmouth's strong traditions in graduate and undergraduate research and teaching. Teaching responsibilities consist of three courses spread over three of four ten-week terms.

The Department of Earth Sciences is home to 11 tenured and tenure-track faculty members in the School of Arts and Sciences, and enjoys strong Ph.D. and M.S. programs and outstanding undergraduate majors. To create an atmosphere supportive of research, Dartmouth College offers new faculty

members grants for research-related expenses, a quarter of sabbatical leave for each three academic years in residence, and flexible scheduling of teaching responsibilities.

Dartmouth College, a member of the Ivy League, is located in Hanover, New Hampshire (on the Vermont border). Dartmouth has a beautiful, historic campus located in a scenic area on the Connecticut River. Recreational opportunities abound all year round. To learn more about Dartmouth College and the Department of Earth Sciences, visit www.dartmouth.edu/~earthsci.

To submit an application, send curriculum vitae, statements of teaching and research interests and objectives, reprints or preprints of up to three of your most significant publications, and the name, address (including street address), e-mail address and fax/phone numbers of at least three references to Environmental Biogeochemistry/Geobiology Search Committee, Department of Earth Sciences, Dartmouth College 6105 Fairchild Hall, Hanover, NH 03755, e-mail: earth.sciences@dartmouth.edu.

Applications received by November 7, 2014, will receive first consideration. The appointment will be effective July 1, 2015.

Dartmouth is an equal opportunity/affirmative action employer with a strong commitment to diversity. In that spirit, we are particularly interested in receiving applications from a broad spectrum of people, including women, persons of color, persons with disabilities, veterans or any other legally protected group.

**ASSISTANT CURATOR, PALEONTOLOGY
(ROLE TITLE: SCIENTIST II)
VIRGINIA MUSEUM OF NATURAL HISTORY
MARTINSVILLE, VIRGINIA, USA**

Salary Range: Pay Band 5 Minimum Starting Pay: \$42,000–\$44,000 Position #00089

An exceptional job opportunity with the Virginia Museum of Natural History is now available. The mission of the Virginia Museum of Natural History is to interpret Virginia's natural heritage within a global context in ways that are relevant to all the citizens of the Commonwealth.

If you meet the qualifications for Assistant Curator–Paleontology, we invite you to apply to join our staff. The starting date for this position is 1 July 2015.

We seek a dynamic individual to conduct integrative, field- and collections-based research in paleontology. The successful candidate will be expected to obtain external funding to support their research efforts. Area of specialization is open, but an active interest in extant museum collections (Cenozoic marine vertebrates and/or invertebrates, Triassic vertebrates and/or insects, paleobotany) is a plus. VMNH is located in Martinsville, Virginia, close to an important Triassic lagerstätte (Solite Quarry). VMNH is also actively involved in the excavation of an important Miocene marine mammal location on the Coastal Plain.

The state-of-the-art fossil preparation lab has full-time technical support and an active core of trained volunteers. VMNH also maintains a range of stereographic and petrographic microscopes, modern collections databases and a research library. Additional facilities are available at Virginia Tech less than two

hours away. Most curators maintain active adjunct faculty appointments at Virginia Tech. This allows, among other things, Internet access to the Virginia Tech library.

General competence in field collection, preparation, care, and management of fossil collections is required, along with the ability to interface with outside scientists requesting access to the collections. Ph.D. in paleontology required.

Duties for this position also include interaction with other museum departments such as education, outreach, exhibits, and advancement. The ability to effectively communicate scientific knowledge to a wide spectrum of audiences is an important qualification.

For more information about VMNH, visit our website at www.vmnh.net.

Only online applications are accepted. In addition to the online application, applicants must submit a cover letter, curriculum vitae, a statement of research and curatorial interests and goals, a list of publications relevant to the application, and names and contact information of at least three references. These documents may be attached to the online application.

The Commonwealth of Virginia online employment application is available at <http://jobs.agencies.virginia.gov>.

Application review will begin 1 November 2014 and continue until the position is filled.

The Virginia Museum of Natural History complies with E-Verify, which is an Internet-based system operated by the Department of Homeland Security in partnership with the Social Security Administration that allows participating employers to electronically verify the employment eligibility of their newly hired employees.

We are an equal opportunity employer. All qualified applicants are afforded equal opportunities without regard to sex, race, color, religion, national origin, age, or disability. The successful applicant must furnish proof of identity and employment eligibility and is subject to a background check.

**TENURE-TRACK FACULTY POSITION
IN LOW-TEMPERATURE GEOCHEMISTRY
OR HYDROGEOLOGY, DEPT. OF GEOLOGY,
CALIFORNIA STATE UNIVERSITY
SACRAMENTO**

The Geology Department in the College of Natural Sciences and Mathematics at California State University, Sacramento, invites applications for a Low Temperature Geochemist or Hydrogeologist. Applicants must hold a Ph.D. in geology by August 2015. Proficiency in marine geology, geological oceanography, stable isotopes, water chemistry, water resources, flood characterization, groundwater modeling, contaminant transport, groundwater flow, and aquifer analysis is a plus. The successful candidate will embrace the opportunity to teach general education courses to a diverse student population, conduct a field-based research program that involves undergraduate and graduate geology students, and be a fully engaged participant in a small, collegial department. Enthusiasm and a commitment to teaching and mentoring are essential. This is a tenure-track position at the Assistant Professor

rank, beginning August 2015. Salary will be dependent on qualifications and professional experience. Screening of applications will begin **October 15, 2014**; position open until filled. For the full vacancy announcement, please visit www.csus.edu/hr/facultyvacancies/vacancies.html.

**TENURE TRACK ASSISTANT PROFESSOR
PALEOCLIMATE/PALEONTOLOGY
CALIFORNIA STATE UNIVERSITY
NORTHRIDGE**

The Department of Geological Sciences at California State University, Northridge, invites applications for a full-time tenure-track faculty position at the level of Assistant Professor in Paleoclimatology/Paleontology. We offer B.S. and M.S. degrees in Geology and in Geophysics. The successful candidate must have a Ph.D. at the time of appointment. Experience in post-doctoral research and/or University-level lecture instruction is desirable. We seek an innovative paleoclimatologist/paleontologist with technical expertise in one or more of the following fields: paleontology, paleoecology, low-temperature geochemistry, paleo-oceanography, geochronology, dendrochronology, palynology, or other techniques. We particularly seek candidates who both complement our current research program and integrate across tectonics, sedimentology, and stratigraphy. The successful candidate is expected to develop a vigorous research program, which includes seeking extramural funding, publishing peer-reviewed papers, and involving undergraduate and M.S. students. Furthermore, the successful candidate is expected to demonstrate teaching excellence and provide effective instruction to students of diverse backgrounds. Potential classes to be taught by the new hire include: a new undergraduate core course in Earth Systems, a general education course in climate change, and elective offerings at the upper-division and/or graduate level in the candidate's research specialty.

Applicants should submit a cover letter, CV, three letters of recommendation, statement of teaching philosophy and experience, and statement of research interests. Electronic submissions are strongly encouraged and should be sent to paleontology.search@csun.edu. Materials can also be sent to Paleontology Search Committee, Department of Geological Sciences, California State University Northridge, 18111 Nordhoff Street, Northridge, CA 91330-8266. Review of applications will begin 1 January 2015. Priority will be given to applications received by this date, but the position remains open until filled. For additional information, see www.csun.edu/geology. The University is an EO/AA employer.

**TENURE TRACK ASSISTANT PROFESSOR
GEOPHYSICS
CALIFORNIA STATE UNIVERSITY
NORTHRIDGE**

The Department of Geological Sciences at California State University, Northridge, invites applications for a full-time tenure-track faculty position at the level of Assistant Professor in Solid Earth Geophysics or Earthquake Processes. The successful candidate must have a Ph.D. at the time of appointment.

Experience in post-doctoral research and/or University-level lecture instruction is desirable. We seek an innovative geophysicist with technical expertise in passive or active source seismology, geodynamics, numerical modeling, or earthquake geophysics. We particularly seek candidates who both complement our current research program and integrate across tectonics and geophysics. We offer B.Sc. and M.Sc. degrees in Geology and in Geophysics. The successful candidate is expected to develop a vigorous research program, which includes seeking extramural funding, publishing peer-reviewed papers, and involving undergraduate and M.S. students. Furthermore, the successful candidate is expected to demonstrate teaching excellence and provide effective instruction to students of diverse backgrounds. A successful candidate will enthusiastically contribute to teaching courses that provide rigorous preparation for students in our geophysics program at a range of levels. Course offerings include: an introductory course "Living with Earthquakes in California," a new undergraduate core course in Earth Tectonics and Structure, undergraduate courses in geophysics, and elective offerings at the upper-division and/or graduate level in the candidate's research specialty.

Applicants should submit a cover letter, CV, three letters of recommendation, statement of teaching philosophy and experience, and statement of research interests. Electronic submissions are strongly encouraged and should be sent to search@csun.edu. Materials can also be sent to Geophysics Search Committee, Department of Geological Sciences, California State University Northridge, 18111 Nordhoff Street, Northridge, CA 91330-8266. Review of applications will begin on 1 January 2015. Priority will be given to applications received by this date, but the position remains open until filled. For additional information, see www.csun.edu/geology. The University is an EO/AA employer.

**DIRECTOR
KENTUCKY GEOLOGICAL SURVEY
UNIVERSITY OF KENTUCKY**

Founded in 1865 as a land-grant institution adjacent to downtown Lexington, UK is nestled in the scenic heart of the Bluegrass Region of Kentucky. Recently ranked as one of the safest, most creative, and the brainiest cities in the nation, Lexington is an ideal location to experience the work-life balance that the University strives to provide to its employees. See for yourself what makes UK one great place to work.

The University of Kentucky seeks a Ph.D.-level geoscientist to serve as the Director of the Kentucky Geological Survey in Lexington, Kentucky, USA, and the 13th State Geologist of Kentucky. This is a high-level administrative position within the university. For more information about the duties of this position go to kgs.uky.edu/StateGeologist. To apply for **job # RE00309**, submit a UK Online Application at www.uky.edu/ukjobs. If you have any questions, contact HR/Employment, phone +1-859-257-9555 **press 2**. **Application deadline is November 16, 2014.**

The University of Kentucky is an equal opportunity employer and encourages applications from minorities and women.

**GEOCHEMIST/PETROLOGIST
OCCIDENTAL COLLEGE**

The Department of Geology at Occidental College invites applications for an Assistant or Associate Professor in Geochemistry or Petrology. Occidental is a nationally ranked liberal arts college recognized for its diverse student body and outstanding undergraduate research program. We seek a colleague who values undergraduate teaching and can sustain an active research program involving undergraduates. Training applicable to teaching mineralogy, petrology, and geochemistry is required; these courses should enhance students' understanding of chemical processes acting on the earth, and increase students' expertise in quantitative and instrumental methods. The successful candidate will also contribute to teaching introductory geology and engage undergraduates in research projects.

Applications should include a statement of teaching and research interests in the context of a liberal arts college with a diverse undergraduate student body. Candidates should specifically address their ability to teach a diverse undergraduate student body and engage students in an ongoing research program. Submit statement, a curriculum vitae, 1-3 significant publications, and contact information for three referees to Dr. Margi Rusmore, Search Committee Chair, at geosearch1@oxy.edu. Search committee members will meet interested candidates at the GSA and AGU meetings; e-mail the committee to make arrangements. Members of underrepresented groups are especially encouraged to apply. **Review of applications will begin October 15, 2014, and will continue until the search closes on December 31, 2014.**

**PHYSICAL HYDROGEOLOGIST
DEPARTMENT OF GEOLOGY & GEOGRAPHY
WEST VIRGINIA UNIVERSITY**

West Virginia University invites applications for a tenure-track position at the Assistant Professor level in the Department of Geology & Geography beginning August 2015. We seek applications from individuals with interests in basic and applied aspects of fluid flow in the critical zone and/or deeper regimes. The successful applicant will possess demonstrable expertise in study of subsurface fluid flow and/or transport processes that may be applied to competitively-funded research problems.

Requirements include a Ph.D. or equivalent degree in geology or a related field, potential to establish a vigorous externally-funded research program, and potential for excellent teaching at the undergraduate and graduate levels. Qualified applicants should submit a single PDF file including (1) statement of research interests; (2) statement of teaching philosophy; (3) curriculum vitae; and (4) list of 3 potential references to hydrogeo@mail.wvu.edu. Review of applications will commence on November 15 and continue until a successful candidate is identified. For additional information, please see <http://pages.geo.wvu.edu/hydrogeo> or contact the search chair Dorothy J. Vesper at djvesper@mail.wvu.edu. WVU is an EEO/Affirmative Action Employer and welcomes applications from all qualified individuals, including minorities, females, individuals with disabilities, and veterans.

**ASSISTANT PROFESSOR
SEDIMENTOLOGY/BASIN ANALYSIS
DENISON UNIVERSITY**

Denison University invites applications for a tenure track position in the Department of Geosciences, to begin in August 2015. We seek a broadly trained scientist engaged in the study of Sedimentology and/or Basin Analysis. Successful candidates are expected to be outstanding teacher/scholars, and contribute to the continued growth of the Department and College. Candidates must have a Ph.D. at the time of appointment.

We require a colleague who is committed to teaching excellence in the liberal arts tradition, is field-based, has broad interests beyond their individual specialty, and will provide a balance of classroom, field, and laboratory experiences for our students. Candidates must have the desire and ability to teach courses at all levels of the curriculum. In addition, successful candidates are expected to maintain a vibrant, ongoing research program that actively incorporates undergraduate students.

Denison University is a highly selective, private residential liberal arts college enrolling approximately 2100 undergraduate students from across the country and around the world. The college is located in the village of Granville, Ohio, USA, 25 miles east of Columbus. For more information about Denison, visit our website at www.denison.edu.

All application materials will be handled electronically at <https://employment.denison.edu>. Applications must include: (1) a letter of application addressing the position requirements listed above; (2) a curriculum vita; (3) academic transcripts of undergraduate and graduate course work (unofficial acceptable); (4) a statement of teaching philosophy and experience; and (5) a statement of your research program in a liberal arts context. In addition, please include the contact information for three persons who know you well, who will then be requested to upload reference letters. Completed application materials submitted by October 27, 2014, will receive full consideration, and evaluation will continue until the position is filled. We plan to meet with selected candidates at the 2014 GSA Annual Meeting in Vancouver, BC, Canada. Denison University is an Affirmative Action, Equal Opportunity Employer. To achieve our mission as a liberal arts college, we continually strive to foster a diverse campus community, which recognizes the value of all persons regardless of religion, race, ethnicity, gender, sexual orientation, disability, or socioeconomic background.

**TENURE-TRACK FACULTY POSITION
IN GEOSCIENCE EDUCATION
DEPARTMENT OF GEOLOGICAL SCIENCES
CALIFORNIA STATE UNIVERSITY
FULLERTON**

The Department of Geological Sciences at California State University Fullerton, <http://geology.fullerton.edu/>, invites applications for a tenure-track Assistant Professorship that will begin August 2015. Area of expertise shall include the study of geoscience education. The successful candidate will be expected to develop an active, externally funded program involving undergraduate and Master's students in the candidate's field of study. The successful candidate must demonstrate interest and ability to teach courses in geoscience education at lower- and upper-division levels. Additional teaching may include introductory-level geosciences and upper-division/graduate courses. The successful candidate shall: (1) coordinate geoscience education courses; (2) help facilitate the integration of teacher preparation into our B.A. program; and (3) be involved in program-level assessment for our department. For a complete position description, see http://diversity.fullerton.edu/jobs/ft/geoscience_education.asp.

To apply, send a single pdf file including (1) a detailed curriculum vita; (2) a letter of application; (3) a teaching statement that includes: a discussion of relevant course work and/or experience in preparation for teaching, a list of courses you are qualified to teach, and a statement of your teaching philosophy; and (4) a statement of your future research plans and/or goals, as the pertain to the geoscience education position. Letters of recommendation from at least three referees familiar with your teaching and research potential should be sent separately. Applicants and referees should e-mail materials directly to Dr. Matthew Kirby: Geoscience_ed_search@fullerton.edu. Applications will be accepted until the position is filled. To ensure full consideration, submit all application materials by November 14, 2014.

California State University Fullerton celebrates all forms of diversity and is deeply committed to fostering an inclusive environment within which students, staff, administrators and faculty thrive. Individuals interested in advancing the University's strategic goals are strongly encouraged to apply. EEO employer. Reasonable accommodations will be provided for qualified applicants with disabilities who self-disclose.

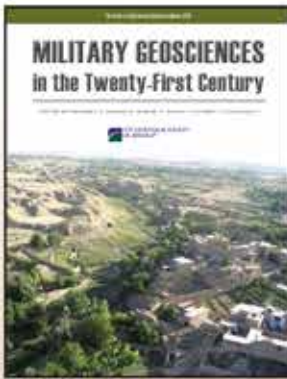
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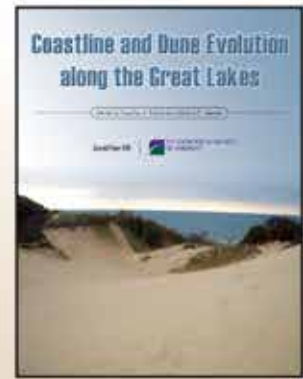
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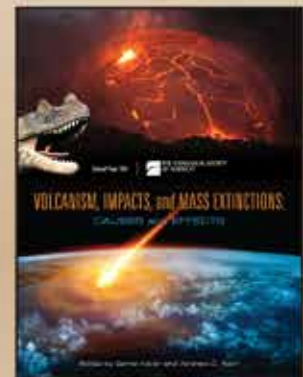
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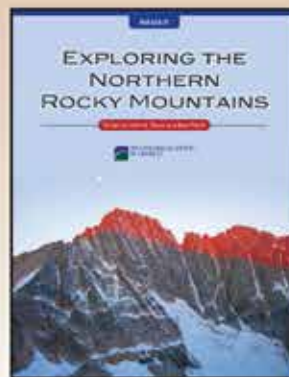
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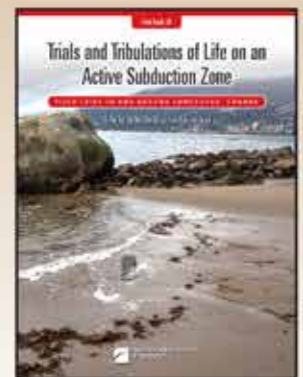
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Call for Applications

2015–2016 GSA-USGS Congressional Science Fellowship

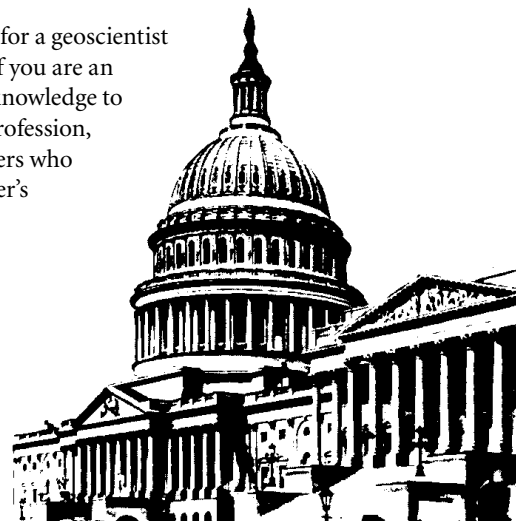
Application deadline: 1 Feb. 2015

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 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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GSA MENTOR PROGRAMS



STUDENTS

Interested in a career in the applied geosciences?

Plan now to attend a Roy J. Shlemon Mentor Program in Applied Geoscience and/or a John Mann Mentors in Applied Hydrogeology Program at your 2015 Section Meeting to chat one-on-one with practicing geoscientists. These volunteers will answer your questions and share insights on how to get a job after graduation.



PROFESSIONALS

Interested in sharing information about your applied geoscience career with students?

Being a mentor is a rewarding experience. If you are interested in becoming a mentor at one of the GSA Section Meetings, contact Jennifer Nocerino, jnocerino@geosociety.org.



The National Park Service
The Geological Society of America®

NPS-GSA Mosaics in Science Program

Paid short-term STEM (Science, Technology, Engineering, and Mathematics) volunteer opportunities at National Parks across the United States.

The summer 2015 Mosaics positions will be posted online
1 Dec. 2014.

Participants from groups that have historically been underrepresented in STEM careers will spend 11 weeks working on a STEM project at a National Park Service site. After completing their projects, participants will travel to Washington D.C. to participate in a career workshop that provides opportunities for them to present their work and meet with various members of NPS staff and management.

www.geosociety.org/mosaics

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GSA Publications Highlights

New Impact Factors Announced, GSA Journals Increase

Thomson Reuters has released its 2014 impact factors, and GSA's journals continued to rise.

With an impact factor of 4.638 and a five-year impact factor of 4.925, *Geology* has held its spot as the #1 ranked journal in the geology category for the eighth year in a row.

Geological Society of America Bulletin's impact factor climbed to 4.398, the fifth consecutive increase. With a five-year impact factor of 4.897, it is the #10 ranked multidisciplinary geosciences journal.

Geosphere's impact factor increased for the second year in a row to 2.372. Its five-year impact factor is 2.743.

Lithosphere's impact factor jumped 24% to 2.687, making it the #5 ranked journal in the geology category. Its five-year impact factor also increased to 2.811.

While Thomson Reuters does not produce impact factors for book series, it indexes GSA's Special Papers, Memoirs, and Reviews in Engineering Geology in its Book Citation Index, which is part of the Web of Science.



Browse GSA's journals and books at www.gsapubs.org.

Image Credit: NASA/Don Davis.

SCIENCE EDITOR

OPENINGS FOR 2016

GSA is soliciting applications and nominations for science co-editors for GSA books, GSA maps and charts, *GSA Bulletin*, *Geology*, and *Lithosphere* with four-year terms beginning 1 January 2016. Duties include: ensuring stringent peer review and expeditious processing of submissions; making final acceptance or rejection decisions after considering recommendations of reviewers; and maintaining excellent content through active solicitation of diverse and definitive manuscripts, books, or maps.

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.

MAPS AND CHARTS The GSA maps and charts editor reviews proposals for printed and digital maps and handles the peer review of submitted maps (and accompanying manuscripts in some cases). The successful candidate will have a wide range of interests and expertise in mapping techniques and standards.

GSA BULLETIN Research interests that best complement those of the continuing editors: Quaternary geology; geomorphology; volcanology; low-T geochemistry; thermochronology; structural geology; biogeochemistry; geobiology; paleobiology

LITHOSPHERE Research interests that best complement those of the continuing editors: Quaternary processes; tectonic geomorphology; low-T thermochronology; neotectonics; geochronology; isotope geochemistry

GEOLOGY Research interests that best complement those of the continuing editors: volcanology; petrology; sedimentology; geochemistry; (paleo)climate/atmosphere/(paleo)oceans; paleontology/geobiology; planetary geology; hydrology; geophysics

GSA Books ▶ 1 position

Maps & Charts ▶ 1 position

GSA Bulletin ▶ 1 position

Lithosphere ▶ 1 position

Geology ▶ 2 positions

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 (journals) 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 Jeanette Hammann, jhammann@geosociety.org.
- ▶ To nominate another, submit a nomination letter and the person's written permission and CV.

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 2015 will be given first consideration.

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